Government of the People's Republic of Bangladesh

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

BANGLADESH FLOOD ACTION PLAN

FAP 13
OPERATION AND MAINTENANCE STUDY

FINAL REPORT

(1)

VOLUME 1
Main Report

March 1992

Hunting Technical Services Limited

in association with:

Flood Hazard Research Centre
Technoconsult International Limited

under assignment to
UNITED KINGDOM OVERSEAS DEVELOPMENT ADMINISTRATION

Sanyu Consultants inc.

under assignment to
JAPAN INTERNATIONAL CO-OPERATION AGENCY

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SUMMARY

S1 INTRODUCTION

The FAP 13 Operation and Maintenance Study is one of the supporting studies to the Bangladesh Flood Action Plan. The study has three main aims:

- to identify the main constraints on effective operation and maintenance (O&M) of FCD and FCDI projects in Bangladesh;
- to draw up guidelines for ways of overcoming these constraints, both for existing projects and for new ones under FAP; and
- to recommend ways of maximising participation of beneficiaries and of mobilising local resources for O&M.

FAP 13 was conceived as a five year project, with an intensive first phase, to be followed by a less intensive second phase in years 2 to 5. In the first phase there were five key tasks:

i. review of O&M of FCD/I projects in Bangladesh;

ii. review of O&M in FCD/I projects in other countries in the region;

iii. report on O&M problems and recommendations;

iv. organisation of a Workshop on O&M; and

v. prepare proposals for the FAP 13 Phase II Work Programme.

The FAP 13 study was carried out in close liaison with FAP 12, the FCD/I Agricultural Study, which reviewed the overall impact of completed FCD/I projects. All FAP 13 team members were also members of the larger FAP 12 team.

S2 INSTITUTIONAL CONTEXT

S2.1 The Institutional Framework

The main organisation involved in O&M of FCD/I projects in Bangladesh is the Bangladesh Water Development Board (BWDB). The BWDB is responsible for planning, design, implementation, operation and maintenance of FCD/I projects, as well as for urban protection. BWDB has a hierarchy of staff involved in O&M, from khalashis responsible for the operation of structures, through Section Officers, Sub-Divisional Engineers, Executive Engineers, Superintending Engineers and Chief Engineers, to the BWDB O&M Board Member. BWDB retains ownership of FCD/I project assets during the O&M phase, and BWDB O&M Divisions are responsible for repairs and rehabilitation of projects, as well as for routine O&M.

At the local level Upazila Parishads were given increased responsibility in recent years. BWDB staff are not, however, deputed to work under the Upazilas and these local bodies currently play a minor role in respect of FCD/I projects. However the Local Government

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

The full series comprises the following reports:

FAP 12

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

Project Impact Evaluation studies of:

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

Rapid Rural Appraisal Studies of:

Protappur Irrigation Project
Nagor River Project
Sonamukhi Bonmander Beel Drainage Project
Improvement of Sakunia Beel
Silimpur-Karatia Bridge cum Regulators
Khatakhali Khal
Halir Haor
Kahua Muhuri Embankment
Konapara Embankment [1]
Polder 17/2
BRE Kamarjani Reach [1]
BRE Kazipur Reach [1]

Draft Final Report (4 Volumes)
Final Report (4 Volumes)

FAP 13

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

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

Most of the training effort is focused on middle and senior level staff. In general there is no training for field level staff (khalashis for example) or for beneficiaries, with the exception of extension services in a few large projects with irrigation components.

S2.5 Previous Assessments of BWDB O&M

Many previous studies have concluded that improved O&M is critical to achievement of intended benefits from FCD/I projects, and to ensuring their sustainability. The evaluations have concluded that operational difficulties occur as a result of unsuitable planning and design, incomplete or poor construction practices, a failure to undertake routine maintenance and inadequate management of O&M.

The weakness of O&M is often partly ascribed to a shortage of resources. It has been suggested by some studies that new projects should be delayed until existing O&M practices are improved, or that higher priority should be given to rehabilitation of existing projects than to new investments. There is a general belief that one of the key requirements is to increase beneficiary participation, both to improve the quality of O&M and to generate increased resources.

S3 O&M ASSESSMENTS FROM RAPID RURAL APPRAISALS

S3.1 Projects Studied

O&M assessments of seventeen completed FCD/I projects were carried out in association with the Rapid Rural Appraisals (RRA) and Project Impact Evaluations (PIE) organised under the joint auspices of FAP 12 and FAP 13. The locations of the projects studied are shown in Figure S1 and some of their key features are summarised in Table S1. The selected projects are representative of the different types of FCD/I projects in Bangladesh and are spread throughout the FAP Regions.

S3.2 Project Operation

Key O&M indicators for the 17 projects are summarised in Table S2. In practice "operation" usually means operation of regulators - opening and closing gates, although in a few cases other operational activities are involved - pumping for irrigation and drainage at Meghna Dhonagoda Irrigation Project (MDIP), for example.

At three of the projects there was no real "operation" involved, because the structures built were no longer in use. Virtually all the other projects experienced operating problems, the ultimate reason often being that drainage facilities were inadequate, or could never be efficient when high river stages coincide with heavy rainfall.

Frequent causes of operational difficulties encountered include:

- project design did not consider operational requirements. The clearest case of this was the use of wooden fall-boards in water control structures, as these are often stolen; easily damaged and at critical times are very difficult to use;
- committees proposed to advise on operation have not always been established or are not active;

Engineering Bureau, which provides technical assistance at the District and Upazila levels, was instructed in 1985 to take responsibility for the O&M of small completed FCD/I schemes. This transfer of responsibility has not so far materialised.

Other agencies which are, or could be, concerned with O&M of FCD/I projects, include the Department of Fisheries, the Department of Agricultural Extension, the Bangladesh Rural Development Board and Non-Governmental Organisations (NGOs).

S2.2 Linkages and Liaison Between BWDB and the Upazilas and LGEB

The linkages between the BWDB, the central agency concerned with FCD/I projects, and the Upazilas and LGEB who are more closely in touch with local conditions, are weak. A system of District level Steering and Coordination Meetings exists, but is not an effective coordination tool. LGEB is assisting in the preparation of five-year plans for Upazila infrastructure development (the Upazila Plan Books), but the process only involves the opportunity for BWDB to comment on Upazila proposals. There is no formalised system for local authorities to comment on BWDB proposals.

S2.3 O&M Resources and Costs

Inadequate BWDB O&M resources are frequently cited as the major constraint on effective O&M. Funds for O&M come from four main sources, the Revenue Budget, Food for Work (FFW) Programmes, the Development Budget and the Cash Foreign Exchange Budget, which is a relatively minor source of funds.

The revenue budget is mainly used to cover establishment (staff) costs and only a small proportion is available to provide for the operation and repair of completed schemes. The FFW programme is one of the main resources for maintenance. World Food Programme wheat is provided to finance unskilled labour used in embankment construction and maintenance, and represents a third of overall O&M resources. The Development Budget is theoretically intended to finance new projects, but in practice it is routinely used to finance O&M of completed portions of on-going projects, and, through special projects, to finance repairs and rehabilitation of completed projects.

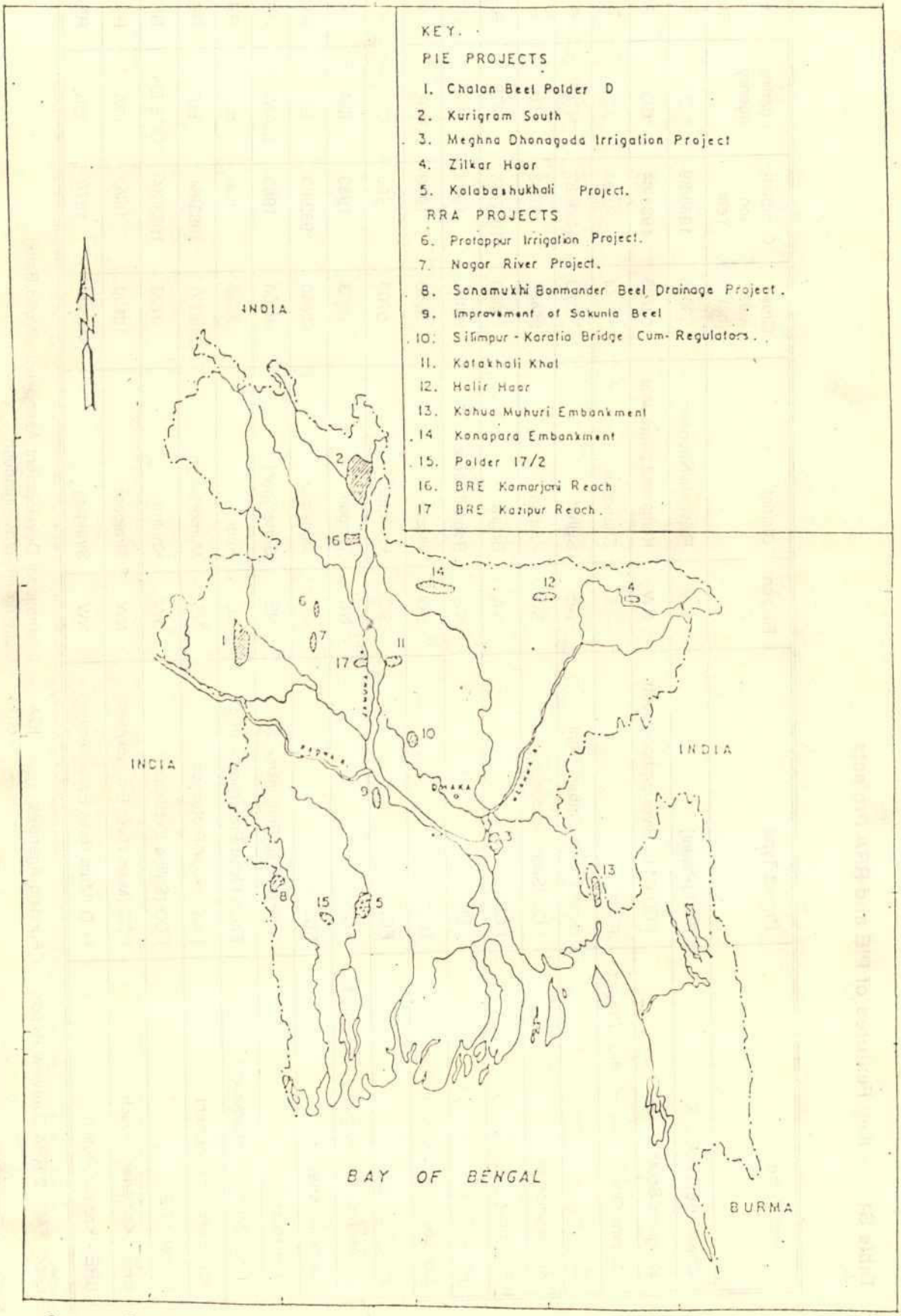
Discussions with BWDB Executive Engineers indicated that revenue budget allocations are usually inadequate even to cover establishment costs, and that O&M staff costs are often charged against the development budget. Wheat allocations are inadequate to permit timely maintenance, and a rotational cycle of deferred maintenance emerges. Quality control of maintenance work financed by FFW is a major problem.

S2.4 BWDB Training Provisions

A major review of BWDB's training and staff development programmes, with special reference to the needs of O&M, is currently being undertaken under the auspices of the European Community assisted component of the System Rehabilitation Project.

BWDB has some 18 000 staff, and a wide range of training needs. The organisation shares a training academy with the Power Development Board, and training facilities are also available at two specialised training institutes, the Hydrology Training Institute and the Irrigation Extension Training Centre. In addition the BWDB Training Directorate and individual BWDB projects organise a range of ad hoc training activities.

Figure S1 Location of Selected PIE and RRA Projects



Source: Consultants

Table S1 Key Features of PIE and RRA Projects

Project Name	Project Type	Region	District	Gross Area (ha)[1]	Completion Year	Funding Agency	Level of Study
Chalan Beel Polder D	FCD (Polder)	NW	Rajshahi/Naogaon	53055	1988/89	IDA	PIE
Kurigram South	FCD (Main River Embankment)	NW	Kurigram/Lalmonirhat	63765	1983/84	GOB	PIE
Meghna-Dhonagoda Irrigation Project	FCDI	SE	Chandpur	17584	1987	ADB	PIE
Zilkar Haor	Submersible Embankment	NE	Sylhet	5263	1986/87	NTAP	PIE
Kolabashukhali	FCD (Saline exclusion)	SW	Khulna	25466	1983	IDA	PIE
Protappur	FCDI	NW	Bogra	5200	1977/78	GOB	RRA
Nagar River	FCD	NW	Bogra/Natore	15400	1986	EIP	RRA
Sonamukhi-Barmander Beel	D	SW	Jessore	9000	1978	GOB(?)	RRA
Sakunia Beel	FCD	SC	Faridpur	5700	1985	GOB	RRA
Silimpur-Kashia Regulator & Bridges	FCD	NC	Tangail	2833	1983	IDA	RRA
Katakhali Khal	FCD	NC	Jamalpur	>2660	1982/83	EIP	RRA
Halir Haor	Submersible Embankment	NE	Sunamganj	>8000	1983	IDA/WFP	RRA
Kahua-Muhuri Embankment	Flash Flood Protection + Irrig	SE	Feni	2638	n.a.	n.a.	RRA
Konapara Embankment	Flash Flood Protection	NE	Mymensingh	3480(?)	1983/84	EIP	RRA
Polder 17/2	FCD (Saline Exclusion)	SW	Khulna	3723	1983/84	GOB/EIP	RRA
BRE - Kamarjani Reach	FCD (Main River Embankment)	NW	Sirajganj	10100	1970	IDA	RRA
BRE - Kazipur Reach	FCD (Main River Embankment)	NW	Sirajganj	10500	1970	IDA	RRA

Source: FAP 12 RRA Overview Report

Notes: [1] Sometimes best estimate only.

Funding Agencies:
IDA - International Development Association (World Bank)
GOB - Government of Bangladesh
ADB - Asian Development Bank
NTAP - Netherlands Technical Assistance Programme
EIP - Early Implementation Project (Netherlands/Sweden)
WFP - World Food Programme

Table S2 Operation and Maintenance Performance of Case Study Projects

Name of Project	Percentage Embankment in poor condition	Embankment use			Erosion	Breaches	Cuts by insiders	Cuts by outsiders	Khalashis active?	Local committees active?	Private surface water management	Participation in embankment protection
		road	house	trees								
Chalan Beel	50%	1	0	2	0	1	2	2	1	0	2	1
Kungram	+50%	2	2	2	2	2	2	0	2	0	0	0
Meghna-Dhonagoda	20%	2	1	1	2	2	0	0	2	1	2	0
Zikar Haor	70%	1	0	0	0	0	0	0	2	1	2	1
Kolabashukhali	50%	2	0	1	1	0	0	0	2	0	1	0
Protappur	80%	1	1	1	0	0	0	0	0	1	1	0
Nagor River	85%	2	0	1	2	0	1	2	0	0	1	0
Sonamukhi	na	na	na	na	na	na	0	1	0	0	2	0
Sakuria Beel	70%	1	0	1	1	1	0	0	0	1	1	0
Silimpur	15%	2	0	1	1	1	0	0	na	0	0	0
Katakhali Khal	50%	2	0	0	0	2	2	0	0	1	1	1
Hail Haor	33%	1	0	0	0	1	2	0	0	1	2	1
Kanua-Muhuri	80%	1	0	1	2	1	2	0	0	2	2	1
Konapara	60%	2	0	1	1	2	0	1	na	0	2	0
Polder 17/2	5%	2	0	0	0	0	2	0	2	1	2	0
BRE-Kamalapur	70%	2	2	2	2	2	2	0	2	0	0	0
BRE-Kazipur	50%	2	2	2	2	2	0	0	na	na	0	0

Notes: 0 no; 1 yes - some/partly; 2 yes, much/many.
1. In Silimpur the sluices are not operated, and in Polder 17/2 the cuts are for wooden box sluices for shrimp farms.
* Cuts and conflict over non-project bunds affect project area.
The table reflects conditions found during field visits in the 1991 monsoon season.

Source: PIEs and RRAs

- the operation of structures is dominated by influential local people. While this is not always necessarily undesirable, it can lead to conflicts of interest;

- in some projects khalashis who are supposed to operate structures were not present. When present they usually take directions from local influential people. They are untrained and receive little guidance or supervision from superior officers in BWDB;

- there are frequent conflicts of interest over operating practices, but no procedures for conflict resolution. Although such conflicts were often predictable at the planning stage, in no case was an effort made at that time to compensate those who might be negatively affected by proposed operational procedures.

S3.3 Maintenance

The most important aspect of FCD/I infrastructure maintenance relates to embankments. Table S2 shows that there is widespread multiple use of embankments. They are usually used as roads, often for cultivation of trees and bushes, occasionally used for housing, sometimes used for markets (hats), and usually available as places of shelter during high floods.

Most of the embankments visited had 50 per cent or more of their length in poor condition. Almost three quarters had suffered from breaches, due to overtopping during greater than design standard events, to river erosion, to failures at weak points or to poor construction.

River erosion was a major cause of breaches in four projects, and affected ten to some extent. In many cases inadequate design set-back distances had exacerbated erosion risks. Substantial O&M resources were devoted to protecting embankments against erosion, repairing breaches or retiring eroded embankments.

10 of the 17 projects had experienced public cuts. These often reflected planning weaknesses, as they were caused either by outsiders negatively impacted by embankments or by insiders attempting to eliminate drainage congestion. The repair of public cuts was invariably a BWDB responsibility, and a further burden on O&M resources.

In general there was very little evidence of maintenance work on regulators, while the excavation of drainage khals was neglected or infrequent - there having in some cases been none since project completion.

S3.4 Costs and Resources

Table S3 summarises data on the financial and economic performance of the 17 projects. There is a lack of systematic accounting for O&M costs on specific projects, and the data must be treated with care. However it indicates that O&M costs on the projects studied were generally higher than the "rule of thumb" figures usually used in feasibility studies (1 to 2 per cent of capital costs).

Actual O&M expenditures (unweighted) averaged 3.3 per cent of capital costs - and even at these expenditure levels the quality of O&M was generally unsatisfactory. It was

Table S3 Financial and Economic Performance of Case Study Projects (1991 price)

Project	Net Benefited Area (NBA) (ha)	Capital Cost/ha (NBA) (Tk)	O&M Cost Cost/ha (NBA) (Tk)	O&M Cost/ha (% of capital cost/ha)	Annual Ag. Bens per ha (NBA) (Tk)	Annual Fishery loss/ha (NBA) (Tk)	Ag+Fish Benefits per ha (NBA) (Tk)	Estimated Economic IRR (%)	Implement-ation period (years)
Kahua Muhuri	2024	11512	235	2.0	12352	208	12143	96	1
Sonamukhi-Banmander	7400	6284	314	5.0	10514	0	10514	65	3
Halir Haor	6686	3671	191	5.2	2372	0	2372	65	1
Konapara Embankment	3116	2634	132	5.0	12095	1161	10934	62	3
Protapur IP	4000	3419	224	6.5	5686	0	5686	54	4
Zilkar Haor (PIE)	4238	17810	333	1.9	3964	n.a.	3964	40	3
Katakhali Khal	2520	7543	0	0.0	3925	1202	2722	30	3
KBK (PIE)	18623	12041	624	5.2	4360	1020	3340	25	7
Kurigram South (PIE)	50000	13672	776	5.7	5610	80	5530	22	10
Silimpur - Karatia	1012	10829	0	0.0	956	n.a.	956	10	1
Sakunia Beel	4400	4787	28	0.6	1023	439	584	10	4
Chalan Beel Polder D	37235	9196	129	1.4	2402	1488	914	9	8
MDIP (PIE)	14367	129205	2417	1.9	14130	693	13437	7	12
BRE Kamarjani	8783	6619	340	5.1	1547	922	625	3	10
BRE Kazipur	8788	5461	280	5.1	1500	1075	424	0	10
Nagor River	9312	7962	n.a.	n.a.	-1074	n.a.	-1074	-10	2
Polder 17/2 (all)	2792	15136	440	2.9	6229	8453	-2224	-10	13

Source: RRA and PIE surveys 1991

Notes: Some figures are very rough estimates and should be treated with caution.
Some figures in original RRA reports have been corrected

however noted that there was some correspondence between relatively high O&M expenditures and project success.

Where establishment details were available, it was found that a high proportion of the staff financed under the O&M budget were not directly involved in O&M. Those staff who were involved lacked incentives to provide an effective O&M "service".

BWDB is not empowered to mobilise resources for its own use, and in only one of the projects studied had any irrigation or drainage fees been considered. In this case (MDIP) the proposed water rates system had not been implemented.

There were only rare cases encountered of local participation in any aspect of maintenance, and in some cases the intervention of BWDB had replaced local community management and maintenance initiatives.

S3.5 Other O&M Issues

The RRA and PIE studies highlighted a number of other issues related to O&M:

- there is a general lack of public consultation in planning and design, and during construction and commissioning. This has led to misunderstandings about project intentions and has often been at the root of subsequent O&M problems;
- sub-standard construction at a number of projects has resulted in projects that could not be operated or maintained effectively;
- O&M manuals have rarely been prepared. None of the BWDB manuals identified were in Bangla, none could be considered to be effective field guides to O&M, none appeared to be in use and in no case where field visits were made were O&M manuals found to be available to field staff;
- the tasks, responsibilities and accountability of those involved in O&M are not clearly defined, and training programmes are inadequate - particularly for lower level staff such as khalashis.

S4 PROJECTS TO IMPROVE O&M

S4.1 Background

Several externally assisted projects now include components aimed at improving aspects of BWDB O&M, and there are also numerous initiatives outside BWDB which are introducing new approaches to O&M. As these initiatives are taking place in a wide range of institutional environments it is important to ensure close liaison between them, so that they can learn from each other, and to ensure that FAP initiatives benefit from their accumulated experience. Unfortunately many of the initiatives are relatively recent, and it is too early to judge their replicability and sustainability.

S4.2 Systems Rehabilitation Project (SRP)

SRP is supported by four separate donors (the World Bank, the European Community, the Government of the Netherlands and the World Food Programme) and has a large number of components, including rehabilitation, improvement and maintenance of some 80 sub-projects with a gross area of about 600 000 ha. Two major themes of SRP are Improved Operation and Maintenance and On-Farm Development. SRP is also placing major stress on beneficiary participation, and it aims to identify O&M strategies which will eventually be adopted throughout BWDB. So far SRP has concentrated on water management, identifying staffing needs in large FCD/I projects, preparing to introduce irrigation charges, and strengthening the involvement of other agencies in O&M activities. SRP is at the start of a 7 year implementation programme and its work is of direct relevance to FAP.

S4.3 Second Small Scale Flood Control, Drainage and Irrigation Project (SSSFCDIP)

SSSFCDIP is supported by the World Bank and the Canadian International Development Agency (CIDA). The project provides for funding of O&M on small schemes for two years after their completion and is making a major effort to involve Local Project Committees (LPCs) at every stage of the project cycle, from project identification to O&M. SSSFCDIP also intends to establish water management groups based on hydrological units, and its experience will be of value as a possible model for management of sub-catchments of FAP projects.

S4.4 Land Reclamation Project (LRP)

The LRP was supported by the Governme.. of the Netherlands and concentrated on the reclamation of land, and estuary surveys in the south-eastern delta of Bangladesh. The project has, in particular, involved Non Governmental Organisations (NGOs) in organising landless cooperative societies which have settled a pilot polder and which operate, inter alia, as labour contractors. This may prove to be an effective model which could be replicable elsewhere. The social development components are to continue as the Char Develo, ment and Settlement Project (CDSP).

S4.5 Delta Development Project (DDP)

This project is also supported by the Government of the Netherlands, and concentrates on the rehabilitation of Coastal Embankment Polders in the Khulna area. DDP is working, in particular, in two polders to develop participatory approaches to polder management and maintenance. In one polder a large number of irrigation schemes (using pipe inlets) have been established, and inlet groups have been established to manage these. In a second polder, routine embankment maintenance is undertaken by landless women recruited through a local NGO. Both these experiments are likely to provide useful lessons for FAP.

S4.6 Early Implementation Project (EIP)

The EIP programme (supported by the Governments of Sweden and the Netherlands) has been working with BWDB for many years, but has recently identified poor O&M as a major constraint on the effectiveness of the projects it has helped to develop. EIP has therefore proposed establishing an EIP O&M component, but this has not currently (early 1992) been approved by the Government of Bangladesh. However, EIP has developed the use of Labour Contracting Societies, formed with NGO assistance, to carry out

earthworks, to ensure better quality of work, and to ensure that labourers benefit fully. This model is relevant to periodic repair.

S4.7 Ganges Kobadak Rehabilitation Project (GK)

GK is one of the oldest and biggest FCD/I projects in Bangladesh. It has had serious O&M problems, and is currently the subject of an ADB assisted rehabilitation project. Amongst the GK's problems are the high operating costs associated with the irrigation system and the failure to collect more than a minute proportion of expected water rates. At the GK Project an effort is being made to strengthen farmers' participation through formation of Tertiary Water Users' Associations (TWUAs). It is reported that over 100 TWUAs are now functioning. They are intended to eventually take full responsibility for tertiary level O&M and, inter alia, to be responsible for collection of water rates. It is too early to evaluate the success of the TWUAs at GK, but the experience of this ambitious project (it is proposed to establish a further 300 TWUAs in 1991/92) should be monitored.

S4.8 Operation and Maintenance Cost Cell (O&MCC)

An O&M cost cell was established within BWDB with assistance from CIDA. The CIDA project, which has now ended, concentrated on the compilation of inventories and the development of computerised databases to provide an O&M planning tool. The cost cell is not yet, however, fully operational and it has been proposed that it should receive additional assistance to work with SRP to improve monitoring and prioritisation procedures.

S4.9 The LGEB RESP O&M Model

The Local Government Engineering Bureau (LGEB) is the undertaking agency for the Rural Employment Sector Programme (RESP) Infrastructure Development Programme. This programme is of direct relevance to FCD/I O&M, as it includes a number of small water management schemes, and it involves women and the landless in execution and maintenance of various income generation projects. The LGEB has experience in working both with women's maintenance groups and with labour contracting societies. The Bureau has established a project cycle in which local people are involved from project identification onwards, and local O&M committees are established. The LGEB has produced appropriate illustrated guides to O&M, it has developed formal scheme handover procedures, has established a well conceived training programme, and is encouraging introduction of payments in kind by beneficiaries to contribute to O&M costs. The LGEB approach is clearly best adapted to the small (not more than 1000 acres - 400 ha) water management schemes the Bureau is concerned with, but nevertheless may offer many useful guidelines to O&M of BWDB and FAP projects.

S4.10 CARE's Food for Work and Rural Maintenance Programme

CARE is involved in five separate large programmes, mostly involving the distribution of food aid. Two of these programmes, the Integrated Food for Work Programme (IFFW) and the Rural Maintenance Programme (RMP) involve the construction and maintenance of rural roads and embankments. The early construction programmes organised under CARE resulted in large infrastructure developments, but their benefits were constrained by poor planning and maintenance. There is now a greater emphasis on maintenance, and CARE supports the employment of rural women to maintain economically important rural roads under

the RMP. This programme has established workable procedures which could be adapted for FCD/I projects and would direct more benefits from FCD/I to the landless poor.

S4.11 Cooperatives and NGOs

Official cooperatives fall under the jurisdiction of the Bangladesh Rural Development Board (BRDB). There is considerable involvement of cooperatives in small scale irrigation (for example through ownership of Deep Tubewells), but relatively little involvement with FCD/I projects. A rare exception is the Chandpur Irrigation Project (CIP) where BRDB staff were seconded to the BWDB project and assisted in the organisation of informal irrigator groups. This arrangement has not however lasted, as the Low Lift Pumps which the irrigator groups rented have been privatised.

There are over 500 NGOs active in various development programmes in Bangladesh, and several are already working in association with BWDB in FCD/I projects - for example with EIP, LRP and DDP. Their main relevant experience is through the system of Labour Contracting Societies organised for the construction of EIP sub-projects. These target benefits to the landless, and are reported to deliver better quality work than private contractors. EIP also has proposed a pilot programme working with NGOs where a group would be responsible for turfing and managing plants on an embankment. NGOs also have experience in irrigation management, through programmes under which landless groups purchased or rented tubewells and sold water to farmers, and are involved in some relatively new ventures in managing resources such as sericulture, tree plantation and fish culture, all of which could be relevant to the utilisation of FCD/I infrastructure.

There could be roles both for BRDB and NGOs in the FCD/I context. BRDB has the advantage of national coverage, and it has shown some ability to be flexible despite the apparent rigidity of cooperative regulations. NGOs generally do not work with farmers, they tend to work with small groups, and most NGOs are only active in limited areas, but they are involved in some pioneering work of direct relevance to FAP, and in many areas FAP projects may be able to work very effectively with locally established NGOs.

S5 INTERNATIONAL O&M REVIEW

S5.1 Introduction

FAP 13 has carried out a review, mainly based on available literature, of FCD/I O&M experience in South and South-east Asia, in order to identify lessons that might be useful in the Bangladesh context. Within the region most relevant experience is concentrated in irrigation systems. The review does indicate some approaches that may be useful, but care must always be taken in applying methods that have succeeded in one context to a different social, cultural, and economic environment.

S5.2 Institutions

The coordination of water management between a number of concerned organisations has been tackled in many countries by the establishment of multi-purpose regional, local government or water management bodies. Elsewhere special inter-departmental agencies have been established, or formal liaison and planning procedures have been introduced to institutionalise planning coordination.

It is always difficult to balance the needs of complex management and farmer participation and it has generally been found that only small and simple projects can be handed over to farmer management. It should be noted in this context that the proposed implementation of linked compartments under FAP is likely to add complexity to water management and may make any handover less likely.

In some countries responsibility for implementation (construction and commissioning) is separate from O&M responsibility. This can facilitate effective O&M, as the O&M body can refuse to accept a project which is demonstrably not operable.

S5.3 Flood Management

Several cases were found which indicate that FAP approaches to flood management have been effectively implemented in the Region. In Thailand and in Japan engineering and management measures have been introduced to permit controlled flooding of certain areas when danger levels are exceeded.

S5.4 Beneficiary Participation

There are several examples of successful beneficiary participation in irrigation projects in the region from which lessons can be learnt:

- successful initiatives have often been built on traditional local practices and water management systems;
- group formation requires major continual inputs from social organisers and extension workers at least for the early years of a system;
- effective beneficiary participation must involve a close dialogue with engineers and water planners, and it should commence at the project identification and planning stage;
- where local involvement is given a high priority, planning and preparation take time. Group formation and public consultation are time-consuming activities, but yield substantial long term operational benefits.

There are hardly any cases of beneficiary participation in flood control projects. The only exception identified is in Vietnam, where voluntary labour is said to be provided for monitoring and repairing embankments during flood seasons.

S5.5 Resource Mobilisation and Cost Recovery

Various means of cost recovery have been tried out in the Region, almost invariably in the context of irrigation services rather than FCD projects. In most cases the levels of cost recovery are poor, but there has been some success when projects are handed over to farmers, or when there has been shown to be a close link between the irrigation service and the fee charged. This is of course clear in the Bangladesh context, where farmers sometimes pay the full cost of privately supplied irrigation water.

FCD projects face more difficult cost recovery problems, the most serious of which is the free rider problem, which affects drainage projects worldwide. Because of the difficulties

inherent in trying to restrict FCD benefits to those who pay for them, the capital, and even the O&M costs, of FCD projects are rarely recovered from farmers except in sophisticated economies where farms are large, the benefits are understood and the tax system is efficiently managed.

It appears that fees for FCD services have so far been unenforceable in the region. Attempts to charge for FCD may even defeat other initiatives at resource mobilisation. There is a potential conflict between promoting farmer participation in management of FCD infrastructure, which requires a sense of ownership, and the levying of fees. Land development taxes offer an alternative approach but are distanced from system management. Participatory management has had some success in irrigation projects (notably in the Philippines, and in Thailand and Japan) and similar approaches may be suitable in Bangladesh.

S6 RECOMMENDATIONS AND GUIDELINES FOR IMPROVED O&M

It is evident from both the FAP 12 studies and FAP 13 investigations that while FCD/I projects often deliver worthwhile benefits they frequently have the potential to perform much more effectively. While poor O&M is not the only constraint on effective performance it is often a serious impediment to project success. This has been widely recognised and numerous intiatives are already underway to find effective means of addressing O&M problems. Many of these are still at the exploratory or pilot testing stage. It is therefore premature to make firm recommendations on approaches to be adopted, and FAP 13 has concentrated on assembling existing initiatives, developing new ideas and drawing preliminary conclusions where there is evidence to support these.

S6.1 Institutional Framework

FAP 26 will be studying the institutional context of FAP in detail. It is clear that there is a need for improved inter-agency coordination at the national level, in flood plain planning and at the individual project level. There are opportunities for FAP pilot or priority projects to test new institutional arrangements, such as multi-agency decision making, establishment of project level bodies representing several concerned Departments, devolution of aspects of management to local government or NGOs or complete handing over of smaller projects to local administrations or beneficiaries.

S6.2 Public Participation

Numerous approaches to public participation are being tested out or elaborated by FAP, BWDB, other Government Departments and NGOs in Bangladesh. It is unlikely that a single approach will be found to be ideal in all circumstances. It is recommended that FAP pilot and priority projects include experiments with a range of participatory methods. Participation from the outset is essential using a variety of approaches to consultation over project planning and design. In many cases FAP projects will need to promote the establishment of farmer and non-farmer organisations. These may take a variety of forms - for example single interest groups (landless labourers, disadvantaged women, or farmers) or multi-interest groups which aim to include all those affected by a project.

S6.3 Planning and Design for Improved O&M

FAP 13 has looked at a range of options for changing designs of some project components in order to facilitate O&M. Particular attention has been given to varying

approaches to embankment design, and to approaches which would reduce negative impacts on fisheries, reducing conflicts over system operation.

Figure S2 illustrates six different approaches to embankment construction, ranging from the conventional type in Option 1 to a "super embankment" in Option 6. These options include introduction of revenue generating measures, designs which incorporate facilities for roads and housing, designs which add to capital costs in order to reduce maintenance costs and designs which are compatible with partial protection, which in some cases will reduce the risks of repairing breaches and cuts. Some of these new options deserve further elaboration and introduction, at least on a pilot scale, by FAP projects. Others may raise insuperable problems related, for example, to land acquisition.

Various structure designs to permit the passage of fish spawn and fry through regulators have also been developed by FAP 13, and it is recommended that these be further elaborated by FAP 17 and given pilot trials at appropriate locations. Their effectiveness will need initial careful monitoring by FAP 17. Outline designs for the protection of beel fisheries have also been prepared (Figure S3) and it is recommended that these also be further developed by FAP 17.

S6.4 The Transition from Implementation to O&M

It has been observed that a number of changes could be made during the process of transition from "implementation" (the process of project construction and commissioning) to the O&M stage. These include training of O&M staff, involvement of user groups in O&M, resolution of initial operational problems and the establishment of specific operating rules for individual structures. The institutional separation of organisations responsible for the implementation and O&M phases could lead to a formal handover process, which would concentrate the attention of the implementing agency on the need to deliver a project which could be easily operated and cheaply maintained.

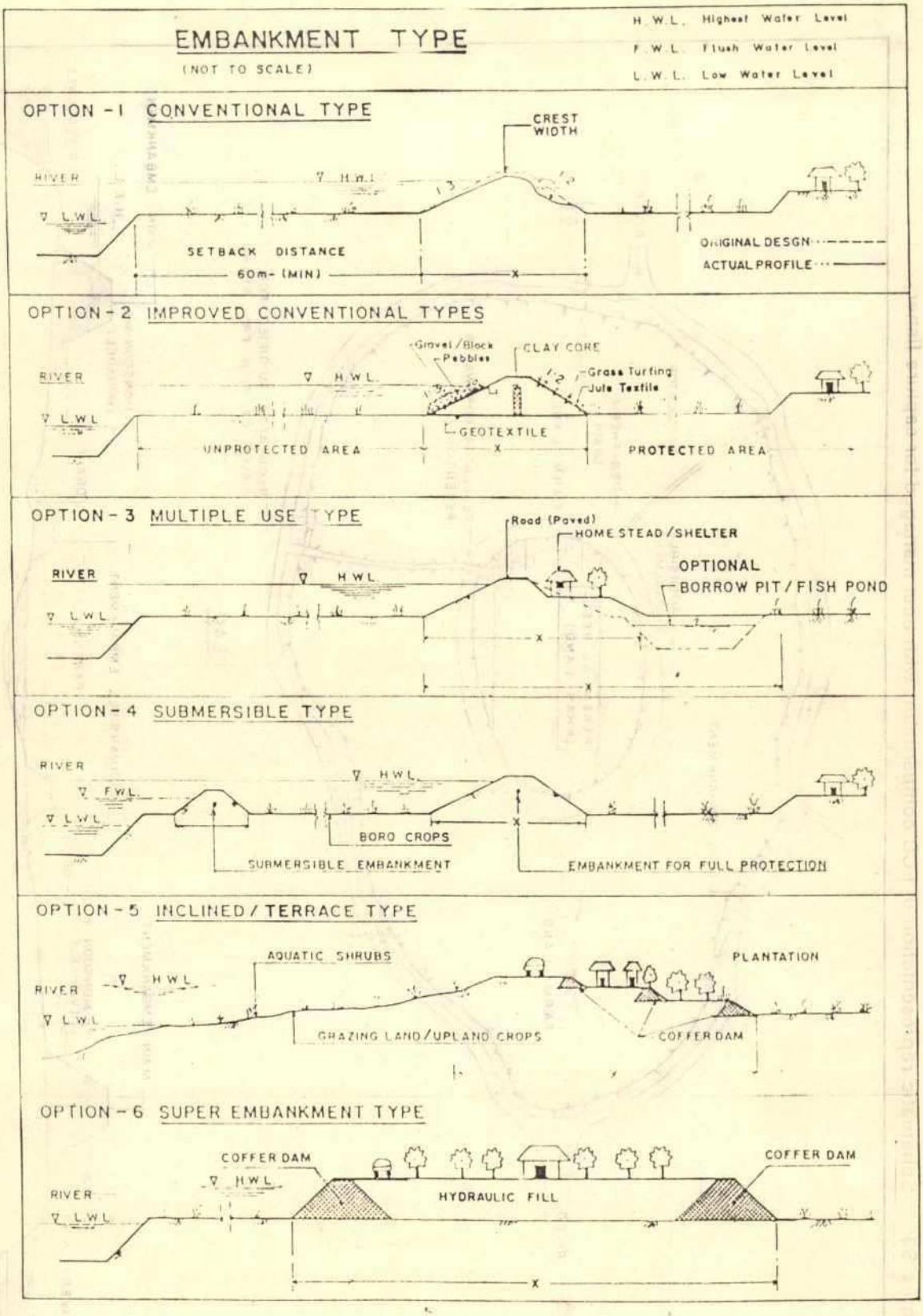
S6.5 O&M Manuals

Project specific O&M manuals are supposed to be prepared for all BWDB projects, but in practive they rarely are. Those that have been reviewed by FAP 13 were excessively comprehensive, they were not in Bangla, and they were not available to, or usable by field staff. It is suggested that modular O&M manuals should be prepared, which include both the detailed information needed for reference by O&M engineers and the basic operating guidelines which would be provided to those responsible for operating specific structures or maintaining lengths of embankment. The basic operating guidelines would be simple, illustrated, written in Bangla and used as training aids.

S6.6 Water Management

FAP 13 has explored a range of issues related to water management and flood management, as these relate to system O&M. There are clear opportunities to involve farmers more in water management in the context of FAP, and in particular when compartmentalisation is introduced. Evidence from elsewhere however suggests that farmer participation is most effectively achieved where projects are relatively small and simple in conception, and FAP 12 has shown that such projects are the most likely ones to be successful in Bangladesh also. If compartmentalisation involves the introduction of complex

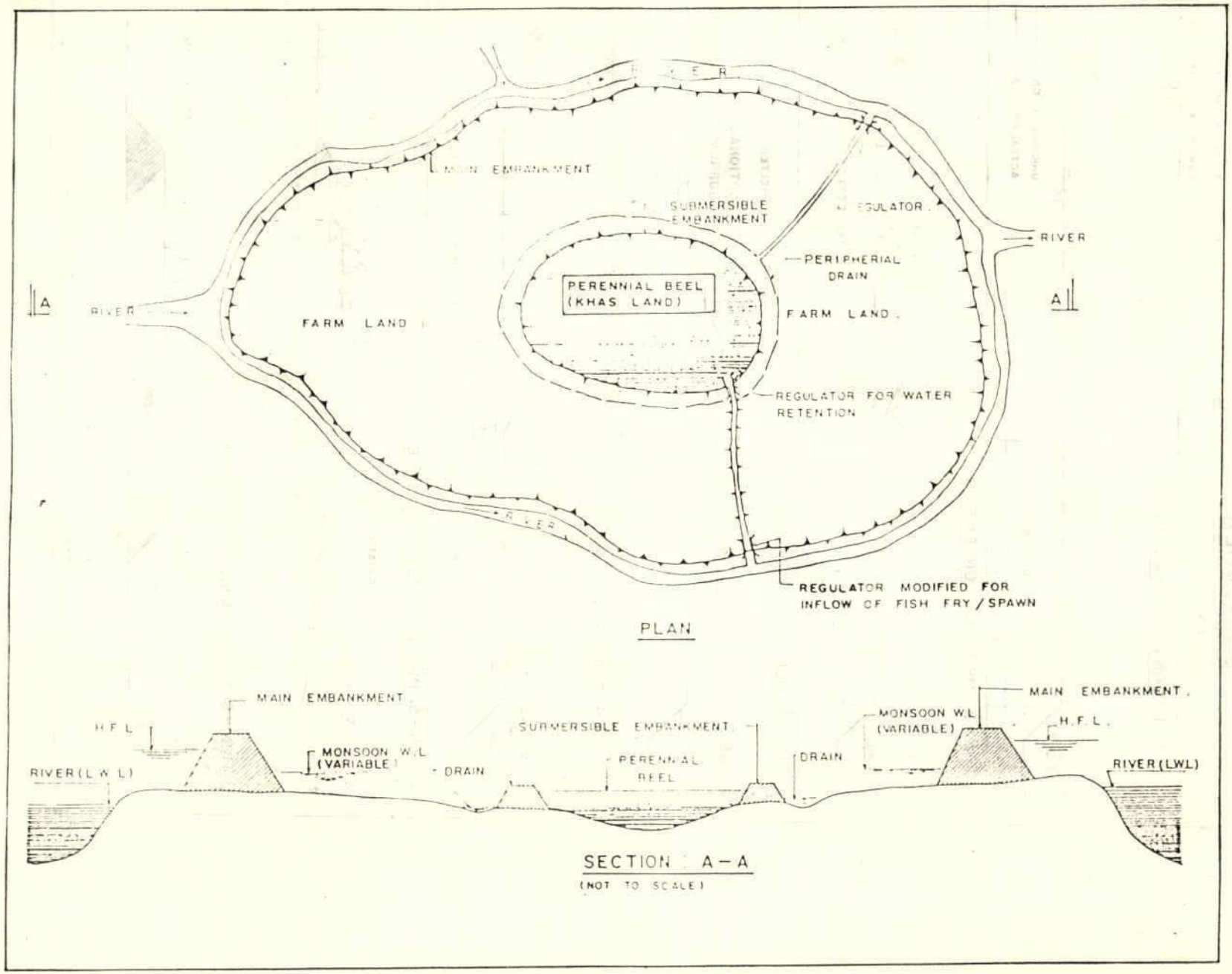
Figure S2 Examples of Embankment Options



Source:

Option 1	Field observation	Option 4	FAP 2, field observation
Option 2	FAP 8b, FAP 15	Option 5	FEC (1989) and FAP 13
Option 3	FAP 13	Option 6	FAP Panel of Experts/FAP 2

Figure S3 Schematic representation of FCD compartment with beel managed for capture fishery



operating procedures, and the need for close collaboration between adjacent embanked areas, it may not be consistent with increased farmer participation.

