POTENTIALS OF REHABILITATING A SMALL SCALE WATER RESOURCES DEVELOPMENT PROJECT THROUGH PEOPLE'S PARTICIPATION

Nurjahan

Institute of Water and Flood Management (IWFM)
Bangladesh University of Engineering and Technology
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CANDIDATE'S DECLARATION

It is thereby declared that this thesis or any part of it has not been submitted elsewhere for the award of any degree or diploma.

Signature of the Student

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(Nurjahan)
Roll No: M10062851P
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ABBREVIATION

ADB	Asian Development Bank
BBS	Bangladesh Bureau of Statistics
BIDS	Bangladesh Institute of Development Studies
BME	Benefit Monitoring and Evaluation
BWDB	Bangladesh Water Development Board
CDP	Canal Digging Programme
EIP	Early Implementation Programme
FAO	Food and Agriculture Organization
FCD	Flood Control and Drainage
FCDI	Flood Control, Drainage and Irrigation
FFW	Food For Works
FGD	Focus Group Discussion
GOB	Government of Bangladesh
GON	Government of Netherlands
HYV	High Yielding Variety
IDA	International Development Association
IFAD	International Fund for Agricultural Development
IMED	Implementation Monitoring and Evaluation Division
IWFM	Institute of Water and Flood Management
IWM	Institute of Water Modeling
LGED	Local Government Engineering Department
LLP	Low Lift Pump
MDG	Millennium Development Goal
NWMP	National Water Management Plan
NWP	National Water Policy
PAPs	Project Affected Persons
PRA	Participatory Rural Appraisal
RWP	Rural Works Programme
SSWRDSP	Small Scale Water Resources Development Sector Project
STW	Shallow Tube Well
TIP	Thana Irrigation Project
WMCA	Water Management Cooperative Association

ABSTRACT

Sirajpur Haor project was designed to create opportunities for HYV Boro rice irrigation and develop fisheries through conservation of water in the Sirajpur Nadi. But, post project evaluation by LGED in 2004 showed that about 85% of the irrigation target and only about 7% of the fisheries target were achieved. The purpose of this study was to assess the present status of the project and ascertain the future rehabilitation potentials through technical evaluation and people's participation.

From the analysis of field data it was evident that at present the project had no area under HYV Boro irrigation and only about 6% of the fisheries target was achieved. Analysis of irrigation potential showed that the available water from Sirajpur Nadi is grossly inadequate to meet the irrigation water demand of 345 ha of planned HYV Boro. From the FGDs it was evident that the farmers of the project never used the water from the river for HYV Boro irrigation and had no plan to also use it in future. HYV Boro is cultivated in the project area using groundwater through STWs. Scarcity of water in the river, conflict with culture fisheries and difficulties in conveying water to the farmers' fields were the main reasons for such non-use. The project's fish production target was not achieved mainly due to illegal settlements in the floodplain and poor management of fish culture by the WMCA. Illegal settlements in the floodplain have reduced the water area for fish culture from 82 ha in the pre-project condition to only about 18.3 ha in 2008. The WMCA has leased out the river for fish culture and the leasers' cultural practices were inappropriate considering species, stocks, fish feed etc. From the FGDs it was ascertained that the fishers of the project were unable to fish in the river as capture fishery system has been converted to culture fishery. Most of the fishers have either left the project or switched over to other profession. Only a few of them now work for the leasers of the river.

Evaluation of fisheries potential showed that with proper management practices, the fish production can be increased by about five times, even in the present water area. The annual profit from fish culture would be about Tk. 2.15 million and would exceed the annual re-excavation cost of Tk. 1.81 million by Tk. 0.34 million. The profit would be much higher if the re-excavation cost is shared by LGED and a conducive environment for culture fisheries is created through re-excavation. From the FGDs with the stakeholders it was evident that the rehabilitation of Sirajpur Haor project would be feasible if the impediments to fish culture (illegal settlements and river siltation) are removed, the WMCA is allowed to function without any political interference and through proper cultural practices (species, stock and fish feed).

CHAPTER 1

INTRODUCTION

1.1 Background

Being a riverine country downstream of several tributaries flowing from the Himalayas, water resources play a vital role in the economic development of Bangladesh. With frequent flood and drought cycles occurring in many places of the country, sustainable water resources management is pivotal for rural development. The food grain production plan of the Government, in line with Millennium Development Goal (MDG), puts major stress on proper utilization of water resources. Substantial water resources development activities of the country were initiated in the early 1960s. The Bangladesh Water Development Board (BWDB) completed a Master Plan for water resources development in 1964 and undertook feasibility studies of a large number of schemes from 1964 Master Plan and initiated follow-up studies and investigations of others. The International Bank for Reconstruction and Development (IBRD) Mission reviewed the 1964 Master Plan and a revised development strategy was enunciated with focus first on modest schemes, which emphasized the use of agricultural inputs with larger flood control, drainage and irrigation projects to follow.

Since independence of Bangladesh, BWDB has implemented a number of large scale irrigation projects and water development projects and simultaneously started experimenting with people's participation in water management. An assessment of past performance of water sector projects is presented in Table 1.1. Apart from long gestation period, both time and cost over-run were endemic problems of these projects. It can be seen from the table that the performance of large and medium scale Flood Control and Drainage (FCD) projects varies from medium success to failure. The main reasons for this below performance are poor economic returns, complexity of operation and management and uncertainties regarding the beneficiaries willingness to accept full responsibility for O&M. Moreover, these projects have several major negative impacts, such as the loss of fisheries, navigation and soil fertility and the exacerbation of drainage problems. On the other hand the small-scale FCD projects appear to be more attractive and sustainable than large scale projects. Apart from their low costs, these projects have the merit of being

highly participatory with beneficiaries' ability to take over the O&M fully. But long-term sustainability is still unproven, because not much time has elapsed for the O&M arrangement to be properly tested and evaluated.

Table 1.1 : Assessment of past performance of water sector projects and intervention

Project type	Performance/Impact				Relative GoB	Ease of
	Technical	Social	Environmental	Economic	O&M Burden	Implementation and Management
Rural FCD						
Inland embankment and Polders	M	L	L	L	H	M
Coastal embankment and polders	M	M	L	M	H	
Compartmentalization Pilot Project	M	L	M	L	H	L
Small-scale FCD	H	M	L	H	L	M
River training and bank protection	M	H	M	M	H	M
Urban FCD	H	H	M	H	M	M
Small-scale Irrigation						
Barind DTWs	H	H	M	M	L	M
Rubber Dams	H	H	L	M	L	M
Khal Re-excavation	M	M	H	M	L	L
Large-scale Irrigation						
Primary pumping	L/M	M	M	L	H	M
Gravity supply	M	M	M	L	M	M
Flood Proofing						
Structural	H	H	H	H	L	M
Non-structural	H	-	-	-	M	M

Source: WARPO, 2001

Note: L =Low Performance/Negative Impact, M = Medium Performance/Neutral Impact, H = High Performance/Positive Impact.

The Local Government Engineering Department (LGED) has implemented Small Scale Water Resources Development (SSWRD) schemes as a component under different

projects. Since 1995-96, LGED has been carrying out SSWRD activities as a sectoral program with participation of local stakeholders. Meanwhile, the Government made major water sector reforms with the formulation of The National Water Policy (NWP) in 1999 and The National Water Management Plan (NWMP) in 2001. The NWP mandates that "the local government will implement Flood Control, Drainage and Irrigation (FCDI) projects having command areas of 1,000 hectares or less" (MoWR, 1999).

During the period from April 1996 to December 2002 the LGED has implemented 280 small-scale water control systems, called subprojects (Phase-I), in western Bangladesh. To implement these sub-projects, people's participation was an important process, which was done in three distinct stages: i) Identification and feasibility ii) Design and institutional building and iii) Construction and first year of joint O&M.

Among the 280 completed subprojects of Phase I, Sirajpur Haor subproject was completed in June, 2002. It is an irrigation, drainage improvement and fishery development subproject. The subproject has a gross area of about 630 hectares with net benefited area of about 470 hectare. It was proposed that re-excavation of the Sirajpur Nadi for 6.40 km and construction of water retention structure (WRS) will conserve more water during dry season and create opportunities for irrigation to about adjoining 500 meter strip of lands (about 470 ha) and will develop fisheries. It was estimated that after completion of the subproject, the HYV Boro area would increase from 0 to 345 ha and the total fish production would increase from 4.92 metric tons (MT) to 147.6 MT (LGED, 1997). At the post-project evaluation in the year 2004, the total fish production was only 10 MT and the total HYV Boro cultivated area was reported as 292.7 ha (LGED, 2009). In a recent visit to the subproject during April, 2008, it was observed that the subproject was in a dilapidated condition with lack of water to meet the demands of both irrigation and fisheries.

Though the Sirajpur Haor subproject was implemented by participatory water management approach but the objectives of the subproject were not achieved. This study was intended to find the reasons of poor performance and the scope of rehabilitation of the subproject with a participatory approach.

1.2 Objectives

The specific objectives of the proposed study are as follows:

- Assessment of the present status and problems of Sirajpur haor subproject through FGDs ;
- Technical analysis of the development potentials of Sirajpur haor subproject using the present infrastructure; and
- Assessment of the rehabilitation potentials through FGDs and interview with different stakeholders.

1.3 Limitations of the Study

The findings of this study are limited to the study area or the sub-project. Extrapolation of the findings of the study to other areas should be done judiciously. While assessing the functions and the performance of the WMCA, it was felt necessary to consider the viewpoints of the local government representatives (e.g. Union Parishad Chairmen and members) and local political elites. Although the local government representatives are not explicitly involved with the activities of the WMCA, their implicit activities directly affected the performance of the WMCA in the study area. During the field visits to the study area, the local environment was not conducive for meetings and discussions with the local government representatives.

CHAPTER TWO
LITERATURE REVIEW

2.1 Introduction

Agriculture is the centrepiece of the Bangladesh economy and supports the vast majority of its population, accounting for 32% of GDP, 13% of exports, and 60% of employment. As most of country's area is located within the floodplains of the three great rivers (the Ganges, the Brahmaputra and the Meghna), floods are a recurring phenomenon. Each year about 22% of the country is flooded and about 60% of the country is flooded during the 100 year flood. Though the people in Bangladesh live with flooding for a long time, the problem has become acute with the floodplains being densely and heavily populated and the extent of flood damage increases over the years.

Water resources planning and management activities in Bangladesh started in the 1960s. The first Master Plan for water resources development was formulated in 1964 and recommended for development of agriculture and irrigation through implementation of about 58 large-scale flood control and drainage (FCD) and flood control, drainage and irrigation (FCDI) projects by 1985.

Since then physical infrastructures for mitigation of flood, facilitating drainage and providing irrigation have been constructed, but still the realized benefits fall far short of the potential. At present almost all of the arable lands (9.0 million hectares) are cultivated, of which 1.57 million ha (17.5%) is single cropped, 4.92 million ha (54.7%) double cropped and 1.83 million ha (20.4%) triple cropped, and 0.68 ha (7.4%) million hectares is cultivable waste and current fallow land. Since 1986, there has been a gradual increase in the cropping intensity from 1.5 to almost 1.8. This implies that there is potential for the cultivation of additional crops, particularly in the dry season (November to April), with the increases in irrigated area. Presently, irrigation covers about 48% of the net cropped area (BBS, 2001). The irrigation area could be expanded to cover a large part of the country by selecting appropriate technology. Currently the quest for sustainable development is a key issue in water resources management.

2.2 Evolution of Small Scale Water Sector Projects

Due to long gestation period of large projects, the IBRD Land and Water Sector Study recommended focusing on quick yielding, less capital intensive and more labor-intensive projects considering land and water as integrated water resources (Islam, 2006). It also emphasized on drought management in the southwest and northwest parts of Bangladesh. In parallel with large-scale systems, small-scale FCDI type projects were also constructed during the period of 1975 to 1995. Bangladesh Water Development Board (BWDB) under the Ministry of Water Resources was the main agency for water resources development. During the period of 1960 and 1990, land and water development facilities were in place to provide flood protection to about 5.0 million ha and irrigation to 4.0 million ha of total irrigable area of 7.6 million ha. In 1996, the Local Government Engineering Department under the Ministry of Local Government, Rural Development and Cooperatives initiated small-scale water resources development sector project (SSWRDSP) to support the local government institutions in the implementation of small-scale flood control, drainage improvement, water conservation and command area development subprojects at union level (lowest administrative unit). Each subproject covers 1,000 ha or less.

The chronological development of small scale water resources projects is presented below:

2.2.1 Thana Irrigation Project (TIP, 1960)

Development of Small Scale Water Resources (SSWR) dates back to 1960 when Thana irrigation Project (TIP) started as a Comilla Model under the Rural Works Programme of Bangladesh Rural Development Academy (BARD). The TIP Programme gave responsibility with Union Parishad members to survey available surface water resources in his/her areas to plan for maximum irrigation coverage. The UP members formed project committee under the Rural Works Programme (RWP) for re-excavating irrigation canals.