There is a lack of contingency plans for managing floods when these do occur in normally protected areas. Such planning should take place and include procedures for routine monitoring of water levels and embankment conditions, provision for emergency repairs, flood warning systems and evacuation plans. The need for public cuts in real emergencies should be recognised as legitimate. If BWDB recognises this they may also be able to insist that those responsible also repair the cuts, under BWDB supervision.

S6.7 Maintenance

At present maintenance is at best periodic and reactive. A well organised maintenance programme would include the following components:

- routine embankment maintenance;
- emergency repair to embankment damage;
- monitoring and record keeping;
- periodic maintenance (for example of drainage channels);
- routine maintenance of structures;
- rehabilitation of damaged structures.

Most of these activities could be effectively achieved through improved management and reallocating resources. Routine embankment maintenance is non existent at present. The relative costs and benefits compared with deferred maintenance need to be assessed, but there are opportunities for FAP projects to introduce new approaches to routine maintenance. The experience of DDP, LGEB and CARE indicates that Embankment Maintenance Groups (EMGs) can be organised, can deliver good quality maintenance and can divert some of the benefits of FCD/I projects to disadvantaged groups. It is recommended that formation of EMGs is given a high priority in the organisation of FAP projects' O&M.

S6.8 Resource Mobilisation

The raising of revenues from FCD/I projects is always difficult in developing countries. Farmers do often contribute to the costs of irrigation, and may even pay the full costs for irrigation services in some circumstances, but it is almost unknown for them to contribute financially to the costs of drainage and flood control. Where FAP projects involve irrigation components efforts should be made to charge for these. It may be possible to introduce value related land taxes in flood protected areas, but other efforts to raise revenue directly are unlikely to be effective, and may be counter-productive if they alienate farmers from systems in whose management they are being encouraged to participate.

S6.9 Infrastructure Use and Resource Mobilisation

In contrast, there are a range of opportunities to use FCD/I infrastructure as an indirect means of resource generation. These include the planting of trees and shrubs on embankments, where this does not undermine the structure's primary objective, fish culture in borrow pits and khals, the sale of land use rights on raised (and therefore protected) land and the use of embankments for roads, markets and housing. These opportunities could be exploited in association with NGOs, farmer groups, groups of otherwise disadvantaged people or with private individuals. It is recommended that pilot and priority FAP projects include trials of various such opportunities in order to identify those that deserve wider replication as means of reducing conflicts over O&M, raising resources for O&M, and saving maintenance costs.

S6.10 O&M Costs and Resource Estimates

It has been found that the "rule of thumb" figures generally used in costing O&M in feasibility studies are significantly lower than the actual levels of expenditure on projects studied by FAP 12 and FAP 13. In general the recording of O&M costs at project level is poor, and a much more thorough approach is needed to cost monitoring before any clear guidelines can be produced. These costs will depend on the detailed project components, and should be analysed both by component and according to the stage of development, as varying O&M costs are incurred at the implementation, transition and operating phases.

S6.11 Training

The training of BWDB staff is the subject of a much more detailed assessment by the EC supported component of SRP. Training of BWDB staff is generally inadequate at present, and this is particularly the case for field staff. If some of the initiatives suggested in this report are adopted there will also be an increasing need for training of non-BWDB staff involved in routine maintenance and in operation of FCD/I facilities.

S7 FAP 13, PHASE II

The FAP 13, Phase I team were required to propose a Work Plan for a second phase of FAP 13. The original FAP 13 Terms of Reference proposed a second phase in which the team would carry out brief annual visits to Bangladesh to review progress in the O&M sphere and organise annual workshops to discuss O&M issues. In the light of the FAP 13, Phase I findings this would appear to be an unsatisfactory proposal. The brief visits would be too short to allow meaningful contributions, and would underrate the critical importance of effective O&M to the success of FAP projects.

It is therefore proposed that FAP 13, Phase II should involve a more substantial presence and a substantial range of activities. The Phase II objectives of the Operation and Maintenance Study would be:

- identify and formulate promising new O&M initiatives and collaborate with other FAP and non-FAP projects in testing these;
- monitor and evaluate innovative O&M initiatives being undertaken by other FAP and non-FAP projects;
- recommend more effective operation and maintenance (O&M) procedures and promote their adoption into new and existing FCD/I projects;
- ensure that all those involved in O&M of FCD/I projects are aware of the progress of new initiatives that relate to their own efforts.

It is proposed that the FAP 13 team would provide a focal point for FAP project activities related to O&M. It is proposed that the team would undertake the following tasks and activities:

a) Liaison

The team would maintain close contact with all non-FAP activities associated with O&M, and with FAP Regional Study teams and those involved in planning FAP projects, to ensure maximum exchange and sharing of experience;

b) Development of O&M guidelines and new approaches

FAP 13 would develop operational guidelines for FAP planning teams on approaches to O&M and would design and evaluate new multi-dimensional O&M options;

c) Review and Advisory Role

FAP 13 would provide a general advisory service to FAP and executing agencies by reviewing FAP proposals from the O&M viewpoint;

d) Feedback and Coordination

FAP 13 would monitor and evaluate the progress of O&M pilot intiatives, and ensure that lessons learnt are widely disseminated. The FAP 13 team would organise annual workshops on O&M issues and report regularly on study progress and findings.

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ABBREVIATIONS AND GLOSSARY

ADB	Asian Development Bank
Aman	Main monsoon season paddy crop
Aus	Late dry season/early monsoon paddy crop
BADC	Bangladesh Agricultural Development Council
Boro	Winter (dry) season paddy crop
BRAC	Bangladesh Rural Advancement Committee
BRDB	Bangladesh Rural Development Board
BRE	Brahmaputra Right Embankment
bund	Earthen embankment
BWDB	Bangladesh Water Development Board
CDSP	Char Development and Settlement Project
CE	Chief Engineer
CEP	Coastal Embankment Project
CFE	Cash Foreign Exchange Budget
CIDA	Canadian International Development Agency
CIP	Chandpur Irrigation Project
crore	Ten million (10,000,000)
C/S	Country side (of embankment)
CTA	Chief Technical Adviser (WFP)
DAE	Department of Agricultural Extension
DB	Development Budget
DDP	Delta Development Project
DOF	Department of Fisheries
DTW	Deep tube-well (with positive-displacement pump)
EC	European Community
EIP	Early Implementation Project
EMG	Embankment Maintenance Group
EPWAPDA	East Pakistan Water & Power Development Authority (see WAPDA)
ERD	External Resources Division
ESCAP	Economic and Social Commission for Asia and the Pacific
FAO	Food and Agriculture Organisation
FAP	Bangladesh Flood Action Plan
FCD	Flood Control and Drainage
FCDI	Flood Control Drainage and Irrigation
FDR	Flood Damage Repair
FFW	Food-for-work
FHRC	Flood Hazard Research Centre, Middlesex Polytechnic
FPCO	Flood Plan Coordination Organisation
FY	Financial Year
gher	Bunded area of saline water for shrimp cultivation
ghog	Animal burrow in embankment
GK	Ganges-Kobadak Irrigation Project
GKRP	Ganges-Kobadak Rehabilitation Project
GOB	Government of Bangladesh
GON	Government of the Netherlands
hat	market
HTS	Hunting Technical Services Limited
HYV	High yielding variety
IBRD	International Bank for Reconstruction and Development (World Bank)
IDA	International Development Agency (World Bank)
IDP	Infrastructure Development Programme (LGEB)

IETC	Irrigation Extension Training Centre (BWDB)
ILO	Intermediary Level Organisation (of SRP Water Management System)
IMP	Irrigation Management Programme
IOM	Improved Operation and Maintenance
IRWP	Intensive Rural Works Programme
ISP	Institutional Suport Programme (LGEB)
JICA	Japan International Cooperation Agency
KIP	Karnaphuli Irrigation Project
KSS	Krishi Samabay Samity
khal	Natural channel/minor river/tidal creek
khalashi	'Cleaner' (actually guard) of regulator/sluice
kutcha	Locally made, not manufactured; earthen (of roads, structures)
LCS	Labour Contracting Society
LGEB	Local Government Engineering Bureau
LLP	Low Lift Pump
LPC	Local Project Commitee
LRP	Land Reclamation Project
mouza (mauza)	Revenue village (may comprise several physical settlements)
MDIP	Meghna-Dhonagoda Irrigation Project
MEU	Mechanical Engineering Unit (BWDB)
MIP	Muhuri Irrigation Project
MIWDFC	Ministry of Irrigation, Water Development and Flood Control
MOF	Ministry of Finance
MPO	Master Plan Organisation
mt	metric tonne (1,000 kg., 2,204 lb.)
NGO	Non-governmental Organisation
O&M	Operation & Maintenance
O&MCC	Operation & Maintenance Cost Cell (CIDA/BWDB)
ODA	United Kingdom Overseas Development Administration
OFD	On Farm Development
Parishad	Elected council (e.g. of Upazila or Union)
PC	Planning Commission
PEP	Production Employment Programme (of BRDB, q.v.)
PIE	Project Impact Evaluations
PMU	Project Management Unit (BWDB)
PP	Project Proforma
PWD	Public Works Datum
RESP	Rural Employment Sector Programme
RHD	Roads and Highways Department
RMP	Rural Maintenance Programme (CARE)
RRA	Rapid Rural Appraisal
R/S	Riverside (of embankment)
SDE	Sub-divisional Engineer
SE	Superintending Engineer
SO	Section Officer
SRP	System Rehabilitation Project
SSDFCP	Small Scale Drainage and Flood Control Project
SSSFCDIP	Second Small Scale Flood Control Drainage and Irrigation Project
SSWCS	Small Scale Water Control Structures
STW	Shallow tube-well (with suction pump)
TOR	Terms of Reference
TWUA	Tertiary Water Users Association
UCCA	Upazila Central Cooperative Association

UDEP	Upazila Drainage and Embankment Plan
Union	Administrative level below Upazila (q.v.), typically 10 per Upazila
UNO	Upazila Nirbahi Officer (principal staff officer of Upazila Parishad)
UP	Union Parishad
Upazila	Administrative unit above Union & below Zila (460 Upazilas in Bangladesh)
USAID	US Agency for International Development
WAPDA	Water & Power Development Authority (precursor of BWDB)
WFP	World Food Programme
XEN	Executive Engineer

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1 INTRODUCTION

1.1 PROJECT BACKGROUND

Hunting Technical Services Limited (HTS) has been engaged by the United Kingdom Overseas Development Administration (ODA) to provide consultancy services to the Government of Bangladesh for Component 13 of the Flood Action Plan, the Operation and Maintenance Study. Support for this FAP component is also provided by the Japanese International Cooperation Agency, which has contracted Sanyu Consultants Inc. to provide consultancy support.

FAP 13 is one of the supporting studies to the Bangladesh Flood Action Plan. The FAP 13 team includes institutions and engineering specialists from Middlesex Polytechnic Flood Hazard Research Centre, Sanyu Consultants Inc., and Technoconsult International Limited of Bangladesh. Although the study for FAP 13 is a separate component of the Flood Action Plan it is closely linked with FAP 12, the FCD/I Agriculture Study. In particular the two studies share a common core of fieldwork and all the team working on FAP 13 are involved in at least part of the work under FAP 12.

1.2 TERMS OF REFERENCE

The particular focus of the study is to provide guidance for the O&M of any new projects or project types which may be taken up under the Flood Action Plan, although it is also expected to be relevant to existing projects. Based on the Terms of Reference (Annex A) there are three main aims of the study:

- to identify the main constraints on effective operation and maintenance (O&M) of FCD and FCDI projects in Bangladesh;
- to draw up guidelines for ways of overcoming these constraints, both for existing projects and for new ones under FAP;
- and to recommend ways of maximising participation of beneficiaries and of mobilising local resources for O&M.

FAP 13 was from the outset conceived as a five year project with an intensive first phase followed by a less intensive second phase in years 2-5. The TOR detail the tasks to be undertaken in each phase. In the first phase there were five key tasks:

a) Review of O&M in FCD/I projects in Bangladesh

This was to cover FAP 12 study projects, other projects experimenting in improving O&M, and a review of previous studies in order to address a list of nine issues which were to be reviewed and recommendations to be formulated. These are listed in Table 1.1 together with the sections of this report where the relevant findings and recommendations are to be found. In Chapter 6 the findings are summarised along with appropriate recommendations.

Table 1.1 Detailed Terms of Reference and Location of Reviews and Recommendations

Abbreviated detailed TOR[1]	Review	Recommendations
Technical requirements for O&M in FCD/I projects	Volume 2 - past projects Section 5.2.2 other countries Section 6.7.3 compartments	Section 6.4 embankments Sections 6.4 and 6.10.2 beels/fisheries Section 6.6 O&M manuals
Effectiveness of O&M practices and procedures in different project types	Volume 2, summary in Chapter 3	na
Reasons for deficiencies in O&M and potential to overcome these	Section 2.6 Previous studies Chapter 3 Case studies	Chapter 6
Extent of participation by public and other bodies in all aspects of project cycle	Section 2.3 Liaison Chapter 3 Case studies Section 4.11 NGOs & Coops Section 5.2.3 International	Section 6.2 Institutions Section 6.3 Participation Section 6.7.2 Water management
Local resource mobilisation and tax collection to finance O&M	Section 4.7 GK Project Section 4.9.3 LGEB Section 5.2.4 International	Section 6.9 Resource mobilisation Section 6.10 Resource generation
Division of responsibility between agencies and beneficiaries to maximise latters role	Section 2.3 BWDB-Upazilas-LGEB Section 4.9.5 Upazilas Section 4.11 NGOs Section 5.2.1 International	Section 6.2 Institutions Section 6.3 Participation Section 6.5 Transition period
Review of training programmes of BWDB, LGEB and Upazilas	Section 2.5 BWDB, Section 4.9.4 LGEB	Section 6.12
Guidelines for O&M cost estimation	Section 2.4 Aggregate Section 3.3.3 Case studies	Section 6.11
Review new approaches to O&M, assess constraints on them and recommend alternative approaches	Chapter 4	Sections 6.4 Infrastructure modifications Section 6.7 Operation Section 6.8 Maintenance Section 6.10 Resource generation

Note [1] The TOR are reproduced in full in Annex A and have been abbreviated here for convenience of tabulation

b) Review of O&M in FCD/I in other countries in the region

Annexes C to K of this report give country wise details obtained from secondary sources. The relevant O&M experience is summarised in Chapter 5.

c) Report on O&M problems and recommendations

This report fulfils this task.

d) Workshop on O&M

On 11-12 August 1991, approximately 1.5 months before the end of phase one, a workshop was held covering FAP 12 and 13 findings focusing on RRA assessments of Project impacts and problems and on O&M issues. The comments and discussions at the workshop were reflected in the Draft Final Report of FAP 13.

e) Proposals for work in years 2-5

A further aim was to prepare, on the basis of the first year's study, a work programme for years 2-5. This has been discussed extensively following the submission of the Draft Final Report. As a result a draft TOR has been developed for a much expanded second phase covering years 2-5 and this is reproduced as Chapter 7. The reasons for the changes in scope from the original TOR proposal for years 2-5 should be apparent from Chapters 2-6. This results from: the diversity of FCD/I projects and O&M problems; the lack of any clear effective model for improved O&M in Bangladesh, because those projects developing such concepts are still at an early stage; and the need for continued advice for other FAP components on O&M, and for liaison between FAP and the various non-FAP projects active in improving O&M.

1.3 METHODOLOGY

Based on the TOR there are three main components of the study:

- assessment of O&M performance and constraints in completed BWDB FCD/I projects;
- review of O&M experience in Bangladesh; and
- review of O&M experience in other countries.

Details of the methodology have already been given in the FAP 13 Methodology Report, but are summarised briefly here and in more detail, particularly for the RRA methods, in Annex B.

1.3.1 Assessments of current O&M experience

The key component of the O&M study has been evaluations of O&M performance in 17 FCD/I projects selected for joint evaluation with FAP 12 (in fact there are 16 projects, but for one - the Brahmaputra Right Embankment - assessments have been carried out in two reaches). The O&M assessments were as detailed as possible within the constraints of time

and resources and were based on a Rapid Rural Appraisal (RRA) methodology using multidisciplinary teams from FAP 12 and 13. The 17 projects were selected in consultation with the Flood Plan Coordination Organisation (FPCO). They are representative of the different O&M experiences in BWDB projects since they cover projects in all the FAP regions and a range of project types, flood hazards, ages and sizes.

The O&M assessments used checklists covering engineering and institutional aspects of O&M (see Annex B and FAP 13 Methodology Report).

Discussions were held with BWDB staff ranging from Superintending Engineers to sluice khalashis concerned with the projects studied. They covered O&M experience and problems, management and decision taking. Various officials of the local administrations were also met and their activities in water management and infrastructure affecting water management were discussed along with the issues of liaison and cooperation with the projects concerned. Most importantly, site visits were made and the state of as much of the physical infrastructure as possible was assessed at first hand. At the same time a wide range of local people were consulted to obtain their views on operating practices and problems concerning the projects. In particular discussions were held with farmers in different parts of the projects and with members of sluice committees where these existed, but the views of other groups which affect operation or maintenance (such as fishermen and settlers on embankments) were also investigated.

It is important to note that the case studies combined O&M with an assessment of all types of project impacts. The emphasis was on identifying the key impacts of the projects and how the projects affected different 'sectors' such as agriculture and fisheries, and the reasons, such as the quality of O&M, for differences between intended and actual impacts. Hence the assessments linked planning, design and construction, and O&M, with qualitative and semi-quantitative assessment of benefits and disbenefits.

The 17 projects evaluated by RRA methods were each visited by a multi-disciplinary team including an engineer and a social-institutional specialist for about a week. Five of these projects were subsequently the subject of more detailed Project Impact Evaluations (PIE). For these projects the O&M assessment was more detailed since the initial RRA visit (in March-April 1991) was followed by a return visit to concentrate on O&M issues during August-October 1991. These follow up visits were necessary for a number of reasons. The initial RRAs were the first ones undertaken and so represented a learning process. In general these are the largest projects investigated by the team and so it was not possible to inspect all structures and embankments during the initial visits. The return visits permitted questions raised by analysis of the RRA information to be investigated, and more detailed data on O&M costs could be collected since the BWDB officials required time to compile such data.

Individual evaluations of the 17 projects have been prepared by FAP 12. In addition separate O&M assessments are presented in Volume 2 of this report. While these are not sufficient to design an improved O&M strategy for each project (this would have taken much longer and was not an objective of this study) they do highlight where changes in planning and design would be necessary before improved O&M could be attempted, the issues involved and some priorities for O&M. The O&M problems revealed by these studies are summarised in Chapter 3.

1.3.2 Review of O&M in Bangladesh

BWDB is the main agency concerned with FCD/I projects in Bangladesh and is responsible for their O&M. Hence this part of the study has described current practice in BWDB (Chapter 2). The case studies were also most revealing on this. Chapter 2 also summarises the findings of previous reviews of O&M in the water sector in Bangladesh, since in many cases the findings of FAP 13 are not new but merely reinforce the identification of problems which have already been identified. The review concentrated particularly on the intentions and experience to date of a number of projects which include measures to strengthen and improve O&M in BWDB either through rehabilitation of existing projects or as part of implementing new projects (Chapter 4).

However, BWDB is not the only agency active in water management and earthworks in Bangladesh. In particular the Local Government Engineering Bureau (LGEB), through the Upazilas, is active in small water management schemes and rural roads and structures. In the past there have been directives that small-medium sized FCD/I projects should be handed over to the Upazilas under the technical supervision of LGEB (although this may now be less likely given uncertainties over the political future of the Upazilas). Hence the O&M strategies it has adopted have also been investigated (Chapter 4).

1.3.3 International O&M review

In keeping with the TOR, a short literature review of experience and innovations in O&M and water management in other countries, particularly in south and south-east Asia, has been undertaken. Much of the experience is in irrigation rather than Flood Control and Drainage (FCD) projects, and some countries are also at an early stage of experimenting with improvements to O&M. Nevertheless some lessons can be drawn, for example on ways of improving farmer participation in water management, which appear to be relevant to Bangladesh and the Flood Action Plan (Annexes C to K and Chapter 5).

1.4 ACKNOWLEDGEMENTS

This study has depended heavily on the fieldwork undertaken jointly with FAP 12. This would not have been possible without the assistance of a large number of BWDB officers of all ranks who discussed with the team the O&M situation of their projects. In addition we are grateful to officers of the Upazilas visited and to the many people operating or affected by FCD/I projects who explained their problems.

This study has also benefited from discussions over the year with senior BWDB staff in Dhaka and the zones, and with the officials and consultants working on projects with improved O&M components: System Rehabilitation Project (Netherlands and European Community components), Second Small Scale Flood Control Drainage and Irrigation Project, Local Government Engineering Bureau, Delta Development Project, Early Implementation Project, Land Reclamation Project, Ganges Kobadak Rehabilitation Project, BWDB O&M Cost Cell, CARE, ESCAP Bangkok, and International Irrigation Management Institute (Bangladesh representative). We are grateful to these teams for showing FAP 13 staff around some of their projects.

The study benefited from the many comments received from those attending the FAP 12/13 workshop during August 1991, and particularly from the comments on the Draft Final

Report received during the review process. Comments from and liaison with a number of FAP components over O&M issues have also been important: notably FAPs 1, 2, 3, 5, 6, 15, 20, 23, and 25. The study has been undertaken effectively as a joint project with FAP 12. We are particularly grateful to FPCO and to all the FAP panel of experts for their continued guidance and valuable suggestions.

2 INSTITUTIONAL CONTEXT

2.1 INTRODUCTION

This Chapter is essentially descriptive and sets out the institutional context of O&M in water management in Bangladesh. It then reviews the previous studies of O&M in Bangladesh which form the context of the present study - since O&M problems have already been identified as a major constraint on the effective provision of flood control, drainage and irrigation in Bangladesh.

O&M might collectively be termed the management of completed projects or 'systems'. What is and is not included in O&M in the context of FCD/I projects should become apparent in this report, but it is worth noting that the System Rehabilitation Project has spent some time in defining those activities which it regards as falling within O&M. For the most part this study (FAP 13) is concerned with structural FCD/I projects and the definitions adopted reflect this. However O&M in non-structural flood mitigation measures is analogous although the emphasis is likely to be more on operation than maintenance. The following working definitions are used in this report:

Operation

Operation is the planning of and execution of water management at the system and sub-system levels. The most common components are the closing and opening of structures which affect water levels in the project (and not just on one individual's plot of land), and the monitoring of this operation and the subsequent adjustment of targets and actions to meet the needs of land users. Operation reacts to changing environmental circumstances in order to achieve targets set to serve the interests of land users within the system. What farmers (and other land users) do in managing their land and the water on it is also 'operation', but only if this interferes with other land users does it require regulation or interference by the public sector or the larger FCD/I system.

Maintenance

Maintenance is defined as actions taken to keep the physical components of a system in a state in which it can operate as desired. There are several aspects to this: routine or preventive maintenance is normally carried out continually to preserve infrastructure in its intended state; sometimes it may be periodic as in the re-excavation of khals which are not accessible to this type of maintenance all the time. Repairs may be undertaken in response to emergencies, which may be anticipated but cannot be predicted with certainty, or may be carried out occasionally when components are so worn as to be beyond routine maintenance.

Operation and maintenance is only one stage in the life of a system. During the feasibility study and detailed planning and design of a project O&M issues are important. The investment will be justified on the basis of anticipated benefits. If the system cannot operate or be maintained as intended then it will not be sustainable and benefits will either never be achieved as intended or will be achieved initially and then either decline as the project falls into disrepair or be suddenly lost when it fails. At the planning and design stage O&M implications of project design need to be explicitly considered to identify impacts on different

groups affected by the project and to ensure that the O&M requirements are compatible with social and institutional circumstances in the project area.

Implementation (the construction and commissioning process) may again affect subsequent O&M since differences from the original plan may arise and inadequate construction may subsequently result in maintenance problems. The transition from construction to normal operation and maintenance is discussed in this report because it appears that this phase has received inadequate attention in Bangladesh although conceptually and financially it may be better treated as part of implementation.

Physical infrastructure is not indestructible and has a finite life after which it becomes uneconomic to make repairs in order to continue operation. At this time the system could be abandoned or rehabilitated to its original form, or a new project to serve changed needs could be designed. At this point the feasibility study stage of the project cycle is again reached.

2.2 THE INSTITUTIONAL FRAMEWORK

2.2.1 Introduction

This section describes briefly the different organisations and governmental agencies which have or could have a role in O&M of water management projects in Bangladesh - the institutional framework. The section draws heavily on the reports of other studies and projects concerned to improve O&M in Bangladesh.

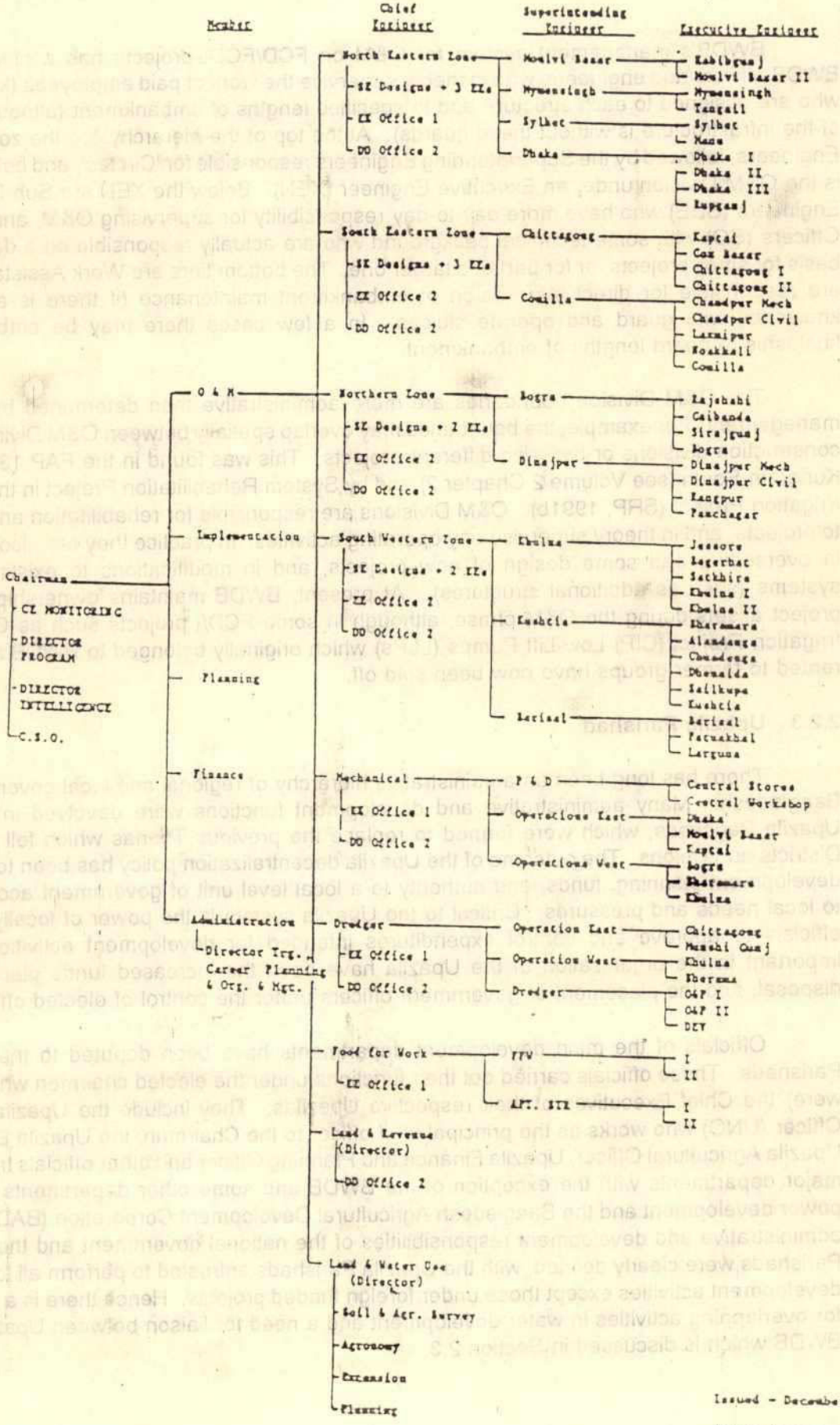
2.2.2 BWDB O&M Organisation

The Bangladesh Water Development Board (BWDB) is a semi-autonomous public agency under the administrative control of the Ministry of Irrigation, Water Development and Flood Control (MIWDFC). It was established in 1972 when the East Pakistan Water and Power Development Authority (EPWAPDA) was split into two agencies. It employs about 18,000 staff (18,013 in December 1987 - World Bank, 1990), is managed by an appointed Chairman and five Board Members, and is responsible for planning, design, implementation, operation and maintenance of FCD/I projects along with erosion and town protection (World Bank, 1985).

BWDB established an O&M organisational structure during the 1980's. In 1983 an O&M Board Member was appointed, and in 1985 the regional breakdown of BWDB zones headed by Chief Engineers was placed under the Member O&M. In this way the field offices of BWDB became responsible formally for O&M through the renaming of Divisions as O&M Divisions (which are the basic unit with O&M responsibilities). In addition Mechanical Engineering, Dredging, and Food-For-Work are under the O&M Member. This organisational structure is shown in Figure 2.1 where the areas under Executive Engineers on the right hand side are the O&M Divisions.

In practice this amounts to general field activities, including smaller new projects, being placed under O&M. Experience in the FAP 13 fieldwork indicated that the change amounted to more of a name change than a change in philosophy or emphasis in actual work. It should be noted that some anomalies exist, such as projects not declared as complete and hence not under an O&M Division but which have been effectively completed and operating for a number of years (a prime example being the Kurigram Project which formed one of the FAP 13 case studies).

Figure 2.1 BWDB O&M Organisation



Source: World Bank (1985)

BWDB's management system for O&M on FCD/FCDI projects has a hierarchy of BWDB officers and engineers, who in theory supervise the work of paid employees (khalashis) who are assigned to each structure and to specified lengths of embankment (although much of the infrastructure is without these guards). At the top of the hierarchy are the zonal Chief Engineers, followed by the Superintending Engineers responsible for 'Circles', and below these is the O&M Division under an Executive Engineer (XEN). Below the XEN are Sub-Divisional Engineers (SDE) who have more day-to-day responsibility for supervising O&M, and Section Officers (SO) with some technical background who are actually responsible on a day-to-day basis for small projects, or for part of a larger one. The bottom tiers are Work Assistants, who are responsible for direct supervision of embankment maintenance (if there is any), and khalashis, who guard and operate sluices. In a few cases there may be embankment khalashis to guard lengths of embankment.

The O&M Division boundaries are more administrative than determined by system management. For example, the boundaries may overlap spatially between O&M Divisions and construction divisions or between different projects. This was found in the FAP 13 study of Kurigram South (see Volume 2 Chapter 2) and by System Rehabilitation Project in the Muhuri Irrigation Project (SRP, 1991b). O&M Divisions are responsible for rehabilitation and repairs to projects, and in theory supervise any operating activities. In practice they are also involved in overseeing and some design of new projects, and in modifications to existing FCD/I systems (such as additional structures). At present, BWDB maintains ownership of FCD project assets during the O&M phase, although in some FCD/I projects such as Chandpur Irrigation Project (CIP) Low-Lift Pumps (LLPs) which originally belonged to BWDB and were rented to farmer groups have now been sold off.

2.2.3 Upazila Parishad

There has long been an administrative hierarchy of regional and local government in Bangladesh. Many administrative and development functions were devolved in 1982 to Upazila Parishads, which were formed to replace the previous Thanas which fell between Districts and Unions. The outcome of the Upazila decentralization policy has been to devolve development planning, funds, and authority to a local level unit of government accountable to local needs and pressures. Critical to the Upazila system is the power of locally elected officials to approve and control expenditures intended for development activities. Also important in the organization of the Upazila have been the increased funds placed at its disposal, and the placement of government officers under the control of elected officials.

Officials of the main development departments have been deputed to the Upazila Parishads. These officials carried out their functions under the elected chairmen who are (or were) the Chief Executives of their respective Upazilas. They include the Upazila Nirbahi Officer (UNO) who works as the principal staff officer to the Chairman, the Upazila Engineer, Upazila Agricultural Officer, Upazila Finance and Planning Officer and other officials from most major departments with the exception of the BWDB and some other departments such as power development and the Bangladesh Agricultural Development Corporation (BADC). The administrative and development responsibilities of the national government and the Upazila Parishads were clearly defined, with the Upazila Parishads entrusted to perform all local level development activities except those under foreign funded projects. Hence there is a potential for overlapping activities in water development and a need for liaison between Upazilas and BWDB which is discussed in Section 2.3.

The promotion of the Upazilas can be regarded as an example of the 'public choice' rationale behind decentralisation, which is founded on the belief that decentralisation will lead to greater accountability in government through more direct links with local governments' customers. However, there has often been criticism by the press of misappropriation of resources, and a study of local resource mobilisation in selected Upazilas by Blair (1989) showed evidence that in these case studies this strategy has often amounted to a 'blank cheque' for local vested interests to usurp resources, and that competition and efficiency in leasing and revenue raising was poor in these Upazilas.

At present (early 1992) the political future of the Upazilas seems uncertain since the Upazila Parishads (the elected bodies) have been dissolved by decree although the administrative staff and functions remain. However, the Upazilas and Union Parishads (UPs - which are a much older form of representative local government - there may be around ten Unions in an Upazila) represented, and in the case of the UP still represent, a potential means of local resource mobilisation and local accountability in development activities. This could be important for improving O&M of FCD/I projects.

2.2.4 Local Government Engineering Bureau (LGEB)

LGEB was created to provide technical assistance to the District and Upazila levels for construction, operation and maintenance of local civil infrastructure. Responsibility for planning, design and construction of small water development schemes was also assigned to LGEB. In a 1985 policy decision, LGEB (in the form of its Upazila staff) was instructed to take responsibility for the O&M of small completed schemes constructed by BWDB. The transfer of BWDB small schemes to LGEB has not yet materialized, and would have added a considerable burden to the Upazila engineering staff, although the range of technical expertise available in the Upazilas could be developed to assist in improving water management and local institutions.

Nevertheless LGEB is important for O&M in FCD/I projects because of activities which impact on the operation of BWDB, and because of its experience in improving O&M (Section 4.9). If FCD/I projects are devolved to Upazilas, LGEB would have a major role in their operation and maintenance.

2.2.5 Department of Fisheries (DOF)

Management of open water fisheries is in a transitional phase between old and new fisheries management policies. Under the old policy all open water fisheries are controlled by the Ministry of Land which leases fishing rights to the highest bidder. The new policy, which is only operating in some areas, is to issue licenses to fishermen (in an attempt to avoid leases being controlled by the rich) and to stock fish into beels and open water systems. The management principle is that the total licence fees should not raise less than the previous leasing system.

The primary role of DOF has been to support aquaculture through demonstration ponds, hatchery construction and operation, research, and extension. Recently, inter-agency agreements have been developed to give DOF fisheries management responsibility in selected waters owned by BWDB. The Upazila Fisheries Officer, deputed from DOF, is responsible for providing services within the Upazila.

Given that the building and operation of FCD/I projects has such a major adverse impact on open water fisheries in most cases (see FAP 12 Final Report), the potential for controlled fishery management and fish cultivation in public waters which are controlled within FCD/I projects (whether natural such as beels, or man made such as borrow-pits) is of great importance in mitigating these impacts. The agency which has some role and could play a greater part in this is DOF, particularly if it is given a role in the planning of FCD/I projects or in their rehabilitation and modification.

2.2.6 Department of Agricultural Extension

The Department of Agricultural Extension (DAE) could play an important role in encouraging the achievement of potential benefits from FCD/I projects, in on-farm/tertiary level O&M, and in articulating the water management problems of farmers in FCD/I projects. DAE has a network of Block Supervisors who could fulfil this role. However, DAE emphasis is on a training and visit system, it is understaffed and under-resourced, has rarely been involved directly in managing FCD/I systems, and its strength is likely to be further reduced. At present some functions overlap with the Land and Water Use Department of BWDB which has a similar role in some FCD/I projects (such as the Chandpur Irrigation Project (CIP) and the Ganges-Kobadak Project).

2.2.7 Bangladesh Rural Development Board

The Bangladesh Rural Development Board (BRDB) is a semi-autonomous body responsible for forming and supporting cooperatives. BRDB could therefore have a role in forming groups for O&M or in providing credit. It has rarely had any direct involvement in FCD/I O&M. However, in CIP for example the formation of groups, and provision of credit, for hiring of BWDB Low Lift Pumps (LLPs) were organised by BRDB officers seconded to the BWDB project management structure. More generally BRDB has been the organising agency for cooperatives which were entrusted with government supplied deep tubewells (see Section 4.11).

2.2.8 Non-Governmental Organisations (NGOs)

There are a large number of non-governmental organisations in Bangladesh, some of which have sizeable rural development programmes, particularly involving income generating activities for the landless. A number, such as Bangladesh Rural Advancement Committee, Proshika, CARE, Grameen Bank, and Rangpur-Dinajpur Rural Services, have experience in organising groups to manage small scale irrigation systems. Relevant experience and the potential for NGO involvement in O&M of FCD/I projects are discussed in Section 4.11.

2.3 LINKAGE AND LIAISON BETWEEN BWDB AND UPAZILAS AND THE LGEB

2.3.1 Existing liaison provisions

There has never been any well defined or established linkage or liaison between BWDB and either the Upazilas regarding general development policies or with LGEB regarding local civil engineering works. Nevertheless there are major jurisdictional overlaps between BWDB on one side and the Upazilas (particularly the LGEB staff) on the other side. There are no ordinances or regulations requiring BWDB to liaise directly with either the Upazilas or LGEB (BWDB Chief Staff Officer, pers. comm.). The only linkages between these two

authorities are at the District level in the form of the District Steering and Coordination Committees, although there is a potential link at the Upazila level.

a) District Steering Committee

The meetings of these committees are presided over by the Deputy Commissioner of the respective District. Executive Engineers of BWDB and LGEB, representatives of NGOs, and the Upazila officials under the same District are invited to attend these meetings. The meetings discuss pre-selected agendas covering ongoing development activities, especially Food-For-Work (FFW) programmes, in the Upazilas of that District. In practice in these meetings the presence of BWDB and/or LGEB officials seems to be optional and depends on the relevant major agenda issues.

b) District Coordination Committee

These meetings include district level officials from the various departments and organizations. On some occasions, representatives from the NGOs involved in that District's development activities are invited to attend. These meetings mainly focus on coordination among different organisation's development activities, their progress, interruption, overlap and future development issues. The attendance by different organisations' representatives (including BWDB) at these meetings varies and is irregular.

c) Upazila Technical Sub-committee

At the Upazila level there is a provision in the FFW Planning and Implementation Circulars for constituting an Upazila Technical Sub-committee to review future FFW and other Upazila development schemes. This committee is headed by the respective Upazila Nirbahi Officer (UNO) with the Project Implementation Officer (PIO) as member secretary. The Upazila Engineer (UE), Sub-divisional Engineer (SDE) of BWDB and a few other Upazila officials are members of this committee. It is expected that such a committee will review proposed Upazila development schemes. However, in general, plans are rarely changed on the basis of wider implications for drainage and flooding, and the BWDB SDEs rarely attend the meetings.

2.3.2 Upazila Plan Books

At present, LGEB is trying to complete and update the Upazila five-year plan books. This is potentially an important endeavour as it could lead to infrastructure plans which are coordinated and take into account flood and drainage conditions and the implications of Upazila works for the operation of BWDB works and vice versa. The Upazila Engineers have been provided with guidelines and indications of linkages with the relevant BWDB sub-division. These are detailed in the following two sections which are summary translations from the Upazila Plan Book documents provided by LGEB to the Upazilas.

a) Upazila Drainage and Embankment Plan

i) Responsibilities:

- major water drainage schemes that need highly technical support (including equipment) will be undertaken by the BWDB;

- the Upazila Parishad through its "Drainage and Embankment Plan" will undertake small scale drainage schemes; and

- BWDB will assist the Upazilas where additional technical assistance is needed in local problematic flood control embankments. In this connection, BWDB will also assist the Upazila in such a way that the nearby Upazilas will not be adversely affected. In this regard, the XEN of LGEB will maintain proper liaison with the BWDB. The responsibility for scheme execution will depend entirely upon technical, planning and implementation skill.

ii) Planning:

- in the first stage the Upazila engineering section will prepare the " Upazila Drainage and Embankment Plan - 1" (UDEP-1) which will include the local water drainage pattern and the areas which have been flooded every year (the current situation);

- after discussing the flood problem mentioned in the UDEP-1 the Upazila will prepare UDEP-2 to include the flood control and drainage schemes proposed by the Upazila (the proposed situation); and

- after review of the UDEP-2 by the BWDB, the Upazila will prepare a revised plan (UDEP-2).

b) Upazila Irrigation Plan

i) Responsibilities:

- BWDB will provide technical assistance to the Upazila for examining the Upazila Irrigation Plan and it will also assist in preparing complicated water control schemes;

- BWDB will operate major water control structures and regulators and will supply irrigation water as and when needed; and

- LGEB will provide technical assistance for the Upazila Irrigation Plan. In this connection, it will supply a Planning and Design manual for irrigation channels and water control structures to the Upazila Parishad. Where necessary it will coordinate among BWDB, BADC and other organizations.

ii) Planning:

- the Upazila will show all its existing and proposed irrigation schemes in the Upazila Irrigation Plan - 1;

- depending on local opinion and experiences, the Upazila will prepare the "Upazila Irrigation Plan - 2" which will include schemes (low cost and easily implementable) proposed for the next five years; and

- after review of this UIP-2 by BWDB the Upazila will prepare a revised plan - "Upazila Irrigation Plan - 3".

2.3.3 Assessment of flood plain planning provisions

In practice so far there has been a complete lack of integration in flood plain planning and in particular in the planning, implementation and management of structural measures in the floodplain - either those designed to control water or those, such as roads, which affect water flows. Committee meetings could be used to solve problems or disputes if there was a statutory planning procedure, but are of very limited use without a procedure which requires both local administration and line departments to prepare plans which are then modified to form an integrated plan.

The Upazila Plan Book exercise is an attempt to correct this deficiency but is at a micro-level. It fails to take account of the serious external impacts which one Upazila may have on another, or which construction work by other agencies such as BWDB may have on that Upazila. In both cases (UDEP and UIP) the consultation framework is one way. BWDB can comment on Upazila plans (although there is no duty on the Upazila to modify its plan based on this review), but BWDB is under no requirement to even submit its plans and proposed projects to the Upazilas for their comments and approval.

A clear definition of responsibilities and technical collaboration would be of great help in achieving the flood plain mapping exercise (UDEP-1). It is unclear if the Upazilas have sufficient guidance for carrying out this important task. More generally planning has been handed over to engineers on a localised basis. There is a vital need for technical expertise in assessing flood and drainage conditions, in evaluating the implications of both new works and changed operation, and in preparing modification to existing works to overcome any problems, and in many cases this is appropriately handled at the local level.

However, planning needs to take account of the development opportunities for the area, for example of agricultural potential and changes in cultivation technology and techniques, and of possible improvements in the farming systems, in order to identify workable ways of improving monsoon season production. Similarly plans for urbanisation and growth of markets have implications for transport and road building, and the latter has a major impact on local LGEB earthworks which in turn affect drainage. Thus the future plans need to be coordinated closely to avoid one construction activity either adversely affecting the aims of another investment or duplicating a facility (roads could act as embankments and vice versa).

There is nothing in the Upazila Plan Book exercise to coordinate the wider flood plain problems in water management, such as impacts of other projects on a particular area or impacts of works planned on outside areas. The only institutional arrangements for coordination or planning at this level are the District level committees. These are unlikely to resolve some of the more fundamental problems which may affect O&M, although they may help in specific cases.

Some form of supra-Upazila level of floodplain planning is called for to integrate various plans which affect water resource development. This would ideally be outside the individual departments and ministries (that is not a LGEB or BWDB initiative but a central or district government initiative) and might work at the FAP regional level or as a District water management planning cell (see Section 6.2).