2.2.2 Canal Digging Programme (CDP, 1979-1982)

The CDP started in 1979 initially under voluntary works and later with assistance from Food for Works (FFW) to de-silt sedimented channels all over the country to increase storage for irrigation water. In addition to increase in irrigation water supply, drainage improvement, tree plantation on canal bank road and fishery development were aimed under the Programme. The CDP was appreciated by the people and they came forward to participate in voluntary earthworks. The CDP used low lift pump gravity flow irrigation system management. Small-scale water control structures resources development schemes were also taken up under the CDP. The CDP implemented following works:

- Khal re-excavation 3276 km
- Pond re-excavation 429, 597 Nos
- Hydraulic Structures 382

The benefited area under CDP was about 419,500 hectares.

2.2.3 BWDB SSFCDI Development (1980-95)

BWDB started implementation of small-scale water resources development schemes in early eighties; first through the Dutch funded Early Implementation Programme (EIP) from about 1980 and almost at the same time with Canadian CIDA and International Development Association (IDA) joint funded Small Scale Flood Control Drainage and Irrigation (SSFCDI). The EIP Programme continued until late 1990s and the Programme discontinued after an evaluation identified that the Programme failed to address issues related to local participation and distribution of responsibilities between national and local governments in the implementation of 88 subprojects during the last two decades (EIP, 2000). The first SSFCDI under IDA credit 955-BD (US$30.0 million) built 204 subprojects during the period of 1983 and 1988 throughout the country where water control structures were constructed appurtenant to embankment earthworks constructed under Food For Works (FFW). A second SSFCDI (1870-BD) for US$40.0 million followed the first one in 1999 that completed 122 subprojects between 1999 and 1995 including rehabilitating a number of non-functioning subprojects of the first project. An

operational status survey (OSS) carried out by CIDA and World Bank in 1992 for the completed SSFCDI subprojects indicated lack of people's participation in completed subprojects. The study conducted for 60 completed subprojects indicated poor performance in 14 subprojects (23%). The Programme discontinued from December 1995.

2.2.4 BWDB System Rehabilitation Project (SRP)

When the operation and maintenance (O&M) performance was poor, rehabilitation of projects were brought to the remedy (Islam, 2006). The system rehabilitation project was undertaken by BWDB in 1992 and continued until 1998. The good aspect of SRP is that the Guidelines for Participatory Water Management were initiated under the banner of this project.

2.2.5 Shallow/Deep Tube Well Project

The national minor irrigation census (1996-97) identified that 2.1 million hectares of cultivated land were irrigated by 630,000 STWs and 0.70 million hectares by 25,000 DTWs. The reminder of the irrigated area was covered by Low Lift Pumps (LLPs). The BWDB and BADC deep tube well (DTW) projects in northern Bangladesh proved to be a failure due to management problems. The abundant use and abstraction of ground water for irrigation water by STWs led to serious arsenic problem in the country (Islam, 2006). The arsenic problem is acute in the southwestern region of the country due to extensive use of shallow tube wells. To redress the severe arsenic problem initiatives for irrigation depending more and more on surface water are needed.

2.2.6 LGED IDP Programme

The rural employment sector Programme's (RESP) infrastructure development project (IDP) component initiated development of small-scale water resources schemes in 1986. The Programme completed 60 small-scale schemes from 1986 to 1996 in six districts (Kurigram, Faridpur, Rajbari, Madaripur, Gopalgonj and Shariatpur) at a cost of Tk 148.0 million. The Programme covered about 20,530 hectares of cultivated land benefiting 51,230 farm families. An evaluation of the Programme by the Bureau of Economic

Research, Dhaka University, in September 1997, concluded that agricultural production increased by 58%, increase in farm employment by about 43% and corresponding increase in wage rate by about 38% (Islam, 2006)

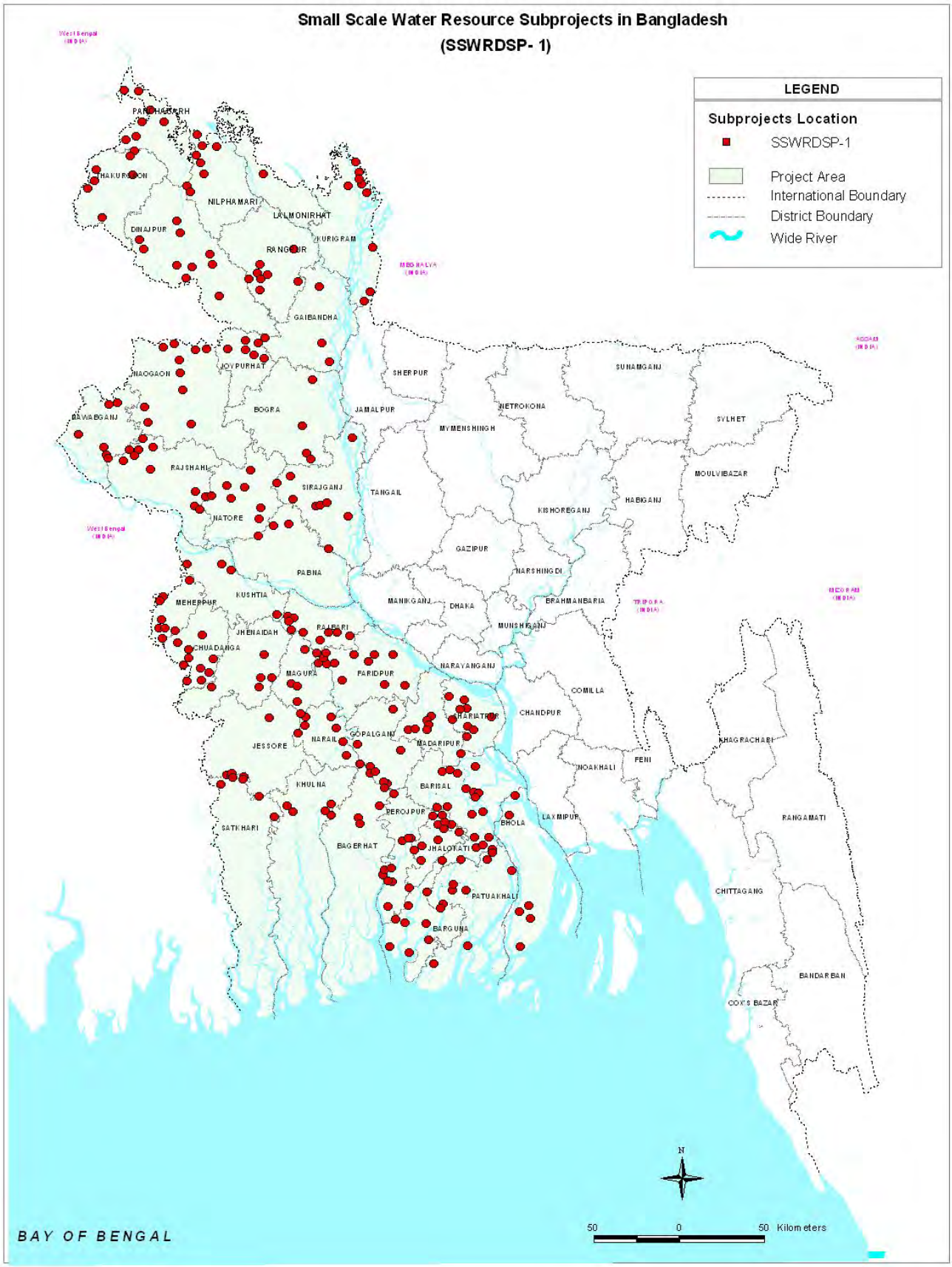
2.2.7 First Small-Scale Water Resources Development Sector Project

LGED started implementing First Small-Scale Water Resources Development Sector Project (SSWRDSP) with joint funding of the Asian Development Bank (ADB), International Fund for Agricultural Development (IFAD) and the Government of the Netherlands (GON) and Bangladesh from 1996. The first phase of the project (cost: US$60.0 million), implemented 280 subprojects in 37 districts of the western half of the country (Rajshahi, Khulna and Barisal Division and Greater Faridpur Districts). The location map of the first phase of SSWRDSP are shown in figure 2.1. The beneficiaries contributed 1.5% of the civil works cost and 3% of the earthwork cost. The 280 subprojects implemented by the first SSWRDSP covered benefited area of about 165,000 hectares of cultivated land. The SSWRDSP aimed at sustainable use of water resources with the participation of local stakeholders to increase agricultural and fisheries production, employment opportunities and income for marginal and small farm families, fishers, landless and destitute women. The subprojects are selected by the people at union level each covering 50 ha to 1,000 ha where agricultural productivity is constrained either by poor drainage, flooding or drought and where 50% of the benefit area is operated by marginal, small and landless farmers and share croppers and less than 30% of the households depend on subsistence capture fisheries. Thus the primary water management systems adopted under the project are: (i) Flood Management, (ii) Drainage Improvement, (iii) Water Conservation, and (iv) Command Area Development to develop irrigation distribution system (Islam, 2006).

Establishment of Water Management Association (WMA) is done along with motivational awareness campaign among stakeholders. The WMA is formalized through registration with Department of Cooperatives when it becomes Water Management Cooperative Association (WMCA). WMCA must fulfil a number of preconditions including (i) enrolment of at least 70% of the direct beneficiary households in the WMCA (ii) collection of full O&M fund from direct beneficiaries and deposit in a joint account operated by WMCA and LGED (iii) project affected persons are consulted,

environmental mitigation and land acquisition plans are prepared and approved. The WMCA monitors construction of infrastructure through a 7-member committee trained on construction monitoring including one man and one woman from the Union Parishad. The members of this committee usually continue to form the O&M Committee. Training is provided to committee members so that they can undertake O&M of complete infrastructure. After having observed the infrastructure performance during the first year O&M, the subproject is handed over to the WMCA through a formal lease agreement with LGED. The WMCA and the O&M committee receive regular trainings so that they are able to carry out O&M of the subproject. The WMCA prepares O&M plans, undertakes routine maintenance works and collects O&M fees from direct beneficiaries in proportion to their land area benefited by the subproject. However, the local government institutions (LGIs) and beneficiaries are consulted in each step of subproject development: identification, design and implementation. Subproject infrastructures include re-sectioning flood embankment for flood management, re-excavating sediment filled drainage channels for improving drainage system, and providing hydraulic structures for water management in subprojects areas.

In 280 subproject areas of the first SSWRDSP, average WMCA membership now covers more than two-thirds of the total households. The membership consists of 91,000 males and 28,200 females from an estimated 181,700 households. The members include marginal, small, medium and large farmers, landless, women and fishers. Woman membership covers almost one-third of the total members. The WMCA members elect a management committee with at least one-third women members. Subcommittee such as credit management, agricultural and O&M sub-committee supports the management committee. The subproject beneficiaries prepare annual O&M plans and budget and mobilize local resources for the O&M costs. In 280 subprojects, beneficiaries' contributed Tk 33.5 million, which is about 93% of the target of Tk 36.0 million. LGED introduced extensive training Programmes for the WMCA O&M sub-committee members to perform regular O&M for the completed works handed-over to them. In 2002, WMCA O&M sub-committee in about 140 completed subprojects prepared annual O&M plans (Islam, 2006).



Source: LGED, 2009

Figure 2.1: Location Map of Phase-I of SSWRDSP

2.2.8 Second Small-Scale Project

After the successful implementation of the first project, Second SSWRDSP was launched in July 2002 with a target to implement 300 subprojects during the year 2003 to 2009 covering the whole country, except three districts in Chittagong Hill Tracts. The project cost is US$78.0 million, funded by ADB, GON, GOB and beneficiaries. The National Water Policy (NWP) required that the all project affected persons (PAPs) will participate in the subproject development process and ownership of completed subprojects covering 1,000 ha or less be transferred to the local governments for operation and maintenance. LGED adopted all requirements under the NWP in the implementation of the first phase of SSWRDSP. The main components are (a) mobilization of beneficiary participation, (b) community based infrastructure development, (c) water resources oriented support Programmes, (d) effective O&M system development, (e) support for institutional strengthening, and (f) capacity building for water management associations for sustainable management. The success of small-scale project depends on the sustainability of Water Management Associations (WMA). The signing of the three-party implementation agreement (IA) amongst WMA, UP and LGED before tendering for any work has proved to be a very useful tool in the process of participation and O&M sustainability.

Participatory water resources development and management is inevitable to effectively implement key principles by strengthening the implementation framework which has been demonstrated under SSWRDSP. Key elements for further incorporation include (i) ensuring stringent coordination of stakeholders at the earliest stages of the project cycle through effective internal quality control and support; (ii) delineating increasing roles for Local Government Institutions (LGI) involvement in line with the local government reforms along with necessary capacity development of LGIs; (iii) reorganizing LGED as an effective water resources sector agency having the necessary managerial capacity in non-engineering issues; and (iv) supporting completed subprojects with sound financial, social, and technical audits. Expansion of the small-scale water resources development is one of the key elements to reduce rural poverty effectively.

Through implementation of the project, incremental cereal production is estimated at about 200,000 tons from about 180,000 hectares of cultivated land. About 280,000 farm

families comprising about 10 million person-days is expected to be generated from about 20 million cubic metres of earthwork implementation. Poverty reduction will also be facilitated through increase in farm labour. Implementation of the project is still under way and the overall progress is approximately 90%. The location map of the Phase-2 are shown in Figure 2.2

Source: LGED, 2009

Figure 2.2: Location Map of Phase-II of SSWRDSP

2.2.9 Rubber Dams Project

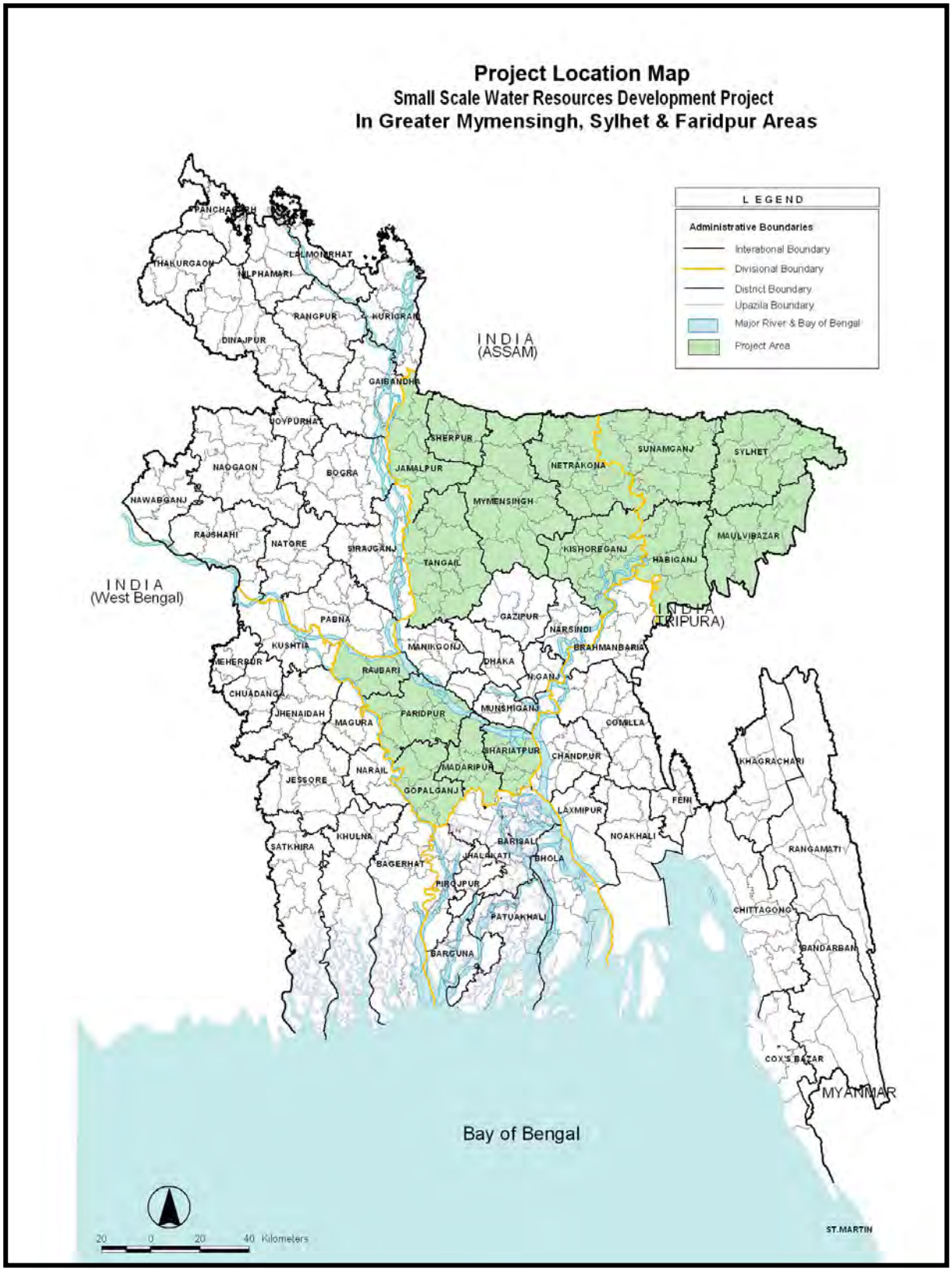
LGED first implemented two Rubber Dams projects in Cox's Bazaar district in 1995 on a pilot basis with the technical co-operation of the Institute of Water-resource and Hydropower (IWHR), China. Rubber Dams are flexible dams made of rubber bags mounted on concrete floor, normally inflated by pumping air, water or both to retain water for purposes like irrigation, water supply, recreation etc. The dam heights are adjustable in height on requirement and can be fully deflated during floods. Fully inflated Bakkhali rubber dam in Cox's Bazaar district is shown in Figure 2.3. Inspired by the success of the pilot projects, the Government considered Rubber Dams for wide replication and, consequently, has undertaken further Rubber Dam Projects in the country. Since them LGED has constructed 14 Rubber Dam funded under the Ministry of Agriculture. Beneficiary participatory irrigation management and O&M system have been adopted for the Rubber Dam Projects. The average implementation cost of rubber dam is Tk 38,500 per hectare (equivalent to US$660) and the average annual cost of maintenance is Tk 250 (equivalent to US$4.30). The projects provide dry season irrigation water to about 7,555 ha of cultivated land with increased rice production by 3,150 tons. Non-rice crop production also increased significantly (Islam, 2006).

Figure 2.3: Bakkhali rubber dam, Cox's Bazaar.

2.2.10 SSWRDP in Greater Mymensingh, Sylhet and Faridpur Areas

Built on the achievements of the 1st and 2nd Small Scale Water Resources Development Sector Projects, the Japan Bank of International Cooperation (JBIC) is funding Small Scale Water Resource Development Project (SSWRDP) under LGED which was launched in May 2007 with a target to implement about 200 subprojects during the year 2008 to 2013 covering 122 Upazilas of 15 districts of greater Mymensingh, Sylhet and Faridpur areas. Total cost of oroject is about US$65.0 million (JBIC loan 70%, Government 30%). The most significant departure from SSW-2 procedures is that the integrated water resources management unit (IWRMU) is responsible for planning and design, as well as project monitoring and evaluation. The IWRMU Planning and Design Section will oversee the preparation of PRAs, Subproject Feasibility Reports and detailed designs. The IWRMU will retain all its previous functions. The main objectives of the Project are to increase agricultural and fisheries production, enhance rural job opportunities and hence contribute in poverty reduction in the project area through development of infrastructures and beneficiaries' participatory institutions for sustainable stakeholder driven small scale water resource development and management subprojects. The objectives are to be achieved by (i) constructing infrastructures and developing/upgrading water management systems in small scale water resources subprojects; (ii) establishing and institutionalizing local stakeholders' participation for sustainable operation, maintenance and management of the systems; (iii) enhancing capacity of Government institutions and facilities in establishing and maintaining sustainable water management systems; and (iv) enhancing access of the landless poor in the subproject areas to employment opportunities and to public natural resources.

The Project will provide improved water management in about 130,000 ha agricultural lands that will benefit about 150,000 farm families. It is expected that the Project will give annual incremental production of 420,000 tons cereal and non-cereal crops and 6000 tons of fish. The Project investment will generate some 6.5 million person-days of local employment for earthworks construction. Besides, further employment will be generated both in farm and non-farm sectors due to the increased production and activities related to that. Thus, the Project will have a strong positive impact on rural poverty reduction. (LGED, 2007). The location map of SSWRDP in greater Mymensingh, Sylhet and Faridpur Areas are shown in Figure 2.4



Source: LGED, 2007

Figure 2.4: SSWRDP area Map.

2.2.11 Participatory Small Scale Water Resources Project (PSSWRP)

Based on the successful outcome of ADB supported sector projects SSW-1 and the ongoing SSW-2, a follow up Participatory Small Scale Water Resource Project at a total cost about US$ 130 millions is in the process of loan approval with ADB, IFAD, GON and GOB. The Project will enhance the effectiveness and increase sustainability in agriculture and fisheries production along with poverty reduction through small scale water resource (SSWR) development. The Project will continue to institutionalize and internalize the beneficiary driven approach for sustainable small scale water resources management. At the same time, the Project will give particular attention to poorer sections of the community by targeting locations having more than 40% of the subproject benefit area owned by landless sharecroppers, marginal or small farmers. Employment opportunity will be generated, both during subproject implementation, and later as a result of increased activity related to the projected significant increase in crop production following subproject completion. Estimates based on the findings of sample subprojects are that general employment opportunities will increase by around 15%, while employment opportunities for women are expected to increase by 20%. Environmental and social safeguards as well as concern for the impacts of climate change have been given a high priority and are integrated with the Project design.

2.3 Impact Evaluation of SSWRDSP

2.3.1 Internal evaluations

After the completion of the Small Scale Water Resources Development Sector Project (SSW-I), LGED published “Project Final Report” of SSW-1 in 2003 (LGED, 2003) which summarizes the project components, presents the achievements and effects, analyses the implementation process and reviews lessons learned for SSW-2. These are described as follows:

Subproject impact on agriculture: Overall increase in land use intensity was a modest 10 percent; there is significant variation from subproject to subproject. Some subprojects declined in land use intensity from the base line or pre-subproject situation. This follows on from a common trend in Bangladesh where if the opportunity to increase monsoon

season crop production is created (in this case through flood control and drainage), farmers are less inclined to produce the less profitable, more management intensive winter and pre-monsoon season crops. Incremental increase in land use intensity in the remaining subprojects was mainly the result of: i) Improved post-monsoon drainage, which allows the insertion of a late monsoon crop (usually mustard but could be other) prior to planting the Boro. ii) Increase residual moisture resulting in an increased area of minor crops in water conservation subprojects (LGED, 2003).

Subproject impact on fishery: Fishery is considered important resources in 91 of the 280 subprojects. Floodplain fishery is a factor in all but 9 of these subprojects and 57 subprojects are producing fish from permanent water bodies. Average incremental production of floodplain fisheries was recorded as 1,175 MT in these 82 subprojects. The incremental production of seven subprojects was 1390 MT. The incremental production increases associated with remaining 34 subprojects in which production increased was 544 MT. There were 36 subprojects in which there was a decrease in flood plain fisheries amounting to 761 MT. The balance of 14 subprojects showed no change. It is shown from the data analysis of genuine fishers and fish cultivators of 91 subprojects that while genuine fishers have been adversely affected, the landless fish cultivators have benefited considerably (LGED, 2003).

Employment generation: Implementation of 280 subprojects required construction or rehabilitation of embankment and re-excavation or excavation of canal. This provided opportunities for 8.40 million person-days of temporary employment to complete 21 million cubic meters of earthwork. Accordingly, US$ 12 million was spent to pay the local laborers for the earthworks (LGED, 2003). The employment opportunity related to subproject earthworks was provided to local landless people. The landless people formed labor contracting societies (LCS). The project organized training for LCSs through the local NGOs. The LCSs ensured that subproject earthworks are directly awarded to the local poor. Trees are grown on the slopes of the embankments. Destitute women have been engaged for taking care of the trees. Farm labor's use has increased in three crop seasons in the year. Expansion of cropped area and more HYV rice production have significantly contributed to labor demand.

2.3.2 External evaluations

Based on SSW-I achievements, the Second Small Scale Water Resources Development Sector Project (SSW-II) had been planned and undertaken for implementation in the period from November 2001 through 2009. The GOB, ADB and GON agreed that an external evaluation of the SSW-I should be done shortly after its completion so that the lessons learned could feed into the SSW-II. Bangladesh University of Engineering and Technology (BUET), Bangladesh Institute of Development Studies (BIDS) and WL/Delt Hydraulics had done the external evaluation in the year 2003 (BUET et al, 2003).

An evaluation of SSW-I was carried out by Evaluation Sector, Implementation Monitoring and Evaluation Division, Ministry of Planning, Government of the People's Republic of Bangladesh in 2005 (IMED, 2005).

In order to examine the performance of the subprojects a Benefit Monitoring and Evaluation (BME) Study was put in place, covering 40 subprojects. The BME study involved a benchmark study of 30 subprojects under SSWRDSP-2, carried out before their implementation. It also consisted of an impact evaluation study, which involved evaluation of 10 subprojects of SSWRDSP-1. Bangladesh Institute of Development Studies (BIDS) was engaged by LGED to conduct the study (BIDS, 2008).