2.4 BWDB O&M RESOURCES AND COSTS

2.4.1 Introduction

Resources are frequently cited as the major constraint on improving O&M in BWDB. However there is evidence that substantial resources are available from a variety of sources for O&M. These different sources involve a complex set of procedures which do not promote efficient or rational allocation of scarce resources to maintenance. The actual sources of resources, planning procedures and costs involved in BWDB maintenance have recently been reviewed in detail by the O&M Cost Cell (O&MCC, 1991c). This section is largely a summary of relevant parts of this report, while examples of problems in O&M resourcing can be found in the FAP 13 case studies (see Volume 2), and in studies by the System Rehabilitation Project (SRP, 1991b).

BWDB receives O&M budget allocations from the following sources:

- Revenue Budget (Revenue Budget Head 163);
- FFW Programmes (WFP);
- Development Budget; and
- Cash Foreign Exchange Budget.

2.4.2 Revenue Budget

The revenue budget is mainly used for establishment (staff) costs. A small percentage goes to the operation and repair of completed projects.

BWDB field divisions submit their revenue budget estimates for the current and the next year to the BWDB, Director Programme (Dir. Prog.) through their respective Superintending Engineers (SEs) and Chief Engineers (CEs). The Director Programme BWDB (see Figure 2.1, directly under the Chairman BWDB) completes the necessary formalities with MIWDFC and Ministry of Finance (MOF) to get the approval of the budget allocation available for BWDB. A lump sum allocation is given and BWDB informs CEs of their allocation. Subsequently the Executive Engineers (XENs) are requested to submit detailed budgets and their work programmes on a project basis. SEs and CEs submit the revised work authorizations to the Dir. Prog. for BWDB approval. BWDB finalizes the work programme and sends a copy to MIWDFC for information, and to the CEs to issue approved work authorizations to the field divisions.

2.4.3 FFW Programmes

FFW scheme proposals are prepared by the field divisions of BWDB and forwarded to the CE/FFW (BWDB) through the respective SEs and CEs. CE/FFW consolidates all the proposals and passes them through a series of formalities and checks by the Chief Technical Adviser (CTA), World Food Programme (WFP) and other involved agencies to get the BWDB's FFW Annual Plan approved. CE/FFW then requests the BWDB field divisions to prepare project proformas (PP) for all approved schemes. After getting WFP's annual plan approval in a tripartite meeting with BWDB, the CTA and WFP, the zonal CEs of BWDB hold consultation meetings with SEs, XENs, Upazila Chairmen and Members of Parliament, and accordingly the XENs submit revised and final scheme proposals to CE/FFW. CE/FFW sends a list of approved schemes to WFP, which forwards this to the Director of Relief and Rehabilitation for the allotment order of wheat.

BWDB takes up FFW schemes mainly for the construction and rehabilitation of embankments and for the excavation/re-excavation of drainage and irrigation canals of completed projects and in addition for a limited number of small new projects. FFW is one of the main sources of resources for maintenance (repairs and resectioning) of completed, partially completed, and on-going projects. BWDB FFW wheat is provided under WFP assistance to Bangladesh. BWDB is in fact the main implementing agency for WFP. However, there are limitations on the use of this wheat: routine O&M is not included in the Plan of Operation between WFP and GOB (O&MCC, 1991c), and the spatial allocation of BWDB's share of WFP wheat (approximately 80 per cent) is determined to a considerable extent by WFP's targets of providing support to Upazilas according to their population and distress level (rather than by the length and age of existing earthworks). Even so BWDB has not always been able to use all, the wheat sanctioned, and World Bank (1985) did not consider WFP rules as limiting BWDB's use of the resource. There are several problems with FFW for maintenance. Earthwork is done in the winter when work and food are available. The late monsoon lean season is unsuitable for new earthworks but routine and emergency maintenance in FCD/I projects could be important then. Quality is compromised because payment is on a piece-rate basis

2.4.4 Development Budget (DB)

The Development Budget is routinely used to finance the O&M activities of completed portions of on-going projects, and also donor funded repair and rehabilitation works, even though the DB is traditionally used to construct new projects that are completely or partially financed by foreign aid.

Development Budget estimates are submitted from the Divisions through the hierarchy to the Dir. Prog. The procedure is that BWDB forwards the consolidated statement to the Planning Commission (PC) through MIWDFC. The PC, after discussions with the External Resources Division (ERD) and other involved agencies, sends it to the MOF for Prime Ministerial approval. The details of the proposed expenditure are then finalised down to the structure level work programme and a revised budget prepared. Revisions to the allocation are made by the Planning Commission.

2.4.5 Cash Foreign Exchange Budget (CFE)

The CFE Budget is used to finance the cost of imported materials and supplies (including pump parts, and lock gates) for completed projects.

BWDB field divisions prepare their CFE Budget requests and send the same to the Dir. Prog. through the respective SEs and CEs. The Dir Prog. prepares a consolidated statement and fulfils the required formalities with MIWDFC and MOF. After necessary revisions MOF approves the budget and sends it back to BWDB and the same is informed to the CEs and SEs for necessary action.

2.4.6 O&M Costs and Resources

Little progress in improving the accuracy of O&M costings at the feasibility study stage seems to have been made since figures given by IECO in 1960 (O&MCC, 1991c). Typically fixed (index linked) percentages of construction costs are taken to represent O&M costs: 2 per cent of earthwork investment and 1 per cent of structure investment. An additional 24 per

cent of this maintenance cost is traditionally estimated for establishment, audit and equipment costs.

O&MCC (1991c) details the budgets available and used for O&M and related activities in BWDB during 1985/86 to 1989/90, while World Bank (1985) summarised overall budgets in 1979/80 to 1983/84 and O&M expenditures in 1984/85.

Table 2.1 summarises the amount and sources of O&M expenditure prior to and after the 1987 and 1988 floods. In 1989/90 an estimated 67 per cent of the revenue budget funds allocated to BWDB went on O&M (virtually all the remainder - 27 per cent went on debt servicing). However the revenue budget contribution amounted to only one third of the estimated expenditure on O&M, deemed to include repairs and rehabilitation, whereas in 1984/85 it had contributed 49 per cent of O&M expenditure. According to O&MCC (1991c) out of Tk 1,578 million spent in 1989/90 Tk 1,091 million was for major/periodic repairs - comprising mainly FFW wheat (92 per cent of the FFW allocation to BWDB) and various donor funded repair projects (mainly flood damage repair (FDR) and repairs to on-going projects). To some extent 1989/90 appears to have been somewhat atypical since post 1987-88 flood damage repair costs were high (hence the high proportion of funds from the development budget compared with 1984/85), but FFW wheat resources were slightly down on the previous years, and there would still be over Tk 1,000 million available without the FDR type projects.

Table 2.1 **Consolidated O&M Budgets of BWDB in two years**

Source	1984/85[1]				1989/90[2]			
	Original request		Actual expend.		Original request		Actual expend.	
	Tk mill	%	Tk mill	%	Tk mill	%	Tk mill	%
Rev. Budget	454	57	294	49	693	30	529	34
FFW Prog.	308	39	285	47	653	29	499	31
Dev. Budget	29	3	22	3	914	40	545	35
CFE Budget	2	0	2	0	10	1	4	0
Total	793	100	603	100	2270		1578	100
Actual as % request			76%				70%	

Sources: 1 World Bank (1985) - all revenue budget expenditure treated as O&M.
2 O&MCC (1991c) - only direct O&M expenditure from revenue budget included.

Two facts are evident from the O&MCC and World Bank studies. Firstly, there are substantial funds available for O&M in its widest sense. In 1983/84 about 21 per cent of BWDB expenditure was on O&M. For an estimated benefited area of 3.4 million ha the expenditure in 1989/90 prices was Tk 460 per ha (O&MCC, 1991c). Secondly, virtually none of this is for water management, routine maintenance or system operation. Apart from establishment costs, O&M expenditures have become dominated by periodic repairs rather than preventive maintenance which might help to reduce embankment failures.

2.4.7 Divisional Repair Experience

In the planning of O&M expenditure at present there are two key levels: the Director Programme who is in a position to plan, prioritise and consolidate into a single integrated programme the diversity of O&M resource claims and sources (in practice the emphasis is on consolidation) and the Divisions which draw up project by project O&M demands.

FAP 13 discussed O&M resourcing with several XENs to understand their perspective of the process. It was reported that the revenue budget allocation is usually inadequate even to meet the establishment costs of the O&M Divisions, and sometimes the actual funds available at the end of the financial year are much less than the approved allocation. Because of this, and to maintain the "O&M staff" of the completed projects, their remaining salaries are charged against development projects, and in most cases the O&M staff are practically put to work in development projects. Thus the regular O&M requirements of completed projects are neglected.

It was reported that wheat allocations under FFW are so inadequate that only emergency repairs are possible on a priority basis. It would appear that the allocations in a given year are insufficient to restore all the completed projects to their original standard, and this simply institutes a rotational cycle of deferred maintenance. Some XENs expressed the view that the partial repair of embankments gives only partial benefit in the projects. The minor problems of the current year in the unrepaired part of the embankment become a major problem and a threat to the existence of the project in subsequent years.

BWDB staff generally take care of the quality control of the BWDB's FFW schemes, but the distribution of wheat is done by the local Upazila chairman, UNO and UP members of the project area, according to the measurement of work executed, prepared by the BWDB staff. Occasionally there are misunderstandings and conflicts between the BWDB and Upazila staff involved regarding quality control of earthworks and distribution of wheat.

2.5 BWDB TRAINING PROVISIONS

The European Community funded component of the BWDB System Rehabilitation Project is currently assessing the needs of BWDB for training and staff development with a special emphasis on O&M. This follows critical reviews of BWDB's existing training programme (World Bank 1985, 1990). A Director General of Training has been appointed and changes to the existing organisation, coverage and content of training can be expected over the next five years. Given this context this section briefly reviews existing training provisions.

Among the 18,000 staff of BWDB are many grades and specialisations. For most there is no formal training or staff development programme, and the Training Directorate is merely administrative, without its own staff of trainers or personnel managers (World Bank, 1985). BWDB and the Power Development Board have an Engineering Academy at Kaptai which runs week long courses for their staff. During 1991-92 31 weeks of training (31 courses) for BWDB staff are being provided with up to 25 staff attending a course and totalling 400 staff members over the year. This amounts to 2.2 per cent of all staff, and 25 per cent of the 1575 class I professional staff, based on data supplied by BWDB DG Training and in World Bank (1990). The breakdown of courses in 1991/92 is 24 reorientation and seven other courses with 10 on administrative and management topics, 9 for accounts and revenue, 8 in civil engineering, 3 in mechanical engineering and one in agricultural extension. This indicates a lack of training directed specifically at O&M issues.

In addition there are two specialised training establishments: the Hydrology Training Institute in Bhagyakul and the Irrigation Extension Training Centre in Baradi (World Bank, 1990). Some ad hoc courses are organised by the BWDB Training Directorate at other institutes or are held by other institutes with BWDB staff participating. In addition some officers are able to study for Masters degrees part-time in Bangladesh at the Bangladesh University of Engineering and Technology, or full time overseas. Special training programmes are also organised by BWDB projects but the Training Directorate is not involved in these. For example, under the Second Small-Scale Flood Control Drainage and Irrigation Project (SSSFCDIP) training courses are provided for mid-ranking civil engineers in a mixture of areas including new works and O&M. Further project linked training may occur on an ad hoc basis in other BWDB projects.

In general there is no formal training for lower level staff - particularly field staff who simply learn on the job. Nor has there been any training or extension service for beneficiaries with the exception of some large projects with irrigation components, such as CIP, where the BWDB Land and Water Use Directorate was active or where staff from DAE and BRDB were seconded to the project. Even in these cases there seems to have been little input of advice on water management for irrigator groups.

2.6 PREVIOUS ASSESSMENTS OF BWDB O&M

The TOR of FAP 13 identify a number of O&M problems and possible solutions in FCD/I projects in Bangladesh. These reflect the result of a number of reviews of O&M in water management in Bangladesh, along with ideas from elsewhere. These form the context of the FAP 13 study and previous findings and diagnoses are therefore reviewed here.

There is a general consensus that improved O&M is critical to achieving benefits from FCD/I projects and in improving their long-term sustainability. This section presents some of the comments made in these studies, highlighting the problems and constraints diagnosed. This forms a background to the fieldwork undertaken in this study and to the attempts to improve O&M.

a) Planning design and construction

Past studies have emphasised that the planning, design, and construction of projects is only likely to achieve worthwhile results if the projects provide the intended benefits for the intended project life - this is dependent on operation and maintenance. Hence one aspect of effective O&M is the achievement of intended benefits. As noted in a background paper for the Agricultural Sector Review (Choudhury, 1988):

> "The benefit does not lie in the successful completion of the project but in the actual utilization of the resources it creates for the end users."

Likewise the O&M review carried out, by EIP included an honest assessment of EIP's own past performance:

> "Operation and maintenance is a neglected component of EIP FCDI projects. Neglect of operation and maintenance has resulted in many flood control, drainage and irrigation projects not yielding their full potential and the expected benefits of improved crop production and increased economic activity in rural areas are not realised."
>
> EIP (1990) executive summary.

However, until recently studies of O&M have not drawn attention to the issue of problems in the planning, design or construction of FCD/I projects which result in operational problems or high maintenance requirements. This reflects limitations of past evaluations of projects. EIP (1990) reported on brief assessments of over 30 completed FCD projects and in some cases notes these constraints. Similar problems were also noted by SSSFCDIP:

> "Much of the existing surface water control infrastructure in Bangladesh is characterized by its deficient operational status. Operational difficulties occur as a result of unsuitable planning and design, incomplete or poor construction practices, failure to undertake routine maintenance, and inadequate management. The issues are complex varying from project to project and even from structure to structure".
>
> SSSFCDIP (1991) p 1-1

Likewise SRP (1991b) has indicated that there are cases of excessive requirements on O&M resulting from planning related issues, and from continued maintenance of non-redundant facilities which have been superceeded by subsequent plans and developments.

b) Existing Condition of Infrastructure

It is nevertheless clear from past reviews of FCD/I projects that maintenance is a problem, and that the condition of existing infrastructure has deteriorated.

In 1984, an inventory of BWDB projects found 139 out of 382 completed projects in need of rehabilitation due to lack of maintenance (EPC, 1989). Another survey of 40 BWDB structures in 1984 found two abandoned before commissioning, five not yet finished, seven not in use (either broken or simply not used) and most of the remainder in need of repair after years of little or no maintenance (Centre for Development Research, 1985).

c) Quality of O&M

While accepting that maintenance is not sufficient the question is why is there this deficiency? It has been observed that:

> "although there is immense scope for improvement, there does exist a basic level of operation and maintenance done by Government and farmers. This is despite difficult physical, managerial, and financial conditions. However, the O&M work that is done, appears poorly planned and uncoordinated."
>
> IRWP (1986) p2.

d) Resources and Costs

The widely held view that resources constrain O&M has been expressed in SSSFCDIP's review of O&M:

> "All funds for O&M are directed through BWDB channels, with all decisions about O&M expenditure kept within the BWDB hierarchy. While there are problems related to planning and budgeting for O&M so that funds can be properly allocated, the major problem is simply a shortage of funds to allocate. Typical budget requests for O&M provide for staff salaries and support with little actual O&M (EPC, 1989). The O&M mission for EIP reported that because of fund shortages BWDB is unable to recruit lower level staff such as khalashis or provide needed logistical support to those that are assigned (EIP, 1990)."
>
> SSSFCDIP (1991) p4-2.

World Bank (1985) also drew attention to costs and noted that establishment costs are somewhat arbitrarily allocated between the Revenue and Development Budgets, and that Revenue Budget allocations were too low. World Bank (1985) also noted that there were opportunities to make better use of existing resources - for example using FFW for preventive maintenance.

However, it was only during the period of the FAP 13 study that SRP (1991b) draw attention to the wider issues which result in inefficient use of resources, and argued that O&M is guided by the available budget rather than the need to manage and maintain FCD/I systems efficiently. SRP (1991b) argued that as a result resources are directed to non-essential tasks.

e) Training

World Bank (1985 and 1990) has highlighted the past concentration on construction which results in a history of training in construction and design skills for higher level staff, and a lack of O&M training and training for lower level staff (the two being interrelated).

f) Public Participation

It has often been asserted that participation is a necessary part of improving O&M. For example:

> "A true decentralization in principle should provide for involvement of beneficiaries from the conceptual stage of a project to its operation. Such involvement will help reveal the preferences of beneficiaries in sharing capital and O&M costs, at least in justifying construction of individual physical facilities of a project. Even transfer of implementation of divisible units of a national project to local government does not satisfy this condition. It is not a question of bottom up approach vis-a-vis the top down one, but an osmosis of both needed to integrate technical and social issues in water resources development."
>
> MPO (1991) pS-45

g) Water Management

The Bangladesh Flood Policy Study (GOB/UNDP, 1989) noted that FCD/I systems are dynamic and that management is needed to maintain the embankments to keep floods out and operation needs to be coordinated to let water out or in as required which is more than just flood protection. If water management becomes more complex, and efficient and equitable management of the existing systems is not simple, then coordination and involvement of beneficiaries would be needed.

h) Previous O&M Recommendations

With the exception of O&M manuals which make detailed recommendations for O&M but are not based explicitly on studies of past performance, most previous studies and reviews of O&M have not made detailed recommendations. Instead there has been a tendency to state the obvious, for example: that more resources are needed, institutional strengthening is needed including more training, and that public participation should be enhanced.

The National Water Plan has recently stressed the importance of O&M of existing water management systems over investment in new FCD projects. The relevant recommendations

made in the National Water Plan bear repeating because they draw out the policy implications of making existing projects function more effectively:

> "The poor condition of structures observed at every FCD and FCDI project, and the inability of Government to prevent public breaches of embankments suggests that caution should be exercised before investing in new projects until solutions can be found to these problems.
>
> Embankments should not be built in places where, for whatever variety of reasons, the problem of public cuts can be anticipated unless some effective way is included in the plan and implemented to prevent such cuts from being made...
>
> Erosion damage must be repaired annually to prevent further weakening and possible failure of the embankment during subsequent floods.
>
> Rehabilitation and productivity enhancing modifications of existing projects should take priority over investments in new projects.
>
> MPO has assigned a high priority to rehabilitation projects because they are necessary to avoid the loss of very large amounts of sunk investment: the capital costs invested in the existing projects. However, to the extent that rehabilitation projects repair preventable damage they are de facto methods of substituting capital investment funds for revenue funds that should have been collected and spent for O&M. A properly planned and implemented project must include an effective O&M programme adequately funded from the increased productivity that results from the project."
>
> MPO (1991) pS-42

> "Programme management can be improved by putting priority on operation, management and rehabilitation of promising completed projects and on completion of projects under construction rather than undertaking new projects."
>
> MPO (1991) pS-46

3 O&M ASSESSMENTS FROM RAPID RURAL APPRAISALS

3.1 PROJECTS STUDIED

O&M assessments were carried out as part of the evaluations undertaken in conjunction with FAP 12. The selection of projects and revisions to the original selection are discussed respectively in the FAP 12 Methodology Report and the FAP 12 RRA Summary Report, and summarised in Annex B. Fieldwork took place in 16 projects, but in one (the Brahmaputra Right Embankment) two reaches were studied. The locations of the 17 'projects' are shown in Figure 3.1. The five PIE projects were visited twice to investigate O&M issues - during the initial RRA and later during August-October in the monsoon. The 12 RRA projects only had an O&M assessment during the main RRA but are typically smaller projects and so the O&M assessments are comparable in the two categories. Brief details of the projects are given in Table 3.1. The selected projects are representative of the different types of FCD/I projects operating in Bangladesh and are spread throughout the FAP regions.

The detailed results of the O&M assessments are presented in Volume 2 of this report. Section 3.2 is a brief case study to illustrate the interconnections between O&M problems. The findings from all the case studies are summarised in the following sections.

3.2 O&M CASE STUDY EXAMPLE - KURIGRAM SOUTH

The Kurigram South Unit was one of the five projects investigated by FAP 12 using full interview survey methods ("PIE"). Information for the O&M assessment was collected during the RRA in April 1991 and for a week in September 1991 while the interview team was in the area (see Volume 2 Chapter 2 for full O&M study). The Project was constructed during 1975-84 but has not officially been declared complete by BWDB since a planned irrigation component has never been implemented. Hence it does not fall under the jurisdiction of an O&M Division. The Project covers 63,765 ha of Kurigram and Lalmonirhat Districts, and was built using Government of Bangladesh (GOB) and FFW resources. The Project comprises 110 km of embankment along the Brahmaputra, Teesta and Dharla rivers, and eight regulators for drainage. A further three small regulators were under construction in 1991.

The Project has a mixture of higher land and low land nearer the main river in the south-eastern part. The Project has afforded some protection from main river and flash floods, but this is incomplete. Yields of paddy crops appear somewhat higher than in a control area. Cropping patterns have not changed because of the Project, but there has been an expansion of HYV Boro because of small scale irrigation as in other parts of the region. Performance is far below Project targets. Overall it has had rather minor impacts, but summed over a large area and against negligible negative fisheries impacts it gives a marginally viable rate of return (EIRR between 2 per cent and 31 percent, best estimate 22 per cent - FAP 12 Kurigram PIE Report) which is highly sensitive to the yield estimates.

The Project has suffered from a continuing need for repairs and new works because of planning, design and construction problems. Parts of the embankment were built from unsuitable soils with little setback in the active floodplains. Consequently they have been prone to erosion and in 1991 there were four breaches in the embankment due to erosion. As a result retired embankments have been built (to low standards), and high costs have been incurred in building groynes and bank protection (although in one case the river had moved away from the erosion point by the time the crossbar was constructed). The breached and unprotected sections around the Project let flood water in, reducing potential benefits.

Figure 3.1 Location of Selected FCD/I Projects for O&M Case Studies

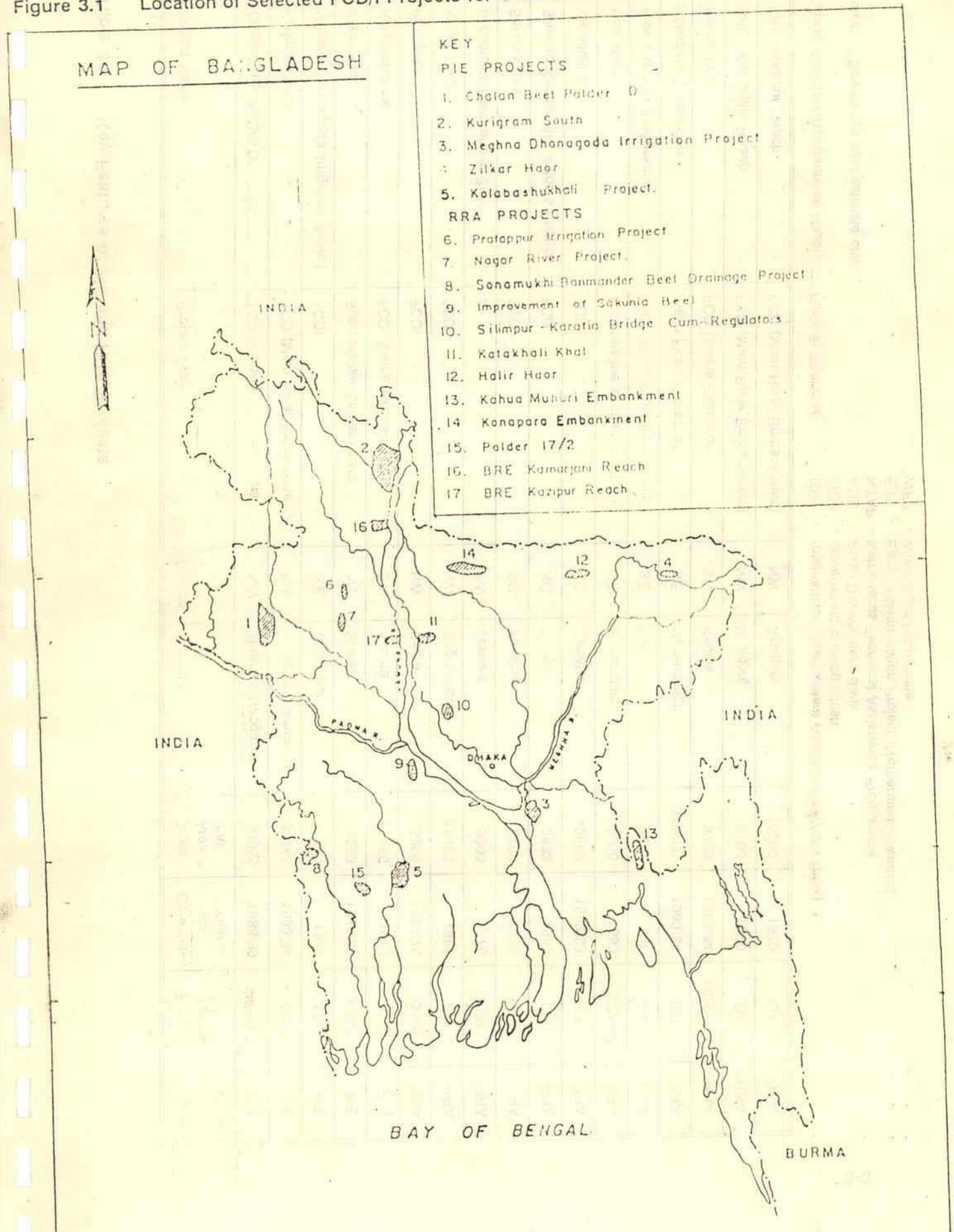


Table 3.1 Key Features of PIE and RRA Projects

Project Name	Project Type	Region	District	Gross Area (ha)[1]	Completion Year	Funding Agency	Level of Study
Chalan Beel Polder D	FCD (Polder)	NW	Rajshahi/Naogaon	53055	1988/89	IDA	PIE
Kurigram South	FCD (Main River Embankment)	NW	Kurigram/Lalmonirhat	63765	1983/84	GOB	PIE
Meghna-Dhonagoda Irrigation Project	FCDI	SE	Chandpur	17584	1987	ADB	PIE
Zilkar Haor	Submersible Embankment	NE	Sylhet	5263	1986/87	NTAP	PIE
Kolabashukhali	FCD (Saline exclusion)	SW	Khulna	25466	1983	IDA	PIE
Protappur	FCDI	NW	Bogra	5200	1977/78	GOB	RRA
Nagor River	FCD	NW	Bogra/Natore	15400	1986	EIP	RRA
Sonamukhi-Banmander Beel	D	SW	Jessore	9000	1978	GOB(?)	RRA
Sakunia Beel	FCD	SC	Faridpur	5700	1985	GOB	RRA
Silimpur-Karatia Regulator & Bridges	FCD	NC	Tangail	2833	1983	IDA	RRA
Katakhali Khal	FCD	NC	Jamalpur	>2660	1982/83	EIP	RRA
Halir Haor	Submersible Embankment	NE	Sunamganj	>8000	1983	IDA/WFP	RRA
Kahua-Muhuri Embankment	Flash Flood Protection - Irrig	SE	Feni	2638	n.a	n.a	RRA
Konapara Embankment	Flash Flood Protection	NE	Mymensingh	3480(?)	1983/84	EIP	RRA
Polder 17/2	FCD (Saline Exclusion	SW	Khulna	3723	1983/84	GOB/EIP	RRA
BRE - Kamarjani Reach	FCD (Main River Embankment)	NW	Sirajganj	10100	1970	IDA	RRA
BRE - Kazipur Reach	FCD (Main River Embankment)	NW	Sirajganj	10500	1970	IDA	RRA

Source: FAP 12 RRA Overview Report

Notes: [1] Sometimes best estimate only

Funding Agencies

IDA - International Development Association (World Bank)
GOB - Government of Bangladesh
ADB - Asian Development Bank
NTAP - Netherlands Technical Assistance Programme
EIP - Early Implementation Project (Netherlands/Sweden)
WFP - World Food Programme

River erosion affects people outside the embankment. For virtually all its length there is settlement of varying density of people displaced from the river char areas. While the embankment provides a vital social service in terms of flood free land for these people, the unregulated housing helps to damage the embankment and hinders maintenance. There is no routine maintenance of the embankment. Instead FFW resources are used each year to resection part of the embankment in reaction to that year's damages, breaches and cuts.

An additional planning problem arises where the Ratna river was left uncontrolled where it enters the Project but has a regulator at its outfall. During the 1988 flood the regulator could not operate as planned. The regulator collapsed and the embankment breached because of the inflow of flood water. This has not been rectified and this area currently (1991) receives no benefit. Resources nevertheless continue to be spent on expensive bank protection of embankments which continue to erode.

Drainage congestion is a common problem in the lower land near the embankment. The drainage channel (khal) network was never completed and re-excavation appears to be almost nonexistent. However, the main regulators do have khalashis (literally cleaners but actually operators and guards of regulators) present and active in their operation, although they have received no training or detailed instructions. No committees of farmers have been formed to guide operation or resolve the conflicts which develop between farmers at different land levels. In general the farmers nearer to the regulators and more powerful landowners appear to be dominant in influencing the khalashis. The response of local people to drainage congestion when river levels have fallen has been to cut the embankment - at least four cuts dating from 1987/88 were still open in 1991. The uncontrolled openings may help to reduce flood peaks and are popular sites for fishermen. In two cases the cuts are close to regulators which had insufficient capacity to cope with the 1987/88 flood events.

Water management in the Project is more complex since the BWDB Kurigram Division is not the only agency involved. The BWDB Dinajpur O&M Division is responsible for a series of regulators used for water retention along one khal within the Project. One of these appeared to function well - its khalashi is a local farmer who has successfully retained water for irrigation over 30 years and worked through three sets of fallboards in the process. There are other pipe sluices in the embankment which appear to have been installed by local government or NGOs with a lack of coordination between agencies. Furthermore there are smaller embankments (Upazila managed, FFW or NGO constructed) outside but adjoining the BWDB embankment and a conflict of interest between BWDB and LGEB over whether structures should be built to drain either into or out of the BWDB Project. Flood Damage Repair funds are being used by BWDB to build additional regulators in such places, although there appears to be little technical justification for their design and they may harm people in the smaller outside projects. Coordinated planning is clearly called for.

It could be argued by BWDB that it has insufficient resources for the O&M problems of the Project, but many of the problems are of its own making. There are 79 staff for the Project, yet none of the Section Officers were encountered in the field during four days in which all the embankment was visited by the FAP 13 team. 66 per cent of staff are involved in activities not directly related to O&M (such as administration and accounts). Redundancies for surplus staff would free resources for maintenance of the structures (several regulators have gates out of order), and for routine embankment maintenance.

3.3 O&M PERFORMANCE AND CONSTRAINTS

3.3.1 Operation

The operating status and problems of the projects studied by the FAP 12 and 13 teams are summarised in Table 3.2. Operation mainly involves operation of water control structures, although cuts in embankments are also made for operational purposes by insiders. In most FCD projects operation is largely concerned with drainage, although structures may also be operated for water retention and in several projects there were some irrigation facilities. Virtually all projects had some operating problem, often ultimately because drainage facilities were inadequate or could never be sufficient when embankments keep out high river stages and heavy rainfall occurs over the internal catchment of the project.

In three projects (Protappur, Nagor River, and Silimpur-Karatia) despite the presence of structures there was virtually no operation of them - in the first case because the water retention structures had fallen into disrepair and groundwater irrigation was more important, in the second because a cut-breach defeats their objective, and in the third because they were not wanted and the project is still open to flooding from a different river.

Sometimes the details of project design cause problems for operation. The most obvious case is the use of fall-boards in water control structures - these were often stolen or removed by groups with different operating objectives (Silimpur-Karatia), or became easily damaged, or could not be removed when operation was needed. The latter is particularly true of the submersible embankment project at Hair Hoar where removal of fallboards to equalise water levels, after the Boro harvest but before overtopping, was hardly possible.

There was also often a lack of clear responsibilities for operation, and conflicts between different interest groups. There are two components to the BWDB model of operation: paid khalashis and committees of local people to advise on operation if there is a khalashi or carry out operation otherwise.

There are two levels of committees which are possible: project level and structure level (sluice or regulator) in the projects studied. The former is only specified in Meghna Dhonagoda Irrigation Project and this is an exception among the 17 cases since it is a major FCDI project with a complex institutional framework laid out in its O&M manual. This does not appear to have been implemented and a lack of consultation and coordination between BWDB and the Upazila was found during the field visits.

Although some form of structure committee(s) had been established in 12 of 15 projects with structures to operate, these were functioning to some extent in only seven of the projects (Table 3.2). Several problems with the approach to date were noted. The precise tasks of these committees appear to be unclear at the field level. There were no attempts to establish these committees as representative and accountable groups for water management with any permanency or formal status in any of the projects studied. Organisation of the committees is typically entrusted to lower level staff - Section Officers and Work Assistants. Even where these staff members are well intentioned and take this task seriously they have no training as community organisers and are inclined to assign responsibility to someone else, often a local influential person. In general there is a lack of institutional and technical support for the committees.

Table 3.2 Summary of structures and operating status of projects

Project	structures	committees	function-ing?	actually operated by?	drainage problems	conflict farmers v fishermen	conflict high v low	private surface water management initiatives
Chalan Beel Polder D	yes	no	no	BWDB	yes ++	yes +	yes +	irrigation inlets
Kurigram South	yes	no	na	BWDB	yes +++	yes +	yes ++	no
Meghna-Dhonagoda IP	yes	yes	some	BWDB	no	yes ++	no	yes LLPs from gravity canals
Zilkar Haor	yes	some	one	BWDB	yes +	yes +	no	yes LLPs through pipe inlets
Kolabashukhali	yes	yes	no	BWDB	yes ++	yes +	yes +	1 khal privately opened & closed for irrigation and drainage.
Protappur IP	yes	yes	no longer	no-one khalashis missing	no	no	no	LLPs as gravity irrigation not possible from river.
Nagor River	yes	some	no	no-one - only 1 khalashi	yes ++	yes +++	no	no
Sonamukhi-Bonmander	yes	no	no	anyone influential	yes ++	yes ++	no	private and local government embankment built, also impact of projects in India.
Sakunia Beel	yes	yes	slightly	committee	yes ++	no	no	LLPs over embankment.
Silimpur-Karatia	yes	no	no	not operated	no	no	yes +	no
Katakhali Khal Project	yes	yes	partly	at direction influential people	yes ++	yes +	yes ++	cuts and inlets for irrigation

Table 3.2 cont. Summary of structures and operating status of projects

Project	structures	committees	function-ing?	operate by?	drainage problems	conflict farmers v fishermen	conflict high v low	private surface water management initiatives
Halir Haor	yes	yes	yes but	influential people manage	some	some	no	regular cuts and repairs for drainage needed.
Konapara Embankment	no[1]	na	na	na	some	no	inside v outside	[1]effectively many privately controlled BWDB drainage outlets
Kahua Muhuri	yes[2]	informal	yes	local people	yes +	no	no	[2]later additions irrigation cuts.
Polder 17/2	yes	yes	yes[3]	BWDB	no	yes +++	yes +	[3]shrimp farmers have installed many private structures and control sluice operation
BRE Kamarjani Reach	yes	no	na	BWDB	yes ++	no	yes +	no
BRE Kazipur Reach	no[4]	na	na	na	no	no	no	[4]washed away, retired embankment breaches annually so open drainage.

Note: where drainage problems and conflicts occur these have been ranked: + moderate, ++ important, +++ severe
BWDB operation means by khalashis
na - not applicable

Source: FAP 12/13 RRAs

Consequently it is no surprise that operation of structures usually becomes dominated by local 'influential' people. Whilst an attempt to improve support for committees or groups might help, it seems from the case study experience that some patronage from local elites is inevitable and probably desirable. In the circumstances it is necessary to ensure that they have common interests with the majority served by the structure. Sometimes local elites (such as UP chairmen) ensure reasonably fair and efficient operation of the structure (Halir Haor). In other cases they operate the structure to further their own interests or remove vital parts to prevent it being operated against their interest (Chalan Beel Polder D).

BWDB has appointed khalashis to 10 out of 15 of the study projects which had BWDB structures. They are often not present, or have disappeared or been reallocated to another project. In seven out of 15 cases the khalashis are actually active in operating structures, and they appeared to be in post at least in the coastal area (Polder 17/2 and Kolabashukhali) and at large regulators in other projects. If they are present they take their directions from local influential people (via a committee if there is one), and can do little more than report events to their superior officers. They receive no guidance or proper monitoring or in-house/on-the-job training, and may not be in a position to compromise or arbitrate between powerful local interest groups.

Operation often adversely impacts at least one interest. There were frequently reported conflicts of interest in opening and closing regulators and sluices. In a majority of projects (nine out of 15) there was some conflict between fishermen and farmers. In a few cases this was severe. Only in two projects (Nagor River and Polder 17/2) did fishing interests clearly have the upper hand (the latter is a special case among the projects studied since much of the project area is under shrimp cultivation). Conflicts over the appropriate level of drainage are also often found. Differences between farmers on high and low land were noted in seven projects. Conflicts between insiders and outsiders are discussed in the next section.

FCD/I projects in general mean that some people gain and others lose. Since project planning never allowed for compensatory measures, other than where land was acquired, and did not involve the different interest groups in project planning, conflicts over operation were always likely.

3.3.2 Maintenance

Maintenance concerns both earthworks (embankments, khals and canals) and structures. The channels and structures are part of the water management problems discussed in the last section, and the state of maintenance of khals often could not be assessed in the field during the monsoon by the team. Table 3.3 therefore concentrates on embankments (which are critical to the flood protection afforded by projects). Operating problems summarised in Table 3.2 may be due to maintenance problems, but this is rarely the entire constraint.

Table 3.3 shows widespread multiple use of project infrastructure, particularly use of embankments as roads and often for cultivation of trees and bushes, but also in a few important cases for housing. Embankments are often used as places of shelter during high floods, by both outsiders and insiders. Most embankments were in a generally poor state of maintenance and unregulated uses contribute to this, although they provide some benefits to users.

Table 3.3 Use and condition of embankment, and overall assessment of constraints or problems for O&M

Project	Embankment used for road	trees	houses	% in poor condition	breaches	erosion	cuts by insiders	cuts by outsiders	Key problem plan design	constr uction	O&M
Chalan Beel Polder D	yes	yes	no	50%	yes	no	yes	yes	**	0	**
Kurigram South	yes	yes	yes	+50%	frequent	yes	yes	no	**	***	**
Meghna-Dhonagoda IP	yes	no	few	20%	yes	yes	no	no	***	***	**
Zilkar Haor	yes	no	no	70%	no	no	no	no	0	0	**
Kolabashukhali	yes	yes	no	50%	no	yes	no	no	*	0	*
Protappur IP	yes	yes	yes	most	no	no	no	no	*	0	**
Nagor River	yes	some	no	85%	yes	yes[4]	few	yes	***	*	***
Sonamukhi-Bonmander	na - drainage project with short private embankment						no	yes	***	0	**
Sakunia Beel	yes	yes	no	70%	yes	yes	no	no	0	**	**
Silimpur-Karatia	yes	yes	no	15%	yes	yes	no	no	***	0	0
Katakhali Khal	yes	no	no	50%	yes	no	yes	no	*	0	***
Halir Haor	yes[1]	no	no	33%	yes	no	yes	no	0	0	**
Kahua Muhuri Embankment	yes	yes	no	80%	yes	yes	yes	no	0	0	**
Konapara Embankment	yes	yes	no	60%	yes	yes	no	yes	**	0	***
Polder 17/2	yes	no	no	5%	no	no	yes[2]	no	***	***	0
BRE - Kamarjani Reach	yes	yes	yes	70%	yes	much	yes	no	**[3]	**[3]	**
BRE - Kazipur Reach	yes	yes	yes	50%	yes	much	no	no	0	**[3]	***

Notes: * = moderate problem, ** = important problem, *** = severe problem
1 seasonal route for moving harvested paddy before flood
2 installation of water control structures by shrimp farmers
3 applies to retired embankment but not to original one
4 very severe erosion due to public cuts and backflow in Nagor river
Source: FAP 12/13 RRAs

Breaches were associated with overtopping due to greater than design standard events, erosion, failure of weak points in embankments (for example cuts made for irrigation inlets - Chalan Beel D, Kahua Muhuri), or more rarely with poor construction. Breaches have occurred in 11 out of 17 projects. Erosion has been notable in four of the projects (Kurigram South, Meghna-Dhonagoda, and the two reaches of BRE - all are along the main rivers), but affects ten projects to some extent. As a result resources are continually expended in protecting embankments from erosion, although the problem is ultimately one of inadequate set back distances compared with the intended life of the project (in MDIP two retirements were needed before the project was completed).

Off-site impacts, including higher water levels during floods, or more rarely impeded drainage for outsiders, were sufficient for people outside the projects,to cut the embankments in four projects (creating a 'maintenance problem'). In one case this was a result of disputes over cross-border flows and structures in India (Sonamukhi-Bonmander). These cuts indicate planning problems resulting in negative off-site impacts or problems in adjacent projects, and this is particularly a problem in the Atrai Basin projects - Chalan Beel Polder D and Nagor River. In other projects, such as Silimpur-Karatia, outside interests mean that the sluices are left open (an 'operating problem'). In some cases the conflict of interest is clear, in others it may be that the project does not adversely affect flood levels outside, but people believe that this is the case.

More common (affecting eight projects) were cuts made by the inhabitants of projects. These cuts were made to facilitate drainage in most cases, and in a few to introduce water for irrigation (Kahua Muhuri) or shrimp farming (Polder 17/2). These are operating problems, but again may be due to inadequate drainage capacity, additional water due to other cuts by outsiders (Chalan Beel D) or higher river levels than anticipated in planning due to confinement of rivers, rather than to simple operating difficulties.

In general there was very little evidence of maintenance work on regulators. Damaged gears were not uncommon, while khal re-excavation appears to be neglected or infrequent in most projects - there having been none since project completion in a number of cases (for example Katakhali Khal).

In the last three columns of Table 3.3 an attempt has been made to rate the relative contribution of planning, construction, and inadequacies in O&M (resources, management, institutional problems) to the overall O&M condition and performance of the projects. It should be noted that of the two projects with no apparent O&M problems Silimpur Karatia is not operated or maintained as the structures have to date been more or less an irrelevance. Table 3.3 indicates that construction failures were relatively less important factors, although they are important in retirement of the BRE and are important contributors to the low performance of three projects. However, the various problems involved in O&M are interlinked and it is difficult to generalise a single cause or even a key symptom of poor O&M. The following sections discuss O&M costs and resources in the case studies and some general issues raised by the studies.

3.3.3 O&M Costs and Resources

Lack of funds for O&M is frequently cited as a constraint on O&M, although Section 2.4 showed that considerable resources are used in aggregate for FCD/I O&M. The case studies reveal somewhat mixed evidence. Table 3.4 summarises the projects in terms of their costs (capital and O&M) and their benefits and economic performance. It should be noted that the O&M expenditure reported in these case studies is based on whatever data was available and that the calculations may not be consistent.

Table 3.4 Financial and Economic Performance of Case Study Projects
(1991 prices)

Project	Net Benefited Area (NBA) (ha)	Capital Cost/ha (NBA) (Tk)	O&M Cost Cost/ha (NBA) (Tk)	O&M Cost/ha (% of capital cost ha)	Annual Ag. Bens per ha (NBA) (Tk)	Annual Fishery loss/ha (NBA) (Tk)	Ag+Fish Benefits per ha (NBA) (Tk)	Estimated Economic RR (%)	Implement-ation period (years)
Kahua Muhuri	2024	11512	235	2.0	12352	208	12143	96	1
Sonamukhi-Banmander	7400	6284	314	5.0	10514	0	10514	65	3
Hail Haor	6686	3671	191	5.2	2372	0	2372	65	1
Konapara Embankment	3116	2634	132	5.0	12095	1161	10934	62	3
Protappur IP	4000	3419	224	6.5	5686	0	5686	54	4
Zikar Haor (PIE)	4238	17810	333	1.9	3964	n.a.	3964	40	3
Katakhali Khal	2520	7548	0	0.0	3925	1202	2722	30	3
KBK (PIE)	18623	12041	624	5.2	4360	1020	3340	25	7
Kurigram South (PIE)	50000	13672	776	5.7	5610	80	5530	22	10
Silimpur - Karatia	1012	10829	0	0.0	956	n.a.	956	10	1
Sakunia Beel	4400	4787	28	0.6	1023	439	584	10	4
Chalan Beel Polder D	37235	9196	129	1.4	2402	1488	914	9	8
MDP (PIE)	14367	129205	2417	1.9	14130	693	13437	7	12
BRE Kamarjani	8783	6619	340	5.1	1547	922	625	3	10
BRE Kazipur	8788	5461	280	5.1	1500	1075	424	0	10
Nagor River	9312	7962	n.a.	n.a.	-1074	n.a.	-1074	-10	2
Polder 17/2	2792	15136	440	2.9	6229	8453	-2224	-10	13

Source: RRA and PIE surveys 1991

Notes: Some figures are very rough estimates and should be treated with caution.
Some figures in original RRA reports have been corrected.

A serious failing to date revealed by the study is the general lack of systematic accounting of O&M costs on a project basis (there are exceptions such as the electricity costs of MDIP). Hence the cost estimates depended on the time XENs and SDEs had available to abstract and allocate out their establishment costs and FFW programmes over recent years to the projects in question in response to the request from FAP 13.

Table 3.4 shows that actual O&M expenditure averages 3.3 per cent (unweighted) of capital costs (at constant 1991 financial prices). This is rather more than the standard percentages which have been in use in Bangladesh (see Section 2.4.6), and yet is a level associated with the often poor maintenance standard of the projects studied. There does appear to be a relationship between relatively higher O&M expenditure and economic performance. Only the BRE has a high O&M:capital cost ratio and an uneconomic return, whereas 6 out of 9 projects with rates of return over 12 percent have O&M:capital costs over the average. However, the correlation is not statistically significant, nor is the negative correlation between O&M cost per ha and Economic Internal Rate of Return (EIRR). O&M costs per ha do appear to be positively correlated with capital costs per ha. However, MDIP biases the results since this pumped irrigation and drainage project has high costs for both construction and O&M (establishment and electricity alone, regular O&M has not yet been incurred due to major rehabilitation works). Omitting MDIP reduced the correlation coefficient from 0.95 ($p<.001$) to 0.5 (not significant). If record keeping improves and is monitored and analysed it may be possible to develop a new factor for estimating O&M costs in pre-feasibility studies, although this would not reflect the annual costs involved in an improved O&M programme (which might be higher or lower).

This analysis does not take into account efficiency in the use of these resources, or the needs of the projects relative to actual resources used. Where establishment details were available it was found that there were many staff not directly engaged in O&M who appeared to be surplus. The staff have no incentive to manage and maintain the projects efficiently since they get their salaries irrespective of performance and there are no incentives for improving O&M.

BWDB is not empowered to mobilise resources for its own use. Only in major projects with an irrigation component are O&M costs supposed to be recovered, and in the one case studied (MDIP) irrigation charges (water rates) were not being collected, even though farmers pay for privately supplied water. BWDB is also unable to raise resources directly for O&M by leasing out use of its khas lands, khals, or embankments, since such leases are administered by the District administration and revenue accrues to the central government. The lack of incentives for efficiency mean that no attempt was found to encourage farmers to raise their own resources. Only in a few cases was there any voluntary mobilisation of resources directly for maintenance (for example, in Halir Haor one regular drainage cut is repaired annually by local initiative). If this were widespread it would raise benefits and reduce the gap between O&M demands and provisions.

In some cases the BWDB project served to reduce local community initiatives in water management (using small bunds, for example, to control tidal flooding of Aman crops in Polder 17/2 and Kolabashukhali, and construction of water retention cross-dams in Protappur). Local resources are no longer raised even if the public project is technically and economically more efficient, since there is an expectation that repairs will be carried out by BWDB/FFW.

Hence it is not clear from the projects studied that availability of resources is the critical constraint on O&M. In general a combination of high demands for resources due to planning problems, flood damages, and bank protection, plus a lack of efficiency in resource use was found implicated. O&M could be improved within the funds available, although some additional resources might still be necessary, at least for some projects.

3.3.4 Other O&M Issues Revealed by Case Studies

There is a general lack of public consultation in planning, design and implementation. Detailed decisions are dominated by engineering and not local opinions, needs, and plans. The beneficiaries may only learn of a project when construction starts. For example in Silimpur-Karatia people thought that culverts were being built, while the sluices which were built remain open but prevent boats from passing, whereas Zilkar Haor and Protappur projects apparently followed local demands and consultation and have good EIRRs.

Construction overruns in time and cost occurred in several projects and in some (Kurigram, Polder 17/2) were associated with sub-standard construction. This can lead to an incomplete project (Polder 17/2 was not closed at the Gangrail river for 10 years) or defective components which then cannot be operated or maintained effectively (regulators which settled in Kolabashukhali).

O&M manuals are supposed to be prepared by the BWDB engineer concerned for a project during the first two years after the project is commissioned. No locally produced practical manuals were found. Some large BWDB projects have O&M manuals prepared by outside consultants (for example MDIP, Coastal Embankment Project - Polder 17/2 and Kolabashukhali). The O&M manuals for these projects, and for several others not covered by the FAP 12/13 field work, were reviewed by the FAP 13 team. None of the BWDB manuals were in Bangla, none could be considered to be effective field guides to practical O&M, none appeared to be used or implemented and in no case where field visits were made were O&M manuals found to be available with field staff.

The tasks, responsibilities and accountability of those charged with O&M (both BWDB and local committees) are not clearly defined in practice. BWDB O&M officers have programmes of work laid down (for example approving every operating action) which are unnecessarily complex and cannot be carried out in practice due to shortage of time and funds. As a result there are minimal checks on the lower ranks directly involved in O&M (khalashis reported only rare visits by superiors). Streamlining of reporting, monitoring and administration might improve supervision of O&M although it would not address the lack of incentives. Training programmes and O&M guidelines would need to be linked with such improvements, to overcome the lack of practical training for regulator operators for example.

3.4 CONCLUSIONS

The case studies undertaken by FAP 13 confirm many of the problems previously identified in FCD/I O&M in Bangladesh. However, they also suggest that O&M expenditures are in a number of cases higher than feasibility studies have allowed for, and that the resource constraint is only a part of a more complex problem. An important component of this is the problem of projects which did not take account in the planning stage of the full range of impacts inside and outside the project and who they would affect. As a result poor alignments and the actions of people adversely affected by the projects result in failure to achieve operating targets (and hence intended benefits) and increase the requirement for maintenance resources. Public consultation and participation have been rare in BWDB projects but there is some evidence from the case studies that it helps to reduce these problems. However, there are also examples where the FCD/I project has replaced local initiatives and replaced a local commitment to maintenance and operation with dependence on government. Issues raised by the case studies and options for overcoming the problems are taken up in Chapter 6.

4. PROJECTS TO IMPROVE O&M

4.1 BACKGROUND

As noted in Section 2.6, there have been a number of review missions and studies which have highlighted O&M as a constraint on the achievement of FCD/I benefits. Consequently several externally aided projects or programmes have now included components aimed at improving the O&M of sub-projects implemented under them. These include the Second Small Scale Flood Control, Drainage and Irrigation Project (SSSFCDIP), the Delta Development Project (DDP) and the Early Implementation Project (EIP). Additionally there are projects which as part of rehabilitating FCD/I systems, for example, are directed specifically at improving O&M notably System Rehabilitation Project. Outside BWDB there are similar initiatives in improving water management and O&M through the Upazilas and by NGOs.

These projects involve a number of innovations and 'experiments', particularly in the field, in encouraging and facilitating beneficiary participation in O&M. Hence their approaches and experience are directly relevant to the aim of FAP 13 to provide guidance to the Flood Action Plan on ways of achieving more effective O&M. Unfortunately in most cases these initiatives have started relatively recently. Hence there is not always a long period over which to judge the replicability and sustainability of the arrangements they are implementing or planning for O&M.

It will be important for the future to ensure close liaison between these different projects to share their experiences - success and problems - and to ensure that FAP components take this experience into account (see Chapter 7). Since each initiative takes place in a separate institutional framework (in most cases in different divisions or projects of BWDB), there is a danger that different approaches will become institutionalised in each initiative. Instead the diversity of experiments should feed into eventual selection of approaches which can be gradually expanded to a unified national strategy for FCD/I management.

The following sections review the approaches to O&M adopted in a number of projects and programmes. They do not attempt to be exhaustive, but are intended to highlight the differences, emphases and innovations.

4.2 SYSTEMS REHABILITATION PROJECT

4.2.1 Introduction

This section is largely based on the SRP Inception Report for the Netherlands component, which is the component most concerned with improving O&M (SRP, 1991a), on the quarterly progress reports, on the reports on O&M planning and implementation of improved O&M (SRP, 1991b, 1991c), and on discussions held with members of the SRP team.

a) Objectives

The main objectives of the Systems Rehabilitation Project (SRP) are to protect and increase agricultural production and incomes and to raise the standard of living, particularly

of landless people and women, through rehabilitation and improved operation and maintenance (IOM) of BWDB's FCD/I projects.

Subsidiary objectives include: increased financing and more efficient use of funds for O&M through better planning and reduction of costs, where possible; improved skills and better motivation of BWDB staff for O&M tasks; and increased involvement of the farmers in planning, construction and O&M, particularly for on-farm development works.

b) Components

SRP comprises the following components:

- rehabilitation, improvement and maintenance of about 80 sub-projects covering a gross area of about 600,000 ha;
- IOM of three existing major irrigation projects [Chandpur (CIP), Muhuri (MIP) and Karnaphuli (KIP) Irrigation Projects] covering a net irrigable area of about 60,000 ha, and seven small flood control and drainage projects covering about 40,000 ha in Nawabganj O&M Sub-Division;
- on-farm development (OFD) schemes works in two sub-projects (Buri Teesta Irrigation Project and Polder 55/1) covering an area of about 17,000 ha;
- training of BWDB staff and beneficiaries, particularly for O&M of the sub-projects;
- benchmark and evaluation studies of ten selected sub-projects: Buri Teesta Irrigation Project; Polders 64/1A, 64/1B and 55/1; Pagner Haor Boro Protection; Sangu River Bank Protection; CIP; MIP; KIP; and one of the seven FCD schemes in Nawabganj sub-division;
- cost recovery study;
- assignment of a financial/administrative adviser on water sector projects; and
- technical assistance for planning, design and monitoring of construction of rehabilitation and improvement works, and for planning and implementation of improved O&M, on-farm development works, training, and benchmark and evaluation studies.

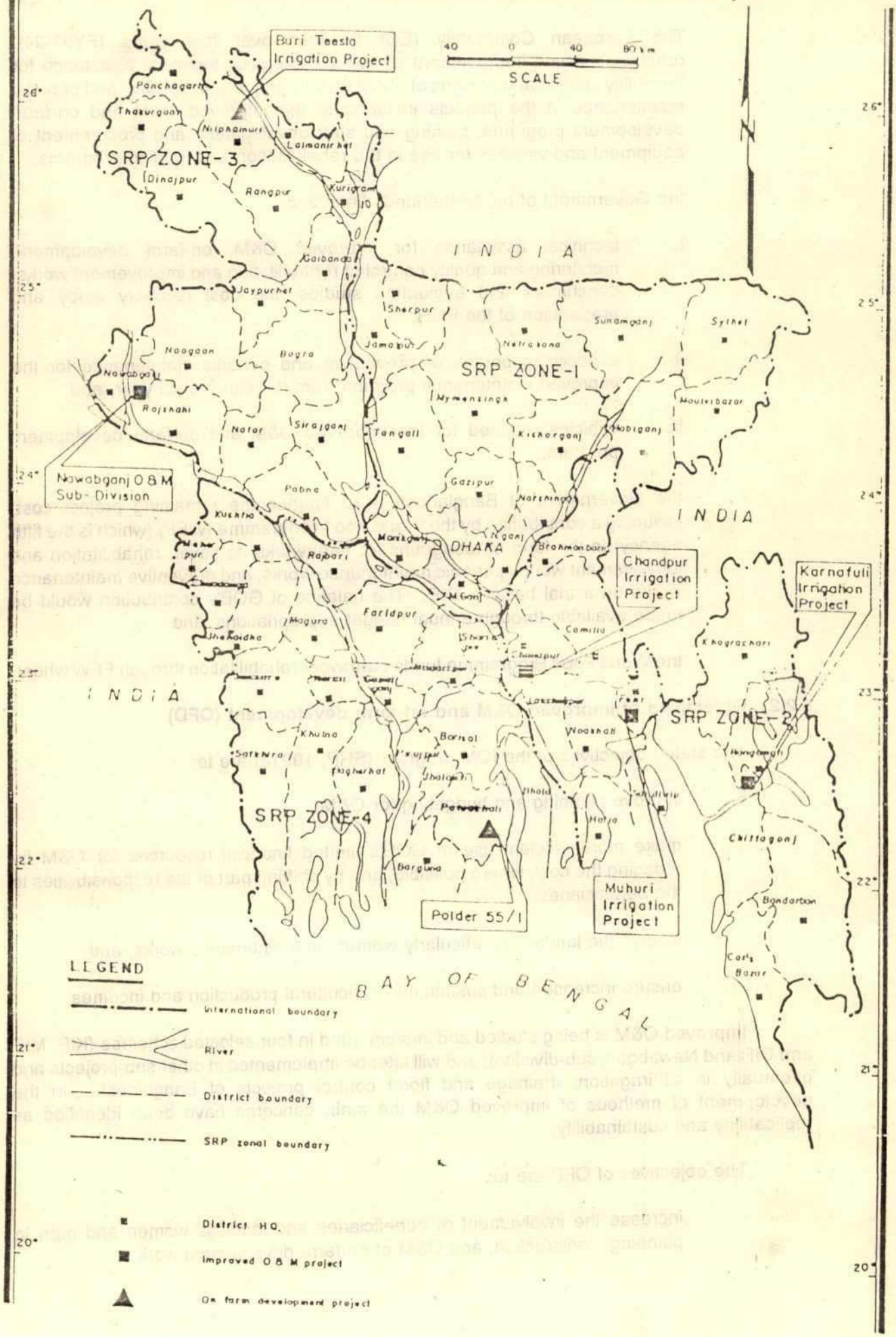
The six main projects where O&M development will take place are shown in Figure 4.1.

c) Organisation

SRP as a whole covers a period of seven years and started in 1990/91. However, the different donor components have different contractual periods. SRP is financed from five different sources:

- the International Development Association (World Bank) finances the investment cost of rehabilitation and improvement works, and a declining portion of BWDB's incremental O&M costs;

Figure 4.1 Locations of O&M components of System Rehabilitation Project



- The European Community (EC) finances over four years (FY91-94): rehabilitation and improvement of five sub-projects, technical assistance for feasibility studies and designs of about 65 sub projects, preventive and periodic maintenance in the projects included in the improved O&M and on-farm development programs, training and staff development, and procurement of equipment and vehicles for use in the rehabilitation and training programs;

- the Government of the Netherlands finances:

  i. technical assistance for improved O&M, on-farm development, monitoring and quality control of rehabilitation and improvement works, benchmark and evaluation studies, the cost recovery study and preparation of the PCR,

  ii. a declining portion of preventive and periodic maintenance for the improved maintenance program from the fifth project year, and

  iii. vehicles required for the improved O&M and on-farm development program.

- the Government of Bangladesh is to finance the remaining project cost, including a contribution by the World Food Programme (WFP) (which is the fifth agency) in the form of foodgrains for earthworks, to cover: rehabilitation and improvement works, periodic maintenance works, and preventive maintenance works on a trial basis in CIP. The balance of GOB's contribution would be made available through annual budget appropriations; and

- the World Food Programme funds earthwork rehabilitation through FFW wheat.

4.2.2 Objectives of Improved O&M and on-farm development (OFD)

The stated objectives of the IOM program (SRP, 1991a) are to:

- improve planning and budgeting for O&M;

- make more efficient use of GOB's limited financial resources for O&M by reducing the cost, where possible, and by shifting part of the responsibilities to the beneficiaries;

- involve the landless, particularly women, in maintenance works; and

- ensure increased and sustainable agricultural production and incomes.

Improved O&M is being studied and implemented in four selected schemes (KIP, MIP and CIP and Nawabganj sub-division), and will later be implemented in other sub-projects and eventually in all irrigation, drainage and flood control projects of Bangladesh. In the development of methods of improved O&M the main concerns have been identified as replicability and sustainability.

The objectives of OFD are to:

- increase the involvement of beneficiaries and landless women and men in planning, construction, and O&M of on-farm development work;

- improve capabilities and motivation of BWDB's staff for handling O&M; and

- increase agricultural production and incomes.

BWDB is responsible for the implementation of the improved maintenance program and the on-farm development sub-projects, assisted by a team of consultants.

It is notable that the O&M Divisions are under there respective Zonal CEs, although SRP is directly strengthening and working through the Chief Engineer O&M with its own BWDB staff and consultants allocated to the focus projects.

4.2.3 Key concepts of major sub-projects of SRP

The central concepts in the objectives of SRP are: improved operation and maintenance (IOM), on-farm development (OFD), involvement of beneficiaries and involvement of landless people. This is within the context of water management systems.

SRP stresses that a water management system is composed of an institutional and a physical dimension which are interdependent. The physical FCD/I infrastructure can only perform well if it is accompanied by an adequate system of organization. Changes in the operation and maintenance of the physical infrastructure may have consequences for the organizations involved, and sometimes changes in the organizations can only be brought about by adapting the physical system.

A fundamental idea in the SRP approach is that in order for FCD/I systems (the top level) to perform well, a communication channel between top and bottom has to exist, and the interests which exist at the bottom level of the system have to be considered in decision-making. Therefore, there has to be an interface between top and bottom - the intermediary level organization (ILO) is a vital link in the SRP approach.

The ILO constitutes the link between IOM and OFD (see Table 4.1). Some conditions for its effectiveness are: its legal status and the authority vested in it, clear demarcation of the lines of accountability, and clear responsibilities for each of the parties involved. SRP does not offer a blueprint for its composition, rules and regulations, or powers of arbitration in case of disputes. This would depend on the technical and socio-economic complexity of the system.

At present solutions to this gap in communication and responsibility are often imposed BWDB takes the initiative to form sluice committees in a top down fashion, which usually reflects the local power structure. This has been amply demonstrated by the FAP 13 case studies. SRP is attempting to overcome this bias by studying existing water management, detailed monitoring, and employing group organisers to help farmers organise for water management and articulate their demands.

Table 4.1 Water Management System

	Institutions	Responsibility
1. Top level	BWDB	-overall system performance -participation in ILO
2. Intermediary level	Intermediary level organization (ILO)	-participation in decision-making -communicate issues from bottom to top level and vice versa -contribute to O&M
3. Bottom level	Groups sharing a common interest in water management	-getting organized in order to participate in ILO -pursue realization of common interest -contribute to O&M

Source: SRP (1991a).

a) Improved O&M

The improved O&M which SRP aims to achieve will address the tasks of the BWDB as an organization, defining the manpower and skills which are needed to perform those tasks, based on an analysis of problems in the water management system - both physical and institutional. The following are components of the planned IOM:

- continuous assessment of irrigation and drainage requirements;
- continuous assessment of flood protection requirements;
- setting of priorities in operation and in maintenance;
- staff requirements and skills development;
- improved planning and implementation procedures;
- communication and involvement of farmers in decision-making; and
- involvement of landless people (particularly women) in O&M.

SRP recognises that despite the creation of an organizational structure for O&M, at the level of the Divisions and Sub-Divisions - where IOM has to materialise - a big task of transformation has to be accomplished. At present, a frequently occurring situation in O&M (not improved) is that maintenance is not done according to the requirements for optimal system performance, causing structures and systems to deteriorate. In systems which include different Sub-Divisions there is a lack of coordination and adequate demarcation of the lines of authority, of areas of competence of staff members, and of accountability. The setting of priorities in maintenance plans is often lacking and in many situations the BWDB has no control over allocation of funds and implementation of works.

By ignoring the underlying objectives of FCDI systems O&M fails to identify priorities in maintenance or the system impacts of a particular operating practice. SRP's approach is to focus on the system in order to identify those critical elements where improved O&M are needed. Many examples of this from three FCDI projects are given in SRP (1991b). Critically SRP regards funds as not constraining O&M. Rather O&M includes funding unnecessary staff (who lack incentives to work efficiently) and activities (such as construction) which are not a task of water management, and recommendations for rationalising staff in these focus projects have been made (SRP, 1991c). SRP sees the lack of involvement of beneficiaries as

constrained by inadequate services, creation of unfulfilled expectations (of benefits), lack of involvement in decisions (such as auctioning of user rights), and the absence of proper routes of communication so that farmers who want to be involved and voice their problems are obstructed from doing so.

IOM also aims at the creation of steady employment for landless people. This is to be achieved, inter alia, by:

- incorporating preventive maintenance in planning and budgeting of O&M;
- creating arrangements for an NGO or another competent organization to negotiate employment on behalf of their target group with the BWDB;
- creation of embankment and structure maintenance groups who will be deployed in maintenance work;
- studying the scope for the cultivation of useful crops (trees, cut and-carry grasses, etc.) on embankments and other land owned by the BWDB; and
- finding and testing of formulae for destitute women to obtain user-rights over stretches of embankment in exchange for preventive maintenance work.

So far this aspect of IOM has concentrated on embankment maintenance groups (EMGs), and a procedure and set of guidelines for their use in SRP sub-projects has been approved by BWDB. EMGs are being set up with the assistance of BRDB based on existing groups of women under BRDB programmes. Labour Contracting Societies (LCS) are also being used for resectioning using FFW resources (rather than for new work as under EIP's programme).

b) On-Farm Development

The 'OFD' element of the SRP is concerned with institution-building - organizing people around a common interest related to water management. Although not necessarily restricted to irrigation this is likely to be the focal point in SRP institution building, defined as development of grass-roots organizations. Hence OFD relates to the creation of the first tier in the organizational set-up of the water management system while IOM is about institutional and physical development at the top level. The main improvement is likely to be continued support for the formation of viable, small, self-managed groups.

Beneficiaries' motivation to actively participate in this set-up will depend on extending to them organizational and technical support in all relevant aspects of water management, and in other uses of project infrastructure (such as fish cultivation).

Thus, IOM and OFD are both integral to the strategy of SRP. If the bottom-level is not organized, there is no feed-back to the top. If O&M of the main system are inadequate, the bottom level cannot be motivated to invest time and money in participation and improvements at the micro-level.

c) Beneficiaries Participation

SRP identifies the 'beneficiaries' as farmers, fishermen, boatmen, and other people affected by or living inside the project area. SRP considers that much of the confusion that

exists with respect to participation is caused by the failure to define and separate responsibilities and tasks, often through the multiplicity of different donors and consultants.

Top level management of FCD/I projects under SRP is to remain with BWDB, which has the technical expertise and can take responsibility for the longevity of the main infrastructure which it built, but it would listen more to beneficiary representatives, and direct work to the landless. To achieve the former some (unspecified) intermediary body representing both interests (BWDB and beneficiary groups) is to be set up. Vital to this is the formation of strong user groups and a mechanism whereby BWDB has to take these interests into account in managing systems. Direct beneficiary participation will involve the following:

- people who share a common interest in water management would participate in the creation of associations which will enable them to better deal with their water management problems at the bottom level;
- as a group they should acquire, operate and maintain equipment and undertake construction, O&M and system improvements at their level;
- the competent agencies are expected by SRP to extend their support to these groups or associations, (DAE, BRDB, Local Government, Fisheries Department, the BWDB and NGOs);
- the groups/associations will appoint their representatives who are to speak on their behalf in the ILO;
- one aim is that organized landless people should be able to negotiate employment in routine maintenance of earthworks of the main system and in periodic maintenance of other engineering works.

The primary focus of SRP has been on water management and farmers' involvement, and on a role for the landless (men and women) is maintenance. The issues raised by impacts on fishermen and people living outside embankment projects have not been given the same attention.

4.2.4 O&M costs

One objective of SRP is to reduce O&M costs and reduce dependency on external resources. This will require clear prioritisation of O&M and firm control of well justified and targeted O&M planning. Such a plan is seen as necessary if BWDB is not to be a "passive spectator" in maintenance work. SRP (1991b) makes the comment that there is a structure bias in BWDB - it is responsible for structures but not water management. Moreover responsibility for structures has often been handed over to committees without their having any guidance and instruction on operation. Hence studies are being made of how sluice committees function to monitor the current practice before attempting to change it. There is also a component designed to achieve cost recovery from irrigation projects by implementing a simplified version of the revised Water Rate Act of 1990, and the experience in implementing this should be monitored for any lessons relevant to FCD project cost recovery.

4.2.5 Remarks

SRP covers a wide range of the post-construction activities on FCDI projects by addressing the issue of finding sustainable and replicable water management systems. Although the O&M projects have an emphasis on large FCDI projects, the experience gained

should cover most of the management issues in FCD/I projects. Because this project aims to determine the O&M strategies to be adopted eventually throughout BWDB it is clearly of great importance to FAP which will, almost certainly, have to work through the same system or combine with SRP in recommending a consistent set of reforms.

SRP is now at the early stage of a seven year implementing period. Its analyses of current O&M and strategy for improved O&M are well founded. The analysis of O&M problems and constraints which emerges from the FAP 13 case studies is in close agreement with that of SRP. It will be vital for FAP to liaise with SRP and monitor how SRP implements its intentions. O&M is ultimately judged on improved performance and benefits to those dependent on the FCD/I systems, so the performance of SRP will depend on changes in the farm and non-farm economies of its projects, particularly from the view point of replicability to other areas.

4.3 SECOND SMALL SCALE FLOOD CONTROL DRAINAGE AND IRRIGATION PROJECT (SSSFCDIP)

4.3.1 Background

This is a combined project with the Small Scale Water Control Structures III (SSWCS III) Project, funded by CIDA, which provides technical and training services and equipment for BWDB related to the IDA credit 1870-BD (SSSFCDI). The programme has two main components:

- construction of small scale flood control, drainage and irrigation sub-projects; and
- rehabilitation of infrastructure damaged in the 1987 floods.

The SSSFCDI Project provides for funding of O&M for a period of two years following completion of sub-project construction. The project has a major component directed at improving O&M, which has been given increasing emphasis. This is focused on participation of beneficiaries in O&M. It includes the following activities:

- holding pre-project meetings in which project concepts are discussed and input from beneficiaries is welcomed;
- forming Local Project Committees that would be responsible for O&M;
- holding field workshops to aid in the training of beneficiaries to take up O&M responsibilities;
- preparing Plans of Operation that form an integral part of the O&M Manual; and
- an O&M Follow-up Program that is envisaged as a program that would support Local Project Committees' O&M activities with appropriate field-level, hands-on assistance for a number of pilot sub-projects.

The following review is largely based on the report of the 1991 operation and maintenance mission which reviewed this project (SSSFCDIP, 1991).

4.3.2 Local Project Committee

The Local Project Committee (LPC) is a key component of this approach and is made up of representatives of local government agencies, farmer groups and fishermen. The LPC is formed during the planning stage of each sub-project. The major functions and responsibilities specified for LPCs (World Bank, 1987) are to:

- disseminate information on planning, implementation, operation and maintenance of the sub-project and to seek beneficiaries' reactions and consent;
- assist in the process of land acquisition as required by the sub-project works;
- develop ways and means to ensure beneficiaries' active participation, in cash and/or labour contributions, in the operation and maintenance of the completed works and to assist in the preparation of a plan of operation in the detailed engineering phase;
- oversee the establishment of adequate agricultural supporting services, including strengthening agricultural extension, supply of seeds, fertilizers and pesticides, and provision of credit; and
- undertake other actions in support of the sub-project objectives and resolve problems arising during various stages of project implementation.

Each LPC comprises the following members:

- Chairman of the Upazila in which the project is located;
- Chairman of the Union Parishad in which the project is located;
- Upazila Nirbahi Officer;
- Upazila Engineer;
- Upazila Officers of the DAE, BADC, BRDB, DOF;
- BWDB Executive and Subdivision Engineers; and
- about seven representatives of high-, medium- and low-land farmers, fishermen, boatmen, landless and others.

The LPC is chaired by the Upazila Chairman with either the BWDB Executive or Subdivision Engineer serving as Secretary. LPC meetings are supposed to be held at least quarterly. The members of the LPC are selected at a pre project meeting where the Upazila Chairman and the BWDB Engineer propose names of possible members. Their membership is generally sanctioned by the Upazila Chairman and the BWDB Engineer after obtaining a consensus from the participants attending the pre-project meeting.

Hence the process of committee formation has generally been from the top down, and is used as a means to obtaining acceptance of the proposed project. It serves the purpose of publicising the proposed project, and comments are likely if it is clear that it would be particularly detrimental. But it is unclear if major changes in planning could arise from the

meeting - it is not a full public consultation since the role of "influential persons" is likely to be dominant.

The next stage in commissioning is that field workshops are held to discuss the details of the project and how it is to function. The inputs to this are largely from the project consultants. In addition plans of operation are to be prepared. However the review mission (SSSFCDIP, 1991) reported that these were based on the assumption that BWDB is responsible for O&M, which appears inappropriate for the type of small schemes developed by this project. Clear divisions of responsibility are not laid down between BWDB and LPCs, nor is there simple practical information on how to operate or maintain structures (videos, diy style handbooks in Bangla, and field trainers are obvious options). The committees in projects in the O&M stage are likely to be dominated by vested interests, and may not be much more effective at overcoming disputes over operation than the traditional BWDB formed committees.

4.3.3 Training

The SSSFCDIP has a regular programme of training courses for BWDB engineers such as XENs and SDEs. This has tended to concentrate on issues related to design and construction reflecting the focus on implementing small water control structures and projects under the Project, but also including pre-project meetings to involve local people. However, the training courses have also had a component on improved O&M, including both practical advice and illustration of the potential for income generating activities and resource saving maintenance arrangements. With the increasing emphasis on O&M, presumably these aspects will get increasing attention, but there is a paradox in that with the division of O&M from implementation the same BWDB staff should not be involved in both. Hence there will be a need to target training more clearly towards supporting staff in their own tasks.

4.3.4 Future developments

The SSSFCDIP is clearly committed to the local committee approach, which should be particularly suited to small structure-based projects. However, the review (SSSFCDIP, 1991) noted the problem of resources as being a major limit on sustainability, recognising the non excludability of FCD benefits and dismissing the possibility of user fee systems. Hence it proposes interim external funding and development of revenue generating infrastructure linked to the project (fish cultivation in borrow pits, and productive use of embankments). The revenue would be ploughed back into O&M and managed to benefit disadvantaged target groups. However, the review notes that these approaches are unproven and experimental.

The review also proposed a very detailed monitoring programme designed to link O&M with assessment of project performance. However, the level of detail and resources required appear to be excessive compared with the cost of the projects and input to group formation. Short but intensive RRA style assessment of progress might be more effective.

As a result of this review and further development of the O&M component of the project, three pilot projects (out of those already built under the project) have been taken up for a period of 27 months to develop sustainable O&M. There will be a permanent field technician for each pilot project available on site plus additional advisors based in Dhaka to cover the range of issues involved in making the groups viable (agriculture, social science, women-in-development and water resource engineering). This should provide a good level of support for encouraging group consciousness and making productive and equitable use of the projects. The water management groups will be based on hydrological units and a bill has been prepared to give them a legal status to receive and disburse funds. This programme should be monitored as a possible model for management of sub-catchments of FAP projects.

However, there is a danger that legislation to institutionalise this approach to participation in system management may preclude opportunities to experiment with alternative models under FAP and the non-FAP projects. The SSSFCDIP O&M sub-projects are at a pilot stage and hence it would appear to be too early for formal institutional changes. Although eventually appropriate legislation will be necessary to cover the O&M and partcipatory management models which evolve from the various experiments.

4.4 LAND RECLAMATION PROJECT/CHAR DEVELOPMENT AND SETTLEMENT PROJECT

4.4.1 Background

The Land Reclamation Project (LRP) started in 1979 with Netherlands government assistance and the following objectives (LRP, 1985):

i. to set up and develop an organization within BWDB which would carry out surveys and studies for the development of long-term plans for land reclamation and estuary control on the southern delta of Bangladesh;

ii. to implement experimental test schemes in the newly accreted area in order to ascertain the appropriate technology for increasing agricultural production by improving water management and more productive use of accreted land by the planned settlement of landless people;

iii. to plan, prepare and monitor the implementation of specific land conservation and reclamation projects within the framework of a long term plan on the basis of experience obtained from the experimental schemes.

The project is headed by a Superintending Engineer who is responsible for general coordination and operation of the project. Under him there are three divisions:

- planning and coordination;
- project preparation and monitoring; and
- land reclamation.

The Netherlands team members are attached to the BWDB in an advisory position. All surveys, studies and projects are mutually agreed upon and the execution of the project activities are the responsibility of the BWDB.

Within LRP there are infrastructural engineering works including construction of embankments, bank protection structures, cross dams, and closure dams which combat erosion and stimulate natural sedimentation and accretion processes.

Of equal importance within the LRP is the experience which is being gained from the experiments in research plots on different technologies for desalination and drainage, their influence on crop yield, and socio-economic aspects related to settlement of reclaimed areas based on cooperatives of landless families, and helping them to become self reliant.

The involvement of the cooperatives in the construction, operation and maintenance of the polder is being studied in collaboration with local consultants.

It is the policy of the Government of Bangladesh to allocated newly accreted and reclaimed government khas lands to landless farmers. This is also strongly supported by the Netherlands government policy, which in the case of LRP, is aimed at providing, transferring, and jointly developing the appropriate technology to increase the accretion and reclamation of new lands.

4.4.2 Action Research

Within LRP a 50 ha research plot is in operation at Char Bagger Dona, Noakhali. The research is directed towards achieving optimum cultivation and land use practices from new accreted saline lands. Research experiments cover crops, livestock, and fisheries. It also includes infrastructure such as drainage desalination. Other aspects are improved cultivation methods using fertilizer and pesticides and motivation of landless farmers' cooperatives to participate in water management, operation, and maintenance of water control works.

The main experiment has been the settlement of a Pilot Polder by landless people who have been allocated land there. The LRP has involved NGOs, such as Nijera Kori ("do it oneself"), in organizing landless cooperative societies. There are 30 such cooperatives operating within the Pilot Polder. The coops include both male and female groups, and have savings and credit programmes under the overall supervision of Nijera Kori and LRP. Training is provided by Nijera Kori, and credit is funded by a commercial bank under a guarantee by the LRP.

These cooperatives are listed as D class contractors of the LRP for construction, as well as operation and maintenance work, under the supervision of the BWDB O&M division. The experience of the coops as labour contractors is encouraging (see also experience of EIP), although credit recovery has run into difficulties.

Each cooperative has on average 30 member families having 2.5 acres (1 ha.) of land allotted each to them for cultivation. In addition they have rights for fish culture in the khas ponds in each block. Initially the families work as landless labourers. They then receive land allocated through the project and become tenants, and finally through continuous settlement they become owners of the land. Out of 900 families only 105 families have left the settlement so far. The rest are living there on a permanent basis.

BWDB has direct access to the groups and uses them for operation and maintenance work. BWDB, NGOs and an Advisory Team ensure quality control through organization, supervision and training with support from Dutch funds for the O&M division.

4.4.3 Future Developments

LRP as such has now ended, however the work of settling people and developing newly accreted land (chars) will continue under a third phase project renamed the Char Development and Settlement Project (CDSP), which would not include the physical monitoring and surveys of the lower delta under taken under LRP. It is expected that CDSP will involve more integrated development programmes for chars in which different government departments would have linked development budget for complementary programmes.

4.5 DELTA DEVELOPMENT PROJECT

4.5.1 Background

This long term project of BWDB with Netherlands Technical Assistance involves rehabilitation of Coastal Embankment Project (CEP) polders in the Khulna area, including improved water management inside the polders, and long term development work. Engineering works are undertaken to provide protection from saline water flooding. There have been proposals that in the next phase of the project institutional changes are made to give local administration a greater role in FCD management, but this was not finalised by February 1992.

Of particular relevance to improving O&M is their ongoing work in two CEP polders (nos 22 and 29), which includes participatory management and maintenance of these polders.

4.5.2 Irrigation groups

In Polder 29 shrimp cultivation has been banned (the polder is lower in its centre so shrimp ghers around the perimeter would affect salinity levels in the interior) and the area is largely free of saline water. The original intention was to rehabilitate the polder and provide a tertiary irrigation system. However farmers preferred wild flooding of irrigation basins from pipe inlets. A large number of irrigation schemes (through pipe inlets) have been set up and inlet groups of farmers have been established to manage these schemes.

The groups are supported by a team of extension workers employed directly on the project. They are responsible for a wide range of water management or O&M advice and assistance. In particular they have the roles of helping to form and support groups advising on water management including O&M carried out by the inlet groups, helping to coordinate groups so that they all aim to control salinity (if one group decided to introduce salt water this would adversely affect others), and assisting in a wide range of agricultural extension activities - technical and practical advice.

Initially committee members were selected by the extension workers. Richer farmers came to dominate the groups. The project is now working to change this in favour of smaller farmers and share-croppers. In the past a Tk 500 deposit was paid by the groups for maintenance of the pipes, but this was paid by the richer members who therefore regarded themselves as entitled to manage the group. The current strategy of DDP is, therefore, to reimburse the rich farmers, and then to collect fees from smaller farmers to cover maintenance, with an additional service fee of Tk 3 per month of irrigation per acre. The funds collected, although arranged by the project, will then go into the group's bank account and be under its control. It remains to be seen how well the groups are able to manage their own resources, although this should be possible since the groups are small scale irrigation groups where the benefits are clear and excludable.

4.5.3 Embankment maintenance

Since January 1990 routine embankment maintenance (preventive maintenance) in Polder 22 has been carried out by landless women recruited through and assisted by a local NGO. Women were selected from existing groups and preference was given to female headed households. The selected women formed a committee with a president and secretary who signed on their behalf a contract with the BWDB (DDP) to carry out regular embankment maintenance. Funds are from the DDP project (Annual Development Programme). The women were originally allocated one mile each, although they work in groups of 2-3.

However, this is now regarded as too heavy a workload, so it is proposed that two women per km should be employed to maintain the whole embankment section (CARE roads have one women per km to maintain only the crest). Pay is Tk 25 per five hour day and supervision is by the BWDB Work Assistant with technical assistance from the SO. This maintenance programme has been an experiment so far, covering 12 miles. It is argued that even with more women per mile the costs of regular maintenance will be less than that of periodic resectioning. Regular income will be provided for poor women, and the embankment should not gradually deteriorate.

The programme has shown that this approach can work for embankments, although there may be problems in implementing it where embankments are already used for other purposes (for housing for example). The main problem within the present institutional setting is that women's maintenance crews replace periodic work which can be funded from external assistance (for rehabilitation) with regular locally financed maintenance. Moreover regular work by small groups/individuals replaces more major earthwork done largely by contractors or under FFW. Hence routine maintenance may involve more administration, and there are vested interests which favour the existing system with its leakages. At present regular maintenance has been funded by the project, but ultimately it should come from normal O&M funds, whether from central government or raised locally, and this is likely to be a problem unless farmers contribute towards the costs.

4.6 EARLY IMPLEMENTATION PROJECTS

4.6.1 Suggestions for Improved O&M

The 1990 review mission on O&M in EIP FCD projects (EIP, 1990) identified many problems in EIP projects which the FAP 13 case studies have also revealed in greater detail. The report highlighted problems in O&M, particularly lack of beneficiary consultation and involvement in management of projects and the lack of resources for O&M. It noted the reluctance of Upazilas to take up O&M of projects since this would involve mobilising resources, and taxes are generally unpopular, especially if there is no return for paying them (as would be the case unless improved O&M led to greater benefits). The report stresses the need for accountability by linking service charge collection with reliability of project services. Local institutions are not yet ready to achieve this but would need to be assisted in developing a capability to generate sufficient funds, as the present system of central government funding is seen as non-sustainable.

Three alternative strategies ('models') for O&M management are briefly discussed by EIP (1990):

a) Project Committees

These would be formed of representatives of sub-committees responsible for individual structures, with government officials invited to attend when required. It is noted that legal responsibilities would need to be defined, and that legislation to give committees revenue collecting powers would take a long time to enact. Technical support might come from BWDB.

b) Upazila Control

Control by the Upazilas, while possible, is regarded as unlikely to be effective. The Upazilas do not have the capacity to directly manage FCD/I projects, but they do collect limited revenue and had elected representatives. However, the lack of a clear hierarchy of

command is seen as a constraint, as could be the different spatial areas of Upazilas and projects. EIP (1990) suggests that Union Parishads might be a more appropriate level to be involved directly in FCD/I projects under EIP.

c) Management Control

Another option is to hand management over to private companies or NGOs. The reward for maintaining the project could be the use of project infrastructure (embankments and borrow pits). This could be done for the project as a whole, for large parts of it, or on an individual basis - leasing out short sections of embankment. Obviously the administrative burden increases in the latter case, and there is a lack of overall management of the project.

4.6.2 O&M Components in EIP

EIP (1990) suggested that experiments with alternative management models are needed. Some comments on the need to monitor the technical performance of the movable parts of structures and submersible embankments are made, although this could be further stressed -design at present appears to have little feed back from the O&M problems actually experienced with alternative designs and constructions.

EIP (1990) recommended that an O&M component be taken up by EIP and observed that this would need to be innovative. The route implied is through strengthening of BWDB, but with emphasis, initially, on the development of sluice committees and on improved routine maintenance of some projects, rehabilitation of others, and redesign of some (such as those along the Nagor river).

One area in which EIP has considerable experience and which can help in improving O&M is in the organisation of Labour Contracting Societies (LCS) which can take up to 25 per cent of construction work on new EIP projects. This approach could be used more widely in rehabilitation, or on standby for emergency works (see Section 4.11.2 b).

The EIP O&M component is currently (February 1992) still awaiting approval from GOB, but preparations for routine embankment maintenance and productive use of infrastructure are in hand. Once this is permitted this will provide further evidence on the benefits and problems of these approaches, and spread improved O&M into medium sized FCD projects throughout the country.

4.7 GANGES-KOBADAK REHABILITATION PROJECT (GKRP)

The Ganges-Kobadak Irrigation project (GK) is one of the oldest and biggest irrigation projects in the country. It was started in 1955 as a supplementary irrigation project to irrigate 350,000 acres of land during the Aus/Aman seasons (in other words from March/April to October/November). It had three units: Kustia, Jessore and Khulna. Out of three only one unit has been completed over two periods: 1969-70 Phase I and 1982-83 Phase II.

Since completion there has been a reported shortage of O&M funds, lack of incentives to manage the system efficiently, and water rate realization has been virtually nil. Many structures, including pumps, have fallen into disrepair, and deterioration of canal conditions is widespread in the entire project. Institutions, such as cooperatives, linked with the project have over the years drifted into dormancy. Extension staff are on the pay roll but their activities are limited because of a shortage of logistic support. They are losing enthusiasm because of the lack of promotion prospects and incentives.

To re-activate the project a rehabilitation programme was started in 1989-90 with Asian Development Bank assistance, which will continue until the end of 1992.

To date much physical rehabilitation of main and secondary canals has been done, but very little work has been done in tertiary canal rehabilitation. The main objectives of these rehabilitation works are to keep the project in operable condition. The executing agency is not aiming to reach every single component of the system for rehabilitation. Major emphasis is being given to the self participation of the beneficiaries in contributing to improved project performance in the long term.

During the FAP 13 field visit to the project site and discussions with the local farmers it was found that they never take part in the operation and maintenance activities of the project. A study supported by UNDP recommended strengthening of farmers' participation through formation of Tertiary Water Users Associations (TWUA). The concept as envisaged is to develop these associations in selected model areas, and after the processes of group formation are developed, to expand them gradually to other areas of GK project. The processes to be developed are those that would lead to organised farmers taking responsibilities for O&M at the tertiary level and below. To advance this intended programme a workshop on "Training Need Assessment and Training Strategy of WUA's and Farmers" was organised in September 1991 by the Irrigation Extension Training Centre (IETC, BWDB Kushtia) in association with Hydraulic Research Ltd., GKRP and BWDB, Kushtia. The main objectives of this workshop were:

- to determine the content of training and appropriate training methods;
- to develop a training curriculum and manual;
- to prepare a training outline, plan and training materials; and
- to prepare an action plan for implementing the training programme.