From these above external evaluations the findings are shortly described as follows:

Subproject impact on agriculture: Agricultural benefits appear to have accrued to the sub-projects due to increased cropping intensity, changes in cropping pattern and higher yields. It appears that among the rice crops, the number of beneficiaries producing Aus has declined to an extent of 47% compared to the before project situation. The number of beneficiaries producing Aman (local and HYV combined) has not increased much (2%) while those producing Boro (local and HYV combined) have changed to a great extent by nearly 134%. Cropping intensity before the project was 176%, while it is 237% now. The yield increase compared to before project situation is the highest for Aman rice (63%, local and HYV combined), followed by Boro rice (31%, local and HYV combined) and Aus (12%). The value of agricultural land has increased by 67% (BUET et al, 2003).

A comparison of yield of rice crop (HYV Boro) between the project and the control areas shows that the yield was lower in the project area (5.06 t/ha) compared to the control area (5.17 t/ha). For HYV Aman the yield rates in both the areas were same but for HYV Aus the yield rate in the project area was marginally higher compared to control area; for LV Boro an opposite situation can be noticed (BIDS, 2008a).

There is a considerable increase of production of crops, especially paddy, wheat, jute, sugarcane, oil seeds, etc. in terms of both quantity and percentage. For example, in project areas the production of paddy like Aus, Aman and Boro increased by 0.0157, 0.0280 and 0.0412 tons per hectare from the pre-project production level. Similarly the production of crops like wheat, barly, corn, sugarcane, jute, pulse etc. increased by about 0.0160, 0.0535, 0.0831, 0.0286, 0.0118 and 0.0156 tons per hectare respectively (IMED, 2005)

Subproject impact on fishery: Natural fisheries seem to have been declining in most of the sub-projects (but not necessarily due to the sub-projects), while opportunity for culture fisheries have been increasing. Poor fishermen (making a living out of natural fisheries) are opposed to development of culture fisheries. Sometimes there is conflict of interest related to natural fisheries, culture fisheries, shrimp culture and agriculture (BUET et al., 2003).

Among the fisher households from the project areas, there had little increase in participation in open water fishing from the small-holder groups, while there was no change in the number of households from the medium and large holder fishing in inland open water. In the control areas, there was slight decrease in open water fishing by the marginal and small farmers. The productivity of ponds in the project and control areas stood at 2.3 and 2.5 tons per hectare respectively, which compared nearly favorably with the national average production of 2.4 tons per hectare. The productivity in the control area appeared to be high compared to that in the project area even though most of the ponds and ditches in the project area were reportedly used for the year-round fish culture (BIDS, 2008a).

Employment generation: The sub-projects have generated labour opportunities for landless people and destitute women, especially during construction. Due to the increased

agricultural activities labour opportunities in this sector have increased. Wage rates in some of the sub-project areas have been raised indicating a tightening of the labour market indicating higher levels of income for hired labour who are generally poor. Labour shortage situation has developed in some areas and that landowners therefore are more inclined to lease their land to landless people (BUET et al., 2003).

Annual mean supplementary income of respondents (intervention groups) from earth, vegetable gardening, poultry and fisheries is Tk. 7891.80, compared to Tk. 6863.74 of the control groups. Before the project, the income of the intervention groups was Tk. 4491.11. The present income shows an increase by 76% (IMED, 2005).

Poverty reduction: The mean monthly family income of the marginal farmers belonging to intervention group increased from Tk. 1805.76 (at pre-project period) to Tk. 2324.67 (during project implementation) which reflects an improvement of their monthly family income additionally by 29% (IMED, 2005). The link between the use of available water resources and poverty reduction is strong in the subprojects areas. Since the rural population is dependent on agrarian land for living, agricultural and fisheries development through improved water resources management is an effective approach to reduce poverty. Employment of local labors in earthworks, increase in agricultural and fisheries production and own capital formation by WMCA through shares and savings in the subproject areas is thus essentially are the instruments to reduce poverty (BIDS, 2008). The average per capita daily calorie intake has been estimated at 2,210 Kcal for the project area, as against 2,336 Kcal for the control area.

2.3.3 Other evaluations

Some post-graduate research has been carried out on a number of subprojects of SSW-I and Small and Medium Scale projects of BWDB. Some of their findings are described as follows:

Mukherjee (2004) studied the agro-socio-economic performance of schemes to identify the key causal factors for the poor efficiency of the projects and to formulate a suitable participatory management approach for small and medium scale water sector development projects in Bangladesh. He worked on four subprojects of SSWRDSP of

LGED and one medium scale water sector development project of BWDB. He reported that beneficiary dissatisfaction about WMCA/WUO activities in most of the study areas is prevailing. Within small scale projects local beneficiaries claimed that most of the times WMCA executives in the area did not involve the members in day-today management activities and they were not informed well about monthly or weekly meeting and decision. He found that improper system maintenance and lack of beneficiary participation was the main reason behind the lesser success of water schemes. He suggested that democratic procedure must be followed in the formation of WMG, WMA and WMF. Internal conflict and power practices by rural articulate people should be kept minimal during organizational formula. The appliance of the proposed management models needs proper authority under strong legislative environment. This study recommended that the performance of existing FCDI projects can be improved significantly by enabiling increased people's participation in local level and by developing a suitable management approach that will have a strong institutional setting.

Harun (2005) studied the some projects on fisheries. He worked on four subprojects of SSWRDSP of LGED. He reported that capture fishery that play an important role in alleviating nutritional deficiency of human being and in particular of the poor are decreasing rapidly due to the implementation of SSWRDSP but the culture fisheries have improved in most of the subproject as the flood and required water depth for fish cultivation are under control. Satisfactory fish production from culture fishery has been found in the subprojects where full responsibility to manage the subprojects was given to WMCA and in this situation the real beneficiaries are affected positively by the subprojects. The number of fish cultivators has increased in most of the subprojects but the number of part-time and fulltime fishermen has decreased significantly due to the restriction of free access to the open water capture fishery and loss of open water flood plain fish habitant. Effective and periodic monitoring and evaluation of the projects with fisheries components by LGED is necessary so as to mitigate the loss of capture fisheries through culture fisheries.

Murshed (2008) studied the management of conflicts between irrigation and fisheries in selected water resources projects. Her findings were: i) there has been severe impact on the livelihood of the fisherman as they were not properly compensated which resulted as extreme poverty in the fishing community; ii) most fishermen were not aware of the

project at the project formulation process; iii) fisheries officers were not closely involved in FCD sub projects; iv) lack of active participation of local inhabitants and fishermen in WMCA; v) WMCA was supposed to rehabilitate the affected communities by sanctioning loan, giving training, providing a training room for female members, etc. but in fact they were approving loan to those who were favorable to their interests. The weaker portion, especially the fisher group, did not gain any benefit from WMCA. She recommended that an external powerful, fair, unbiased group/ authority are vital to resolve the social conflicts.

Saleh (2008) studied the impact of the Kawraid River Rubber Dam Project on agriculture performance and poverty. Result of his study show that the average yield of Boro rice per ha in the year 2006-07 was about 30% higher than that of 2000-01 and the irrigation intervention with the project has reduced the poverty by 4.5%. For each percentage increase in irrigated area, poverty reduction was found to be about 0.2% in the with project area.

Rahman (2008) studied the performance of the participatory water management of some selected small-scale water resources projects of LGED. The research focused on the evaluation of agro-socio-institutional performance of the schemes. He worked on three subprojects of SSWRDSP of LGED, two from Phase-I and one from Phase-II. His findings were i) a large number of beneficiaries were not aware of the WMCA formation activities (ii) many of the EC members were not much dedicated to their responsibilities and there was also internal conflict within WMCA executives and (iii) due to lack of proper O&M, most of the structures remained inactive.

Runu (2009) studied the water poverty status in selected small-scale water resources projects. She assessed the water poverty status in her study area based on a Water Poverty Index (WPI). She found that the overall WPI has improved by about 30% and 9% in the Narayankhali and Boronurpur subprojects, respectively. She recommends that WPI structure may be considered for feasibility study and project monitoring of LGED.

CHAPTER THREE
STUDY AREA

3.1 General

The study area was selected on the basis of poor performance of subprojects. Therefore, a completed subproject, Sirajpur Haor FCD subproject was selected as the study area among 280 completed subprojects of Phase I of Small Scale Water Resources Development Sector Project of LGED. The project was selected because it had all the water management components (flood control, drainage, irrigation and fisheries development) and past familiarity of the project by the researcher.

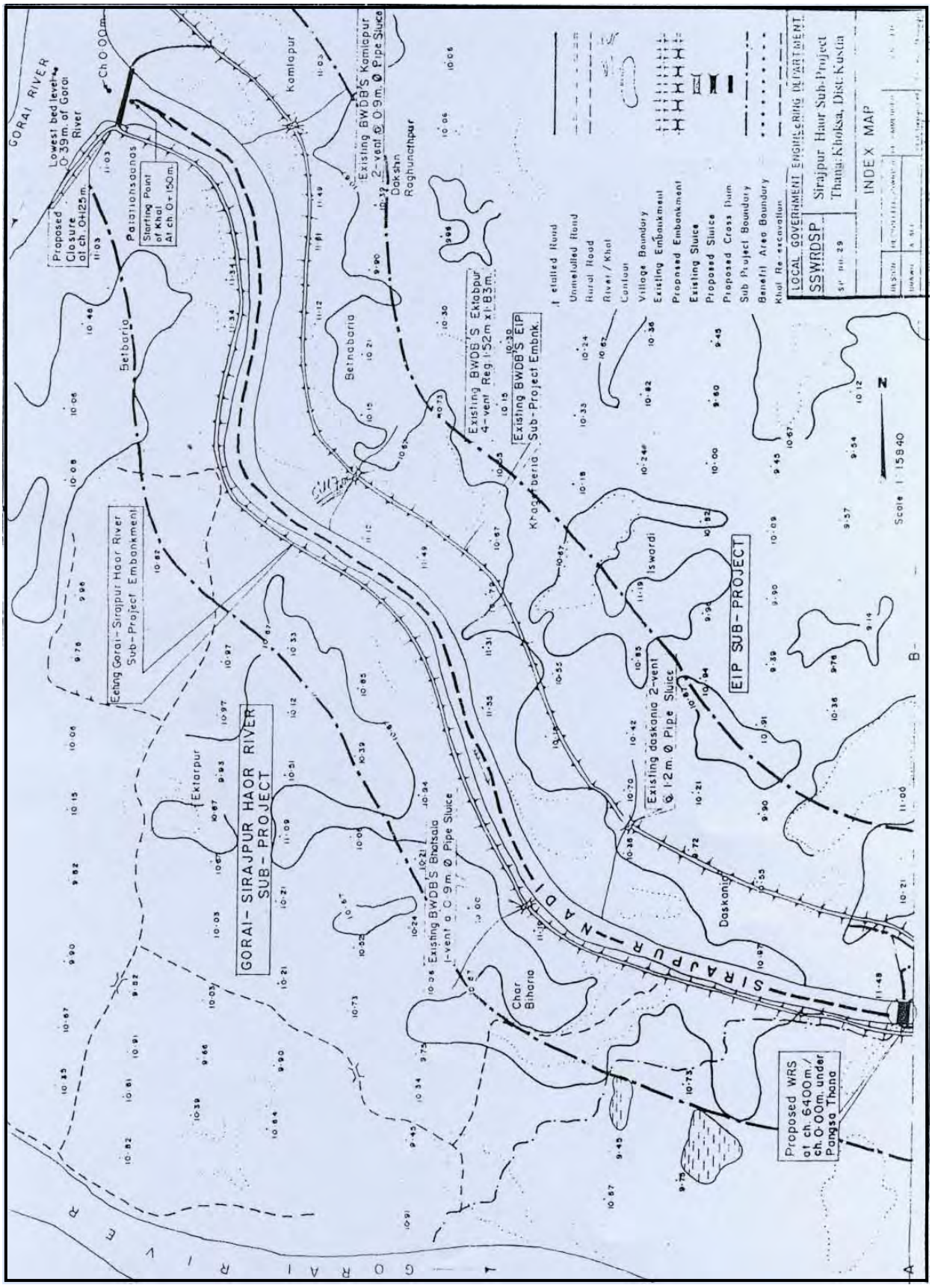
Sirajpur Haor subproject was completed in June, 2002. It is an irrigation, drainage improvement and fishery development subproject. The subproject has a gross area of about 630 hectares with net benefited area of about 470 hectare. It was proposed that re-excavation of the Sirajpur Nadi for 6.40 km and construction of water retention structure (WRS) will conserve more water during dry season and create opportunities for irrigation to about adjoining 500 meter strip of lands (about 470 ha) and will develop fisheries. It was estimated that after completion of the subproject, the HYV Boro area would increase from 0 to 345 ha and the total fish production would increase from 4.92 metric tons (MT) to 147.6 MT (LGED, 1997). A brief description of the study area is presented in the following section.

3.2 Location

The Sirajpur Haor FCD subproject is located in Khoksa Upazila in Kustia District. It falls in Khoksa and Janipur unions of Khoksa Upazila. Approximate geographical location is between $23^0 45'$ to $23^0 47'$N latitude and $89^0 17'$ to $89^0 19'$E longitude. The area is bounded by the BWDB Gorai Sirajpur Haor subproject on the east and south and an Early Implementation Project (EIP) on north and west. The Khoksa Upazila map with the location of the subproject and index map of the subproject are shown in Figure 3.1 and Figure 3.2, respectively.