It is reported that at present 104 TWUAs are functioning in the field. Tertiary Water Users Association (TWUAs) would be formed with the representatives from Outlet Committees (OC) representing farm families having land on both sides of the field channels. The representatives would be selected from headend, middle and tailend farmers, and from big, medium and marginal farmers, one third from each category. The TWUA would be given a direct contract for digging the earth channels and building other structures by BWDB, ensuring a higher quality of work and source of income for the Associations. The Project Director expects to form 300 TWUAs within the next 12 months.

TWUAs would be responsible for collecting water charges at the rates of: for Kharif I @ Tk.100/-acre, and for Kharif II @ Tk.250/-acre. All farmers would be members and would pay water-rates according to the terms and conditions of the by-laws to be approved by BWDB. Renewed emphasis has been placed on irrigation fee recovery but the performance has been very poor: in 1989 the total assessment was Tk 91.96 million but only Tk 2 million was collected (Kyi, 1990).

GK is a gigantic project. Ganges water has to be brought in an intake canal which requires annual dredging to a pumping station. Then the water goes to the main canal (193 km) then secondary canals (467 km) and then to tertiary canals (996 km) and finally to field channels (3500 outlets). There are hundreds of structures and earthen channels which have to be maintained and can easily fall into disrepair. After many years much of the infrastructure including the pumps has worn out. The Project Director claims that for proper O&M the annual maintenance and operation cost would be Tk.200 million; and that if there is 100 per cent water-rate collection there would be a revenue of Tk.40 million only. A careful

analysis of ways of minimising costs, and of the benefits of improved irrigation management will be necessary. The water charges proposed are low compared with private charges for HYV Boro cultivation using ground water, but the benefits of irrigation in GK project may not be so high.

A particular problem for cost recovery in GK project is that it is difficult to isolate the impact of project water (supplementary irrigation) from that of natural rains. With a fixed rate charge farmers may argue that they did not benefit in a particular year and hence refuse to pay. Despite the establishment of TWUAs in GK project serious "free-rider" problems (see Section 5.2.4) are likely to continue over payment for irrigation water.

The improvements to water management and participatory rehabilitation approach of GK are at an early stage. The new farmers' organisations are already in dispute with the BWDB engineering staff because of delays in payment of their contract bills. Time will be needed before a judgement can be made on its effectiveness as a model for other projects in terms of beneficiary participation.

4.8 OPERATION AND MAINTENANCE COST CELL (O&MCC)

4.8.1 The Project

An O&M Cost Cell has been established within the Directorate of Evaluation and Monitoring of BWDB to help rationalise and systematise financial management of O&M. The technical assistance for O&MCC funded by CIDA ended in 1991 and concentrated on management systems for improved O&M planning and prioritisation of maintenance work. The approach developed will be through compiling detailed inventories of project facilities, and monitoring of their maintenance status, along with standardised and revised costing schedules. The project is essentially concerned with improved management and prioritisation of maintenance by BWDB, and with more consistent and standardised budgetary control over contractors' work (primarily in new construction and rehabilitation rather than routine maintenance).

The project concentrated on compiling inventories and on developing computerised databases prepared within a detailed structured system to record system facilities, and to provide an O&M planning tool aimed at achieving levels of service for given facilities and prioritising annual work programmes. Reports covered an assessment of O&M planning procedures at present (O&MCC, 1991a), and the detailed data bases and proformas recommended for monitoring the physical condition of systems which would then be used to prioritise maintenance expenditure (O&MCC, 1991b, 1991c).

4.8.2 Assessment

The project assumes central funding for O&M which would be coordinated through BWDB. Although it could be a tool for improved local management of FCD/I projects it is geared to improving the existing centralised system. There is a presumption that funds are a constraint on O&M, although the information systems would help to make efficient use of O&M resources. It assumes that O&M budgets go to O&M rather than staff, but makes no recommendations on the optimal levels of staffing to achieve improved system management. There are likely to be problems in implementing the detailed methods proposed (although the approach seems sound) since they assume sophisticated data collection and management capabilities. However, much would be achieved if there is an accurate structured data base covering the facilities BWDB actually operates (rather than facilities which have since decayed or been lost), and if a simple monitoring of their annual status can be achieved, upon which maintenance decisions can be made. Its greatest contribution could be in monitoring drainage

system performance and prioritisation of khal re-excavation so that the critical reaches on which farmers depend function effectively.

The O&MCC is not yet operational and it has been proposed that it receive additional assistance so that it can work with SRP to improve monitoring and prioritisation on a pilot basis with a more simplified version of the procedures proposed.

4.9 LGEB (RESP) O&M MODEL

4.9.1 Introduction

There are three projects under the Rural Employment Sector Programme (RESP) which the Ministry of Local Government, Rural Development and Cooperatives is involved in, through the agencies under it:

IDP: Infrastructure Development Programme with Upazila Parishads. The Local Government Engineering Bureau (LGEB) is the implementing agency.

ISP: Institutional Support Programme: this is a national level support programme for Upazila level engineering. Aspects of relevance to this study include the drawing up of technical design manuals, hydrological data bases, management support and training. ISP is mainly concerned with setting up a regional laboratory for preparing design and operating manuals, hydrological study, and training. LGEB is the implementing agency.

PEP: Production Employment Programme. Bangladesh Rural Development Board (BRDB) is the implementing agency. This programme provides employment for the poor, particularly women, in creating and maintaining infrastructure, for example under similar systems to those supported by CARE (see Section 4.10) by employing individual women to maintain stretches of earth road.

4.9.2 Infrastructure Development Programme (IDP)

The IDP has direct relevance to FCD/I O&M for two reasons: it involves women and landless groups in execution and maintenance of various projects for income generation employment, and it includes a number of small water management schemes. Its scope of work includes:

- building of new rural infrastructure such as roads, bridges, and culverts;
- feeder roads;
- growth centres; and
- water resources projects.

The water resources cell assists in design, construction and O&M of small scale (usually drainage and irrigation) schemes. This water management programme is in the form of a pilot project concentrated in five Districts: Kurigram (17 completed schemes), Faridpur (11 schemes), Madaripur (3 schemes), Rajbari (2 schemes), and Gopalganj (no schemes completed). Schemes are all small (up to about 1000 ha with one rather larger scheme with an area of 2400 ha.). Planning and implementation continue - for example during 1992 it is planned to start schemes covering about 35,000 acres (14160 ha), but in 1993 it is planned to stop the IDP in Kurigram (by which time three more schemes should have been completed

there) and to add Sariatpur to the programme, thus concentrating the effort in Greater Faridpur. Out of the 33 completed schemes 26 have so far (February 1992) been handed over to the beneficiaries to manage (see following section).

Maintenance work is carried out by the following bodies according to the type of work involved:

- landless labour groups;
- labour contracting societies; and
- local contractors.

The landless labour groups are organized by field assistants at the project level and paid by the Upazila Parishads out of the project fund through a bank account. In some of the projects maintenance work is done by women's groups who are paid Tk. 20/day by LGEB. There are provisions for having work site facilities for the female labour force.

The earthwork maintenance programme provides employment to women and landless labour groups round the year. Similarly structure and feeder road maintenance also provides round the year employment to the labour force which consists mostly of landless groups. Labour Contracting Societies get work only during winter months for periodic maintenance and construction. During the monsoon they have to find alternative work, which is a problem for their long term cohesiveness and sustainability.

The growth centre development work includes building of market sheds for different commodities such as fish, vegetables, and groceries, with supply of drinking water, sanitary facilities and drainage network.

4.9.3 IDP Water Control Projects and O&M Model

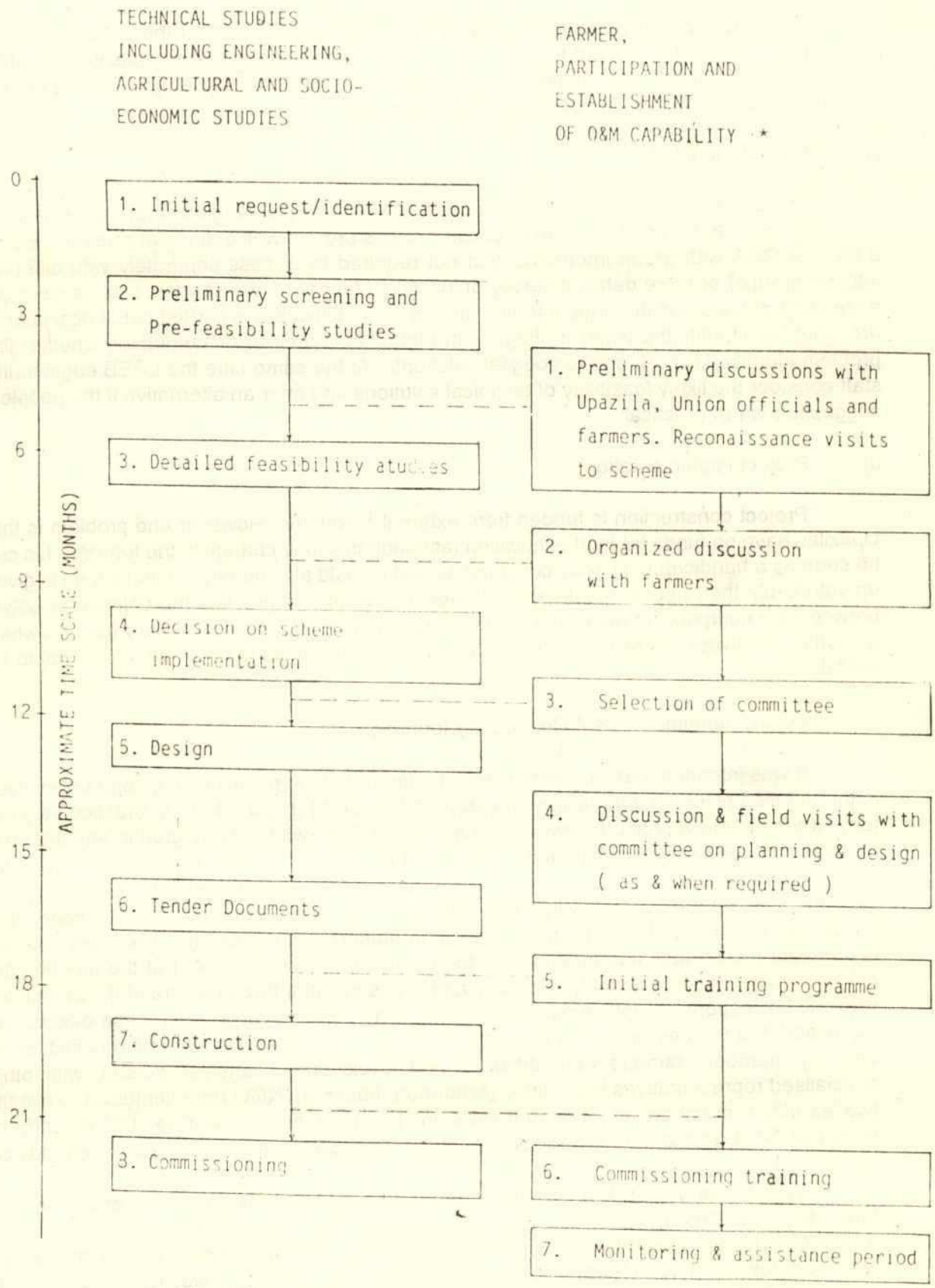
a) LGEB Project cycle

The general procedure follows that drawn up from a review of O&M in the Upazila initiated small scale FCD projects (IRWP, 1986), which showed that some local committees were working, and also resulted in a planning, implementation and handing over procedure, a general O&M manual for these schemes, and in suggestions for use of project khals for fish culture. At the planning stage of these schemes local O&M committees are to be formed among affected groups. Some training, for example in operation and routine maintenance, is provided. Figure 4.2 shows the planned timetable and links in the planning and implementation process for FCD/I projects.

The project cycle in LGEB supported small water management projects can be broken down into: project identification, planning, implementation, group formation, hand over and transition, and O&M. These aspects are reviewed in the following sub-sections.

In general the schemes are centred around water control structures and cover relatively small areas. The Rupatala Water Resources Scheme, visited by the FAP 13 team, is an example of a completed scheme. Its committee was reportedly formed in 1986, after a study in 1985, implementation was in 1987-89, and training in O&M was in 1990. However, it appears that during a four year period there was little involvement of the client farmers in how their project was shaping up or in preparing the group to take over on completion.

Figure 4.2 Intended Development Process for Upazila FCD/I Projects



* When there is no sluice structure only a maintenance committee is required and the programme can be reduced to stages 1,3,6 & 7 only

Source : IRWP (1986)

b) Project identification

It is reported that potential projects may be identified based on the petition of local people (to the Upazila or direct to LGEB), or by local government (UP or Upazila). If, after an initial visit by the LGEB engineering and socio-economic staff, the project appears to be potentially feasible then it moves to the planning stage.

c) Project planning

The LGEB procedure involves a form of participatory planning although the procedure and techniques to be used in different circumstances are not well defined at present. Either a form of RRA with group interviews (but not required to discuss separately with different interest groups) or more detailed survey of individual farmers (very short interviews covering a checklist of flood and drainage information and area cultivated) is carried out. Local people are asked to identify the water management problems in their area, confirming whether the problem identified is real, and to suggest solutions. At the same time the LGEB engineering staff consider the likely feasibility of technical solutions and offer an alternative if the peoples' suggestion is not practical.

d) Project implementation

Project construction is funded from external resources. However one problem is that Upazilas have no funds for land acquisition (although this may change in the future). This can be seen as a handicap to speedy construction, but it could also be argued that if land is given up voluntarily then people must expect to benefit overall. In practice the balance of power between the complex interlocking interests of rich and poor, patron and client (groups which are often relatives) is unclear and detailed study of the distribution of land loss would be useful.

e) Local Committee (O&M Committee) formation

It was intended that local committees be formed at the planning stage and be involved in the detailed planning and design and prepared for O&M (Figure 4.2). In practice they are formed for the O&M phase following informal discussions with various groups and interests at earlier stages, and so the formal involvement in planning is less than intended in IRWP (1986). The procedure is for the local authority to hold a general meeting open to all and presided over by a local elite, with LGEB staff as facilitators. At the meeting the concept of the project is explained and the task involved in managing it discussed. The main purpose is to select the officials and members of the committee. Those present at the meeting are asked to nominate a President, Secretary and Treasurer (the three officers of the committee who will be responsible for running the project). The qualities required in these officers are discussed, but the decision is up to a vote of hands. The committees are also to include as ordinary members farmers from different land levels and a landless person, with other specialised representatives if available (fisherman, boatman, NGO representative), while the two ex-officio members are the Sub-assistant Engineer of that Upazila (LGEB staff) for technical O&M advice, and the Block supervisor (DAE staff) for water management advice.

Whilst this process might be termed democratic, it is more top-down, in that representatives are created on the spot with no foundation of an interest group, and hence a lack of cohesion would be expected. The rules, by-laws and procedures for the groups were laid down in IRWP (1986) which recognised that larger farmers would tend to dominate a committee, but argued that if they represent different areas and land levels this should lead to fair operation since farmers, rich or poor, have a common interest in efficient operation of

structures. There is no provision for specialised social organisers to be allocated to the projects to assist in group formation, although there is a practical training programme for the groups. An appropriate illustrated guide to practical O&M has been drafted (IRWP, 1986), and the Block Supervisors are expected to assist the committees.

f) Handover to O&M

The LGEB approach involves a formal hand over of the scheme using a prescribed form (IRWP, 1986) with the UNO, Upazila Engineer, and previously sometimes the Upazila Chairman handing over the scheme to the President, Secretary and Treasurer of the Committee (OMC) and witnessed by other Upazila officers (although the committees do not have a formal legal status). Preparation for this involves training for the committee members, and a series of registers are provided. OMCs are expected to hold monthly meetings at which decisions are taken (although fixed meetings are unlikely to have a direct bearing on operational decisions), and to keep a register of contributions by beneficiaries. OMCs are encouraged to raise their own resources by collecting a small share of the harvest benefited by the scheme - at a suggested rate of 2 sheers per bigha (approximately 15 kg/ha), which may be sold to raise cash, in order to cover maintenance costs such as khal excavation. The accounts books are supposed to be kept against receipts and to be checked by an auditor each year before approval at an annual general meeting.

The operation of a sluice gate is undertaken by one delegated person who must reside near to the gate. The gate should be operated according to predefined river levels. In addition to a general O&M manual (in Bangla, based on IRWP, 1986) setting out general principles and responsibilities (for example for ex-officio members), specific O&M 'manuals' were to be drawn up for each scheme (but have not been prepared).

4.9.4 Training and Manuals

There are two levels of training involved in the LGEB water management programme. Training courses are held for Upazila Engineers (but not for extension staff such as Block Supervisors) separately in planning and design and O&M. However this has not covered all Upazilas yet and most of these engineers have limited scope for applying what they learn since they do not work in Upazilas where LGEB concentrates its IDP water projects. Without an opportunity for construction there is little incentive to apply the training. This extends to the focus Upazilas where ex-officio staff, despite belonging to LGEB, are hardly accountable to the IDP and may lack an interest in O&M when there is no longer new construction work.

This affects the second level of training and support since the Upazila staff are the resource people (along with other LGEB advisors) for training and supporting the scheme committees. These committees are given three days of training before handing over of the schemes covering: socio-economic awareness and agricultural development, the expected functions of the committee and how it should liaise with the Upazila, the agricultural problems and potentials of the scheme area and the services offered by the Upazila. Technical aspects of operation and maintenance are covered in one day including practical demonstrations. This is supported by the general O&M manual (along the lines of that proposed in IRWP (1986) but in Bangla and with photographs illustrating routine O&M activities). This may now need revising in the light of experience. Again no specific scheme instructions are prepared.

There is a provision for refresher courses two years after handover, but there appears to have been a lack of continued support and on-the-job training during the critical early phase of the schemes.

4.9.5 Assessment of LGEB Experience

The LGEB O&M report (IRWP, 1986) is one of the best assessments of O&M in small projects in Bangladesh and provides detailed guidance to LGEB on establishing an O&M capability in water management schemes. However, it did not recommend any long term advisory support to the groups formed (such as extension staff dedicated only to this). This may be a reason why the sound ideas for improved O&M have not necessarily materialised yet into sustainable farmer managed schemes. However, this programme is at an early stage, and is encouraging, in that groups are operating, and that basic levels of O&M appear to have improved.

Resource mobilisation to ensure the sustainability of the schemes is obviously a critical area and there is a problem of motivating people to invest in the scheme, and hence share responsibility for it. However, the approach adopted by LGEB, to encourage people to contribute a small part of the harvest and deposit it into a scheme fund to cover O&M costs, appears promising since it is directly linked to the achievement of agricultural benefits compared with pre-scheme conditions.

The projects are very small (not more than 1000 acres). Even if the approach adopted by LGEB proves successful in the long run, it may not be replicable over FCD/I projects in general in Bangladesh, particularly the larger ones under BWDB. For example one local committee is sufficient for these small schemes, but this would be very unlikely to be able to coordinate operation within a large project.

It appears that the Upazilas/LGEB perform better in establishing small projects than BWDB, at least in the focus areas. The two agencies could work together in these areas, with LGEB taking a lead in sub-components of larger BWDB FCD/I systems as an experiment. However, in the rest of the country the Upazilas have the same official staff as in the five focus districts but perceive that they have no funds for new water management works (although there is potential for these under FFW schemes). Technical Assistance would be a problem as, for example, Upazilas have no social scientists or participation specialists to make small schemes work and successfully hand them over to groups. This may be possible over time for new small schemes. However, handing over BWDB schemes would simply add to the responsibilities of Upazila staff with no incentives for those staff. Larger projects would need to be split up while there is no assurance that the handed over schemes would be self sustainable unless they achieve perceptible benefits and there is an intensive input to forming groups.

The power structure of the groups may appear reasonable but is likely to become dominated by the elites. This may be good or bad. Their tacit or active support is needed to make schemes work and often in agriculture they may have the same interests as other farmers, but there is also a need to empower poorer sectors of society to check potential abuse of power. It may be that the LGEB approach would benefit from greater concentration on social organising skills among extension workers and BRDB staff, or through appointment of fixed term social organisers.

4.10 CARE'S FOOD FOR WORK AND ROAD MAINTENANCE PROGRAMME

4.10.1 Food For Work Context

At present, the FFW programme in Bangladesh has three primary contributors:

- The Government of Bangladesh (GOB) operates its own FFW schemes (about 40,000 mt. pa) and acts as the coordinating body for all FFW projects in Bangladesh;

- USAID provides about 120,000 mt pa of wheat which it consigns to CARE at the US port. It also pays CARE's hard currency costs and a fraction of its Taka costs; and

- World Food Programme (WFP) in conjunction with a number of bilateral donors including the EC, UK, Canadian International Development Agency (CIDA), and Australia, contributes about 270,000 mt pa (much to BWDB for repair and rehabilitation, see Section 2.4).

In addition CIDA makes further contributions through CARE to the maintenance of earthen roads, by providing approximately 90,000 MTs per annum of monetized wheat for payment of Rural Maintenance Programme (RMP) crews' wages (the particular focus of this section).

The FFW projects of the three main agencies (GOB, WFP, and CARE) are similar, and follow closely aligned implementation methodologies. The primary difference between the three types of projects is the degree of monitoring and supervision provided. CARE falls at one end of the scale with intensive field level supervision of FFW activities, the GOB takes the opposite position with a little Dhaka-initiated supervision, and the World Food Programme falls in between the GOB and CARE.

The practical effect of differing levels of supervision lies in the degree to which the GOB bodies (both central and local) are accountable to donors for use of resources. CARE, with intensive random sample monitoring of pay rates and measurements of actual work accomplished, hopes for better accountability for the resources entrusted to the GOB. The central GOB capacity to demand accountability of local GOB bodies in its own FFW projects is, on the other hand, quite limited. Evidence summarised in World Bank (1991) indicates, however, that leakage from the system is still widespread: leakage of up to 35 per cent has been reported by WFP, while CARE has estimated 20-35 per cent misappropriation at Upazila and Union levels. Despite its monitoring system CARE does not reduce Upazila allocations where there is misuse.

4.10.2 Background to CARE FFW

CARE has been functioning in what is now known as Bangladesh since 1955. Since 1971 and the signing of a basic operational agreement in 1974, CARE has worked closely with the Government and local agencies on income generating and health improvement activities. Project activities are approved by both CARE and the Government. Each project is separately funded and operates under a separate agreement with the counterpart ministry. CARE-International's programme in Bangladesh comprises five projects (LOTUS - Landless Owned Tubewell User's Support has now ended):

IFFW	- Integrated Food For Work;
RMP	- Rural Maintenance Programme;
WDP	- Women's Development Project;
LIFT	- Local Initiatives for Farmer's Training; and
TICA	- Training Immunizers in the Community Approach.

Both IFFW and RMP provide wages through the construction and maintenance of rural roads and embankments to labourers at the lowest income levels. Annually, IFFW reconstructs more than 6,000 miles of roads and constructs 600 bridges and culverts and RMP maintains 60,000 miles of rural roads. These externally funded efforts support the development of rural communications, and also the development of project management systems within local institutions.

4.10.3 CARE's Integrated Food For Work Programme

Between the late 1970s and early 1980s the CARE-FFW programme was involved in rural earthen road construction, but it was gradually felt by both CARE and its donor agency (USAID) that it had been useless to build roads with many gaps which made the roads discontinuous. Hence, from 1983 CARE undertook construction of small scale bridges and culverts to ensure FFW road surfaces are continuous. Thereafter the project became known as the "Integrated Food For Work Project" (IFFW). An institutional assessment in 1987 by Management System International indicated that saturation was being reached in rural road construction in Bangladesh. In order to address this issue CARE has switched a significant part of its programme from road construction to road reconstruction. At present, this kind of earthen road reconstruction could be considered as periodic maintenance.

There have been a number of studies and evaluations of the CARE rural infrastructure programme. The one by Abt Associates in 1989 indicated a number of negative conclusions: maintenance has been poor and in many places roads are deteriorating, especially approaches to bridges; too many alignments actually impede drainage, resulting in unofficial cuts, maintenance problems and poor access for rickshaws and jeeps; and Upazilas have spread the benefits throughout their areas rather than concentrating on alignments with good development potential.

Major recommendations were to improve maintenance and drainage. It was suggested that these objectives could be accomplished by revising the focus of the programme and concentrating on the following activities: promoting institutional development at the Upazila level; allocating additional resources to maintenance, including suitable equipment; stepping up training for Upazilas; providing incentives to Upazilas; and allocating more resources to Upazilas which are constructing structures along alignments with high development potential. The first of these activities would seem to be the key one: institutional development.

4.10.4 CARE's Rural Maintenance Programme

Year-round maintenance of earthen roads, such as those reconstructed through FFW, is carried out through CARE's Rural Maintenance Programme (RMP) a separate project from IFFW which started in 1984 and is jointly funded by CIDA and the GOB. This is now a nationwide project, employing 60,000 destitute women to maintain 60,000 miles of earthen roads yearly in 4095 out of 4600 unions. Supervision is done by local Union Parishad members. Without regular maintenance a newly constructed earthen road will within one year of reconstruction lose to washout from rains: 17-20 per cent of its total volume, 45-50 per cent of the earth added during reconstruction, and 15-20 per cent of its height (CARE, 1989). With maintenance, such as through RMP, the loss is significantly less (though difficult to quantify

precisely) and the road remains serviceable for a significantly longer period of time. Hence, the need for RMP is immense. Similar assumptions of earth loss are implicit in the settlement factors for flood control embankments.

Each Union currently employs 15 women, many of whom are divorced, separated, or widows, to maintain 24 km. (15 miles) of economically important rural roads, thereby facilitating year-round-transport and communication which can be associated with positive impacts on the rural economy. The following information is based on a translation of Directorate of Relief and Rehabilitation (1988).

The women in each Union are divided into three groups (crews), and the members of each group should be residents of the same ward. They work 6 hours a day and 6 days a week (excluding GOB holidays). The women are paid Tk. 24.00 a day and payments are made after every 14 days from the "maintenance crew account" maintained in a local government bank. Each crew member is issued with a spade and a basket, and a crew of 5 women will have a rammer for compaction. The crews keep their equipment serviceable and are held responsible for any loss or damage to the equipment.

Normally, each woman maintains 18 feet (length) of road a day. But, if any major erosion or potholes occur due to heavy rains, then their work is not limited to 18 feet a day. The crews will not work on a road which is selected for reconstruction. They will basically maintain the surface of the road and side slopes and repair patching and wheel cuts created by vehicles.

4.10.5 Observations

CARE has successfully set up and motivated RMP so far, but the management of the programme is being handed over to GOB. Hence CARE has identified a need for training local government officers in supervision and monitoring. This will be met by Union level training sessions and a reduced level of CARE random monitoring where training has taken place.

There is no prioritisation of maintenance within the selected earth roads, although a routine programme is needed, as a quick response to localised erosion and rain cuts.

The RMP is dependent on external resources, and the costs of supervision and monitoring are unclear.

Nevertheless the RMP provides an important example or model which is being pursued by some projects for improving FCD/I maintenance and directing some benefits from FCD/I projects directly to the landless poor. Issues which need to be addressed in its application to embankments are the larger size of many embankments and hence the length of embankment per team. Monitoring/reporting on embankment condition by the teams and prioritising repairs during the monsoon season would also be necessary. There could be a role for BWDB Work Assistants in supervising, monitoring and assisting female work crews (for example in the heavier work of repairing ghogs). If landowners would contribute the funds for routine embankment maintenance this could make a significant contribution to reducing the widening inequality gap, and to spreading the benefits from embankments more widely.

4.11 EXPERIENCE OF COOPERATIVES AND NGOS

4.11.1 Cooperatives

a) Historical Background

Credit cooperatives were introduced by the British with the passing of the Cooperative Credit Societies Act of 1904 in the Indian Sub-Continent in response to the poverty of small cultivators. As a result many cooperative societies were formed. The Act was revised in 1912 to accommodate the formation of non-credit cooperative societies. In Bengal the Act of 1912 was recast in 1940 and the rules thereof were framed in 1942. After many years the same Act was revised in 1985 and rules were framed in 1987 by the Government of Bangladesh.

Organisation of official cooperatives falls under the jurisdiction of the Bangladesh Rural Development Board (BRDB). Any groups registered under the Act are called cooperatives, otherwise they remain as groups even if they are sponsored by BRDB, BADC or any other Government department, or by any NGOs or Grameen Bank. To use the word cooperative as its name a group must be registered under the Act, be subject to statutory audit by the Cooperative Department and follow the Cooperative Rules. All NGOs and Grameen Bank have opted to form non-registered groups.

From the earliest stage membership and control of the cooperative credit societies gravitated towards property ownership and landed security. Being affluent and influential rather than poor became the norm for membership in the cooperative societies. Hence the better off farmers enjoyed the benefit of cheap credit disbursed through coops by the Government.

The cooperative model with most influence over recent decades has been the 'Comilla model'. As it developed this centred on village level cooperatives, particularly farmer's cooperatives - KSS (although BRDB has expanded into target group credit with landless cooperatives - BSS, and women's cooperatives - MBSS) which are essentially credit organisations obtaining credit through a centralised intermediary the Upazila (previously Thana) Central Cooperative Association (UCCA), which checks requests and consolidates these before requesting loans from a commercial bank.

b) FCD/I Experience

The Chandpur Irrigation Project was a rare exception among FCD/I projects in Bangladesh where BRDB staff (along with agricultural extension staff) were seconded to the BWDB project. Irrigation in this system is by a double lift system - water is retained and pumped into a natural river and khal system linked with a borrow-pit around the interior of the embankment. From this system some 1000 lowlift pumps (LLPs) distribute water to the fields. During 1987-1990 these pumps were privatised (sold off). Previously they were owned by BWDB and rented to irrigator groups. The groups were informal but linked to the cooperative system. LLP command areas bear no relationship with KSS membership, so the existing cooperative system could not form the basis for water management. Instead LLP scheme managers were required to be KSS members. The UCCA paid BWDB the rental on the pumps and then collected this back from the managers who kept accounts for the scheme - collecting water fees from beneficiaries to cover the rental charge, fuel, labour and staff, and repair costs (Thompson, 1986). Hence the format of the KSS shows considerable inflexibility in providing institutional support to water management, but ways around this could be found.

There is similar experience in Deep Tubewell (DTW) management - which involved BADC and BRDB throughout the country, and with more intensive support under the small scale Irrigation Management Programme of BRDB. These are organised on a KSS basis, but at the village level and not by command area. Moreover, as is general in the KSSs, those richer farmers with better contacts took the lead in the schemes and as a reward divert the benefits to themselves, effectively resulting in privately managed schemes. The performance of tubewells schemes managed by KSS has been worse than privately managed ones, and many have dropped out of the IMP (Mandal, 1987).

SRP in its planned programme of Embankment Maintenance Groups will have BWDB work with BRDB, the latter organising the EMGs and administering their payment from BWDB funds.

c) Advantages and disadvantages of BRDB system

The main advantage of BRDB is that it has nation wide coverage (unlike most NGOs - see below), and being a government agency has greater permanency. Hence institutional strengthening of it to take an active role in forming user groups in FCD/I projects seems an attractive option (which is being adopted by SRP). Moreover, unlike the NGOs, BRDB works with farmers as well as with landless target groups. Hence there is an opportunity for it to have a role in water management groups (irrigation or drainage for example) - perhaps in group formation, arranging credit and in advice on financial management.

However, the inflexibility of the present system and the need to define a water management group which transcends the traditional alignment of the KSSs are potential constraints on this role. In order to provide the potential benefit of a formal status for water management groups, BRDB would have to change its policy towards farmer groups. It is enabled to do this since it can form non-credit cooperatives.

There are also problems with the existing credit cooperatives. There are many dormant societies and possibly an equal or bigger number are operating at a loss. Many more are bad credit risks. Overdue repayments are piling up constantly and causing shrinkage in credit distribution by the cooperatives. The overdues are in some cases 60-80 per cent of the total outstanding amount. This is the major weakness of the existing cooperatives.

Moreover the membership of KSS does not reflect the social composition of rural areas evenly. They are dominated by rich and middle-class landowners, with smaller numbers of small farmers. The wealthier groups take the fullest advantage of what the cooperatives can offer. They are the "insiders" and control the cooperatives. In fact the village power structure imposes its own pattern upon the cooperatives.

For farmer management of water where groups generate their own resources credit related problems may not arise, but better coverage of all farmers in an irrigation or drainage command area would need to be achieved (in terms of size of holding and levels of land). Furthermore, farmer based groups would not internalise negotiation over disputes between farmers and other affected groups (fishermen and boatmen for example). A broader based cooperative might offer a chance for these interests to be taken into account and some benefits directed to other groups, but would risk large farmers usurping these benefits.

4.11.2 NGO Groups

a) General

There are over 500 NGOs active in various development programmes in Bangladesh, about a fifth supported with foreign aid. However, despite this very substantial activity NGOs may reach only about 15 per cent of the population. NGO sponsored groups are mostly smaller in size than cooperatives, and informal in character. They may or may not have the same kind of rigid system of accounts and audit requirements as cooperatives have. Nevertheless they have advantages in catering for poorer sections of the population, having closer supervision and better recovery of loans. NGOs have concentrated their efforts on target groups (such as the landless and destitute women) and are not active in working with farmers. The NGO sponsored groups sometimes suffer from uncertainties of continuation of credit facilities because of funding of NGOs by donors for a limited period of time.

Most NGO sponsored groups are multipurpose in character and objectives. They aim at integrated development activities by group actions which usually include promoting income generating activities through group formation, savings and credit operations, extension services including marketing facilities, and sometimes informal education.

Various NGOs have been involved in three types of activity which have relevance to FCD/I management: FCD/I earthworks, small scale water management, and other resource management programmes, mostly on public lands.

b) NGO involvement in FCD/I earthwork

The main experience of NGOs working with BWDB has been through the system of Labour Contracting Societies (LCSs) organised for construction of part of the EIP sub-projects (see Section 4.6). As reported, this has the benefit of targeting payment to the landless directly without problems of contractors, and results in better quality work, although additional supervision is involved. EIP has mainly worked with seven NGOs in this field: Bangladesh Rural Advancement Committee (BRAC), PROSHIKA (in the past and proposed for routine maintenance), Association for Social Advancement (Patuakhali), Association for Village Advancement, Jacaroni Chakra (Jessore), Ghono Khalian Kendro (Gaibhanda), and Friends in Village Development, Bangladesh (Sunamganj). In 1990/91 four NGOs were active in facilitating LCSs. Because of the large number of NGOs and often their localised coverage this programme has depended on the availability of NGOs interested in organising LCSs, but appears to have had considerable success and provides an alternative model for regular maintenance programmes - for example for submersible embankments and for drainage khals. However, several problems are still encountered: in new projects LCS may be in conflict with landowners who are not properly compensated; wage rates averaged from contractors' rates are often less than the schedule of rates of BWDB; and bills are paid late when funds do not reach the BWDB field office.

Additionally EIP has a pilot programme for NGOs to work on vegetative protection of embankments linked with FFW resectioning, where the NGO group would be responsible for turfing and managing plants which can yield a return without harming the embankment. NGOs have also been involved in routine maintenance programmes on BWDB projects: DDP has piloted this approach (see Section 4.5) and LRP has similar experience working with Nijera Kori, and the same type of programme is proposed by EIP. Where NGOs are active in an area they have an obvious advantage in organising and assisting these groups, particularly as BWDB has no staff skilled in doing this themselves. However, the evidence is that such programmes are dependent on the interest of the NGO and of external project

assistance. BWDB has not yet taken on this model as something which it should continue indefinitely, and does not appear to reallocate its funds in order to continue routine maintenance (which is not surprising since it replaces free FFW wheat with a demand on the revenue budget allocation, which implies cutting other staff).

c) Irrigation management

During the 1980s a number of NGOs set up irrigation management programmes in which landless groups are responsible for managing Shallow Tubewells (STWs), DTWs, and LLPs and selling the water to farmers. The rationale for this is that the great fragmentation of holdings in Bangladesh increases the transaction costs of organising irrigation efficiently. Hence there was an opportunity for an efficiency gain and at the same time the landless could have access to another critical resource for agriculture - water - which they could sell for a share of the crop. A number of NGOs have developed such programmes including: PROSHIKA (providing credit and technical training and advice and the groups charging a crop share from their customers), BRAC (similar programme, credit for buying or renting equipment provided), CARE under its Landless Owned Tubewell Users Support programme, and Grameen Bank. The latter is now buying up DTWs itself and running these for a profit. Most of these programmes provide advisory services including legal advice and where necessary protection against vested interests (such as powerful customers).

Experience of these programmes has been somewhat mixed. In terms of technical and agricultural performance some landless-managed schemes perform better than private ones and others give lower returns (Mandal, 1991). Profits have tended to decline when tubewells are installed in less favourable sites. However, loan recovery rates have tended to be high compared with agricultural loans. For example, PROSHIKA achieved over 75 per cent repayment and Grameen Bank has achieved high repayments but at the cost of permitting the tubewells to be taken over by a few group members (Mandal, 1991). CARE has now terminated its LOTUS programme as existing landless irrigation groups should now have graduated to self-reliance and the subsidies for DTWs have been reduced making the financial viability of any new groups less likely, despite past success is managing existing DTWs (Haggblade, 1990). Despite considerable drop out of groups, which quite often are bought out by a few members of the group or even by non-members, these programmes have shown some success in directing part of the benefits of agricultural growth to the rural poor.

The potential for this model in FCD/I projects seems limited, since in FCD projects there is no divisible service or good which a group could supply. However, if local management does occur and external resources for maintenance are withdrawn there could be a role for landless groups providing a drainage management service - clearing khals, operating and maintaining sluices in return for a share of the crop. NGO support could help to avoid problems of non-payment of dues by farmers, but ultimately such a scheme would depend on an increase in output.

d) Other resource management

There are some relatively new ventures in landless resource management outside the water sector, such as sericulture, tree plantation and fish culture, where NGOs are showing some good results. For example, BRAC is leasing/using roadsides and some embankments (for example in one of SSSFCDiP's sub-projects) and allocating them to groups of landless women for plantations of mulberry and other trees, as part of its sericulture programme. This may be in lieu of maintenance of the earthwork. Similarly some NGOs lease water bodies for fish culture by landless groups. These are new ventures and it will be some time before they can be properly judged. Nevertheless there is scope for greater use of FCD/I infrastructure

and for it to be targeted at the rural poor (see Section 6.10). This could be facilitated by involving NGOs in FCD/I projects where NGOs with the appropriate skills and experience are working.

4.11.3 Summary

While NGOs appear to have more relevant experience and a better performance in areas suitable for adoption in FCD/I projects, there is still a potential for BRDB involvement, particularly as its potential coverage is more complete (spatially). This would require a change in BRDB's emphasis and greater flexibility, and an improvement in its support services for groups. There is considerable potential for NGOs to be involved in O&M of FCD/I projects, particularly if there are some resources available at the initial stage for their programmes, although the aim should be to establish self sustaining management groups. It is likely that this will be easier where the groups have direct control over some productive assets (such as embankments, borrow-pits, and khas land).

5 INTERNATIONAL O&M REVIEW

5.1 INTRODUCTION

A brief review of relevant international O&M practices in FCD and irrigation systems, particularly of management systems (including farmer participation), administrative frameworks, and resource mobilisation, has been undertaken to place in context the current Bangladesh O&M systems in water management.

The review has also tried to identify the key methodologies or models of management in O&M used in other countries and to assess their applicability to Bangladesh. These are compared with practices and organisation of water management in Bangladesh, and indicate some of the alternative arrangements which could be tried in Bangladesh. Within the limited time available this study has been largely limited to a literature review.

The reviews were intended to cover the following information:

- Country description: natural conditions, socio-economic conditions, development policy, agricultural pattern;
- Institutional arrangement for FCD management: vertical and horizontal divisions, legislation, regulations, procedures and practices;
- Organisational setup: organisational charts of relevant agencies, water users/management associations, farmers groups;
- O&M cost implications: government subsidy system, project cost amortisation, water levies, O&M cost levels, cost recovery in general;
- public/beneficiary participation mechanisms, their success and problems; and
- the extent of representation and accountability in the water management and O&M system.

A summary of background information relating to water management and O&M in the countries reviewed is given in Table 5.1. However, it has not always been possible, or necessarily desirable, to collect all of this information for each country considered. Annexes C to K give the detailed country reviews. Where possible these concentrate on differences in water management between countries, the different institutional arrangements, the extent and approaches to beneficiary participation in O&M, and innovations which might be of relevance to Bangladesh.

The annexes follow a standard format:

- country description, concentrating on water resources;
- administrative/institutional set up, with particular reference to water management;
- O&M, concentrating on the organisation and separation of responsibilities, on the extent of beneficiary involvement, and on the sources of resources; and

Table 5.1 Comparison Table for Countries in O&M Review

Headings of Information	Japan	Thailand	India	Vietnam	Myanmar	Netherlands	Srilanka	Phillippines	Malaysia
1. Country description: - natural conditions - socio-economic conditions - development policy - agricultural pattern	- islands - advanced - environment - paddy	- peninsula with delta - middle - diversify crops - paddy	- semi continent - developing - production - very diverse	- delta - developing - production increase - paddy	- peninsula with delta - developing - production increase - paddy	- delta - advanced - environment - diversified	- islands - developing - cash crop - paddy/coconut	- islands - developing - production increase - paddy	- peninsula - middle - flexible cropping - tree crops/ paddy
2. Institutional arrangement for FCD management:	- MOC's initiatives (FC project) - farmers' initiatives (DI project)	- RID under MOAC - request of influential persons	- ID - farmers local initiative (tanks)	- government - cooperatives	- large scale I/D project - small scale farmers project	- farmers - many water authorities	- ID	- farmers (irrigation system)	- DID's initiatives
3. Organisational setup: - relevant agencies - water users/management associations - farmers group	- MOC/MAFF - regional/local bodies - LIA	- RID deputy DG - O&M P.M. - WUG/PIS	- state ID	- local/regional administration - coooeratives	- ID under MOA	- water authorities	- Mahaberi Authority - ID - LDB	- NIA - IA	- DID in MOA - Regional Agricultural Development Authorities
4. O&M cost implications: - government subsidy system - project cost amortisation - water levies, O&M cost level - cost recovery in general	- despite 80% subsidy for large scale project - C.R. is critical	- fully borne by government - but tends to collect water levies	- government subsidy - very poor cost recovery	- government subsidy - labour and food contributions	- ID's initiatives	? local and central taxes	- directly managed by ID	- sustainable O&M directly from farmers	- government subsidy
5. Public/beneficiary participation: - mechanisms, - success, - problems, - prospect	- historically established - but negative aspects emerged	- success in PIS - but some problem in WUG	- authoritarian in past - lack of local management	- CIT's initiatives	- farmers group apply rural project	- public representation - consultation - strong farmers lobby	- ID's initiatives	- IAs formed with beneficiaries - organisers needed to form groups	- mostly DID's initiatives
6. The extent of representation and accountability in the water management and O&M system: - general background	- LIA managed - but shifting to basinwise public management	- RID's initiative	- answerable to state government	- cooperative	- ID's initiatives	elected members of WA board	- ID's initiatives	- IA elected boards	- DIS's initiatives - advanced

ABBREVIATIONS: MOC - Ministry of Construction; MAFF - Ministry of Agriculture, Forestry and Fisheries; LIA - Land Improvement Association; C.R. - Cost Recovery; RID - Royal Irrigation Department; MOAC - Ministry of Agriculture and Cooperatives; DG - Director General; P.M. - Project Manager; WUG - Water Users Group; PIS - Peoples' Irrigation System; ID - Irrigation Department; CIT - Cooperative Irrigator Teams; I/D - Irrigation and/or Drainage; WA - WaterAuthority; MOA - Ministry of Agriculture; LDB - Land Development Bureau; NIA - National Irrigation Administration; IA - Irrigators Association; DID - The Department of Irrigation and Drainage

lessons based on the information available which may be relevant to Bangladesh.

Findings based on these reviews are summarised in Table 5.2 and in the following section. Bangladesh is not alone in experiencing O&M problems and constraints in water management and resources are a problem to a greater or lesser extent in virtually all the countries in the region. However, there are a number of positive aspects of experience elsewhere which might be adapted to Bangladesh conditions.

Table 5.2 Key Aspects of International O&M Review Relevant to Bangladesh

Country	Annex	Relevant Lessons
Japan	C	Different scales of project are managed by different institutions which are separate from implementation.
Thailand	D	Experience of participation in large water management projects is mixed, better resource mobilisation when traditional water management is improved. Some experience of controlled flooding (flood retention).
India	E	Very poor cost recovery in large irrigation systems, attempts to improve management by increasing responsibility of farmers at an early stage.
Vietnam	F	Rare examples of participation (in flood fighting) and resource mobilisation in flood control projects, apparently achieved through cooperative-commune system. More critical recent review would be useful.
Myanmar	G	Compulsory purchase of part of crop and water tax's for cost recovery.
Netherlands	H	Separate regional/local water management agencies which are locally accountable and linked to the administrative system by hierarchy of plans, checks and balances. Public consultation institutionalised.
Sri Lanka	I	Increased emphasis on O&M resulting in measures to increase efficiency of resource use (better prioritisation of work) and to mobilise resources. Farmer management of tertiary level in irrigation systems shows some success but cost recovery by service fees still poor.
Philippines	J	Farmer managed small-medium irrigation systems successful in recovering costs of construction, O&M managed by groups. Considerable experience is using social organisers to achieve farmer participation from outset.

Sources : Annexes C-J.

5.2 LESSONS FOR FCD O&M FROM OTHER COUNTRIES

5.2.1 Institutional

At the top institutional level it is clear that improved O&M is only part of water management. In many countries there are regional bodies, either multi-purpose regional/local government or purpose specific water authorities, which can coordinate and plan flood plain development and water management development. These bodies try to ensure that private developments and projects of other agencies take into account both flood risks and the operating needs of water control projects. This may be through inter-departmental agencies (Philippines) or systems of formal liaison and planning consultation (UK, Netherlands). The lack of and need for similar integration in Bangladesh has been noted (Section 2.3). Without clear legal constraints and national arbitration, local management of water may result in the operation of one area's projects to the detriment of another area (the Netherlands has such institutional controls since there are many local water authorities).

At the system level different institutional arrangements are appropriate to different scales of projects. For example, very large projects require more sophisticated management and because of their scale usually have greater requirements for technical expertise. Smaller projects can be handed over completely to farmers who own and manage the system - and there is considerable experience of handing over small irrigation systems to farmers. This difference in potential for farmer management means that there is a danger that in more complex systems farmer groups will be alienated by having less control over their own water management, and hence not be encouraged to pay for O&M. Finding a balance between the technical needs of complex operation and local needs is a problem (Japan, Thailand). This might also arise in Bangladesh as FCD project management may be more complex under the FAP if linked compartments are implemented.

Separation of construction by an implementation agency (usually by or overseen by a central or state government agency) from the client responsible for O&M - whether a user group or a regional government or water authority - can help to clarify responsibility and liability to provide an operable and worthwhile project (for example in Pakistan and Japan). This may involve handing projects over to farmers or at least to a separate management division of the government agency. Associated with this is the task of correcting implementation problems so that a viable system is handed over.

In general it appears that local organisations to manage FCD/I systems, involving clear legal responsibilities, local participation and accountability, and integrated local, regional and national planning are in most cases a precursor for better water management and local funding (for example, Netherlands, Philippines). In many cases recent improvements in local participation in management have been based on some experience of traditional systems and well established institutions such as local communities. Similar traditions existed in Bangladesh but have been supplanted by state provision of infrastructure and services in many cases.

5.2.2 Engineering

O&M problems are being given increased attention in many countries. This may be because the scope for new projects may be limited as potential projects have already been implemented, or because implementation of new projects has recently been suppressed due to difficulty in land acquisition, poor cost recovery, and consideration of adverse environmental

impacts of new projects. Effective use of existing facilities is a major concern for several countries studied (for example, Japan, Thailand, the Netherlands, Sri Lanka, Philippines, and Malaysia).

Several problems arise during the transitional hand-over from construction to management. The management side sometimes refuses to receive the completed facilities by claiming that there are defects. An exact inventory of system facilities is indispensable to identify the entire project to be handed over and to avoid such problems. The inventory is also useful for preparation of the O&M manual for training of O&M staff. However, in almost all countries, the inventory is not prepared, causing a serious bottleneck for proper O&M.

The controlled flooding proposed under FAP requires high levels of management. A similar practice to controlled flooding has been operated for a long time at the Chao Phraya Diversion Dam in Thailand. When the flood water level exceeds danger level in this system, a part of the river flow is diverted to branch canals to alleviate the flow in the main river course. The diverted flows are released on to designated less productive lands to minimise overall damage. Compensation for the damage due to such artificial flooding is achieved by an allocation of irrigation water or equivalent goods during the next dry season.

One type of intended flooding is practised by deliberately providing vulnerable (low) sections in embankments. These sections are intended to be overtopped, releasing water into sacrifice areas, when outside water levels reach the danger level for the system. For this approach to work well, flood conditions have to be anticipated according to the magnitude and impacts of floods, and local consultation is imperative during the planning stage. In most cases, newly developed areas are designated with vulnerable sections during the approval of the new project (for example, Japan, Myanmar).

5.2.3 Beneficiary participation

There are numerous examples of, and lessons from, successful beneficiary participation in FCD/I projects in the Region:

- activities of the Land Improvement Association and the Flood Fighting Association in Japan have a successful history and may give useful ideas for means of increasing local participation in FCD/I projects in Bangladesh;
- traditional local initiatives and water management systems have provided a model for public fund supported projects, both in the institutional framework and in achieving beneficiary participation (for example, Thailand, Philippines);
- group formation requires major continual inputs in the initial stages from social organisers/extension workers to help overcome rural power structures and the biases of engineering agencies, but can build strong and sustainable local management groups (for example, the Philippines);
- the initiative for group formation and consciousness raising in new projects and rehabilitated systems has come from professional organisers, extension workers, or action researchers. It requires different skills from those of water engineers (India, Philippines);

- although group formation can be stressed, a dialogue with engineers and water planners is also vital so that technically viable systems are developed;

- there are hardly any cases of beneficiary participation in flood control projects. The exception is Vietnam where there is voluntary labour for repairs and monitoring embankments during the flood season. This might be transferable since communities living just behind an embankment have an obvious interest in ensuring it does not breach;

- where beneficiaries are to have a major role in projects this should start from project planning, and beneficiaries should be encouraged to oversee construction, to ensure that the project handed over to them is what they want and that they get value for money;

- where local involvement is given a high priority, project planning and preparation involves group formation (Philippines) and public consultation (Netherlands), both of which seek to compromise between different interests, and take time and this slower process of feedback needs to be built into project planning. It then goes a long way to reducing problems over operation.

Manor et.al. (1990) have summarised experience using social organisers in farmer managed irrigation systems in the region. This reveals two different models adopted: recruitment within a single agency; collaboration between government agencies, farmers, and research institutions; and assistance from NGOs and research institutions to strengthen the government agencies and farmer groups (which eventually take over implementation). The types of organisers used are discussed along with ways of providing incentives and motivating them in their works (principally through training, proper remuneration, study tours, and increased and clearly defined authority).

5.2.4 Resource mobilisation and cost recovery

There has been much more study of resource mobilisation in the region for irrigation than for flood control and drainage projects. This section first summarises irrigation related evidence and then considers the additional problems and experiences posed by drainage and flood control. Kyi (1990) has synthesised resource mobilisation experience for O&M in irrigation systems in Asia. Following his review four different systems for resource mobilisation are identified:

- charging irrigation fees depending on the area irrigated. These are collected by the irrigation agency, rarely cover full O&M costs (in Bihar not even covering collection costs) and go to central government and not back into system maintenance. This system is found in a number of countries including Bangladesh although irrigation fees are very imperfectly enforced;

- service fees linked to defined levels of service (usually improved service over past performance). This becomes a kind of contract between the agency and user and is being tested in Indonesia and Sri Lanka. There is a similar growing emphasis on levels of service in the UK water industry although it is not clear that there is any legal duty to provide the levels of service, which tend to be determined by the agency involved without consulting customers;

- the 'tail end' of systems is turned over to farmers - that is smaller components of the system such as distributaries. This should promote shared responsibilities for management; and

- transfer of small systems entirely to farmer management. This is practised in the Philippines, Nepal and Indonesia. This is not an alternative to the other systems as it is the small scheme version of the third system above.

There are some other possibilities or variants on these systems which the FAP 13 review can add:

- management by the local administration which is empowered to collect fees (this is found in the state Irrigation Departments in Pakistan and India which have experience identical to the first system above) but it might be managed at a more local level as in the Netherlands Water Authorities and Internal Drainage Boards in England and Wales, with consequent greater accountability and a direct link between revenue raising and spending on the system or in the locality;

- the charging of land development taxes as in Japan at a higher rate where additional services are provided to farmers. This is similar to the second system above but would form part of the revenue department's activities without a separate fee structure for water management. Thus land taxes would depend on the normal or average annual financial returns from land;

- deriving income from provision of irrigation services indirectly, through taxation, pricing or procurement systems. This used to be common in Asia, through export taxes on irrigated crops (Pakistan, Thailand) or through compulsory purchase of a proportion of the irrigated crop at a low price (Vietnam, Myanmar). In recent years these methods have become less common as they gave poor pricing signals to producers, and falling world crop prices reduced the taxable margin available (especially in the case of Thai rice).

None of these systems usually envisage recovering all or part of construction costs although those which involve fee payment could be adjusted to this aim while farmer participation can achieve this if farmers are involved from the planning stage and hence contribute to construction. In some cases O&M funding and cost recovery have been better funded where the resources come from the country itself - there has been some success in encouraging farmers to pay full or partial development costs in Philippines, Japan, and UK for example.

As a general rule local resource mobilisation for O&M is easiest in irrigation projects where customers' water supply can be controlled. Thus in Bangladesh water users pay the full cost of the service when it is provided privately (such as by STW), and in CIP when LLPs were rented from the Project there was a control over access to water, although this was subject to abuse and did not cover full O&M costs.

For FCD Projects there are several problems. The most serious of these is the free rider problem, which affects revenue generation from drainage projects almost world wide. If an area is being drained, then an individual farmer's land in that area is drained, whether he pays his drainage cess or not. Each individual has an incentive to take a free ride on the back

of his neighbours who pay. Drainage projects often mainly benefit low-lying farmers - are they to pay for drainage of higher level land? The benefits of drainage are also less tangible to the individual farmer - particularly when drainage of farmed land allows rehabilitation of saline or flooded land belonging to another individual. The capital and even the O&M costs of drainage are rarely recovered except in sophisticated economies (UK, Netherlands) where farms are large, the benefits are understood and the tax system efiiciently managed.

Flood control should fall between irrigation and drainage in terms of ease of cost recovery. FAP 12 and 13 studies have confirmed that the benefits of FCD to crop production, and hence farm incomes, are usually significant, and appreciated by the beneficiaries. They are clearly reflected in the increases in land prices on protected land. Some of the data collected even suggests that the perceived value of flood protection is exaggerated (the tendency for homes and enterprises to be built in areas protected from normal floods but still vulnerable to more extreme events such as the 1988 floods).

In practice, however, flood control also has free rider characteristics, and the difficulties of revenue generation are similar to those related to drainage. In South and South East Asia only one case has been found of successful cost recovery from flood control, in Vietnam, where a proportion of the harvest is procured by the State in flood protected areas. This approach is clearly only feasible in a command economy.

A further problem is likely to arise if a linkage between fees and system performance is attempted: levels of service are difficult to define in flood control and drainage in a form which customers can understand. For example, it is necessary to prove that the storm causing damage to farmers crops was a 1-in-15 year 10 day rainfall pattern whereas the level of service was a 1-in-10 year 10 day rainfall pattern and that had the latter occurred the system would have performed adequately.

More fundamentally it appears that fees for flood control and drainage are unenforceable in the region (see Sri Lanka and Bangladesh experience). At best fees can be charged for irrigation. Charging fees and farmer participation can be in conflict. The participatory management model is at odds with the role of farmers as service receivers and fee payers. Fee payment does not promote a sense of ownership and frequently brings farmers into conflict with the relevant government department, particularly if fees are legally enforced.

System sustainability in terms of duration and resourcing appears to be greater where the project demand comes from farmers, where they have an expectation of co-funding, and where the local organisation builds on existing social institutions (several countries, including Philippines, Japan and Thailand). Hence a participatory management model appears more attractive and while farmer groups might raise funds or contributions in kind they would not be subject to fees and taxes from outside since they would not be receiving a service from outside. This raises a problem, which has not yet been adequately solved, where there is a public main system and farmer managed components (tail ends). There is, however, some evidence that farmers in this situation may be encouraged to contribute in kind to main system maintenance (Sri Lanka), but continued subsidy from outside the locality appears inevitable.

5.3 RELEVANCE TO BANGLADESH

Within the region most relevant experience, particularly in local participation, is concentrated in irrigation systems. There is no country where flood control projects have a high percentage of costs recovered from beneficiaries - even in developed economies this is usually cross-subsidised. However, a distinction must be drawn between flood protection, which often relates to protecting urban or semi-urban areas, and land drainage which (as with irrigation) aims at achieving private agricultural gains. In the latter cases an expectation that farmers will pay towards and manage part of the system is widespread, although the expectation is rarely fulfilled in developing countries.

While the reviews indicate some approaches which might be useful, care is needed in concluding that the same approaches would work in Bangladesh. Many of the water management systems adopted elsewhere would require major administrative changes and changes in the expectations of flood plain residents in Bangladesh before they would be feasible, and this may not be practical within the existing social and political context.

6. RECOMMENDATIONS AND GUIDELINES FOR IMPROVED O&M

6.1 REASONS FOR IMPROVING O&M

FCD/I projects in Bangladesh have had very simple ultimate aims: to manage water levels in such a way as to increase crop production and provide security from flooding. Ultimately this is intended to improve the economic well being of the people and to alleviate poverty. In the process very few FCD/I projects have addressed negative impacts such as loss of fisheries (an exception is Chandpur Irrigation Project), while FAP 12 (Final Report Annex M) has shown that in a number of cases FCD/I projects have failed to increase security of non-farm activities from damage in extreme floods.

The performance of FCD/I projects already existing in Bangladesh has often been below expectations. FAP 12 has evaluated the impacts of FCD/I projects to identify the negative and positive impacts and their magnitudes. These impacts have a direct bearing on the O&M problems identified by FAP 13 (see Volume 2).

To summarise, there have been significant agricultural benefits in many FCD/I projects, although these often merely keep up with population growth. Drainage problems and embankment breaches may mean continued insecurity both for crops and livelihoods. Capture fisheries are usually severely damaged by FCD/I projects, with the exception of submersible embankments. Even where projects offered worthwhile benefits, performance appears to have declined over time as project infrastructure falls into disrepair, or breaches, erosion and cuts negate the intended benefits. The substantial resources used to maintain the systems are not generated locally, there is a lack of incentive to manage them efficiently to attain and to improve on targets, and there is a lack of local accountability to the customers.

The target of improved FCD/I system management, operation and maintenance, is the achievement of FCD/I objectives at the least cost and in a sustainable way. The system should achieve the benefits intended (or the best welfare gain possible in changing environmental and economic circumstances) for the lowest possible annual costs for the intended project lifetime, and hence give Bangladesh value for money. Ideally a sustainable system would generate sufficient resources both to cover annual O&M costs and eventually to replace the infrastructure when it became too run down to repair. Otherwise an external investment would again be required.

This study was intended to provide guidelines and recommendations for improving O&M in FAP projects which could be implemented by FAP components. While the problems are well known, the possible solutions are relatively new in Bangladesh and have only started to be tested over the last few years. This recent and evolving experience and the diversity of FCD/I projects (by flood type, scale, and impacts) mean that a single recommendation under each topic investigated cannot be given. This Chapter discusses a range of options identified for different aspects of improving O&M, and suggests options and principles which may be considered in greater detail by FAP components when planning interventions. Some options would eventually require national level changes, but these must depend on the experience of trials and on the experience of non-FAP projects, particularly SRP.

Options in the following areas are discussed: institutional changes; public participation; modified FCD/I plans and designs; operation; maintenance; resource use and mobilisation; O&M costs; and training. The need for a transition phase from construction to management is also discussed. The focus is on FCD projects since SRP is already working on

recommendations for major FCDI projects and FAP is perhaps less likely to recommend new major FCDI projects. Many aspects of O&M have some overlap with other FAP components, because system management (O&M) is central to achieving the intended benefits of FCD/I projects.

6.2 INSTITUTIONAL FRAMEWORK

6.2.1 Existing situation

Chapter 2 has described the organisations involved in FCD/I and related fields such as fisheries and agriculture, and NGOs and their experience in the water sector. Relevant aspects of resource management were discussed in Section 4.11. The key features are the range of organisations with separate functional interests, the lack of BWDB involvement in the local administration system where many other line departments are represented, and inadequate inter-agency cooperation in project planning.

6.2.2 Reasons for improvement

Part of the explanation for the poor historical performance in the O&M of FCD/I projects in Bangladesh relates back to the existing institutional system, which does not encourage efficient publicly accountable management after completion of these major public investments. Section 2.3 noted the lack of an effective floodplain planning system and the absence of effective two-way liaison and planning between BWDB and the Upazilas. Hence at the national level there are reasons for improvements which could help to involve different government agencies and their skills in FCD/I planning. Moreover at a national level the different programmes of donors with the same agency sometimes create a confused picture. This may result in lost opportunities to avoid mutual detrimental impacts (such as flood plain confinement and increased risk of failure in adjacent projects) and to promote mutual benefits (such as fisheries development in polders). At the system level there is also reason for institutional change in order to achieve greater and more effective public participation in system management, and to coordinate the efforts of different agencies towards a common goal of achieving economic development in the floodplains.

6.2.3 Policy Options

A separate FAP component (FAP 26) is expected to recommend institutional reforms to complement the activities proposed under the FAP. The first phase study under FAP 26 will begin early in 1992, and undoubtedly will develop and expand on the recommendations presented here.

a) Macro-level options

It is more appropriately the role of FAP 26 to identify options in this field. However, obvious options include:

- strengthening the existing District level coordination system by having a water management committee led by BWDB and LGEB and involving all the other relevant interests and departments. However this would not be able to address wider problems of coordination;

- setting up a regional level of planning with a primary objective of coordinating flood plain development and vetting infrastructure proposals so that they are

consistent and not damaging from a hydrological viewpoint. This would be able to take account of regional/basin level water management, but could not be involved in detailed decisions, and would need a supra-ministerial level of coordination; and

- reorganising the administrative system to follow water management boundaries, and separating implementation from the new local administration, with the latter identifying and articulating needs and upon completion taking over management. This would involve major institutional changes and take a long time. A change in resource allocation would be implied, as would the need for secondment of water management/engineering staff to the administrative levels (as in other departments). It could place FCD/I under the control of locally accountable government which might more easily implement revenue raising measures.

b) System and mid-level options

Various options have been considered for changes in the management of BWDB systems and projects. These are described and explored briefly.

- FCD/I projects could remain under the control of BWDB in its present form but with potential for other departments to be involved. Coordination might be strengthened through establishment of a District/Upazila level management advisory board. BWDB is particularly suited to manage large (cutting across administrative boundaries) and technically complex projects, but this does not ensure local consultation in planning and O&M;

- control of FCD/I projects could remain within BWDB but with more integrated management encouraged by linking departmental development programmes within a project to each other under a common linkage of floods and water management. This might involve funding conditional on a coordinated plan, but would need to guard against inter-departmental rivalries;

- BWDB could be divided more clearly into implementation and O&M wings with separate but linked staffing structures to reflect different skills involved in the O&M cadre or sub-cadre, in order to develop appropriate skills and motivation for O&M in BWDB managed systems;

- to make BWDB managed systems more efficient, clearer and greater local responsibilities could be given, for example over budgets and financial decisions to facilitate emergency responses and to give incentives to better management. These new powers would need to be carefully controlled to avoid potential abuses of power. One approach to this would be to have a board or boards which would represent the various resource management groups (water, embankments, khals) to which system officials would be accountable, and to have a public accounting system with audited system accounts which would make it clear whether a system was being managed efficiently. The auditing would amount to policing by a higher authority responsible for national or regional water management. However, this would add an additional institutional tier to the government sector;

- separate semi-autonomous system management boards could be established recruiting contract staff on the open market. Some state subsidy (from central or local government) might be provided but the Boards would be authorised to collect revenue from beneficiaries. These Boards would need to be organised at the planning stage so that public support for the project could be established. If they ran at a loss they could be terminated, saving wasted expenditure. However, this would be a very major change from the current system of management and might well add to administrative complexity;

- smaller projects could be handed over to Upazilas, or even Union Parishads, where they do not cut across Upazila or UP boundaries. The projects would need to be in a good state of maintenance before handover and the technical staff in Upazilas/UPs would need strengthening (transfer from BWDB to LGEB for example). It would also probably be necessary to transfer part of the revenue budget and FFW allocations, as past attempts have not worked because handing over has been seen by the local authorities solely as a transfer of liability. This might place management under a locally accountable body. However the future role of Upazilas and the future form of local government are unclear at present. UPs lack technical staff but could provide a lobby in higher levels of the administration to represent small farmer managed systems; and

- within projects NGOs, or other departments/agencies could be motivated to take over part of management - for example programmes for using and maintaining borrow-pits, beels or embankments (Section 6.10), thus using the experience and skills of NGOs in working to benefit the poor. However, the resource implications would need to be clear, and the combination of O&M duties and income generating activities of NGO assisted groups would have to be technically acceptable and viable.

This is an illustrative list of options, it is not exhaustive and the details of the options remain to be established. Whichever improvements are tested it is important that responsibilities between different agencies and interests (especially local interest groups) are clearly defined.

c) Potential areas for inter-agency cooperation

BWDB might avoid some past problems in project planning and reduce conflicts and unplanned uses which ultimately affect O&M by cooperating with, for example:

- the Department of Fisheries and its projects (such as the Third Fisheries Project) or with NGOs engaged in fisheries development. Such cooperation might involve mitigating adverse fisheries impacts through stocking or fish cultivation programmes, or might involve the details of modifications to project design and determination of operating rules (see Section 6.4.5);

- the Roads and Highways Department might negotiate with BWDB to take up an embankment as a road and hence share design and cost responsibilities where the embankment and structures are modified to higher standards. It might equally be the case that embankment alignment is modified, with an existing road being used as an embankment and the FCD project paying to convert bridges into water control structures; and

- in other cases a deal to abandon a village road might be struck with the Union Parishad and Upazila. If for water management purposes it would be an impediment in a project, then the embankment could act as the village road (with a maintenance agreement with the Upazila, since it would be replacing its existing road). The old road could be dismantled under FFW, the earth being used to build the new embankment or raise homesteads, freeing land for cultivation.

The aims would be to utilise the expertise of the different agencies and to make the most efficient use of the floodplain/project area, at the same time sharing or saving costs, and resulting in a project which would be easier to maintain - either for physical or institutional reasons. The main problem is that different sectoral policies are not coordinated and have different priorities. Some form of coordination (see (a) above) might be required to facilitate such collaboration.

6.2.4 Recommendations

It would be possible to make some changes in the institutional arrangements related to projects implemented under FAP alone, but this would merely result in a proliferation of variations on the basic institutional theme without changing the whole system within which FAP will have to work.

At the regional and national levels it is recommended that FPCO and FAP 26 assess the long term need for integrated flood plain planning, the potential role of regional planning bodies to follow on from the regional plans of FAP, and the potential for mutual gain from inter-departmental cooperation in flood plain area development.

Since SRP is involved in strengthening and making more distinct the O&M wing of BWDB, FAP institutional strengthening, so far as O&M and project management are concerned, should liaise closely with BWDB and SRP, and adopt a common policy.

At the system level it seems appropriate for FAP pilot/priority projects to test alternative or complementary institutional arrangements involving: multi-agency decision making (possibly at District or Upazila level depending on project scale) or setting up a project level body with relevant departments etc coopted; and/or devolving aspects of management to NGOs or other government departments. Handing over of larger projects to local administration does not appear likely to succeed, (for example if compartment systems under FAP require linked management), but steps could be taken to increase local participation and local administrative involvement in these larger projects.

6.3 PUBLIC PARTICIPATION

6.3.1 Existing involvement

As Chapter 3 has shown there has been minimal involvement of local people in planning FCD/I projects in the past. The extent of participation in most projects is a few people involved in local sluice committees. However in several of the innovative projects discussed in Chapter 4 there are initiatives which give local people some greater involvement - either in committees, or in using resources, generating incomes for people who would not benefit otherwise. There is a lack of involvement by public representatives, and even by other government departments (see Section 6.2). In general the approach is "top-down", without

a clear process of planning driven by local demands, which may then be modified according to technical, economic and wider regional factors.

6.3.2 Reasons for improvement

The reviews of water management in some other countries (Chapter 5 and Annexes C to K) show that where farmers manage small irrigation systems or parts of larger systems operation can become more efficient and some local resources can be mobilised for O&M (even for construction in the Philippines). Based on the case studies in Volume 2, Chapter 3 argues that much local knowledge of drainage patterns and flooding, for example, could be obtained from local people to facilitate improved design. Consultation and participation also offer a means of reaching compromise over the conflicts of interest which as Chapter 3 showed, can threaten project success. Ultimately participation from the outset should help to generate a sense of ownership and involvement in a project which could ensure its sustainability. Where existing FCD/I projects reflected a local demand and there had been somewhat better consultation, the projects have generally been more successful.

6.3.3 Options

Public participation is the means to promote interventions which people want, which bring benefits, and which are sustainable, and to facilitate arbitration where there are conflicts. Participation should take place at the planning and design, implementation, and O&M stages. The first of these is considered in some detail here as it is regarded as necessary for the third stage and hence for improving O&M.

a) Planning and design - public consultation

Public participation at this stage does not replace the roles of various specialists - in agriculture, fisheries, and engineering for example, but determines the needs and problems to be addressed. A variety of methods are available:

- Rapid Rural Appraisals to understand the existing situation, impacts of past interventions, and needs of people, using informal group interview methods. This is a quick method, but it tends to result in mixed groups rather than separating interests, and it is difficult in a short time to investigate women's perspectives. It is an effective means of introducing senior staff from multiple disciplines to the problems of the area, and could be used to determine the details of subsequent consultation steps;

- formal interview surveys of all interest groups, covering peoples' problems, opinions, suggested interventions and willingness to contribute to these. These would take longer to administer and analyse, and normally lose vital spatial information relevant to planning options;

- participatory diagnosis of problems and potential measures - for example group mapping of drainage patterns (tested in Bihar). This takes more time and may be better suited to smaller development areas. It assumes that the planning team has no preconceived ideas and needs to guard against the influence of powerful individuals - perhaps by having separate needs assessments for different interest groups (separate meetings with farmers, fishermen, landless, women of these categories, and local representatives, for example);

- public meetings can be easily dominated by local elites, but are a good means of publicising issues and options. They are probably best suited to discussing the responses of the planning team to identified needs, and to discussion of generalised options along with their advantages and disadvantages. Public meetings could be at village or Union level. Where a general meeting might highlight potential conflicts, but not solve these, further separate interest group meetings might also be needed;

- formal committees for planning involving a hierarchy from village level to Upazila have been suggested. However, this would add a separate structure to the existing representation system, and the means of making committees representative is unclear. This might be appropriate if village level and Union level cooperatives were to be the focus of management;

- consultations with elected representatives to understand their prioritisation of problems and possible solutions/interventions; and

- consultation with NGOs and governmental development agencies concerning their priorities in the area.

In all these approaches specialists from the different planning disciplines need to be involved (agriculture, environment, fisheries, livestock, economics, women-in-development, social science, health, engineers, etc.). There is a need for local officers in these disciplines to be consulted and informed of the process, and then to act as counterparts for the planning team in the meetings. It is inevitable that the process will take longer as it will need to iterate between the public, agencies, and planning team as needs are identified and prioritised, and as options for interventions are identified and then rejected or refined.

In order to resolve conflicts, and encourage active participation in the completed project, there is a strong argument for formation of the groups who will be involved in managing the project by the detailed design stage (when the type of intervention has been selected and the options are at the detailed level). During detailed design further consultation will be needed to take advantage of detailed local knowledge.

b) Public participation in the management phase

To achieve public participation in managing completed projects, some level of institutional support in the long term will be necessary, but the main input is expected to be in the initial phase of group formation. It is assumed here that public participation will involve some form of user groups. Such groups should be established as soon as possible - at least by the detailed design (see above) or construction stages. If farmers are to contribute towards construction costs (in cash or in kind) then their groups should be formed sufficiently early so that they can take an active part in ensuring that construction is efficiently carried out to the standards which they have agreed to.

Options for this phase are:

i. multi-interest local project or sub-catchment committees, following the approach of SSSFCDIP and LGEB. These attempt to include all interests and could be strengthened into management groups rather than coordination committees. However there is no evidence yet for their viability in larger FCD projects, while there are dangers that they would be dominated by richer interests or officials/representatives, and that poorer groups will not be

empowered. Committees, as currently formulated, are not a means to manage components of FCD/I systems since they tend to be imposed and to lack a group identity. However, they could be appropriate for conflict resolution between different interest (management) groups, and are a necessary means of liaising between different agencies and between these and the project inhabitants, and for these purposes should be strengthened and rationalised.

ii) Single interest groups - representing for example farmers, fishermen, landless, and destitute women. While conflicts within a group would still be possible (between low and high land farmers for example), groups which followed on from the interests and conflicting impacts identified in planning, and which the project would be designed to minimise, would probably be stronger and are closer to the existing resource management and cooperative models in Bangladesh (Section 4.11).

iii) Multi-purpose groups (either multi or single interest) could be involved in managing several types of resource - for example operating a sluice and maintaining the khal and cultivating fish. This would create opportunities for infrastructure to be used for secondary productive purposes, which could help to make the O&M tasks of such groups self-sustainable.

iv) Single purpose groups. These could be multi-interest - for example committees designed for water management with different interest groups involved to prevent some adverse impacts. Compromise might be achieved but there would be little scope for creating new benefits. Some interests (such as fishermen) would only have negative power. They would, for example, prevent or modify water management, but could not take up new fishery development activities within the group. Single interest groups would include, for example, embankment maintenance groups of poor women; such groups may pose fewer organisational problems than multi-interest groups.

There is no reason why more than one type of group might not be active within a project. However, for water management in particular some form of hierarchy linking farmer groups to system management would be required. Further issues related to farmer participation in water management are discussed in Section 6.7.2.

c) Methods of organisation

The experience of farmer managed irrigation in other countries (Chapter 5) shows that social or community organisers are widely used, although in NGO organised resource use groups in Bangladesh there is less likely to be one organiser per group (since the groups are typically much smaller). In general the input of organisers with farmer groups is for a limited, but not inconsiderable, time (12-18 months for example), after which the group and its system should be sustainable. Given the long implementation periods in larger FCD/I projects a longer or intermittent input in group organisation may be necessary. Options for group organisation include:

- recruiting organisers and extension workers to BWDB. This would add these skills to the staff available for long term management of FCD/I projects;

- contracting social scientists/social workers to BWDB to carry out organisation and act as extension workers. This may help to ensure engineering staff take

note of organisers' work, but the body of experienced organisers may be easily lost if the cost is seen as too high;

- working with DAE and BRDB which would provide organisers, organising skills, additional resources and inter-departmental cooperation. This would contribute to institution building, but some aspects of organisation in FCD/I projects would not easily fit into existing programmes (for example water management groups - see Section 4.11);

- working with or sub-contracting NGOs to lease FCD/I resources and/or organise groups. This would depend on the availability of suitable NGOs in a project area, and is unlikely to be possible for farmer groups, and

- assisting beneficiaries to work as organisers. This has been tried in the Philippines with farmer organisers for irrigation systems, but assumes a high level of motivation, integrity, and technical competence.

The first of these options is contrary to current government policies. The fourth has been adopted in several projects (SSSFCDIP, EIP, DDP) and experience is building up. However, there is a risk of such programmes collapsing once external resources are removed, or of the emphasis and interest of the NGO changing, since their presence in an area is not institutionally fixed. SRP is developing improved O&M using the third approach, and will be testing this over the next 6 years.

6.3.4 Recommendations

It is likely that a combination of the options discussed will be necessary, since there is very little experience of public participation of this nature in large projects in Bangladesh, and particularly not in FCD projects. A variety of consultation techniques are expected to be useful at different stages of planning for an area. However, there is relatively little experience of village level development programmes and a lack of a cohesive social grouping centred on the village. Most experience is of single-interest groups or at least of those with a common interest and it is likely that these would fit more easily within the existing frameworks of NGO and BRDB programmes. If continuity and a career structure could be guaranteed then social organisers and specialists in relevant disciplines could join BWDB, but at present strengthening and working with other government departments seems preferable.

6.4 PLANNING AND DESIGN FOR IMPROVED O&M

6.4.1 Context

From the FAP 12 and 13 fieldwork it is apparent that, in order to reduce conflicts over O&M in FCD/I projects, benefits need to be directed towards groups who normally disbenefit. Net benefits may be increased and their distribution improved, but at the cost of modifications to standard designs and associated new institutional arrangements for management. This section concentrates on embankments and wetlands. While there are other aspects of FCD/I projects where designs might be modified to improve operation or maintenance (such as sluices and drainage systems), there is considerable evidence in Chapter 3 and Volume 2 of poor embankment maintenance and conflicts over embankments, and in the FAP 12 reports of fisheries disbenefits. In each case one possible plan is considered in some detail, but this is then considered with a suite of other options, each of which may be suited to the situation in a particular area.

6.4.2 Embankment Options to Reduce O&M Problems

In general embankment design should be considered from the viewpoints not only of civil engineering, but also of minimising land acquisition, reduction of O&M problems, multiple use for resource generation, institutional implications, and cost (of construction and O&M). However, alternative embankment types cannot overcome the bank erosion problem. Any embankment option should be set back far enough and/or linked with countermeasures against erosion (such as river training programmes). The options discussed are illustrated in Figure 6.1.

a) Option - 1 conventional type

Conventional earth embankments built by hand have been widely adopted in Bangladesh due to their low cost and the availability of the required resources. The following problems and features were observed in the case study projects:

- raincuts and ghogs damage these embankments, particularly the shoulder and adjacent side slopes (both river side (R/S) and country side (C/S)). Crest widths of the embankments vary from 2.44 m. (8 ft.) to 6.10 m. (20 ft.) depending on local circumstances;

- the embankment crest is used as a local road but this is not fully effective due to poor maintenance;

- the side slope is usually 1:3 for R/S and 1:2 for C/S. However, when the embankment height exceeds 6.0 m. a gentler side slope with berm is sometimes considered;

- the setback distance is specified to be more than 60 m., but bank erosion is often a problem even with greater setbacks; and

- unauthorised housing (temporary and permanent) on embankment slopes has weakened embankments by destroying their intended section.

While improvements are needed, these could take the form simply of improved maintenance, for example by routine maintenance (see Section 6.8.2). However, this would continue to require financial resources.

b) Option - 2 improved conventional types

There are several ways in which conventional embankments could be improved to reduce routine O&M requirements without increasing land acquisition.

i) Jute Textile

Embankments built with less cohesive materials can be covered by Jute textile, combined with grass turfing to protect the embankment section from raincuts and wave action. This is less expensive than geo-textiles as the material is locally available. It is bio-degradable, but has a limited life.

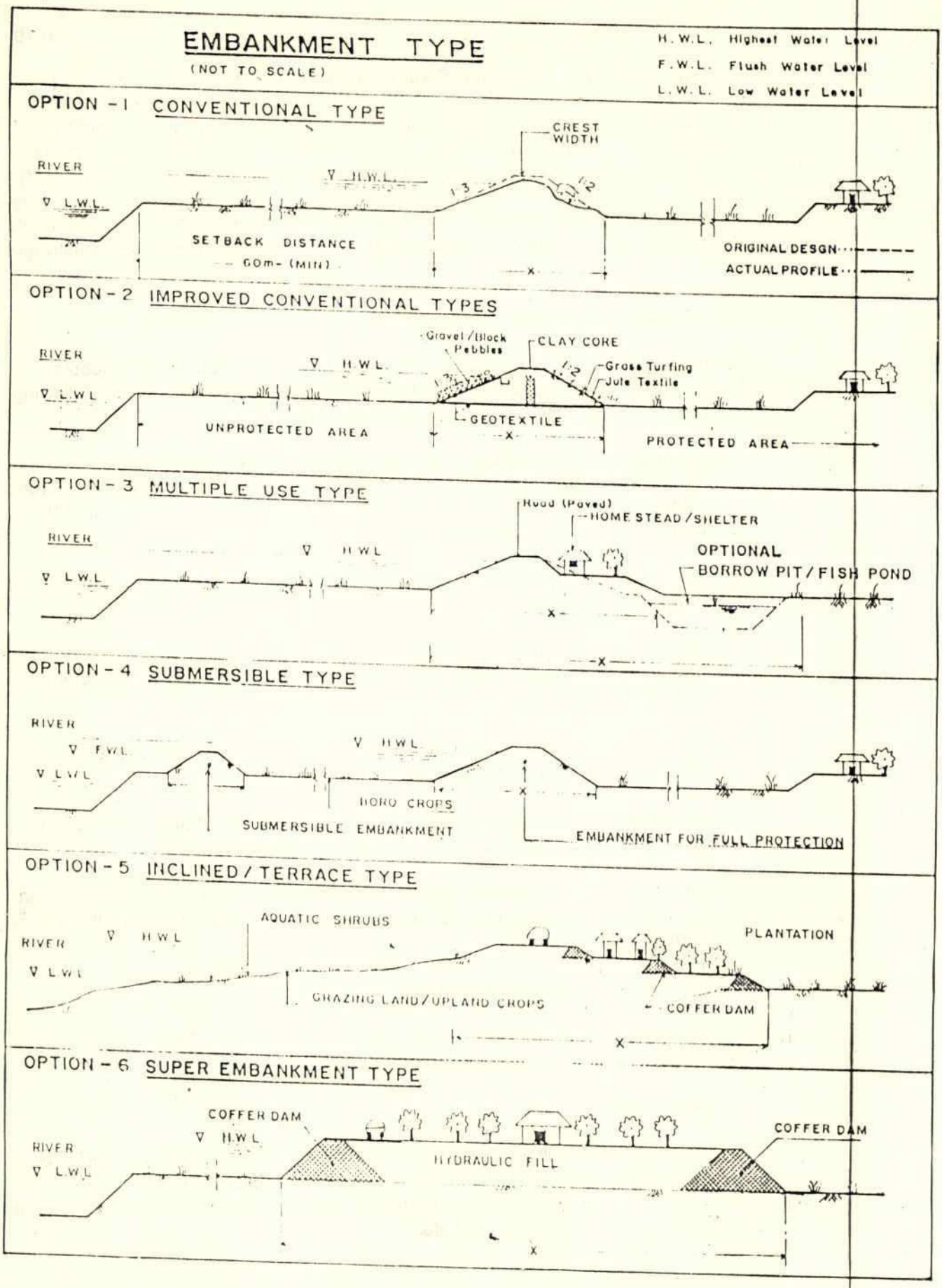


Figure 6.1 Alternative Embankment Types

ii) Geo-textile

Geo-textiles are sometimes used for protection of embankment slopes from wave action, frequent fluctuation of water levels, and erosion due to river currents. This is often to protect filter layers in conjunction with hard bank protection (stone, concrete or brick).

Use of geo-textiles may reduce maintenance problems. However, the material is very expensive, and where it is used covering materials, such as pebbles and boulders/blocks, are not easily available and are expensive. The covered side slope cannot be used for other purposes such as grazing lands.

iii) Clay Core

Clay cores are used for embankments built with largely permeable soil to stop seepage and, frequent 'ghogs' (animal burrows) moving through the embankment. This adds to construction costs, but may prevent failures and the need to reconstruct embankments.

iv) Improved compaction

While mechanised compaction has sometimes been proposed (and in the case of the BRE, adopted), there is scope for applied research on improving manual soil compaction, improved quality control, and incentive systems in earthwork such as manual embankment construction (World Bank, 1991). However, FFW payment systems, for example, would need to be modified to make this possible.

c) Option - 3 multiple use type

This embankment option is developed in detail in Sections 6.4.3 and 6.10.1. The major objective of this type is integrated land use along the embankment alignment taking account of engineering and social problems. This type could provide space for housing/temporary shelter and be used for plantations on embankment berms, and optionally for fish culture in intermittent country-side borrowpits for fund generation and maintenance of the embankment. The option of the embankment also serving as a paved road could be more efficient by sharing construction costs and avoiding extra impediments to drainage.

However, this option would depend on local participation in maintenance, and on being acceptable from the planning stage. This type of embankment requires acquisition of a wider strip of land, but the problem of public objection may be reduced as ex-landowners could benefit from use of the embankment and borrowpits.

The O&M costs of the embankment should be reduced as public cuts would be opposed by the beneficiaries (users of the embankment and the borrow-pits), who will be required to carry out routine maintenance.

d) Option - 4 submersible type

this type is widespread in the North-east region, and its use in other regions has been suggested (FAP 2 Interim Report, Section 3.1 and Figure 3.3, 1991) to reduce channel confinement in peak flow periods (hence the full embankment set further back in Figure 6.1);

- the land between the main embankment and the submersible embankment would be used for Boro crop cultivation;

- the O&M costs of submersible embankments are relatively higher than those of conventional full flood protection embankments, because of damage during submergence each year, but repairs could be undertaken using FFW and Labour Contracting Societies (LCSs).

e) Option - 5 inclined/terrace type

- this type requires a large amount of earth movement but could be effective where there is bank erosion and to permit continued land use. The idea is to artificially create a raised natural style river levee;

- very gentle river side slopes planted with aquatic grasses, reeds and shrubs would dissipate river energy and protect the embankment from bank erosion;

- this type could be implemented using hydraulic fill or conventional manual methods, and could be built in stages. Relatively small coffer dams are needed;

- viability would depend on the potential uses of riverside land being sufficiently productive to suit landowners as it would be too expensive to acquire;

- O&M of terraces would be achieved as in option 3.

f) Option - 6 super embankment type

This type has been suggested by the FPCO Panel of Experts. This type is actually implemented in Japan as part of the re-development of urban rivers but the cost there is borne by the beneficiaries who can build businesses and houses on the embankment.

- construction would be relatively costly and would depend on the high land created having a higher value, for example as urban land, so that it need not be acquired. Even so compensation for loss of use during the construction period would be necessary;

- many uses of the land created would be possible without damaging the structure (villages, roads, tree crops), but paddy probably could not be grown. The option might be most suitable where towns and villages are relocated because of erosion;

- O&M needs would be minimal;

- this embankment type would be able to withstand overtopping, but it cannot overcome bank erosion. A large setback or separate countermeasures under river training works would be needed to avoid a huge investment being lost too quickly.

6.4.3 Embankment design for multiple use

Multiple use of FCD embankments (option 3 in Section 6.4.2) is seen as an important option for improving maintenance and for targeting of FCD/I benefits for the following reasons:

- there is a lack of routine maintenance of embankments at present;
- there is great pressure on resources in rural Bangladesh;
- there is considerable informal use of these embankments which is productive but often damages the embankment's primary function; and
- there are groups in the project impacted areas who do not benefit or only marginally benefit at present from flood protection (the landless for example) or who are adversely impacted (living on the river side).

To address these issues the design and construction of embankments could be modified. Figure 6.2 is an illustration of a modified embankment design which takes explicit account of the potential uses of the infrastructure and would be part of an integrated engineering and social/economic development component of a project. The principle is to minimise any additional land acquisition needs, but to provide at intervals a country-side berm to be used for housing (where there is pressure to live permanently on the embankment due to river erosion), or for flood shelters (for those with homesteads on the river side or in case of embankment failure). Country-side borrowpits to be used for fish cultivation could optionally be created on acquired land along some reaches of the embankment.

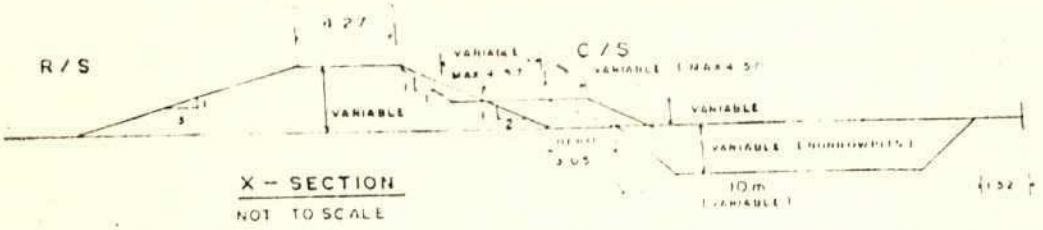
The engineering is relatively simple but the institutional arrangements linked with this would be more experimental.