Source: Banglapidia

Figure 3.1: Khoksa Upazila, Kustia



Source: LGED, 1997

Figure 3.2: Index map of Sirajpur haor subproject

3.3 Climate and rainfall

The typical climate of Bangladesh having two distinct seasons - the monsoon Season (April-October) and the dry Season (November-March) separated by two transition periods- the pre-monsoon and the post-monsoon prevails in the study area. Kustia district does not have a climatic station. The nearest climatic station to the project area is located at Jessore and the nearest rainfall station to the project area is located at Kustia (Table 3.1). Mean annual district rainfall is 1593 mm. Table 3.1 shows that the rainfall is heavily concentrated during the monsoon season (June-October, 1223 mm), which accounts for about 77% of the total annual rainfall.

Maximum temperatures vary from 25.4^{0}C to 35.9^{0}C. The highest temperatures are experienced during the pre-monsoon period (Aril-May). Daily minimum temperature can fluctuate significantly during the year, ranging from about 10.5^{0}C to 25.7^{0}C. Daily mean humidity can fluctuate significantly during the year, ranging from about 62% to 87%.

Table 3.1 Climatic data applicable to the study area

Parameter	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Temperature (^{0}C):												
Max	25.5	28.4	33.6	35.9	35.2	32.9	31.4	31.6	32.1	31.4	28.8	26.4
Min	10.5	18.7	18.7	23.2	24.9	25.6	25.7	25.7	25.4	22.9	16.6	11.5
Humidity (%):												
9 AM	81.0	77.0	72.0	75.0	79.0	85.0	86.0	88.0	87.0	84.0	80.0	82.0
6 PM	67.0	59.0	52.0	57.0	71.0	82.0	86.0	87.0	86.0	83.0	74.0	74.0
Mean	74.0	68.0	62.0	66.0	75.0	83.0	86.0	87.0	86.0	83.0	77.0	78.0
Mean rainfall (mm)	6.52	20.94	21.61	93.99	199.96	274.16	320.73	251.66	256.59	120.59	15.81	10.83

Source: BRRI

3.4 Topography

The study area lies in the non-tidal region and is characteristically comprised of medium low and flat lands. The elevation of the study area varies from 8.99m PWD to 11.89 PWD (LGED, 1997). The area can be divided into three land types. These are highland (F0), medium highland (F1) and medium lowland (F2). The highlands account for 36.6% of the cultivated area where occasionally the flood depth reaches 0 to 30 cm during monsoon.

The medium highlands where seasonal flooding ranges from 30 to 90 cm, occupy 46.4%. The medium lowlands account for 17.0% of the cultivated area where seasonal flooding ranges from 90 to 180 cm.

3.5 River Water Level

The subproject is situated along both banks of the Sirajpur Nadi, a distributory of the Gorai river and is adjacent to the Gorai river. The water level in the subproject area is directly influenced by Gorai river. There are two water level gauge stations on Gorai river in the vicinity of the subproject. One station is located at Gorai Railway Bridge, 22.50 km upstream of the starting point of the Sirajpur Nadi, and the other station is located at Kamarkhali, about 32.5 km downstream. The monthly water level at Gorai Railway Bridge and Kamarkhali are shown in Appendix A and Appendix B, respectively.

3.6 Socio-economic situation

Table 3.2 depicts the information regarding the ownership of land in the subproject. It is stated that approximately 79% of the beneficiaries of the subproject area belongs to the small and marginal category (own less than one ha of land). This group of farmers own approximately 36% of total land in the subproject area.

Table 3.2: Land ownership pattern

Category of Farmers	% of households by category	% of land owned by category of farmers
Landless (up to<0.2 ha)	34	8
Marginal farmers (0.2 – 0.6 ha)	26	15
Small farmers (0.6 – 1.0 ha)	19	13
Medium farmers (1.0 – 2.0 ha)	13	20
Medium large farmers (2.0 – 4.0 ha)	6	26
Large farmers (4.0 ha and above)	2	18
Total	100	100
Farmers owning less than 1 ha	79	36
Farmers owning more than 1 ha	21	63

Source: LGED, 1997

Farming and the selling of labour, particularly for agricultural activities, are the main occupation in the area. The numbers of people engaged in government services or petty trading are insignificant; factory workers are totally absent in the area. Farming and its related activities are the main source of income for the subproject beneficiaries. There is a seasonal variation of wages for agricultural labour.

3.7 Agriculture profile

The net cultivated area (486 ha) accounts for 77.1% of the gross area (630 ha). Benefited area (470 ha) accounts for 96.7% of the net cultivated area. The land classification of the study area is shown in Table 3.3.

Table 3.3: Land classification by flood depth of study area

Land Class	Land Type	Gross Area (ha)	Net Cultivated Area (ha)	Benefited Cultivated Area (ha)	Non-cultivated Area (ha)
F0	High (d<30cm)	220	188	172	32
F1	Medium High (30cm<d<90cm)	248	218	218	30
F2	Medium Low (90cm<d<180cm)	80	80	80	-
F3	Low (d>180cm)	-	-	-	-
F4	Very Low (Non cultivated low land of which permanent water body)	82	-	-	-
Total		630	486	470	144

Source: LGED, 1997

In Kharif-II (monsoon), transplanted Aman is the main crop grown under rainfed conditions. Local T. Aman has a longer stem and can withstand some degree of flooding while short-stem HYVs are cultivated on lands with lower depths of flooding. B. Aman, i.e. deep water rice, is able to grow in deep water of more than 2 meters and is mainly cultivated in beels and depressed basins. It is a photosensitive crop with 7 to 8 month growth duration.

Rabi (dry) crops such as wheat, mustard, pulses and vegetables are mainly grown on residual moisture and sometimes with available irrigation water. HYV Boro is the main rice crop which is mainly irrigated by shallow tube wells (STWs). Lack of surface water during the dry season limits the expansion of low lift pumps (LLPs). The dominant cropping patterns in the study area are Boro – Fallow – HYV T. Aman, Fallow – B. Aman and Vegetables – Jute – T. Aman. Major cropping pattern in the study area is shown in Table 3.4.

Major cultivated areas of subproject are irrigated by Shallow Tube Well (STW) and rest is irrigated by surface water from Sirajpur Nadi. Low Lift Pump (LLP) is used for surface irrigation from Sirajpur Nadi.

Table 3.4: Major cropping patterns in the study area

Cropping Patterns		
Rabi	Kharif-I	Kharif-II
Boro	Fallow	T. Aman
Fallow	B.Aman	
Vegetables	Jute	T. Aman
Wheat	Jute	T. Aman
Pulses	Jute	T. Aman
Oilseeds	Aus	T. Aman

Source: Upazila Agricultural Office

3.8 Fisheries profile

Sirajpur Haor is an old channel of Gorai river. During the pre-project situation the important species of fish available in the subproject water bodies are Rui, Catla, Shing, Koi, Mrigal, Mirror Carp, Shorputi and Magur. The area of open water body along with depths of water during the dry season and monsoon months are recorded and the fish production, pre-project fishery management and the number of professional fisher-persons are listed in Table 3.5

Table 3.5: Fishery survey data

Open Water Body	Dry Season		Monsoon Season		Annual Production (kg)	Pre-project Management	Fisher Person (No.)
	Area (ha)	Depth(m)	Area (ha)	Depth(m)			
Sirajpur Haor	64.00	1.5	100.00	8.0	4920	Natural	80

Source: LGED, 1997

3.9 Physical components of Sirajpur Haor FCD subproject

Details of physical components are shown in Table 3.6. The earthen cross-dam, re-excavation of the Sirajpur Nadi and water retention structure (WRS) have been constructed for the purpose of conserving more water during dry season and create opportunities for irrigation to about adjoining 500 meter strip of lands and for developed fisheries. The water retention structure is also designed to have adequate capacity to drain the total drainage flows of all existing sluice on both banks of Sirajpur Nadi.

Table 3.6: Physical components of the subproject.

Name of Works	Size / Length
Earthen Cross Dam	0.06 km
Sirajpur Nadi Re-excavation	6.21 km
Flushing Sluice (WRS)	2 – V (1.5m X 1.8m)
Fish Screen	–

3.10 Water management and governance

The Small Scale Water Resources Development Projects (SSWRDSP) is designed in such a manner that the water management and governance of the projects are carried out by the beneficiaries themselves. For this purpose, LGED formed Water Management Cooperative Associations (WMCA) in every subproject by the direct vote of

beneficiaries. WMCA consists of a President, Vice President, Secretary, Cashier and at least 6 to 8 members. WMCA is the proper authority to manage the SSWRDSP. One of the prime responsibilities of WMCA is to collect 2% (average) of the implementation costs of the project from the beneficiaries. The personnel of WMCA are trained by LGED/others organizations on fish culture practices, integrated pest management, as well as the use of compost and green manure fertilizers. The optimum benefits of agriculture and fisheries from the subproject area largely depend on the active and proper involvement of WMCA. For Sirajpur Haor FCD sub project, the WMCA was formed on 27th January, 1997 and registered on 13th February, 1997. The date of last election is 17th March, 2007. Total fund (share and savings) of WMCA is Tk. 123153.00. With this money they mainly run their micro credit activities.

CHAPTER FOUR
METHODOLOGY

4.1 General

This study deals with the assessment of the present status and problems of Sirajpur haor subproject and its rehabilitation potentials through Focus Group Discussion (FGD) and interview with different stakeholders. Another objective of this study is the technical analysis of the development potentials using the present infrastructure. To meet the specific objectives both qualitative and quantitative data were collected on Sirajpur Haor subproject area from primary as well as secondary sources. Primary data were collected using various social observation tools and field measurements. Secondary data were also collected to support the study's analysis and findings. A brief description of methodology for data collection and analysis are presented in the following section.

4.2 Data Collection

Both qualitative and quantitative data were collected on Sirajpur Haor subproject area from primary as well as secondary sources.

4.2.1 Primary data collection

The primary data collected are (i) Agro-hydrologic (types of crop grown, timing and use of irrigation, crop area, cropping pattern, yield, etc) (ii) Fishery (fish types, yields, timing of fish cultivation and fish catch, status of fish cultivators and fishermen, reasons for increase/decrease in production etc.) (iii) Technical surveying (cross section data of Sirajpur Nadi, water level, adequacy of drainage) and (iv) Socio-economic (status of WMCA, perception of stakeholders about subproject status and future potentials etc).

4.2.1.1 Field measurement of cross-section and water level

For the assessment of water availability in Sirajpur Nadi, cross-sectional data (9 staff reading at an interval of 3m to 6m) were measured at 21 locations at an interval of 300m

along longitudinal profile (Appendix C). For estimating the seepage and percolation (S&P) loss, the water level of Sirajpur Nadi was measured at an interval of about one and half month. A typical picture of taking cross-sectional data of Sirajpur Nadi is shown in Figure 3.3.

Figure 4.1: A view of taking cross-sectional data of Sirajpur Nadi

4.2.1.2 Stake holders' assessment with the help of PRA

In order to assess the agro-hydrologic, fishery and socio-economic status in the study area focus group discussion (FGD) were conducted with different stakeholders such as farmers, fishers, members of WMCA and mixed groups of community people with similar interest. Four FGD meetings were arranged during the several field visits from April 2008 to December 2008. FDG's were conducted at Ektarpur Bazaar in Khoksa. In each FGD about 10-15 people took part in the discussion.

Apart from FGDs, Key Informant Interviews (KII) was also applied for collection of information on the overall aspects of the study based on observations and experiences of

the local community. Structured Interviews with resource persons of different organizations, such as LGED, Agriculture and Fisheries Departments were conducted with a target to collect both qualitative and quantitative information on certain aspects as per requirement of the study.

4.2.2 Secondary data collection

The secondary data was collected from the appraisal report of the subproject, local and head office of LGED, different government sources like agriculture extension offices, fisheries offices and BWDB etc. Rainfall data from 1961 to 2002 (Appendix D) and water level data from 1981 to 2002 for Gorai Railway Bridge and Kamarkhali were collected from BWDB. Crop coverage, cropping pattern, irrigation practice and performance data were collected from Upazila Agricultural Office and WMCA. Types of fish cultivated, area and production etc. data were collected from Upazila Fisheries Office and WMCA. The data on total number of people and groups (farmer, fishermen etc.) that are considered as beneficiaries of the subproject were also collected from WMCA.