Lengths of, say 10m, of embankment with berm would be leased out for housing on long term renewable leases to households, with preference given to those landless who have lost their riverside homesteads to floods and erosion, or lost homesteads to the embankment itself. Typical house sizes on existing embankments (for example at Kurigram) are about 3-4m x 2-2.5m (10-12'x6-8'), so relatively small lengths could be leased out to each household. The condition of the lease would be for the household to maintain the embankment to the correct cross-section.

Where land could be acquired for borrow pits, the group of households living on a reach of embankment would form a borrow pit management group which would have a lease on a section of borrowpit nearby for fish cultivation as a source of income. Linked to this, the adjacent embankment would have to be maintained. As there is likely to be pressure from richer people to have access to these resources, some of the borrow pit sections (constructed so that there are separate ponds) could be leased on an auction basis as a means of raising funds to pay for routine maintenance teams to work on the adjoining embankment.

Where the embankment berm is intended to be available for temporary flood shelter, one option, to ensure proper maintenance and that it is not encroached upon, would be to hand it over or lease it to the Union Parishad for use as a hat (market) or for some other public purpose. The UP would then be responsible for ensuring that those paying to use the hat contributed directly or in cash for embankment maintenance on a specified reach. The UP would also be responsibie for organising use of the berm in an emergency, subject to checking by O&M staff to ensure that damage was not done.

TYPICAL PLAN & X – SEC. OF F.C EMBANKMENT FOR MULTIPLE USES



X – SECTION

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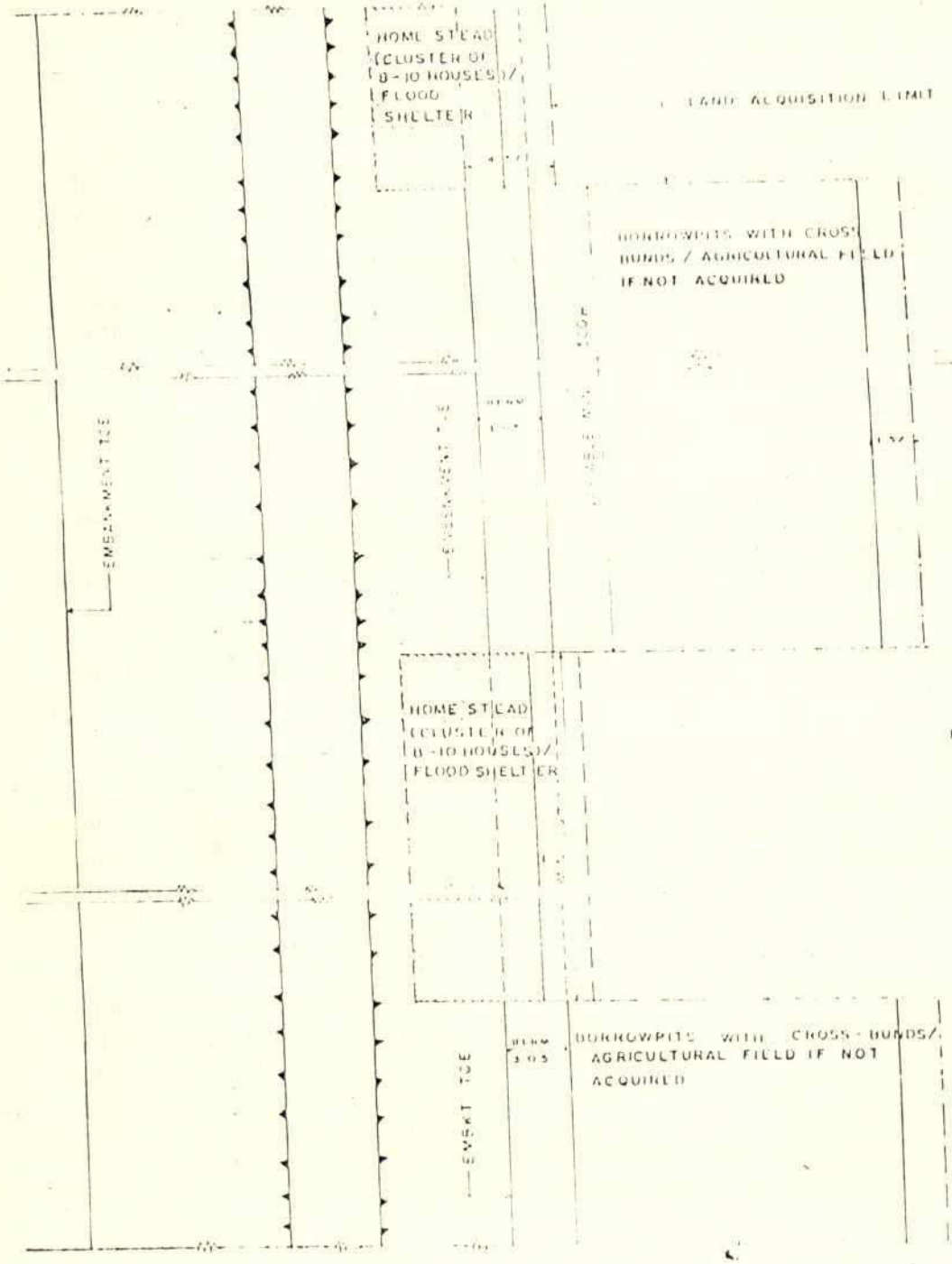


NOTE :—

1. ALL DIMENSIONS ARE IN METRES
2. C/S SLOPE OF EMBANKMENT FOR THE HOMESTEAD PORTION (SHOWN IN DOTTED LINE) MAY BE ( ) ACCORDING TO THE KIND OF MATERIAL
3. BORROWPITS AN C/S MAY OR NOT BE CONTINUOUS DEPENDING ON FIELD CONDITIONS
4. ALL VARIABLES WILL BE CONSIDERED ON FIELD CONDITIONS
5. BORROWPITS WILL BE USED FOR FISH CULTURE

PLAN

NOT TO SCALE

Figure 6.2 Typical Plan and Cross-section of Flood Control Embankment for Multiple Use

Refinements to this proposal, experiments in promoting its acceptance, and trials with alternative institutional arrangements will be needed, and this is only one of a range of options.

6.4.4 Embankment recommendations

The choice of embankment type will naturally depend on local circumstances. Some of the options considered would involve major engineering tasks and would need much more detailed work on their environmental and economic implications before they could be tested. However, other options, particularly the multiple use concept discussed in Section 6.4.3, could easily be tested by modifying existing projects or in ongoing ones. Construction costs would increase, although this would be in order to reduce maintenance costs.

6.4.5 FCD/I design and operation for fish passes/migration

There has been a general negative impact of FCD/I projects on capture fisheries (FAP 12 Final Report). Embankments and regulators have restricted the free migration of mature fish from beels to the rivers, and the return movement of fish spawn/fry/fingerlings from the rivers to the beels. In addition there is a tendency for complete reclamation of the lower beel areas (khas land) for paddy cultivation following improved drainage. This has severely reduced the area of water available for fish during the dry season, and practically extinguished all kinds of fish in the beels. If adult fish cannot survive in the project area there can be no future fish production.

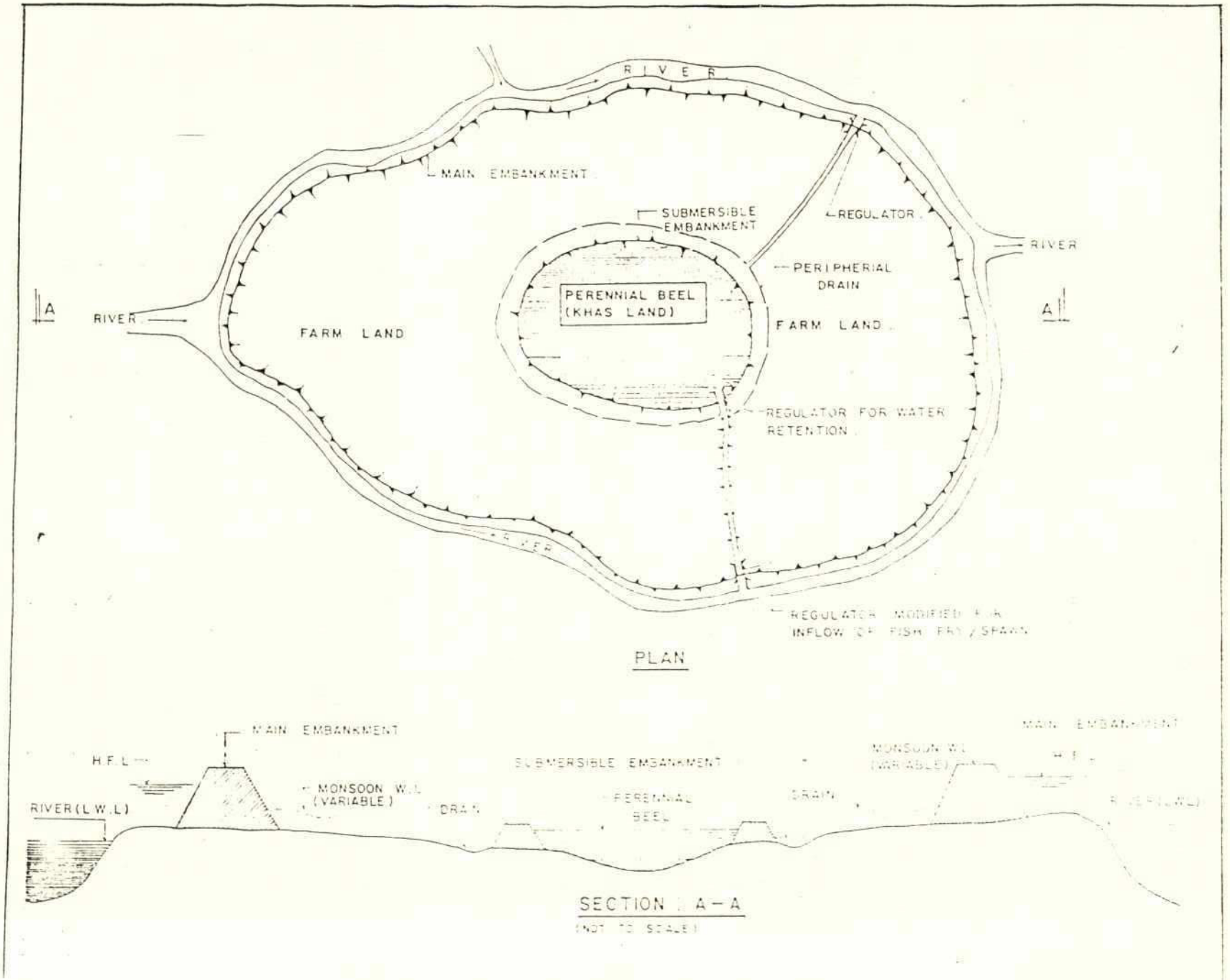
In order to overcome these problems and to conserve and save the natural fish population within FCD/I projects, a combined package of modifications in project planning, regulator and sluice design, and FCD/I operating procedures would be needed. An option which might make this possible in suitable project/compartment areas is detailed in this section (other fisheries management options linked with FCD/I O&M are considered in Section 6.10.2). This is a new concept which could be tested in a pilot project or compartment where there are beels with important fisheries, and where controlled flooding is the preferred option.

a) Project planning - perennial waterbodies

The complete reclamation of the lowest beel beds (generally khas lands) for agriculture would have to be controlled in the planning and implementation stages. To create wetland conservation areas, submersible bunds (see Figure 6.3) would be built around the beels or parts of the beels, with the spoil taken from the beel (to help excavate perennial "ponds" for fish in khas land in the lowest parts of the beel) during project implementation. These perennial ponds would ensure that there was sufficient water available for fish to survive up until the time they need to migrate to spawn, and provide a year round habitat for non-migratory species. Figure 6.3 shows a hypothetical polder/compartment of this type in plan and section. The khals connecting the beels and rivers might also need to have low bunds, depending on the land levels nearby, the system of operation (see b) below) and the crops at risk in the early monsoon.

During the monsoon the low submersible bunds of the beel or its ponds will be submerged and the young fish which enter the project would live in the controlled flood plain. Openings in the bunds and provision of fish shelters would attract the fish into the conservation areas as the water level falls. If the openings in the beel bund are gated the bund could be used for water retention in the dry season, which might also bring a benefit to irrigation. The project area would also need to drain out water - either directly through separate regulators or indirectly from the beel.

Figure 6.3 Sample Sketch for Perennial Beels within FCD/I Projects



b) Fish Spawn/Fry Passage in Regulators/Sluices

To permit a managed migration of fish both new operating rules and modification to structures would be required. To permit the spawning migration of fish the regulator gates would need to be wide open in April-May when the mature fish swim out against the first inflow of rising monsoon water; they are not strong swimmers and so could not escape against a strong current or head of water (provision of fish ladders might also be considered). Bunds to prevent flooding of HYV Boro crops might be needed at this time.

When the mature fish release spawn in the rivers, the spawn and fry generally move in the sub-surface water (2"-4" below the surface), and would normally float into the floodplain during June-August. As regulator vents are normally opened from the bottom, the fish spawn/fry which are floating near the water surface cannot enter into FCD/I projects. To solve this problem one or two vents (depending on the size of the regulator and the intake channel) could be modified to allow passage for the fish spawn/fry/fingerlings into the project area. Figure 6.4 shows an example of the modification proposed; the dimensions would depend on the details of a particular project. A suitable slope (perhaps 1:2) should be provided on the country side of this passage with a dividing wall to protect the delicate spawn from being damaged by water turbulence. The vertical gate for this passage would be rested below the floor of the passage so that the flow could be adjusted by raising the top of the gate to allow only about 15cm (6") depth of water over it.

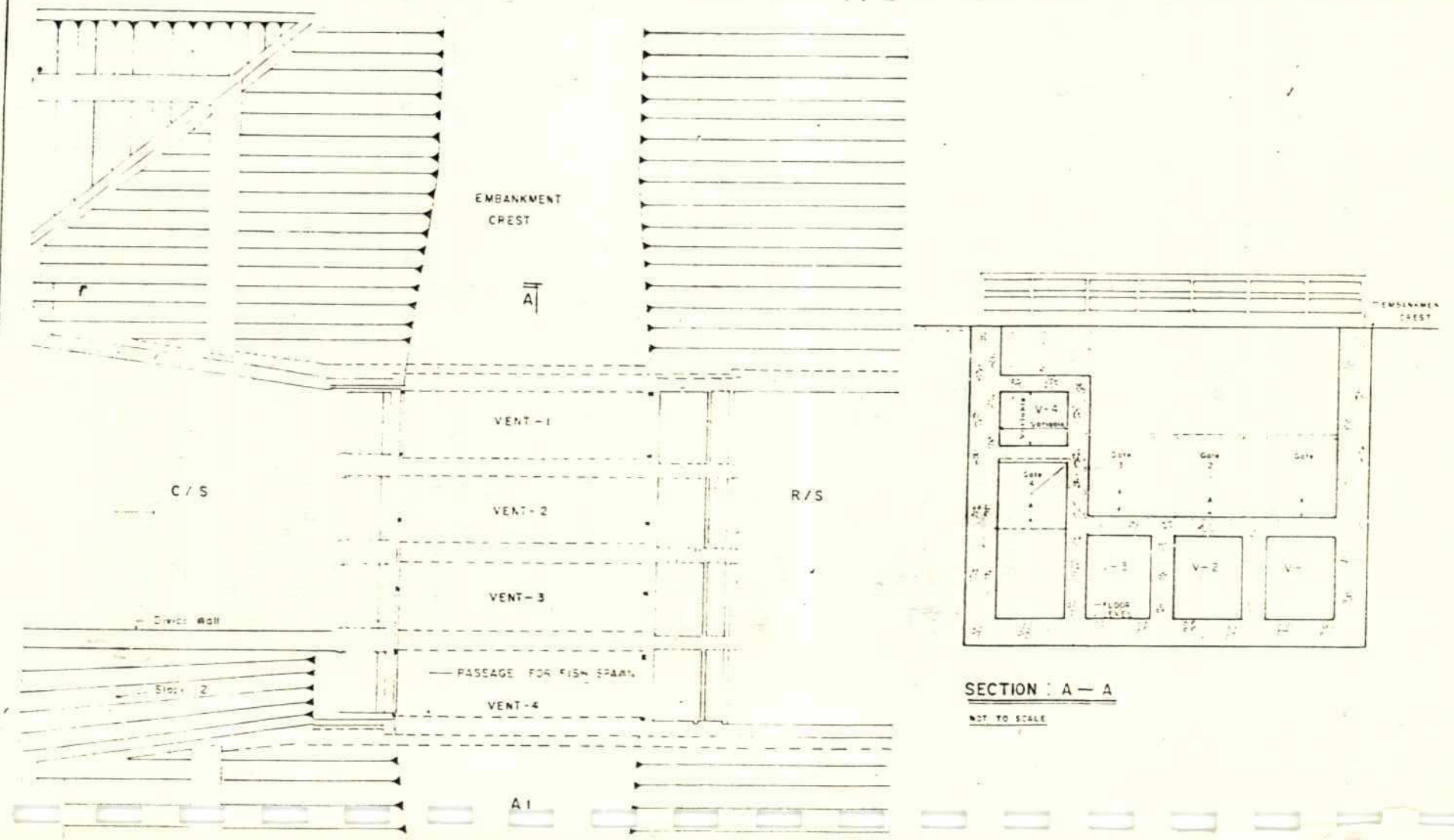
The floor level of the spawn passage would have to be fixed by careful examination of the lowest water level of the river at that spot for the months from late June to mid-August, to allow sufficient flow during a dry year. Operation of the new spawn and fry passage gate would thus aim at keeping the top of the gate about 15cm below the outside water surface. Guide bunds on the riverside might be needed to help direct spawn and fry into the regulator, and it should be located at sites adjacent to areas where spawn are known to concentrate.

c) Institutional design

A managed "natural" fishery will not only require new engineering and operating rules. It would also depend for its success on management by a fisherman's cooperative strong enough to regulate fishing activity. This would be necessary to prevent fishermen catching all the adult fish as they leave the project for the spawning grounds, and to prevent fishermen scooping out all the fry and spawn from the regulators which were purpose built to concentrate them. Even if the managed system described above is technically feasible, it will only succeed if there is a considerable input to help the traditional fishing community using the project beel(s) to organise themselves. They will need to be able to exclude other fishermen/ businessmen who might try to take advantage of the fishery component of the project and to act together to limit their own fishing activities. This would be a major breakthrough, considering the failure of most nations to manage common property fisheries. One option to achieve this would be to focus on the community cohesiveness (actual and potential) of traditional fishing communities (which are usually Hindu).

Ownership of the enclosed beel would need to be clearly defined. There may be a mixture of khas land and tanks under private ownership, in which case the private waterbodies could be acquired as part of the project costs, simplifying the leasing/licensing arrangement. Alternatively tank owners could receive a share of the fish crop.

Figure 6.4 Sample of Modified Regulator/Sluice Designed to Permit Passage of Fish Spawn Fry



Water management would no longer be aimed only at agricultural objectives. The system management would need to understand fishery management, from both the technical and social viewpoints, as well as agricultural water management. This points to the need to employ appropriate staff, re-train existing staff in fishery management, or make the project a combined and jointly funded DOF/BWDB project. A budget for these institutional components (training and fishing community organisation) during the construction and transition period would be required.

d) Restocking

It is unclear whether this conversion to a managed natural fishery would work in an existing FCD/I project where the major carp fishery had already been destroyed. Restocking the beel with fingerlings would be perfectly possible (as is being done by the World Bank Third Fisheries Project), but it is not known whether hatchery raised fish would behave naturally - whether they would mature and migrate at the right time or find their way to spawning grounds. A long term experiment would be necessary along with monitoring and tagging of the fish population.

6.5 TRANSITION PERIOD

6.5.1 Existing Situation

In an increasing number of FCD/I projects there is now a provision for funding of O&M during the first two years after completion (for example SSSFCDIP). However, in most cases there has been no special arrangement for transforming the completed project into a functioning and sustainable system.

6.5.2 Reasons for a formal transition

The aim of this transition would be to correct any problems or defects which became apparent after construction was completed and to ensure that the system functions as intended and is handed over in an acceptable state. This would clarify responsibilities and liability: the operating agency/division or beneficiaries would only accept the system when it was proven to perform as required in the original specification (with any agreed modifications). If it was not happy the operating agency would refuse to accept the system until defects had been corrected. It would be up to the implementing agency to correct these or to require correction by any liable contributor to construction, design, or the approval of plan and design. This could be the contractor or the consultant. If there is a mistake or omission someone should be liable for putting it right.

6.5.3 Possible transition tasks

The following tasks may need to be executed during the transition period in order to facilitate effective O&M:

- the system O&M staff and the user groups could receive on-the-job training in their tasks and responsibilities, from the project consultants, other agencies, and system staff;

- there could be a major emphasis on assisting the user groups in taking over operation or maintenance (as appropriate) and in ironing out any problems or disputes which arose - for example between groups;

- the intended water levels would be the initial targets for operation. System staff, water management groups, group organisers, and implementation staff would monitor operation and water levels inside and outside the project, and the field implications of these. This would amount to calibration of operation in order to achieve (as far as possible) the ultimate agricultural aims and intermediary water level targets, and adjustment of operating procedures and target water levels at the structures as appropriate;

- based on this trial stage, specific operating rules/target levels for each structure could be set along with a general operating plan;

- this trial period would enable practical guidance and rules of thumb (including O&M 'manuals') to be prepared for O&M during the remainder of the project life which would be specific to the project and which would be followed since the customers were involved directly in their preparation;

- the user groups should be active in monitoring and identifying problems through regular inspections of their components of the project. They should be encouraged to identify O&M requirements and any problems which may require modifications to the project or additional works;

- implementation of any necessary additional works - new structures, modifications, new khals; and

- formal handing over of the project to the management organisation (O&M Division) and of responsibility for components of the infrastructure to user groups which would sign contracts with the management organisation.

6.5.4 Recommendations

In order to ensure that potentially sustainable FCD/I systems are handed over to O&M it is recommended that formal transition periods are tested. In the first instance a two year transition could be financed as a continuation of implementation. One important task which would be transferred to this period from the implementation period would be the preparation, testing and dissemination of O&M manuals. This is discussed in detail in the following section.

6.6 O&M MANUALS

6.6.1 Existing practice

An important aspect of improving O&M is the guidance given to those responsible for O&M. The O&M manuals of a few projects have been reviewed to cover the history of their development in Bangladesh, including: Coastal Embankment Project (Leedshill de Leuw, 1967), Meghna Dhonagoda Irrigation Project (Chuo Kaihatsu Corporation, 1985), LGEB (Intensive Rural Works Programme, 1986), and Naogaon Polder I (PMU, 1990).

Despite the rule that O&M manuals for all projects should be prepared by the BWDB engineer concerned during the first two years of the project's operation, this does not happen,

iii. key operating guidelines (in accordance with the manual) could be permanently inscribed in Bangla on part of the concrete of the structure. These would give, for example, the order of gate operation needed to ensure the safety of the structure, and specify opening and closing in stages. Publicly available instructions would be a check on proper operation. There is usually someone in the area who could read them if necessary - for example if the regulator has to be operated when the regular operator is not available;

iv. there should be permanent gauge marks inscribed on both river and country sides of the regulators/sluices to enable monitoring of operation by farmers, the structure operator, and superiors.

6.6.4 Recommendations

As part of the strengthening of training programmes (see Section 6.12) the general guidelines for O&M discussed in 6.6.3 i) could be prepared, possibly by a joint LGEB - BWDB project. If recommendations for a transition period between construction and O&M are taken up (Section 6.5.4), then the preparation of modular and practised O&M manuals should be one of the tasks during this period.

6.7 OPERATION - WATER MANAGEMENT

6.7.1 Introduction

This section concentrates on FCD operation. Small irrigation systems are mostly privately managed, while large irrigation systems have some additional problems of their own and improved O&M is being developed in these by SRP and the Ganges Kobadak Rehabilitation Project.

6.7.2 Farmer participation

a) Context

Farmers are normally actively concerned with water management, as noted by SRP (1991b). In FCD/I projects they are unfortunately forced to adapt to the prevailing conditions, and are not given the opportunity to work with the project to improve operation in the interest of as many farmers as possible. Operation is often influenced by powerful local interests. This may be good for agriculture if larger farmers represent the majority of farming interests in an area, and may be important in establishing protective patronage over a structure. It may equally favour fishermen when water retention would otherwise benefit farmers, or help high or low land farmers depending on the capacity of regulators and the strength of the lobby from different land levels. Depending on the project circumstances this may result in major disputes or minor problems (Volume 2), but negotiations could lead to fairer compromises. Other problems such as leaking regulator gates which farmers would like repaired but which they are not responsible for, and which BWDB is unable or unwilling to attend to, are not uncommon.

b) Principles in improving participatory management

It is presumed that farmer participation in water management will be adopted to improve O&M. Improving farmer participation would ultimately involve farmers in directly managing water in their sub-catchment through the appropriate regulator and khals. However

as is noted in Section 3.3.4. In general those O&M manuals which are prepared are very comprehensive and as a consequence are too elaborate and voluminous. Typically O&M manuals are prepared by outside consultants (usually those involved in project design) during the construction phase of the project, and without the benefit of experience of operating problems.

6.6.2 Reasons for improvement

Whilst accepting the need to properly document a completed project and to have reference material to hand, O&M manuals in their present form do not serve the field personnel, are rarely if ever referred to, and hence have little influence on practical O&M. The field staff responsible for O&M of FCD/I projects are mostly not highly conversant in English and so are unable to follow O&M manuals which are both highly technical and in English. If an O&M manual will not be used and lead to improved O&M it is not worth writing.

6.6.3 Options for recording and disseminating O&M guidance information

The "O&M manual" could include the following types of information: a record of system facilities and their intended performance; details of responsibilities and institutional framework for project management and O&M; operating instructions; monitoring and record keeping procedures; and a description of maintenance tasks. Some of these purposes may be achieved by a comprehensive volume in English for CEs, XENs and consultants to refer to, but other staff require simple specific guidelines in Bangla covering their area of responsibility.

It is suggested, therefore, that the O&M manual should become modular. The system manager and other senior staff would have comprehensive versions, and others engaged in O&M would only receive the guidance they need in an understandable form. The material prepared should be suitable for use as a training resource for the system's O&M staff, as well as being reference material when a problem arises. This material would be prepared during the transition phase and its production would be required as part of the TOR of consultants and agency staff working during the handover period.

Even before the transition period, at the design and construction stage, several measures could be taken to improve O&M manual information:

i. specific guidelines on operation and preventive maintenance can be prepared for all the standard structures, embankments and drainage khals. These would be in simple "how to do it" sequences, with illustrations (see IRWP, 1986 for example), and in Bangla. They would form both a training aid and an aide memoire for those carrying out O&M: khalashis, water user groups, and maintenance teams. These could be prepared once and for all for use in all systems. Examples include: operating a sluice; cleaning and greasing it; repairing rain cuts and ghogs. The advice of training specialists and NGOs should be taken by the unit/project preparing this material so that the media developed would be used and would carry their message across, as well as being technically correct;

ii. the contractor would be obliged to submit a set of, say, six as-built drawings for each structure, which would be approved by the XEN responsible for construction before final payment for the contract. The as-built drawings would be filed appropriately (with central design, and in the system manager's master O&M manual for example), and would be available in the event of O&M problems or when major repairs are needed;

where there is a very major regulator serving a large catchment control by the system management (BWDB) would need to continue - for example employing a trained khalashi to ensure proper operation; with decisions approved by a responsible officer but determined in consultation with farmer groups. The improvements depend both on system management and on farmer management.

i. The responsibilities of farmer groups and system management must be clearly specified and agreed. Farmers should have a say (possibly through a committee of farmer group representatives) in system management since this affects them.

ii. In the project or system there should be a much clearer channel of communication in both directions between farmers and system management. This involves feedback on water levels and on the agricultural impacts of operating decisions. There should be an officer specifically charged with liaison with farmers (customer services), so that farmers know who to contact when there are problems or grievances and that they will be listened to seriously. The liaison officer would actively seek comments and feedback during regular visits to farmer groups.

iii. Farmer groups will only be strong enough to take control over water management in their area if they are given sufficient institution building support. Usually in irrigation system improvements this is achieved by employing "social organisers" who are agents of change in improving the management capabilities of farmers. The achievements of social organisers in small irrigation systems in the region have been well summarised in Manor *et al* (1990), and it is suggested that this approach is adopted (Section 6.3.3 considered further details). The initial experience of organisers for water management should be carefully analysed to learn from experience, and the personnel involved would become the trainers of other field workers/organisers.

iv. There is a wide range of activities involved in developing farmer groups: collecting base line information on existing water management, agriculture and the farmers involved; identifying leaders and potential key members of a water management group; providing training in management - problem solving, decision making and analysis of successes and failures; enabling representative boards or committees to be formed; aiding farmers to plan and implement changes in O&M. These changes cannot happen overnight. Even one organiser per sub-catchment (water management group) for two years during the implementation and transition phases may not result in a sustainable farmer group, but it would be a major step forward.

v. There should be continual monitoring of system performance in which farmers should take part. Water levels and agricultural production are the best indicators to monitor. This is necessary both to guide operating decisions and to permit modifications to system management as agricultural and economic conditions change over time. A short annual report could be produced for the system detailing the performance and problems of the year, and changes proposed for the next one. Operation (and maintenance) need to be documented in order to learn from the past and from other projects' experience.

vi. Khalashis will probably continue to be needed for large structures which remain under the direct control of the system. Rather than employ a khalashi, one option may be to provide a plot of homestead land, or even a simple house, free of charge, on condition that the khalashi guards, operates and does basic maintenance on the structure. This would reduce recurrent budget costs.

c) Recommendations

Since SRP is developing improved water management through farmer participation, involving a number of the principles discussed in (b), this experience should be closely monitored and its applicability to FCD projects assessed.

6.7.3 Compartmentalisation

FAP 13 is required to comment on O&M of compartments which might be undertaken under FAP using the concepts of controlled flooding and interlinked polders (compartments). Some comments relevant to controlled flooding have already been made with respect to FCD design and operation intended to protect capture fisheries of migratory fish (Section 6.4.5).

Because there are no compartments which are managed in an integrated way at present it is difficult to base guidance on past experience. However, the case studies undertaken by FAP 13 do indicate a number of factors which should be considered in assessing the feasibility of water management using compartments.

Compartments, it is argued, could reduce flood pressure in river floodways by spreading water into the protected floodplain in a controlled and planned way, either individually or by being interlinked, and could localise damage during failures. Key issues in operating compartments may be controlled flooding, deciding which areas will have which water levels during normal and unusual monsoons, and linkages between drainage systems. Where a project has sub-compartments there are new opportunities for local/decentralised management, but where larger compartments are interlinked, problems of coordinated management may increase.

a) Operating plan from the outset

An operating plan should be the basis of the design stage and be agreed by the people who will be affected. They must want controlled flooding and may have to accept some losses of potential gains so that others are less badly affected, if this is what the operating plan calls for. Otherwise it is likely that there will be public cuts which will pass on water irrespective of operating decisions, since people will look after their own interests. One approach to this might be to designate planned cuts in the event of a emergency (since unusual floods will test the system most). These would be based on avoiding losses to high value land uses (infrastructure, urban areas, or high value crops). If there are areas that regularly or occasionally disbenefit from linked compartment operation, then real compensation in some form will be needed to avoid public cuts or sabotage.

There would need to be very careful modelling of the operating practices allowed in normal conditions and different flood events, and of what would happen in terms of damage relative to land uses for different scenarios. This information could be presented during public consultations in order to gain both acceptance of the general idea and detailed feed back on local factors which could require plans to be altered. The operating benefits of a set of linked compartments would need to be clear to both planners and flood plain occupants before a

plan could go ahead. It is expected that FAP 25 will be developing the information and methods on which operating plans for compartments could be drawn up.

b) Single compartment (polder) operation

Operation of a single compartment should not raise different problems from those already known in FCD/I projects, unless sub-compartments are created (as has been suggested for some polders) for improved water level management.

It is possible through common sense on the part of local people and khalashis to operate structures in isolation. Nevertheless better coordination between operation of regulators in a project would help - if there is a channel linking them for example. There may also be differences of interest between high and lowland farmers (see Table 3.2). If some farmers would prefer to retain water when others want to drain more out, this will require negotiations between the groups. However, in many small-medium FCD projects farmers have a common interest in the drainage provided by the structure serving them. In these cases there is fortunately a lack of the serious main-system management problems typical of large irrigation projects. Principles for improving operation in this context have been discussed in Section 6.7.2.

c) Operating linked compartments

Operation/water management in linked compartments would be more like the operation of main irrigation systems, which is notoriously problematic. It seems very likely that the problems of irrigation main system management would reappear in a new FCD form. For example tail-end compartments may be disadvantaged - receiving too much water when floods are passed down to them.

Linked compartment operation would have to be planned both for normal monsoon conditions and for relatively extreme floods (when it would be a form of emergency management). Plans based on simulations of flood and storm events of different magnitudes would be needed, along with a monitoring system which would forewarn of these events, and a communication system to ensure that the operators of regulators or planned cuts acted at the right times.

In the current context of water management in Bangladesh it seems over optimistic to believe that this would work. Even if local compartment managers have rules of thumb to guide their operating decisions there may well be communication difficulties in the monsoon, and people may in the event be unwilling to accept operating decisions which harm them. One option to reduce this problem would be non-operated openings between compartments, so that the control is determined at the design stage (see (d) below).

d) Minimising operational decisions

Many structures require operation (usually of gates or fallboards). The stronger the conflicts of interest are over operation, as they are likely to be in linked compartments, the greater the operational problems. Openings, spillways, and to a lesser extent weirs and flap-gates (which normally operate automatically but can be opened and closed), do not require human operation - the design and water levels determine the result. Hence non-gated restrictions on water flows might be a preferred option both in permitting flooding in a controlled way, and in defining drainage and water retention. If this option is adopted it will put heavy emphasis on the public consultation and participation phase in project design to ensure that there is acceptance of the implications of such a plan/design among the different

interest groups - principally farmers on different land levels and fishermen in the compartment (or compartments where they are linked). Volume 2 of this study shows many cases of people making cuts (and some building bunds) when their interests are threatened, so this option would need testing.

This strategy of minimal operation water control might not work when there would be a need to let in water earlier so that the rising water during a flood could come in more slowly and hence cause less damage. This is entirely analogous with submersible embankments, which are the prime example of controlled flooding used at present in Bangladesh. There the main operating problem is in having enough time after harvest to open the regulator gates and let in sufficient water to minimise the head difference (and thus damage) when the embankment is overtopped. In such circumstances fine tuning of embankment standards and easy and timely operation are essential. Similar issues would arise in full flood protection compartments, since Boro is widely grown and timing of controlled flooding would have to be coordinated with cropping choices and the timing of agricultural operations in a particular year.

6.7.4 Emergency plans and operation

There is a lack of contingency plans for emergencies in existing FCD/I projects, although Chapter 3 and Volume 2 show that breaches and cuts are common. An integral part of FCD/I operating plans should be an emergency plan to cope with floods greater than the design event, with rainfall and drainage patterns which exceed the design capacity, and with erosion, and structural failure. This appears to be a serious gap in current O&M.

Emergency plans should be developed by the system including the representatives of those benefiting and using the system, and involving the local administration. The most critical part of the emergency plan will be coping with embankment failure (including erosion) since the risk to life and property is greatest in such events. The following tasks could be involved in emergency operation:

a) Monitoring

Routine maintenance teams and SOs could provide early warning of the risk of overtopping or of other failures since they are on the embankment every day. They should have a specified water level below crest height which would be the danger mark for the project, and which would signal the activation of the emergency plan. They would have a duty to report a risk of failure immediately to the SDE or system manager. Forecasts from BWDB's flood forecasting service of forthcoming dangerous water levels should also be available in advance direct to the system manager.

b) Emergency repairs

If a potential failure is detected in time the system should organise emergency repairs, possibly with the assistance of the Upazila and on a voluntary or muster roll basis (see also comments in Section 6.8.3).

c) Warning

Repairs to prevent failure may not be feasible (for example where the embankment erodes), so the networks of user groups, system employees, and local administration should be trained in disseminating warnings of the likelihood of a failure to the areas which are expected to be affected, and in giving advice on actions to take. There would be a great advantage if the members of user groups and maintenance teams disseminate warnings since

they are local people working on the system and would thus have more credibility. They would form a semi-formal network receiving information from the system staff and then passing it on to the population. Some funds should be available to cover travelling costs incurred in disseminating warnings, so that those responsible know they will get reasonable reimbursement of out of pocket expenses and will not be restricted in giving warning.

d) Evacuation plans

The sudden onrush of flooding in an embankment failure may be so severe that people should move to higher shelter. Since it is responsible for water level management the system management should be able to prepare estimates of the areas and depths of flooding inside the project during a number of failure scenarios. From this the need for safe places and locations above flood level could be identified. Liaison with the Upazilas and UPs in modifying buildings to act as flood shelters would probably be necessary, although the embankment could also be modified to act as a flood shelter (Section 6.4.2). Evacuation would not generally be necessary, but if it is required the important need is for there to be assurance of security for evacuees. User groups and system staff should have the trust of the local community so that they could patrol to protect property during the flood peak. The local police would have to guarantee the system management that they would take prompt action in case of any problems.

e) Public cuts

In extreme events drainage congestion may tempt people to cut the embankment. This should be pre-empted by predicting that drainage capacity may be exceeded and that problems could arise. The system management would agree with the water management groups that they may cut the embankment in designated places or that farmers would accept a given level of water damage and not cut the embankment. Approval of cuts would be conditional on the same water management groups repairing the cut once the water level is acceptable, and so restoring flood protection. This would need to be enforced by legal liability to repair cuts. If public cuts became regular this would indicate that an additional structure might be needed, and the groups disadvantaged by having to cut and repair frequently would form a powerful lobby demanding an improvement in the system.

The organisation of emergency maintenance is covered in Section 6.8.3.

6.8 MAINTENANCE

6.8.1 Activities

Maintenance is required to keep system facilities operating as intended in the face of both regular wear and tear and of emergencies. At present maintenance of structures is at best periodic and reactive to needs - for example periodic re-sectioning of embankments and occasional replacement of rubber seals or entire gates, or repairs of breaches, cuts and ghogs. Improved maintenance would aim at achieving intended project objectives (levels of service) at the least cost. This involves routine or preventive maintenance, periodic repairs, and emergency repair of exceptional damage due to hazards such as erosion, extreme floods and earthquakes.

Different types of work need different arrangements. The evidence is that in a well managed system improved maintenance can be linked with targeting benefits to poor/

vulnerable groups, and cost savings can be made (since leakages to contractors and local leaders/officials are reduced). The following tasks are involved:

- routine embankment maintenance;
- emergency repair of embankment damage;
- monitoring and record keeping;
- periodic maintenance (for example of drainage channels);
- routine maintenance of structures; and
- rehabilitation of damaged structures.

- For each of these activities an institutional/management approach is needed.

6.8.2 Routine embankment maintenance

a) Existing arrangement

The traditional BWDB approach used to be the employment of embankment khalashis. These were little more than guards, did not physically maintain the embankment, and are now rarely employed. Periodic re-sectioning has become routine at present, using FFW wheat, but this means that the condition of the embankment declines over time and may be vulnerable to failure before resectioning. Continuing this option has the advantage of using external FFW resources, but is less effective at preventing O&M problems and at directing benefits to target groups.

The alternative of regular maintenance teams has now been applied throughout most of Bangladesh for earth roads under CARE's RMP, and under RESP, and has already been used on a small scale by BWDB within the Delta Development Project (see Section 4.5). This approach is discussed in some detail below. Another option is linking embankment maintenance to use of the embankment rather than through regular paid employment. This is discussed in Section 6.10.1.

b) Embankment maintenance group (EMG) option

Based on the experience of DDP, LGEB and CARE, the recently approved EMG programme of SRP, and EIP's similar proposals, the recommendations for routine maintenance are:

- employment of local poor women (for example widows or women from households with less than 0.2 ha of land) on a regular basis in all female work teams;

- allocation of 0.5 km of embankment per woman (shorter lengths than the 1 km or 1 mile on roads because the side slope and section must also be maintained);

- women would work in teams of up to 10;

- selection would be from the women involved in development activities of an NGO or BRDB, or if none are active in the project area, by the Union Parishad;

- supervision by Section Officers, if the system employs these, or under a management contract with an NGO, which would receive funds from the system budget, or by BRDB;

- tasks of the teams would comprise: filling raincuts, pot holes, ruts etc.; hand compaction in order to retain the cross section as handed over (that is the design cross section); turfing and protecting vegetation; and reporting if major repairs are needed;

- working conditions (based on 1990/91 arrangements in existing women's maintenance programmes) would be a five-hour six-day working week with Government holidays off - paid at Tk 25 per day (including all days off) equivalent to Tk 9125 pa (year round work);

- each team would have an elected leader and deputy leader/secretary to manage the accounts. They would be encouraged to form an association of team leaders in the project to act as a lobby in protecting their interests, and to be represented in system management boards or committees;

- system management should open a bank account locally for each group, into which three months salary is paid in advance, and then supervise regular (weekly or fortnightly) payment of wages (either by the Section Officer or NGO depending on the form of management);

- each woman would receive a hoe and basket, and each team a mallet (durmuss) from the system. Replacement of damaged tools would be by the team member, but there would be a regular schedule of replacing worn tools;

- there would be an attendance register, but an absent team member could send a female substitute if necessary; and

- a team member who could not achieve a good standard of work would be replaced in consultation with the team.

It is normal to have a forced savings component in EMG programmes where team members must keep part of their salary in a savings account until the end of the year. This encourages members to build up some capital and ensures that they continue in the programme (this features in CARE's programme since the intention was that women would 'graduate' from the programme with some resources to set up their own income generating activities).

The routine maintenance programme might develop into a sustainable use and maintenance programme (such as tree cultivation, see Section 6.10.1), but this would need to be planned from the outset, so that the women understand and agree with the plan and with what they are working towards.

Supervision and management of the maintenance programme would be critical, since BWDB section officers have no experience of day-to-day management of such a programme. The options for a FCD/I system are thus:

- to contract out to NGO's, reducing the number and cost of SOs but possibly favouring group formation/management over technical supervision;

- retraining SOs in the social aims and methods of the programme and keeping more or less the same staff;

- making an agreement with BRDB to take up group formation and support for the EMGs; or

- replacing SOs with new staff (who may not initially have the technical/practical training needed).

The use of women's maintenance teams can run into problems as it depends on NGOs coordinating and representing the women, on the availability of funds for the team members when their pay is due, and on the interest and goodwill of the engineering staff towards this approach. Organisation by NGOs has been adopted in the past, but there is a risk that these may cease to operate in a specific area. SRP (Netherlands assisted component) has recently formulated a programme for EMGs to be formed by BRDB and to work with BWDB in its focus projects for improved O&M, and this has been approved by BWDB in January 1992. It therefore seems appropriate for the SRP implementation guidelines to be adopted in any FAP pilot projects, pending feedback on their performance, as arrangements with an NGO would need separate BWDB approval. Full details of the EMG procedures developed by SRP are available from SRP. The similar EMGs organised by DDP resulted in an annual maintenance cost of Tk.17,000 per km of embankment per year.

EMGs have only recently been established, it will be important to monitor their performance compared with the normal pattern of periodic resectioning in order to establish whether annual average maintenance costs are reduced, and whether the frequency of embankment failure is reduced.

This does not address routine maintenance of drainage channels such as clearance of obstructions (water hyacinth). This might best be improved on secondary channels by being part of the responsibility of water management groups, where these are formed.