4.3 Determination of Monthly Water Availability

To determine the monthly water level in Sirajpur Nadi, water level during the of time of closing sluice gate, monthly rainfall, monthly evaporation and seepage and percolation (S&P) data of Sirajpur Nadi is required. It was observed that in the month of September the gate was closed. The monthly water level and the monthly volume of water available in Sirajpur Nadi were calculated from the following equations:

$$WL_{month} = WL_{P.month} + R_{(month)} - EV_{month} - S\&P_{month} \quad (4.1)$$

$$V_{month} = \bullet A_{water} * d \quad (4.2)$$

Where, WL_{month} = monthly water level

$WL_{P.month}$ = water level at the previous month

$R_{(month)}$ = monthly rainfall

EV_{month} = monthly evaporation

$S\&P_{month}$ = monthly seepage and percolation

V_{month} = monthly volumn of water available in Sirajpur Nadi

A_{water} = cross-sectional area of Sirajpur Nadi at different section

d = distance between two cross-sectional area.

4.4 Computation of Irrigation Water Requirement (IWR)

Irrigation water requirement depends on evapotranspiration, effective rainfall, seepage and percolation. The 80% probable rainfall has calculated by using the Gamma Distribution. The rainfall data from 1961 to 2002 were used in probability analysis. Average values of maximum and minimum water levels were considered for calculation of monthly water level in the study area. Monthly rainfall data applicable for the study area is shown in Appendix D.

Water requirement for Boro paddy was estimated as this was the major pre-project irrigated crop. The major criteria considered for estimation of irrigation water requirement are:

1) Land preparation (LP) water requirement was assumed as 150mm (IWM, 2001).
2) Crop Evapotranspiration (ET_O) data were calculated by using CROPWAT software (FAO, 1998).
3) Crop coefficient (Kc) for different growth stages were considered as 1.10 for vegetative phase (60 days), 1.20 for reproductive phase (30 days) and 0.9 for ripening phase (30 days, IWM, 2001).
4) Seepage & percolation (S&P) rate was considered as 5 mm/day (Appendix I)
5) As in the dry season, the precipitation is very minimal, it was assumed that no water will be lost through surface run-off and the total rainfall was considered as effective rainfall. The irrigation water requirement (IWR) has been estimated using the following relationship.

$$IWR = ETc + S\&P - R \quad (4.3)$$

Where, ETc = crop evapotrnspiration (mm/day),
S&P = seepage & percolation (mm/day) and
R = 80% dependable rainfall (mm/day).

The Scheme Irrigation Requirement (SIR) has been calculated by considering on overall efficiency of 70% IWR (IWM, 2001).

4.5 Calculation of Volume of Earth Re-excavation of Sirajpur Nadi

As the sill level of flushing sluice gate which was constructed at chainage 51m of Sirajpur Nadi at 8.1m PWD, the design bed level of Sirajpur Nadi was considered 0.5m bellow the sill level (as per LGED design consideration) i.e 7.6m PWD at the starting point of re-excavation. According to the cross section of Sirajpur Nadi (Appendix C) the design bed width is considered as 20m and side slope is 1.5:1. AutoLISP program and AutoCAD software are used for the calculation of volume of earth re-excavation.

CHAPTER FIVE
RESULTS AND DISCUSSION

5.1 Present Status of the Subproject

The present status of the project was ascertained from the analysis of both primary and secondary data and from the FGDs with the stakeholders.

5.1.1 Agriculture

It has already been mentioned that the implementation of the subproject was expected to increase the cropped area and HYV rice production due to drainage improvement and availability of irrigation. The fish production was also expected to increase manifold.

5.1.1.1 Crops and cropped area

The major crop in the subproject area was transplanted Aman which was cultivated in about 260 ha during the Kharif II (monsoon) season. The Aman cropped area was expected to remain the same after the implementation of the subproject. All the Kharif-I and winter/Rabi crops other than Boro were expected to be replaced by new irrigated HYV Boro due to the subproject implementation. During the field visit in 2008, it was observed that due to scarcity of water and also use of the water for culture fisheries, the water of Sirajpur Nadi was not used for HYV Boro cultivation. The farmers use STW for Boro irrigation and very limited amount of water of Sirajpur Nadi is used for irrigation of sugarcane, wheat etc. The irrigated crops and cropped area of the Sirajpur Haor subproject area (pre-project, planned, during 2004 and 2008) are shown in Table 5.1.

5.1.1.2 Development of irrigation

It is evident from Table 5.1 that the subproject has failed in achieving its main objective of increasing the irrigated HYV Boro area from 0 to 345 ha. In the subproject area it was found that ground water is mainly used for rice irrigation. Most of the farmers have STW.

Table 5.1: Cultivated crops and cropped area of the study area.

Crops	Pre-project (1996) Condition	Post/Planned project Condition	During 2004 Condition	Field Visit (2008) Condition*
	Cropped Area (ha)	Cropped Area (ha)	Cropped Area (ha)	Cropped Area (ha)
Jute	94	0	23.5	10
Wheat	72	0	74.5	30
Oilseeds	59	0	60	15
HYV Boro	0	345	292.7	0
Local Boro	125	125	300.4	40
Sugarcane	0	0	0	60
Banana	0	0	0	10
Betel Vine	0	0	0	10
Turmeric plant	0	0	0	7
Vegetables	0	0	64.2	15
Total	350	470	815.3	197

Source: Field data and LGED, 20094

* Cropped areas which are irrigated only by surface water from Sirajpur Nadi

Only small amount of water from Sirajpur Nadi is used for household purposes and for some non-cereal crop irrigation. The farmers are interested to cultivate sugarcane and betel leaf and the betel leaf area is increasing day by day after the subproject implementation. Water is carried by the 7.5 cm diameter hose pipe through LLP to the crop fields. Farmers do not have to pay for the water of Sirajpur Nadi. Due to the difficulties of water conveyance and water availability from Sirajpur Nadi, farmers are not interested to use this water for HYV rice irrigation purpose. The present total irrigated area is 197 ha (Table 5.1).

5.1.2 Fisheries

It has already been mentioned that at the pre-project stage, Sirajpur Nadi had an open water capture fishery production system. Due to prevention of fish migration from Gorai river and re-excavation of the Sirajpur Nadi, it was converted to a culture fishery production system. But, the fish production is at a deplorable state. Violating the rules of project, the Water Management Cooperative Association (WMCA) has leased out the Sirajpur Nadi to some local commercial fish farmers (non-fishermen) for fish cultivation. Fish cultivators have constructed temporary earthen cross dams in the river to make

compartments in order to facilitate fish cultivation and also for conservation of water. Four such cross dams of about 2.4 m in height from the river bed level have been constructed at chainages 1.28 km, 3.1 km, 5.6 km and 6.1 km. In the project area, September to June is the period for fish cultivation. From the discussion with the WMCA members it was revealed that when the water level at chainage 0 (near the sluice at the mouth of Sirajpur Nadi) is at about 10m PWD in September, then the gates of the sluice are closed. The gates are opened again in June after the harvest of the fish and before the onset of the monsoon.

5.1.2.1 Water area of Sirajpur Nadi

The area between both banks of Sirajpur Nadi and the BWDB embankments are encroached day by day due to the settlements by poor and landless people. During the pre-project condition the total water area of Sirajpur Nadi was 82 ha (LGED, 1997). But, due to the increasing settlements, poor supervision and management by WMCA and social conflict (conflict between fish cultivators and traditional fishermen and boatmen, conflict between different political leaders and WMCA, etc), the present water area has been reduced to only about 18.3 ha. Such a tremendous decrease in water area not only affected the project fish production target, but also has put further fishery development potential of Sirajpur Nadi at stake. A post-project designed cross-section and present typical cross-section of Sirajpur Nadi are shown in Figures 5.1a and 5.1b respectively.

5.1.2.2 Fish production

During the pre-project condition, the yield of fish from capture fishery was low (60 kg/ha) and the total fish production was only 4.92t (LGED, 1997). It was expected that after the implementation of the project and with the adoption of modern cultural practices, the fish yield would rise to 1800 kg/ha and the total production would be 147.6t (LGED, 1997). During the post project condition, the fish production did not increase significantly and in 2000 the total production was estimated as 10t. (LGED, 2009). During the field visit in December, 2008, Secretary and some of the members of WMCA said that in the year 2008 fish cultivators sold fish at Tk.6,00,000.00 (Taka Six lacs). They also said that fish was sold approximately at Tk70.00/kg. From this information the fish production in that year was estimated as about 8.6t. From the present water area of the river, the

estimated yield of fish is only about 470 kg/ha (about 26% of the expected post-project yield). The yields and productions of fish (pre-project, planned, during 2000 and 2008) are shown in Table 5.2.

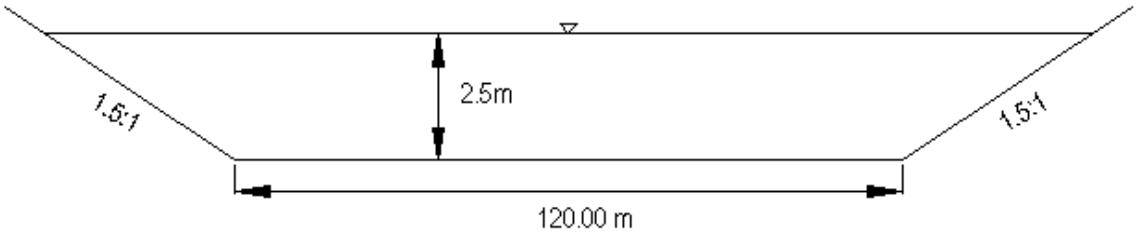


Figure 5.1a: A post-project designed cross-section of Sirajpur Nadi.

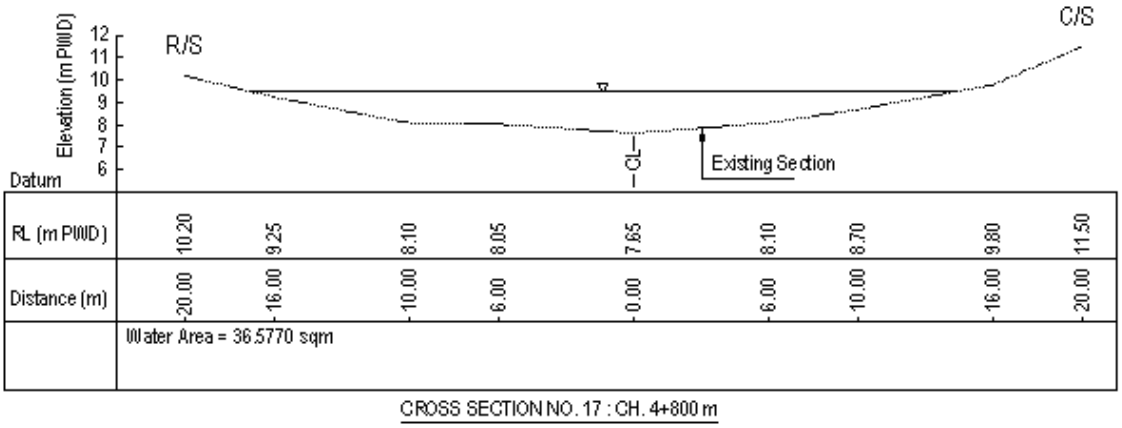


Figure 5.1b: Present typical cross-section of Sirajpur Nadi

Table 5.2: Status of fisheries (all species) in the study area.

Pre-project (1996) Condition			Post/Planned project Condition			During 2004 Condition			Field Visit (2008) Condition		
Water Area (ha)	Yield (kg/ha)	Production (kg)	Water Area (ha)	Yield (kg/ha)	Production (kg)	Water Area (ha)	Yield (kg/ha)	Production (kg)	Water Area (ha)	Yield (kg/ha)	Production (kg)
82	60	4920	82	1800	147600	-	-	10000	18.3	470	8600

Source: LGED 1997, LGED 2009 and Field visit

5.1.2.3 Fishers

During the pre-project days, there were 80 professional fishers in the project area (LGED, 1997). Due to the conversion from capture to culture fishery, poor management of the WMCA and leasing out of the river to the fish farmers, the fishers of the project area had to switch their profession. The number of fishers was reduced to only about 25 in the year 2001. During the field visit in 2008, there were no professional fishers directly involved in the fisheries management in the project area. From the discussion with the present fishers, it was found that most pre-project fishermen were not aware about the subproject at the subproject formulation process. The fishing community was not properly compensated but at present some fishermen are appointed by the fish cultivators to take care of fish of their leased area. Most of pre-project traditional fishermen were considered as problem creators by some of the influential people of WMCA because they talked about their rights on Sirajpur Nadi. For this they are forced to leave the project area by some of the influential people of WMCA. Now they are living in other nearby open water bodies for their livelihoods.

5.1.3 Water management and governance

Water Management Co-operative Association (WMCA) is the basic institution through which all the activities relating to the subproject should be carried out. All activities of WMCA should be run in a democratic way. WMCA was established under the legal framework of the Cooperative Societies Act 2001 and Cooperative Societies Rules framed there under. WMCA must fulfil a number of preconditions including (i) enrolment of at least 70% of beneficiary household as WMCA members; (ii) collection of full beneficiary contributions for O&M, (iii) project-affected persons are consulted, and (iv) environment mitigation and land acquisition plans are prepared.

The sub-project was handed over to WMCA on 27th May, 2004 and it was controlled by the politically powerful people. A significant number of primary stakeholders (fishermen & farmers) did not participate at the project formulation process. WMCA discouraged the original fishermen to join their activities. The total number of household in the subproject is 1,120 out of which 550 households are beneficiaries. Out of the total beneficiaries, 323

households (about 59%) are members of WMCA. The collection of full beneficiary contributions for O&M is 100% (LGED, 2009).

5.2 Technical Analysis for Development Potentials

It is evident from the preceding discussion that the Sirajpur Haor subproject has failed to meet both its irrigation and fisheries development targets. Lack of adequate water in Sirajpur Nadi and poor management of the subproject by the WMCA were the main reasons for the poor performance of the subproject. A technical analysis of the future development potentials without any major change in the present infrastructure was carried out and is presented in the following sections.

5.2.1 Assessment of water availability in Sirajpur Nadi

The water level in the subproject area is directly influenced by Gorai River. There are two water level gauge stations on Gorai River in the vicinity of the subproject. These stations are located at Gorai Railway Bridge (stn#99) 22.50 km upstream of the starting point of the Sirajpur Haor River subproject and the other station is located at Kamarkhali (stn#101) about 32.5 km downstream. From 20 years (1981-2002) of water level data at Gorai Railway Bridge and Kamarkhali (Appendix A, Appendix B), the average values of maximum and minimum water level of 5 year return period have been calculated (Table 5.3). By interpolation of the water levels from these two stations, the monthly average subproject water levels were calculated and are shown in Table 5.3.

For estimating the quantity of water availability in the Sirajpur Nadi, one of the necessary things is to find out the water level inside the khals. Water levels were obtained from the gate operators and were verified with the local people. Table 5.4 shows the post project water levels in the Sirajpur Nadi as obtained from equation 4.1. The rainfall data were obtained from long term (1961-2002) rainfall data (Appendix D) of Kustia. The 80% dependable rainfall was used in the analysis. The seepage and percolation (S&P) was considered as 5mm/day (Appendix I). Figure 5.2 shows the pre-project, post- project, field visit monthly water level variation and indicates the periods when sluice gates are opened or closed. In the figure it is shown that the water level during the field visit is nearly the same as the analysed post-project value. Equation 4.2 has been used for the

calculation of water availability in the Sirajpur Nadi. The calculation of monthly water availability is shown in Appendix E and the summary of monthly water availability in Sirajpur Nadi is shown in Table 5.5.

Table 5.3: Water level data applicable to the study area

Month	Water Level at stn#99 (m PWD)	Water Level at stn#101 (m PWD)	Water Level at Subproject (m PWD)
January	5.31	2.50	4.16
February	4.89	2.05	3.72
March	4.60	1.82	3.46
April	4.52	1.80	3.40
May	5.11	2.33	3.97
June	7.18	4.09	5.92
July	10.39	6.84	8.93
August	12.08	8.29	10.53
September	12.16	8.36	10.60
October	10.10	6.73	8.72
November	7.62	4.62	6.39
December	6.11	3.23	4.93

Source: BWDB

Table 5.4: Water level in Sirajpur Nadi

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Rainfall (mm)	3	12	12	60	97	178	224	161	140	75	5	8
Evaporation (mm)	57	74	123	153	138	109	88	89	83	85	77	64
S&P (mm)	155	140	155	150	155	150	155	155	150	155	150	155
Water level (m)	9.19	8.99	8.72	8.48	8.29	8.20	8.93	10.53	10.00	9.84	9.61	9.40

Source ; BWDB, LGED, BMD

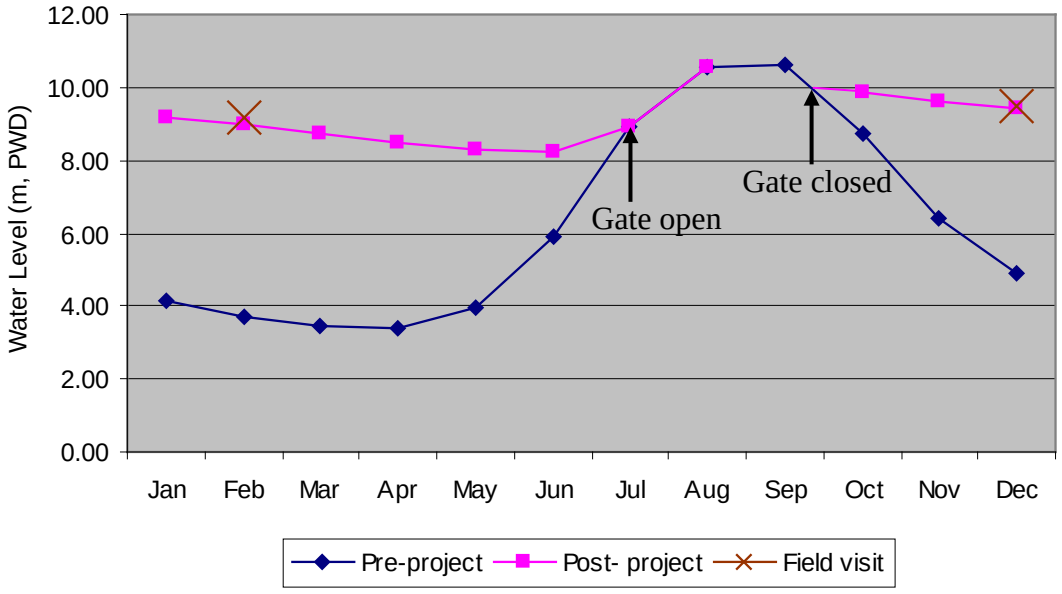


Figure 5.2: Water level variation at Sirajpur Nadi

Table 5.5: Water availability in the Sirajpur Nadi

Month	Water quantity (m^3)	Comments
Jan	242328.25	When the sluice gate is open, the water level variation is due to the fluctuation of Gorai River. But when the sluice gate is closed, the water level variation depends on rainfall, seepage & percolation and evaporation loss.
Feb	208802.89	
Mar	166863.09	
Apr	130126.90	
May	101741.31	
Jun	90182.33	
Jul	-	
Aug	-	
Sep	390071.55	
Oct	357742.65	
Nov	316090.67	
Dec	278278.55	

5.2.2 Assessment of water demand for irrigation

It has already been mentioned in article 5.1.1.2 that one of the objectives of this project was to increase the irrigated HYV Boro area from 0 to 345 ha, which the project has failed to achieve. In this section the water demand for irrigating 345 ha of HYV Boro is presented. The details of the calculations are presented in Appendix F.

Assuming a crop season of 110 days (1st January to 20th April), the crop water requirement using CROPWAT (FAO, 2001) is 1011 mm. With a land preparation requirement of 150 mm and scheme irrigation efficiency of 70% (IWM, 2003) and considering 80% dependable rainfall of Kushtia, the scheme irrigation requirement for irrigating 345 ha is 1534 mm. Thus the total volume of water required to irrigate 345 ha is 5.29 million m^3.

5.2.3 Adequacy of supply from Sirajpur Nadi and demand for irrigation

The monthly water availability from SirajpurNadi is presented in Table 5.5. It is evident from the table that the maximum available storage from the river during the irrigation season is about 0.24 million m^3, which is in January. During the peak irrigation season (March), the volume would decrease to about 0.17 million m^3. Thus, the maximum area that can be brought under HYV Boro irrigation with the available supply from Sirajpur Nadi (assuming that all the available water is only used for irrigation) is 11ha (about 3% of 345 ha).

Thus, it is evident that irrigating 345 ha of HYV Boro (as was envisaged in the project appraisal report) is not possible with the available supply from Sirajpur Nadi. The local farmers have also expressed the same opinion and have not opted for HYV Boro cultivation with the river water. It is not clear how it was estimated in the appraisal report (LGED, 1997) that the irrigated HYV Boro area would increase to 345 ha during the post-project condition. There is neither any estimate of water requirement for irrigating 345ha of HYV Boro nor any estimate of water availability from Sirajpur Nadi for irrigating the aforementioned area in the appraisal report. Preliminary calculations of water availability considering the post project design section (Figuure 5.1a) show that even if all the available water is used for irrigation only, the maximum area that can be brought under HYV Boro cultivation is about 129 ha (Appendix F). As has been mentioned in article 5.1.1.2, irrigation is now limited to 197 ha of local Boro and non-rice crops like sugarcane, wheat etc. requiring little irrigation (one or two irrigations during the crop season).

5.2.4 Assessment of water availability for fisheries

It has been mentioned in article 5.1.2.1 and Table 5.2 that the project has also failed to achieve the desired fish production target. Apart from poor management by WMCA, the drastic reduction in water area of Sirajpur Nadi in the recent years due to human settlements has been the main impediment towards achieving the fish production target. In fact, the water area has been reduced from 82 ha during the pre-project condition to only about 18.3 ha in 2008.

Considering the present water area (18.3 ha) and the potential level of production of 2300 kg/ha (BIDS, 2008), the potential fish production from Sirajpur Nadi is about 42.5 mt. The potential level of production is about five times the present level of production (8.6 mt as has been mentioned in Table 5.2). The detail calculations of potential production are presented in Appendix G. Considering a net profit of Tk. 50.50/kg from fish culture (BIDS, 2008b) the total profit from culture fisheries is Tk. 2.15 million.

The gradual siltation of Sirajpur Nadi has also been restricting the potential fisheries development of the river. After the implementation of the project in 2001, gradual deposition of silt from the surrounding drainage basins and Gorai river has significantly raised the river bottom. The fish farmers are of the opinion that for culture fishery, the preferred water depth is between 2 to 2.5 m. But, at a number of sections of the present river (Appendix C) the river bottom has been raised by up to 2m due to siltation. As the designed water depth was 2.5 m (Figure 5.1a), the present water depths at these sections are less than 0.5m and are not conducive to proper fish culture.

5.2.5 Assessment of re-excavation cost and profit from fish culture

An attempt was made to analyse the re-excavation cost of Sirajpur Nadi to bring back the desired depth for fish culture. The details of the analysis of re-excavation costs are presented in Appendix H. The total cost of re-excavation is about Tk. 12.70 million. Considering that the project was under operation from 2002, the life of the project till the period of survey (December, 2008) is 7 years. Hence, the yearly re-excavation cost is about Tk. 1.81 million.

It has already been mentioned that the total profit from fish culture would be Tk. 2.15 million. Hence, even after meeting the yearly re-excavation costs (without considering the price of re-excavation soil), the WMCA would make a profit of Tk. 0.34 million per year. As per contract between LGED and WMCA, the capital cost of majore rehabilitation (such as replacement of gates, re-excavation of khals etc.) are to be partially or fully (considering the report of LGED officials) borne by LGED and WMCA would bear the only the routine O&M costs. Hence, WMCA would not have to bear the total re-excavation costs but may share the costs with LGED. This signifies the huge fisheries development potentials of Sirajpur Haor subproject.

5.2.6 Discussion on development potential

It is evident from the preceding sections that with the present volume of water available from Sirajpur Nadi, the development of HYV Boro irrigation is not possible in future. Hence, Sirajpur Haor project should be declared only as a fisheries development project and in future efforts should be given for the enhancement of fisheries. On technical considerations and keeping the present infrastructure as it is, the only investment in the future should be for re-excavation of the river, so as to create a water depth conducive for culture fisheries. On economic considerations, it was ascertained that the yearly return from fisheries would exceed the costs involved in yearly re-excavation by about Tk. 0.34 million. It can be expected that the return from fish culture would be even higher than Tk. 3.27 million (Appendix G) as the water depth in the re-excavated river would increase from the present level. A higher depth would result in a more favourable environment for fish culture resulting in higher level of production.

The future of Sirajpur Haor project, even for fisheries development, also depends upon stopping any further encroachment of the river by the illegal settlers. As has been mentioned earlier, illegal settlements have resulted in reduction of the water area of the river from a pre-project level of 82 ha to only about 18 ha. Any further encroachment would further reduce the water area and even with re-excavation, would ruin any prospect of future fisheries development in the project.

5.3 Assessment of the rehabilitation potentials through people's participation

Assessment of the rehabilitation potentials of Sirajpur Haor subproject was done through several FGDs and interviews of various stakeholders and from the observations during the field visits. The findings are summarised below according to the stakeholders.

5.3.1 FGDs with the farmers

During the FGDs, the farmers of the study area opined that after the implementation of the project they did not use the river water for Boro irrigation and are not interested to use the river water for HYV Boro rice irrigation even in future. Because of scarcity of water in the river and conflict with culture fisheries, they have been using groundwater for Boro rice irrigation. Most of the farmers have STWs and the others (without STWs) buy irrigation water from the pump owners. Conveyance of water from the river to the farmers' fields has also been a major impediment towards the use of river water. Most of the farms are far away from the river and the river has embankments on both of its banks. There are no provisions in the embankment (irrigation inlets) to take water from the river to the farms. Moreover, illegal settlements in the floodplain have made construction of irrigation canals even more difficult. At present, the farmers use limited amount of water for irrigation (mostly for local Boro and non-rice crops) using hose pipes that run over the embankments.

The farmers are concerned about the future of irrigation using water from Sirajpur Nadi due to conflict with fish farmers and encroachment by the settlers in the floodplain. As the fish farmers and not the WMCA run the fish culture, it is possible that the fish farmers may not allow the farmers to withdraw any water from the river in future. Due to erosion in the adjacent rivers and rehabilitation of people by the local political leaders, illegal settlements of the people are increasing day by day along both banks of Sirajpur Nadi. As a result, the Sirajpur Nadi is encroached day by day and the water availability of the river is decreasing. So far, the WMCA has failed to take any action to stop the illegal settlements

5.3.2 FGDs with the fishermen

It has already been mentioned in article 5.1.2.3 that after the implementation of the project, most of the fishermen of the project area have either left the project or have changed their profession. Most of the fishermen who took part in the FGDs are either fish farmers or their employees. These fishers take yearly lease of different compartments of the Sirajpur Nadi from the WMCA. These farmers are of the opinion that in order to facilitate fish culture, the river should be made into 4-5 permanent compartments with nets for drainage of water. They said that they need 2-2.5 m water depth for better fish cultivation and siltation of Sirajpur Nadi is one of the problems for increasing their fish production. At present the fish farmers do not use any fish feed for fish cultivation but would do so if the authorities provide an environment conducive for fish culture.

When asked about the future potential of Sirajpur Haor project the fishers mentioned that they are happy with the present status of the project but would like to have the compartments and the re-excavation work done in order to enhance the fish production. When asked about sharing the cost of further developments (compartments and re-excavation) the fishers mentioned that as it is a government project, the LGED should bear all the costs of future development.

5.3.3 FGDs with WMCA

From the discussions with the members of the WMCA it was evident that the WMCA was unaware of the irrigation development target as mentioned in the Appraisal Report. The WMCA agreed that irrigation of Boro rice was not practiced in the past and there is no such potential at present nor there such a development potential even in the future. As the WMCA is unable to cultivate fish (because of lack of funds and manpower), each year they lease out the Sirajpur Nadi to the fish farmers.

The WMCA also agreed that with the present infrastructure the Sirajpur Haor subproject should only be a fisheries development project. The WMCA demanded that in order to facilitate fish culture a submersible weir at the end of the river (chainage 6.1 km) be constructed to conserve more water. Such a weir would increase the fish production and also the amount of lease. The members of the WMCA unanimously mentioned that they

are unable to perform their normal activities because of interferences by local politicians (help illegal settlers to settle on the floodplain, giving less lease money by unlawful influence etc.) and also for fear of terrorist activities of banned political parties.

5.3.4 Interview with the local officials

The issues of present problems and future rehabilitation potentials of Sirajpur Haor project were discussed with the relevant officials at Khoksha Upazilla. Although the Upazila Nirbahi Officer (UNO) is the chairman of the Conflict Resolution committee of the project, the UNO was unaware of his responsibilities and was never approached by the WMCA with their problems. As regards the illegal settlements in the floodplain, the UNO expressed his limitations in enforcing his power to stop such encroachment on public land due to political backing on settlements. But, the UNO reiterated that any further encroachment of the floodplain has been stopped with the help from the local politicians. The Upazila Engineer (UE) informed that he is aware of the problems of the project but as the O&M responsibilities lie with the WMCA, he has not interfered in their activities. The UE reaffirmed that the project now has only fisheries component and with the present infrastructure would remain so even in future. He also mentioned that he received an application from WMCA for constructing a submersible weir, which he has already forwarded to the higher authorities of LGED. When contacted, the concerned design office of LGED informed that about Tk. 8 million would be required for such a structure, which is not cost effective for this subproject.

The Upazila Agricultural Officer (UAO) informed that the water of Sirajpur Nadi is not sufficient for Boro rice irrigation but some limited non-rice Rabi crops are irrigated by using the river water. He also mentioned that the water from the river irrigates mostly vegetables and betel vines. The Upazila Fisheries Officer (UFO) informed that the fisheries potential of the project has remained under-utilized. If the WMCA works efficiently and fish cultivators use proper cultural practices (right species, adequate stock of fingerlings and fish feed) at the Sirajpur Nadi, the fish production can be increased significantly in the existing water area. The UFO expressed his concern regarding the aggravated siltation problem of the project and opined that steps should be taken in future to re-excavate the river.

5.3.5 Discussion on development potential

It is evident from the FGDs with the stakeholders and the discussion with the officials at the Upazilla level that the Sirajpur Haor project has not been used for Boro irrigation and the development of HYV Boro irrigation is not possible in future. At present, the fisheries potential of the project has remained under-utilized and in future the fish production can be increased with proper management (technical, social and institutional) and re-excavation of the river.

From the discussions and interviews with the primary (direct beneficiary from the subproject, such as farmers, fishermen, WMCA etc.) and secondary stakeholders (different government and non government organizations, such as LGED, agricultural department, fisheries department etc. who have interest for the subproject) it is also clear that the original water area of the project (82 ha) cannot be reclaimed but attempts would be made to stop any further encroachment of the floodplain. In future, the rehabilitation of the Sirajpur Haor project should only be limited to re-excavation of the river. In order to reap the future development potentials of the project, the WMCA must be allowed to work efficiently and independently and interference from the local politicians and banned political parties must be stopped.

CHAPTER SIX
CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

From the technical and economic analyses, field visits and FGDs with the stakeholders, it is evident from this study that the Sirajpur Haor project was planned, designed and implemented without proper analyses and people's participation. The following conclusions can be made from the analyses presented in the preceding sections:

1. Although as per the Appraisal Report, Sirajput Haor project was designed to irrigate 345 ha of HYV Boro, the project has failed to bring any area under HYV Boro cultivation. Scarcity of water in Sirajpur Nadi, conflict with culture fisheries and illegal settlements in the floodplain of the river were the main reasons for such failure.
2. At present, only about 26% of the fish production target has been achieved. Drastic reduction in river water area due to illegal settlements, reduction in water depth due to siltation and poor management of fish culture by WMCA were the main reasons for the poor performance.
3. Analysis of water demand and water availability for irrigation showed that the river water was inadequate to meet the demand of 345 ha of HYV Boro. The farmers did not use the river water for irrigation in the past and were not interested to use the water for HYV Boro irrigation in future.
4. Although the river water area available for fish production has decreased by about 78%, even then, with proper management (right species, proper stocks of fingerlings and fish feed, adequate water depth, etc.) the fish production can be increased by five times.
5. Analysis of river re-excavation cost and profit from fish culture showed that even after meeting the re-excavation cost the annual profit from culture fisheries would be about Tk. 0.34 million.
6. The future development potential of Sirajpur Haor project through rehabilitation depends upon stopping of any further illegal settlements in the floodplain of the river, allowing WMCA to work without the influence of and interference by local

politics and banned political parties, re-excavating the river and proper management of culture fisheries.

6.2 Recommendations

Although the Sirajpur Haor project was designed as an irrigation improvement and fisheries development project, henceforth the project should be declared as only a fisheries development project. The local officials and political parties should stop any further encroachment in the floodplain and should extend their wholehearted support to WMCA for the enhancement of culture fisheries.

CHAPTER 1

INTRODUCTION

1.1 Background

Being a riverine country downstream of several tributaries flowing from the Himalayas, water resources play a vital role in the economic development of Bangladesh. With frequent flood and drought cycles occurring in many places of the country, sustainable water resources management is pivotal for rural development. The food grain production plan of the Government, in line with Millennium Development Goal (MDG), puts major stress on proper utilization of water resources. Substantial water resources development activities of the country were initiated in the early 1960s. The Bangladesh Water Development Board (BWDB) completed a Master Plan for water resources development in 1964 and undertook feasibility studies of a large number of schemes from 1964 Master Plan and initiated follow-up studies and investigations of others. The International Bank for Reconstruction and Development (IBRD) Mission reviewed the 1964 Master Plan and a revised development strategy was enunciated with focus first on modest schemes, which emphasized the use of agricultural inputs with larger flood control, drainage and irrigation projects to follow.

Since independence of Bangladesh, BWDB has implemented a number of large scale irrigation projects and water development projects and simultaneously started experimenting with people's participation in water management. An assessment of past performance of water sector projects is presented in Table 1.1. Apart from long gestation period, both time and cost over-run were endemic problems of these projects. It can be seen from the table that the performance of large and medium scale Flood Control and Drainage (FCD) projects varies from medium success to failure. The main reasons for this below performance are poor economic returns, complexity of operation and management and uncertainties regarding the beneficiaries willingness to accept full responsibility for O&M. Moreover, these projects have several major negative impacts, such as the loss of fisheries, navigation and soil fertility and the exacerbation of drainage problems. On the other hand the small-scale FCD projects appear to be more attractive and sustainable than large scale projects. Apart from their low costs, these projects have the merit of being

highly participatory with beneficiaries' ability to take over the O&M fully. But long-term sustainability is still unproven, because not much time has elapsed for the O&M arrangement to be properly tested and evaluated.

Table 1.1 : Assessment of past performance of water sector projects and intervention

Project type	Performance/Impact				Relative GoB	Ease of
	Technical	Social	Environmental	Economic	O&M Burden	Implementation and Management
Rural FCD						
Inland embankment and Polders	M	L	L	L	H	M
Coastal embankment and polders	M	M	L	M	H	
Compartmentalization Pilot Project	M	L	M	L	H	L
Small-scale FCD	H	M	L	H	L	M
River training and bank protection	M	H	M	M	H	M
Urban FCD	H	H	M	H	M	M
Small-scale Irrigation						
Barind DTWs	H	H	M	M	L	M
Rubber Dams	H	H	L	M	L	M
Khal Re-excavation	M	M	H	M	L	L
Large-scale Irrigation						
Primary pumping	L/M	M	M	L	H	M
Gravity supply	M	M	M	L	M	M
Flood Proofing						
Structural	H	H	H	H	L	M
Non-structural	H	-	-	-	M	M

Source: WARPO, 2001

Note: L =Low Performance/Negative Impact, M = Medium Performance/Neutral Impact, H = High Performance/Positive Impact.

The Local Government Engineering Department (LGED) has implemented Small Scale Water Resources Development (SSWRD) schemes as a component under different

projects. Since 1995-96, LGED has been carrying out SSWRD activities as a sectoral program with participation of local stakeholders. Meanwhile, the Government made major water sector reforms with the formulation of The National Water Policy (NWP) in 1999 and The National Water Management Plan (NWMP) in 2001. The NWP mandates that "the local government will implement Flood Control, Drainage and Irrigation (FCDI) projects having command areas of 1,000 hectares or less" (MoWR, 1999).

During the period from April 1996 to December 2002 the LGED has implemented 280 small-scale water control systems, called subprojects (Phase-I), in western Bangladesh. To implement these sub-projects, people's participation was an important process, which was done in three distinct stages: i) Identification and feasibility ii) Design and institutional building and iii) Construction and first year of joint O&M.

Among the 280 completed subprojects of Phase I, Sirajpur Haor subproject was completed in June, 2002. It is an irrigation, drainage improvement and fishery development subproject. The subproject has a gross area of about 630 hectares with net benefited area of about 470 hectare. It was proposed that re-excavation of the Sirajpur Nadi for 6.40 km and construction of water retention structure (WRS) will conserve more water during dry season and create opportunities for irrigation to about adjoining 500 meter strip of lands (about 470 ha) and will develop fisheries. It was estimated that after completion of the subproject, the HYV Boro area would increase from 0 to 345 ha and the total fish production would increase from 4.92 metric tons (MT) to 147.6 MT (LGED, 1997). At the post-project evaluation in the year 2004, the total fish production was only 10 MT and the total HYV Boro cultivated area was reported as 292.7 ha (LGED, 2009). In a recent visit to the subproject during April, 2008, it was observed that the subproject was in a dilapidated condition with lack of water to meet the demands of both irrigation and fisheries.

Though the Sirajpur Haor subproject was implemented by participatory water management approach but the objectives of the subproject were not achieved. This study was intended to find the reasons of poor performance and the scope of rehabilitation of the subproject with a participatory approach.

1.2 Objectives

The specific objectives of the proposed study are as follows:

- Assessment of the present status and problems of Sirajpur haor subproject through FGDs ;
- Technical analysis of the development potentials of Sirajpur haor subproject using the present infrastructure; and
- Assessment of the rehabilitation potentials through FGDs and interview with different stakeholders.

1.3 Limitations of the Study

The findings of this study are limited to the study area or the sub-project. Extrapolation of the findings of the study to other areas should be done judiciously. While assessing the functions and the performance of the WMCA, it was felt necessary to consider the viewpoints of the local government representatives (e.g. Union Parishad Chairmen and members) and local political elites. Although the local government representatives are not explicitly involved with the activities of the WMCA, their implicit activities directly affected the performance of the WMCA in the study area. During the field visits to the study area, the local environment was not conducive for meetings and discussions with the local government representatives.

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