6.8.3 Emergency Repairs

At present those responsible for FCD/I systems have insufficient discretion and responsibility for their system and budgets to be able to repair damage speedily and thus prevent delayed repairs and increased costs. This is clearly frustrating when project staff can see benefits being lost and a long delay before an unnecessarily large sum is spent on major repairs. The O&M Cost Cell (O&MCC, 1991c) has recommended in the current BWDB O&M system that, instead of field officers having no specific funds allocated for emergency repairs, limits of authorisation should be specified for emergency repairs. Those recommended are: XEN Tk 1 lakh, SE Tk 2 lakh, and CE Tk 5 lakh (1 lakh = 100,000). Part of the annual budget would be available in emergencies based on past repair expenditure, but would be allocated as needed. This seems to be an appropriate proposal.

To avoid potential abuse of this system there would be a notification of the work to a higher authority at the time and a later justification. In a system management context there should be better checks on the expenditure since the system board could approve the expenditure on the spot and would have to include the justification in their accounts. There would also be the problem of emergency funds coming from central government assistance and hence dependent on general taxes and not local resources. There would also be a danger of projects being left unmaintained until they suffer severe damage for which emergency funds would be available.

6.8.4 Periodic maintenance

The main maintenance task for drainage channels (apart from routine maintenance) is periodic but 'routine' re-excavation, which requires that the khal is drained. This is required when drainage is sufficiently impeded to affect agriculture, or would do so in the next monsoon season.

Submersible embankments require substantial regular maintenance but this is only possible over part of the year. They provide a once a year flood protection service (keeping out floods up to Boro harvest completion) and repair is only possible and needed during the dry season.

Traditionally most of this periodic maintenance is carried out under FFW programmes. These repairs should remain under the responsibility of the system management, but the alternative of using Labour Contracting Societies (LCS) as developed by EIP should be tested, both for quality of work and distributional reasons. The initiative for the LCS system comes from the EIP rather than from BWDB. It depends on labourers being organised by an NGO. The labourers are paid the average wage implicit in contractors work (which tends to be below the approved schedule rates), with much of the payment as a weekly food advance instead of payment on completion. However, by ensuring that labourers receive better pay and by giving better supervision of work, EIP has found that standards of work improved. This approach would replace wheat with cash payments, which may be a problem depending on the availability of funds. The solution might be to borrow some of the organisational arrangements of LCS for FFW repair and this is being tried by SRP in Nawabganj during 1992. Just as critical are the needs for sufficient resources to be available for the repairs identified as necessary, and for proper prioritisation of work to avoid waste.

6.8.5 Structure maintenance

A number of types of task are involved. With farmer management of most structures, excluding very large ones, the simple tasks of keeping the gates clear would be the responsibility of the group. This might be done by voluntary labour or by hiring someone. Regular preventive maintenance such as painting gates, along with minor repairs to the structures could be undertaken by a structure maintenance group but there may not be enough work available to keep such a group occupied unless they are prepared to travel (and get paid for travelling). So far there is little experience of structure maintenance groups, and it is unclear whether water management groups would be able to fund this maintenance. System staff helping to supervise a brief input of voluntary labour from the user group would save costs.

6.8.6 Rehabilitation

Major works including new structures and embankment retirement would not be suited to a streamlined O&M organisation. Instead they should be the responsibility of the implementation division or agency. System management and beneficiary groups might monitor work to ensure adequate quality.

6.8.7 Monitoring

It is vital to improved maintenance to know what the state of system facilities is, so that critical risks and components can be identified and priorities set. O&M manuals typically set out detailed reporting and checking procedures, but in practice there is a lack of incentives

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The main maintenance task for drainage channels (apart from routine maintenance) is periodic but 'routine' re-excavation, which requires that the khal is drained. This is required when drainage is sufficiently impeded to affect agriculture, or would do so in the next monsoon season.

Submersible embankments require substantial regular maintenance but this is only possible over part of the year. They provide a once a year flood protection service (keeping out floods up to Boro harvest completion) and repair is only possible and needed during the dry season.

Traditionally most of this periodic maintenance is carried out under FFW programmes. These repairs should remain under the responsibility of the system management, but the alternative of using Labour Contracting Societies (LCS) as developed by EIP should be tested, both for quality of work and distributional reasons. The initiative for the LCS system comes from the EIP rather than from BWDB. It depends on labourers being organised by an NGO. The labourers are paid the average wage implicit in contractors work (which tends to be below the approved schedule rates), with much of the payment as a weekly food advance instead of payment on completion. However, by ensuring that labourers receive better pay and by giving better supervision of work, EIP has found that standards of work improved. This approach would replace wheat with cash payments, which may be a problem depending on the availability of funds. The solution might be to borrow some of the organisational arrangements of LCS for FFW repair and this is being tried by SRP in Nawabganj during 1992. Just as critical are the needs for sufficient resources to be available for the repairs identified as necessary, and for proper prioritisation of work to avoid waste.

6.8.5 Structure maintenance

A number of types of task are involved. With farmer management of most structures, excluding very large ones, the simple tasks of keeping the gates clear would be the responsibility of the group. This might be done by voluntary labour or by hiring someone. Regular preventive maintenance such as painting gates, along with minor repairs to the structures could be undertaken by a structure maintenance group but there may not be enough work available to keep such a group occupied unless they are prepared to travel (and get paid for travelling). So far there is little experience of structure maintenance groups, and it is unclear whether water management groups would be able to fund this maintenance. System staff helping to supervise a brief input of voluntary labour from the user group would save costs.

6.8.6 Rehabilitation

Major works including new structures and embankment retirement would not be suited to a streamlined O&M organisation. Instead they should be the responsibility of the implementation division or agency. System management and beneficiary groups might monitor work to ensure adequate quality.

6.8.7 Monitoring

It is vital to improved maintenance to know what the state of system facilities is, so that critical risks and components can be identified and priorities set. O&M manuals typically set out detailed reporting and checking procedures, but in practice there is a lack of incentives

to properly record the status of facilities since maintenance resources are not clearly linked with needs.

During 1991 the Operation and Maintenance Cost Cell of BWDB prepared detailed recommendations and data base structures for improved information and management systems (Section 4.8). These were designed to standardise monitoring and enable maintenance to be well planned and prioritised, and thus to achieve more efficient management. Detailed guidance on the improvements recommended by O&MCC can be found in their reports (O&MCC, 1991a, 1991b). O&MCC worked on centralised information/management systems, but the same principles would apply with greater system/regional control of budgets, since there would still need to be checking and monitoring in case major repair works were needed and for approval of any central funds.

The key components of a monitoring system are: an inventory of system facilities, an annual check on the state of repair, and an assessment of the risks of failure without repairs. O&MCC (1991b) produced formats for this procedure including data bases and proformas. These were complex and very comprehensive. It is important that the monitoring system adopted is achievable, can be followed by field staff such as SOs, does not generate excessive work, and can be easily compiled at the system or Divisional level. SRP expects to continue technical assistance for O&MCC in implementing a simplified monitoring programme in its sub-projects, which may lead to a general monitoring format which can be widely adopted.

6.9 RESOURCE MOBILISATION

6.9.1 Existing practice

Resource mobilisation depends on the type of project. In major FCD/I projects there are provisions for charging irrigation fees which would be paid into central government funds. However, Chapter 3 showed that in the one such case studied by FAP 13 (MDIP) this has not yet been implemented, while Section 4.7 shows a poor revenue collection performance in GK project. In normal BWDB FCD projects there is no provision for beneficiaries to contribute to running costs. However LGEB has introduced locally managed small water management schemes where farmers collect some resources for O&M.

6.9.2 Reasons for improvement

O&M resources are scarce, and are a constraint on effective O&M even if there are other serious problems associated with O&M. If beneficiaries contributed to the costs involved in continuing to provide the services they enjoy this would save government subsidies. When funding for O&M does not come from beneficiaries there is no incentive system or accountability - O&M staff can carry out their duties irrespective of project performance. In systems where beneficiaries contribute to O&M costs poor project performance leads to reduced incomes from service fees, and improved performance can lead to increased resource mobilisation.

6.9.3 Options

Section 5.2.4 detailed seven options found in other countries for mobilising resources for irrigation system O&M. These are potentially applicable in Bangladesh, as are some additional alternatives. The following options are considered for FCD projects. These projects

offer the greater challenge in resource mobilisation because the services they provide are not individually excludable (see Section 5.2.4).

a) Direct fees

These are more suited to irrigation, but a direct tax on an area basis could be tried in FCD projects. The most attractive way of implementing this might be a land development tax which reflected the productivity of land. People who gained from higher net returns because of FCD would pay more than they did before and this could contribute to public sector O&M costs. However, land taxes are not popular and this would require major changes in legislation and policies. There would be no link between the tax and FCD system performance.

b) Service fees

Chapter 5 showed that some countries have favoured service fees (Kyi, 1990) but in the context of irrigation systems. The advantage of this option is that the fee is paid directly to the agency managing the system for that service, resulting in, it is argued, greater efficiency and accountability. This is unlikely to be suited to small FCD projects, but in major FCDI projects in Bangladesh this may be the best strategy. In MDIP, for example, a service fee might be charged for irrigation and drainage services in the secondary system. However, this would require changes so that BWDB could collect fees for its own use, and separate systems of project by project audited accounts. In FCD projects service improvements may be difficult to verify and cannot be withheld from non payers so it is questionable if service fees will be workable.

c) Farmer managed and resourced systems

Small systems could be transferred entirely to farmer management. In large systems turnout/drainage groups could be responsible for managing final distribution and local drainage channels. This latter component appeared to work in CIP where the members of pump groups paid for the costs of clearing the irrigation channels from the pump point but did not contribute to main system costs and complained of problems in the re-excavation of khals and timeliness of water supply (Thompson, 1990). The evidence from smaller surface irrigation systems outside Bangladesh is encouraging, and LGEB has had some positive experience with FCD schemes in Bangladesh (Section 4.9). Success in mobilising resources rests on the group maintaining sufficient motivation, and finding the system gives worthwhile benefits, and on leaders not being allowed by the members to usurp fees. An attraction is that small schemes or sub-basins/compartments run by farmers can much more easily manage contributions in kind (for example a small share or fixed amount of the crop per ha, or so many person days of work per ha) which would involve prohibitive administration costs in a large system.

d) Use of Infrastructure for Resource Mobilisation

The most promising opportunities for resource mobilisation are associated with the use of FCD infrastructure. Use of infrastructure could be a pure revenue raising activity aimed at raising O&M funds, or be a means of requiring users to carry out maintenance work free. In the latter case resource use might be diverted towards disadvantaged groups. The possibilities of using access to infrastructure for housing as a means of obtaining maintenance contracts have been discussed in Section 6.4.2. The possibilities of leasing borrow pits on an auction basis for fisheries were also noted in that section. These, and other opportunities associated with multiple use of infrastructure, are discussed further in the next section.

6.10 INFRASTRUCTURE USE AND RESOURCE GENERATION

6.10.1 Use of embankments for trees and other crops

There is some debate over the desirability of trees on embankments. World Bank (1985) notes that under Section 58 of the East Bengal Embankment and Drainage Act, 1952, cultivation and forestry are not permitted on embankments. However, the same report noted that a clear policy on productive use of embankments and maintenance of access roads was needed, and that it might encourage properly planned forestry which did not damage the embankment's primary function.

Although trees are now planted along roads as a policy of the Roads and Highways Department a number of objections have been voiced to trees on embankments by BWDB. For example, in recent O&M manuals (PMU, 1990) the following problems were reported:

- trees and shrubs promote side slope erosion by concentrating rain runoff;
- trees and shrubs suck moisture from the embankment reducing the cohesive strength of soil;
- roots reduce embankment compaction and promote seepage. Dead roots may result in piping;
- trees blowing over in a storm can reduce the effective embankment width; and
- dense vegetation provides a habitat for rats and snakes which burrow into the embankment inducing seepage and piping.

In practice there has been a lack of detailed assessments to determine the reasons for embankment failures and a lack of justifications for and comparisons of maintenance costs for different levels of embankment vegetation. Many embankments in Bangladesh are well vegetated and have good growths of trees (BWDB does not usually control tree planting, and in some cases it may be unofficially encouraged), but there is a lack of hard evidence to confirm or refute their impact on embankment stability. Some old embankments have plenty of trees and have not failed (CIP), others had trees and have eroded (BRE), while some embankments with only grass for vegetation have failed (MDIP). Rats and crabs certainly burrow - routine maintenance would solve this problem - but the snake species usually found do not create their own burrows but make use of existing holes and predate on the rats which damage crops and embankments.

Since trees are likely to be planted informally, it would be better to have some control over this use of embankments, to target it towards deserving groups, and to ensure that those benefiting improve maintenance. Experiments and the expertise of forester/horticulturalists are required (see Chapter 7), but there are some obvious criteria for selection/use:

- there should be a relatively quick economic return (not long term timber species); and
- trees should not be very tall or inflexible, so that storms do not damage the embankment, and preferably should have root systems which help to bind the soil together.

Soil, climatic and embankment conditions vary between locations and projects so there will be no single prescription, but the preference might be for smaller fruit trees, species which can be coppiced for fodder and fuel, species which can be grown on short duration rotations for sale as fuel wood, grasses and ground cover crops. Potentially suitable tree species should be grown on an experimental basis with monitoring of the performance of the embankment and the input require to maintain it. Species which might be used include:

- coconuts in the coastal areas;
- Hijal (*Barringtonia* sp.) and Kross on submersible embankments in the haor areas (flood tolerant species which can be coppiced);
- Babla (*Acacia nilotica*) and other fast growing species such as Mader (*Erithrina indica*) and Bakful (*Sesbania grandiflora*) (a preferred fuelwood species). Grown on a four-year rotation, these would make a valuable contribution to fuelwood supplies, while the flowers can be used as a vegetable and the leaves can be used for poultry feed; and
- mulberry bushes for sericulture (which are already being grown on roadsides and a minor embankment which forms one of SSSFCDIP's pilot O&M focus projects).

Trees might be obtained from commercial sources, or from the Forestry Department. However, in a large project there would be a high demand, so the establishment of nurseries by local people familiar with propagating and tending trees and with a guaranteed market on project completion might be desirable. Such nurseries might even be subsidised during project construction.

Experiments would be needed with different tree species, densities of planting and micro-habitats. Where an embankment is wider than normal (for example serving a dual purpose as a road) trees might be planted along the edge of the crest. In other cases the side slope might be acceptable, and where there is a berm this might be ideal for trees. If there is unused land in the set-back distance (although usually it is cultivated) this might be leased for tree plantations which could help protect against erosion, although care would be needed not to site these where accretion might constrict the outside channel. Vegetation on the side slope could directly benefit maintenance by protecting against wave action which can be a problem on submersible embankments or on the countryside of the embankment where there is controlled flooding. Trees, bushes and ground cover vegetation are more productive and environmentally preferable to brick mattressing.

The potential costs and benefits of social forestry on embankments would need to be worked out in detail. Some indicative costs have been obtained in the Kurigram South project area (see FAP 12 PIE Report) and they indicate that the incremental costs of planting and maintaining trees would be small if Embankment Maintenance Groups (see Section 6.8.2) were already in place.

Trees and bushes would provide longer term yields for the life of the project, but shorter duration cultivation might also be beneficial, particularly ground cover plants which can hold the embankment together against rain and water action. There is already a policy of turfing embankments, and if this is taken up and maintained by user groups there would be a cost saving. Sand and soil binding grass species such as *Veteberia giganoides* could be planted (for example between rows of trees) to further reduce erosion but care will be needed to select suitable species which help to reduce soil erosion. User groups could be permitted

to cut and carry grasses as fodder, so avoiding damage to the embankment from cattle (grazing of small stock on embankments is already widespread). Alternatively ground cover crops which do not require land preparation could be tested.

The purpose of any form of social forestry in an FCD/I project is to make more productive use of underutilised land, to direct benefits to people who would otherwise not gain from the project, and to achieve routine maintenance without the need for perpetual subsidies or direct taxes on farmers to cover its costs. The social forestry component of system management would depend on a strong social programme for developing and supporting user groups, and a use pattern which is financially viable for the groups.

6.10.2 Fish Culture in Borrow-pits and Khals.

Khals and borrow-pits are often substantial areas of under-utilised water within FCD/I projects. Since FCD/I projects often have an adverse impact on capture fisheries, measures to expand fish production are an important component of any strategy for flood plain development which depends on embankments, both to compensate for the loss and to make maximum use of the project infrastructure. If fisheries development is targeted at traditional fishermen (by supporting their use of public water bodies for fish culture) this would also help to mitigate any adverse distributional impact of FCD/I projects. However, any form of flood control will inevitably reduce the open access flood plain fisheries to which people previously had access. Compensatory fish culture development may at least help fishermen, but it probably cannot help all the villages and casual fishermen in a project since it depends on a managed fishery in much the same way that FCD/I means water management.

Fish cultivation is possible in both irrigation and drainage channels, but in most FCD projects the likely locations are khals and borrow pits. There are two main options:

i. after stocking of the waterbody with fish, access to the fishery could be restricted by leasing out reaches of the channel to fishermen's groups. Thus in Pabna Irrigation Project the Bangladesh Rural Advancement Committee (BRAC) has been assisting in organising fishermen's groups. These take up leases on 1 km reaches of channels which have been stocked with fish, but there is no cultivation as such and the reaches are only defined by length - the fishery as a whole is common;

ii. artificial sectioning of channels or borrow-pits and practising intensive fish culture in these.

Issues mainly related to option (ii) are discussed below.

a) Borrow-pits

Borrow-pits are usually equivalent to ponds in that there is no normal flow of water. The exception is where they have been designed as part of the internal drainage system (for example in Chandpur Irrigation Project) in which case guidelines and comments related to khals should be followed. If they are too large to be managed intensively as a single unit, borrow-pits could be permanently divided up, for example by cross bunds, without affecting water flows.

The risk in a borrow-pit on the riverside of the embankment will be from flooding - so the group using the borrow-pit would need to build their own bund to protect against moderate floods. This can already be found in some areas (for example, Polder 17/2, Volume 2,

Chapter 15, and in progress in MDIP). However, the risks of flooding would need to be built into their business plans, while the further flood plain constriction created by borrow-pit bunds would have to be considered in the planning of the project.

Internal borrow pits might be less risky and could assist in drainage, but they take agricultural land which would have benefited from the project out of cultivation. The location of borrow pits and the potential intensity of their use for fish culture would depend on the relative average annual costs and benefits inside the embankment compared with outside, and compared with alternative land uses. Stocking practice need be no different from private ponds. In fact, if the borrow-pit has no function in project water management it could be sold off in the form of readymade ponds for fish culture. The disadvantage of this would be that richer households would be found to gain. Alternatively the borrow-pits could be leased to groups of fishermen (as suggested for khals). This should be more equitable but would require continuing inputs from system management, NGOs, and Government Departments in supporting the groups.

b) Khals

Drainage channels, usually natural khals, are the main project waterbodies inside a FCD project (although main irrigation canals are similar so far as fish are concerned). It is important that use for fisheries does not interfere with the khal's primary function of draining water, that system management will leave sufficient water in the khal for long enough for fish to grow to a marketable size, and that the fishery is at least sustainable (ideally it should contribute to O&M resources). Channels in which water is retained by a regulator during the dry season are ideal, but the risk of drainage problems resulting in the overtopping of the khal and loss of fish in the monsoon should be allowed for - it may only be possible to stock the khal from October to June (for example).

Nets would be needed to permit water to flow unobstructed, while retaining the fish. The ideal method would be rigid nets of plastic coated metal mesh so that they could be regularly changed for cleaning without causing disturbance to the fish or loss of fish. It would be necessary to stock the khals with fingerlings. An efficient management model might be for the project to purchase fry, contract a pond owner to raise these to fingerling stage, leave the pond owner with enough to stock his pond as payment, and release the fingerlings into the khals.

It is important that fishery management should complement water management. This might be achieved by: stocking with fish species which would eat the water weeds and so keep the khals clear (for example grass carp and tilapia *Tilapia rendalli* or *T. zillii*, but care should be taken to prevent their escape into paddy fields); by regular clearing of debris in the khal; and by periodic re-excavation of the khals - which the fishing groups would need to do to maintain the volume of water for fish culture. There would need to be agreement between farmers and fishermen to ensure that the latter did not drain out khals (to catch fish or re-excavate), and deprive farmers of water at critical times in the process. A formal agreement between the khal lessees and system management or sub-basin farmer group could define the rights and responsibilities of each (for example re-excavations, draining and khal water levels, access to fish, and restrictions on pesticides).

Fishery management might also need to be adjusted if a high intensity cultivation method is adopted, since there is likely to be a flow of water through the khals. In the downstream end of the khal water would tend to become contaminated with waste from the fish. If the khal is broken up into netted reaches the downstream areas (and the system as

a whole) should not be overstocked and the size of reach might be larger at the downstream end.

c) General Management Issues

The fishermen's groups would need support, in the form of technical advice, credit for initial working capital and investment costs, and support for group cohesion in defending their fish against theft by more powerful people. Ideally this might be achieved through a combination of Department of Fisheries extension staff and NGOs. Leases would primarily establish use rights for long enough for fishery development to be seen as viable - perhaps a minimum of five year renewable leases. If re-excavation is already a condition of use, and the fishery is targeted at traditional fishermen, then the leases would be a service charge to cover technical/NGO staff inputs rather than be aimed at maximising revenue.

The existing fisheries projects of this type include a khal at Shikhir Char in Meghna-Dhonagonda Irrigation Project which has been stocked with fingerlings in the last two years; fry and advice came free from the Department of Fisheries, and the project is targeted at the village as a whole rather than fishermen. The area for fish cultivation/stocking is being expanded with FFW resources, but so far local people have a limited role in managing and benefiting from the project. The Oxbow Lakes Fishery Project gives an indication of the potential performance of fishery development in khals; according to World Bank (1989) the maximum realistic fish yield is about 700 kg/ha from a semi-managed large waterbody.

On the whole, if improved khal maintenance is to be linked with use of water bodies for fish, the more intensive approaches (rather than just restocking undivided khals) are likely to be more effective since each reach would have its own group who could have their lease revoked for failing to keep the khal functioning. The system management level should provide a forum for ensuring that fishing groups keep their sections of khal clear in a coordinated way, and to mediate in any conflicts with farmers. The alternative of simply restocking khals to compensate for loss of wild fish would be simple to organise, but would only be sustainable if species of fish which can reproduce within a closed waterbody are stocked.

6.10.3 Other uses of project infrastructure and public land

Use of embankments for housing and roads has already been discussed in Sections 6.4.2 and 6.4.3. There would be several reasons for such use - such as construction cost sharing, minimising adverse drainage impacts and avoiding damage to embankments when people are forced by erosion and floods to move onto them. The institutional aspects of such changes are as important as the modifications to design, implementation and costs.

The system management would have to be authorised to enter into maintenance contracts with such users, formally specifying the target condition of the embankment and the responsibility of the user. For example, the Roads and Highways Department (RHD) might be responsible for all repairs including breaches, whereas people permitted to settle on the modified embankment would not be liable for repair work if there was a breach or cut by other people. These responsibilities would need to be enforced: with RHD the penalty might be financial - a transfer of funds needed by the system authority to effect speedy repairs if RHD did not do the work; with individual users and small user groups the penalty would be the termination of the lease. The system authority should be under pressure to ensure high maintenance standards from project inhabitants, who will otherwise be at risk from flooding.

Khas land within a project could also be leased out for use as a means of compensating disbenefited groups, mainly fishermen, or of spreading benefits more widely.

However, it is unlikely that there would be O&M implications, with the exception of managed beel fisheries. Other linked uses could include duck farming on the beels and waterbodies, and grazing when water levels are low.

6.11 O&M COSTS AND RESOURCE ESTIMATES

6.11.1 Existing situation

Section 2.4 showed that substantial resources are available and used in O&M, and that they come from several sources, largely the GOB revenue budget, FFW, and the Development Budget (foreign aid). There are rules of thumb for estimating O&M costs usually giving figures of between 1 and 2 per cent of capital costs (Section 2.4.6), but there appears to have been little or no empirical testing either of whether these are followed or of whether they result in appropriate quality of O&M. Section 3.3 showed that in 17 case studies of existing FCD/I projects annual O&M expenditure (mainly salaries/establishment and periodic/deferred maintenance) averaged over 3 per cent of construction costs (at constant prices). In a number of projects the figure exceeded 5 per cent. O&M was frequently unsatisfactory even at these levels of expenditure.

6.11.2 Reasons for improvement

Before implementation there need to be better estimates of O&M costs at the feasibility study level. The implications of a project for long term resource needs should be clear, particularly as a large number of FCD/I projects already exist and more are expected to be implemented under FAP.

The feasibility of a project is justified on the basis of detailed estimates of construction costs and of the expected benefits and disbenefits, but the implications for operation and maintenance should also be estimated in detail since these are the means of achieving the ultimate objectives from the initial investment. The lack of empirical data on actual O&M expenditures, and on incremental benefits and costs from increasing O&M expenditures, makes blanket percentages inappropriate. Innovations in improving O&M are expected to have varying cost implications. It will therefore be essential for O&M costs on new FCD projects, and especially on projects with innovatory components, to be calculated in detail, rather than derived as a percentage of capital costs. These detailed estimates will have to be subsequently monitored, so that better empirical information on actual O&M costs can be used in future planning.

An important component of the GOB revenue budget contribution to O&M (56 per cent) is staff - establishment costs. An overriding requirement for more efficient O&M is to specify the minimum tasks necessary for efficient water management and basic maintenance and hence identify staff needs. There is an urgent need in new projects to avoid employing on permanent terms staff who may be unnecessary during the operating phase.

6.11.3 O&M related cost types

O&M costs will depend on the detailed circumstances of the project and the type of resources created and to be managed. For a composite FAP compartment involving all the management options and compensating measures suggested, O&M related costs would include:

a) Implementation phase

- staff for public consultations and surveys (RRA or interview);
- water management and other infrastructure use group organisers. The optimal level of staffing in Bangladesh is not yet clear. Assume one field worker per 2-3 groups for a year;
- training in management skills for system manager(s);
- increased implementation costs for project facilities designed to mitigate adverse impacts and to ease O&M.

b) Transition phase

- continued inputs for group organisers, plus additional support for formation of routine maintenance teams, particularly if these teams are to establish productive use of embankments;
- costs involved in stocking fish or planting tees or other crops;
- any equipment costs to enable regular staff to function in the long term;
- normal staffing and routine O&M costs (see below);
- extensive monitoring to establish system performance and develop operating rules;
- preparation of detailed O&M guidelines;
- a contingency fund to cover modifications to the system to overcome any serious problems.

c) Operating phase

- minimum staff needed to manage the system, carry out routine maintenance and supervise/organise user operation/management (these staff may be from departments other than BWDB);
- travel and materials costs for routine O&M;
- contingency, possibly out of FFW, for emergencies and unusual repairs;

Drainage system maintenance appears to be a neglected area and involves routine and periodic maintenance. Estimates based on construction costs are not likely to be useful as FCD projects typically make use of existing rivers and khals, re-excavate a few existing channels and perhaps excavate a small length of new channels. Long term maintenance of new channels may be a function of construction costs, but for re-excavated channels it is likely to be the same sum repeated every few years. There is no guarantee that existing channels which were of adequate cross-section during implementation will not silt up and require re-excavation later.

6.11.4 Recommendations

Items under a) and b) could be legitimately costed as part of the project's investment costs - taking the project through to full commissioning. A critical change would be to employ on fixed term contract people who would only be involved in the first two stages (so that pump operators and khalashis engaged on construction sites do not remain with the project longer than necessary). Items under c) would presumably come out of the same sources as at present (revenue budget, and FFW). However, as discussed in Sections 6.9 and 6.10, there is considerable scope for local resource mobilisation and cost savings by linking O&M directly to use of the project - water management group's operation and routine maintenance and use of regulators, fishing group's management and excavation of khals for example. How effective this would be depends on there being incentives for improving O&M and public pressure for its achievement.

6.12 TRAINING

6.12.1 Existing situation

Section 2.5 reviewed existing training provisions in BWDB and identified the inadequacies and some of the needs. This is the subject of a much more detailed assessment by SRP. There is a lack of practical training of BWDB staff. Training for BWDB staff is generally inadequate at present, particularly when the bulk of staff must learn on-the-job without any training. Improved training is needed to manage BWDB's existing responsibilities effectively, hence the existing initiatives. The needs are likely to be greater as improved O&M initiatives and the FAP evolve.

6.12.2 Reasons for improvement

If new approaches to O&M are adopted in BWDB and under FAP then new skills will be needed and training and empowering education will also be needed to enable people to participate in system management. The rationale for a greater emphasis on training would be to ensure that staff are able to carry out their functions and keep up with new ideas and changes in practices, to develop a professional pride and to achieve individual advancement. To achieve this a mixture will be required of retraining and of new appointments to reflect changed emphasis and to replace skills which are less important.

6.12.3 Options

a) Who to train

There is an argument to be made for more and better training at every level involved in improving O&M from senior management to beneficiaries. It will be vital to evaluate training programmes so that resources are not wasted on ineffective or irrelevant training. Examples of training levels include:

- routine maintenance teams would receive practical demonstrations/training in how to repair rain-cuts, turfing, etc., and in identifying more serious problems;
- water management groups would have training in regulator operation and simple maintenance, where this responsibility is handed over to them;

- user groups with housing or tree crops on embankments or managing a fishery in the project would receive instruction in maintaining their stretch of infrastructure and a clear specification of the standard of maintenance which would have to be maintained as a condition of continued use;

- lower level staff such as khalashis of large structures and main pump house operators would likewise receive practical training in O&M;

- at the intermediary field level, SOs and equivalents in other departments such as Block Supervisors in Agriculture, are important since O&M on a daily basis is supervised by them. Moreover they and NGOs would be suited to training beneficiaries, provided they themselves receive training in how to do this. SRP is focusing initial training efforts on this group, as it strengthens government institutions which could then continue to provide the service in the long term;

- the officers, system management staff, and higher level staff in the separate O&M or water management agency or agencies should have skills covering the range of disciplines required for efficient management. This means a strong emphasis on investing in new skills for improved management, either through re-training or new appointments in a major re-organisation;

- training is also appropriate at more senior levels (BWDB Circles for example). It is understood that none of the senior staff of BWDB have an MBA or equivalent qualification. It is to their credit that the staff of BWDB have kept the organisation running for so long given the lack of appropriate training in the skills needed for managing such a huge organisation.

b) Who trains

Training may be provided in house, by other specialised institutions or by specialists recruited from outside.

There are already some specialised institutions both within BWDB's existing training system and outside it - for example World Bank (1985) identified a number of technical and vocational training establishments where skill training could be offered to staff engaged in maintenance work (typically commercial skills relevant to maintenance of structures, but also relevant to rural social services). These are suited to training for BWDB staff but not for beneficiaries if they take up basic maintenance responsibilities.

Trainers for user groups could be local departmental staff who would have local knowledge and be continually available to offer advice. This approach is used by LGEB (see Section 4.9). However these staff would need appropriate training. For some purposes it may be more efficient to use staff of NGOs, for example, to carry out this training.

c) Staffing aims

Within BWDB a better mix of specialists and wider training for generalist managers might be a target. Thus lower level staff might receive training in social organisation, agricultural extension, fisheries management, or forestry and tree cultivation, depending on the aspect of system management they would be working on, to complement their knowledge of maintenance. Alternatively personnel with experience in these fields could be recruited and receive some training in water management and in the practical needs of FCD/I maintenance.

For system management generalists with perhaps a background in engineering with business or economics might be the ideal people. Training for the intended managers during the implementation or transition phase in these other skills would be important. Awareness of these other disciplines is important, but would not replace staff with these technical skills. To obtain inputs from such staff BWDB could work with other departments in system management.

At higher levels a small number of advisors in such fields as management/business methods, law, accountancy, economics, social work, agriculture, fisheries, and forestry, could be recruited to trouble shoot management problems and to run short courses tailored to FCD/I staff.

6.12.4 Recommendations

In the first instance the training initiatives undertaken through SRP should indicate how improvements can be effected. It is recommended that the approach adopted should strengthen existing institutions and training capabilities (whether BWDB or other agencies) rather than add completely different cadres (such as a few fisheries specialists to BWDB projects) to the organisation. Ad hoc training, where the experience gained may easily be lost, should be avoided. There are likely to be economies of scale and mutual benefits if different BWDB projects, and FAP pilot projects, cooperate in developing training programmes with the relevant institutions rather than develop piece-meal and unrelated programmes.

If resources are put into training as part of the institutional development to improve management in a project there should be an assurance that these staff would continue in that project (or at the very least in FCD/I projects) for several years. This would be made easier by a clearer division of O&M from implementation, since it would create a career structure in system management in which different skills from those needed in implementation would be valued.

6.13 O&M IN NON-STRUCTURAL FLOOD MITIGATION

So far this report has been concerned with structural FCD/I projects. However, the Flood Action Plan is to include both structural and non-structural measures to mitigate flood losses. In Bangladesh only structural measures have so far been undertaken on any large scale, and as a result the past experience of O&M is restricted to such projects.

The details of O&M for non-structural flood mitigation measures will have to be worked out once detailed measures are proposed. However, some general statements can be made which may be of use when choices between alternative flood mitigation strategies are necessary.

Non-structural measures tend to have relatively more institution building and less physical investment costs, and associated with this the operating costs tend to be high compared with investment costs. This typically reflects a need to employ people, for example in public relations, providing flood risk information, on stand by to give warnings, and in vetting building proposals from both private and public sectors. Minimising the running costs would depend on building these activities into the normal practices of local government (Upazilas and Districts) and of FCD/I systems. However, it should be acknowledged that within these organisations there would be some staff implications (both resources and training), and that it will be a slow process to build up this capability. Additionally emergency response measures are infrequently taken, so to maintain the response capability resources have to be

allocated to training and to simulations where all the agencies involved take part in mock flood emergencies, and then analyse the problems they would encounter and improve their flood emergency planning.

Flood proofing measures, where these relate to increasing the resilience of infrastructure and the economy to flooding, should reduce maintenance requirements and this is one way of measuring their potential benefits. For example, roads and public buildings which are flood proofed should suffer reduced damages when they are flooded, and hence maintenance costs will be reduced.

7 FAP 13 PHASE II

7.1 INTRODUCTION

The FAP 12 Phase I team were required to propose a Work Plan for a second Phase of the study. This has been the subject of considerable discussion, and at the conclusion of Phase I agreed terms of reference for Phase II had not been finalised.

In the following section the Draft Terms of Reference, under discussion in February 1992, are presented.

7.2 DRAFT TERMS OF REFERENCE FAP 13 - PHASE II

1. BACKGROUND

1.1 The disastrous floods of 1987 and 1988 stimulated the Government of Bangladesh to carry out a comprehensive review of flood policy. A number of studies were undertaken and, in June 1989, the Government of Bangladesh requested the World Bank to coordinate the development and implementation of a five year Action Plan (1990 - 95) as the first of several stages in the Government's long term flood control programme.

1.2 The need for coordinated international action, in support of the Government of Bangladesh, to find solutions to the flood problem that are technically, financially, economically and environmentally sound was endorsed at the G-7 summit in Paris in July 1989.

1.3 The Action Plan supporting activities (Items 12 to 17 of the Action Plan) aim to review the agricultural, social and environmental experience with existing flood control and drainage (FCD) and flood control, drainage and irrigation (FCDI) projects in order to guide the design of new projects under the Action Plan. The Operation and Maintenance Study is one of these studies. The first phase of the study commenced in January 1991, and the Final Report was submitted at the end of February 1992.

2. REGION

The study would cover all the Regions identified for planning purposes in the Action Plan.

3. SCOPE OF WORK

3.1 The Phase I report of the FAP Operation and Maintenance Study has shown that:

- the lack of effective O&M is a major constraint on the ability of FCD/I projects to achieve their intended impacts;

- O&M constraints have technical and institutional (management, social, financial, legal) features, but the institutional constraints are the more critical. Many of these relate to the weakness of beneficiary participation in O&M;

- numerous initiatives are underway to address O&M issues, both within FAP and outside it;

- there are many other O&M options which have been proposed by FAP 13 and/or other agencies and which deserve further exploration and testing.

3.2 The original FAP 13 Terms of Reference proposed a second phase in which the team would carry out brief annual visits to Bangladesh to review progress in the O&M sphere and organise annual workshops to discuss O&M issues.

3.3 In the light of the FAP 13 findings this would appear to be an unsatisfactory proposal. The brief visits would be too short to allow meaningful additional contributions, and would underrate the critical importance of effective O&M to the success of FAP projects.

3.4 One of the important features of O&M of FCD/I projects is diversity, in the range of problems, in the number of solutions that are being proposed to these, and in the number of FAP and non-FAP agencies addressing these problems. It is unrealistic to expect each FAP planning team to independently tackle the range of issues, and to maintain independent liaison with the range of non-FAP agencies involved in O&M initiatives. It is therefore proposed that FAP 13, in its second phase establishes an O&M cell, attached to FAP and supporting FAP projects involved in planning, design and implementation of FCD/I projects.

3.5 It is considered important that the existence of FAP 13 should not allow any division of responsibility between project planning, design, construction and O&M. Project planners should consider O&M issues as an integral aspect of the project under consideration. It is not therefore proposed that FAP 13 would initiate its own O&M projects. It would however be closely associated with the design, monitoring and evaluation of pilot O&M initiatives incorporated into FCD/I projects under FAP auspices. It would also ensure that pilot O&M initiatives under FAP and non-FAP projects were complementary rather than have efforts duplicated, and would provide feedback to all the projects involved in improving O&M, and the water sector in general, on the merits and demerits of different alternatives to improving FCD/I O&M.

3.6 The initial focus of FAP 13 Phase II would be on FCD/I projects. However its scope will be extended to cover O&M aspects of other FAP activities which may include:

- River training;
- Main river embankments;
- Major drains;
- Flood proofing;
- Cyclone protection projects;
- Urban town protection measures.

4. TERMS OF REFERENCE

Objectives

4.1 The Phase II objectives of the Operation and Maintenance Study would be to:

- identify and formulate promising new O&M initiatives and collaborate with other FAP and non-FAP projects in testing these;
- monitor and evaluate innovative O&M initiatives being undertaken by other FAP and non-FAP projects;
- recommend more effective operation and maintenance (O&M) procedures and promote their adoption into new and existing FCD/I projects;
- ensure that all those involved in O&M of FCD/I projects are aware of the progress of new initiatives that relate to their own efforts.

Activities

4.2 The FAP 13 team would establish an O&M cell which would provide a focal point for FAP project activities related to O&M. Specifically the small team in this cell would undertake the following tasks and services.

a) Liaison

Maintain close contact with all non-FAP initiatives in O&M (the activities of the following projects and organisations, and any subsequent initiatives: SRP, DDP, SSSFCDI, EIP, GKRP, CDSP, O&M Cost Cell, LGEB, RMP, NGOs) in order to ensure that FAP teams are kept aware of the progress being made in different approaches and types of project. (In Annex A to these ToR brief details of each of these projects are presented).

The FAP 13 Phase II Team would work closely with the FAP Regional Study Teams and those planning FAP Projects (FAP 1 to 9 inclusive and FAP 20, 21/22, 23 and 24). The team would liaise with FAP 26, the Institutional Development Programme concerning aspects of O&M and any changes to the legal framework required to enable improved O&M. FAP 13 would utilise the results of FAP 12 and FAP 15, the Agricultural Review and the Study of Land Acquisition and Resettlement.

b) Development of O&M guidelines and new approaches

FAP 13 will develop operational guidelines for FAP Planning Teams on appropriate approaches to O&M and techniques to be applied in improving O&M. For different scales of project this would cover:

- O&M cost estimation;
- resource generation for O&M;
- O&M management;
- public participation in project planning, project implementation, and in O&M.

This would draw on experience to date and recommend alternative methods for trials where there are alternatives and there is relatively less experience of what works in Bangladesh FCD/I projects, for example in public participation and resource generation.

FAP 13 will also design and evaluate new multi-dimensional O&M options, incorporating technical, social, institutional, legal and financial aspects, and present these proposals for incorporation into appropriate FAP projects. These projects may include:

- pilot schemes;
- rehabilitation of and improvements to existing schemes;
- new projects.

This will be carried out in collaboration with both FAP and non-FAP projects, and in particular in close liaison with SRP.

Particular issues to be addressed include the linkages between alternative structural designs (for example of embankments, raised bunds to conserve/create beel fisheries) which could facilitate the generation of resources and improvements in maintenance, or which would have operating implications. Potential uses of embankments, including housing and productive vegetation, need to be assessed against the potential damage to the primary aim of flood protection - new designs may avoid increased structural risks and may replace the problem of prohibiting current informal uses with planned and regulated uses. The relative merits of institutional arrangements which aim to redistribute benefits and create benefits for disadvantaged groups, against systems where resources to cover O&M are maximised will need to be assessed. Again different approaches are likely to be appropriate for different types and scales of projects. Experience in resource mobilisation through the implementation of the revised Water Rate Act by SRP would also be monitored to assess implications for FCD projects.

An early priority for FAP 13 will be the development of operational guidelines for participatory planning, implementation and operation and maintenance and to develop and run training courses for professionals to understand and appreciate the importance of bottom-up and participatory approaches. This will probably involve developing participatory rural appraisal approaches, using multi-disciplinary teams and building on the RRA experience built up by FAP 12. These activities will be carried out in close collaboration with NGOs and BWDB FCD/I projects - particularly those currently being implemented under EIP, SRP and SSSFCDIP. International experience in developing participatory rural appraisal techniques would also be utilised.

In order to maximise the use of international experience more generally, the FAP 13 long term team would be supported by regular short visits by a high-level team of specialists in aspects of O&M (engineering, management, finance, participatory approaches). This team would visit the project about once every six months to:

- review the progress of FAP 13 Phase II;
- contribute to the design of new multi-dimensional O&M options;
- advise on useful lessons to be learnt from broader international experience;
- evaluate and advise on the future FAP 13 Phase II Work Programme.

c) Review and advisory role

FAP 13 would provide a general service to FAP and its executing agencies by reviewing in detail reports and proposals from FAP teams from the O&M viewpoint to ensure that they are correctly costed, that the procedures proposed for O&M are appropriate to project scale, to ensure that opportunities for beneficiary participation in planning and O&M are being exploited and to review engineering designs in the light of their O&M implications. Advice would be given on ways of generating sustainable resources for O&M. Opportunities for incorporating new approaches to O&M would be identified in these projects, so that FAP projects would include 'pilot' initiatives in O&M.

The FAP 13 team would be available to discuss O&M approaches and initiatives with all those involved in planning and implementing FAP proposals. The FAP 13 team would take an active part in developing and testing new O&M approaches and the use of public participation in FAP projects .

d) Feedback and coordination

FAP 13 will monitor and evaluate the progress of O&M pilot initiatives, carrying out regular field investigations in selected projects where experimental O&M systems are being introduced. FAP 13 will ensure that the lessons learnt are dispersed to both FAP and non-FAP organisations concerned with O&M. This will result in gradual refinement of the operational guidelines and selection of approaches and arrangements for more effective and efficient O&M.

The FAP 13 team will organise an annual workshop at which O&M issues and new initiatives in O&M are explored in detail by all those involved in developing effective FCD/I O&M procedures in Bangladesh. The workshops would be a means of exchanging lessons between different projects, and from the monitoring and evaluation programmes of FAP 13 and of non-FAP projects involved in improving O&M of FCD/I projects.

Outputs

4.3 The above activities would result in:

- planned and coordinated O&M provisions within FAP projects;
- a cumulative learning process of how to achieve the diverse components of better O&M;
- detailed, and regularly updated, guidelines on key aspects of O&M, such as public participation, resource generation, use of project infrastructure, and system management; and
- dissemination of field findings to and between FAP and non-FAP projects.

5. REPORTS

5.1 Within three months of commencement the team would produce an Inception Report which would include a detailed Work Plan for the first year and details of the projects with which FAP 13 would initially be working. The team would produce Annual Reports on FAP

13 progress, occasional special studies on specific aspects of O&M, and a Final Report on O&M of FCD/I projects - the Draft of this being submitted four months before the completion of the four year assignment.

6. DURATION AND SCHEDULE

6.1 The assignment would be continuous over the four years from April 1992. There would be a mid-term review after two years to reconsider the work programme and inputs for years 3 and 4.

7. STAFFING AND OTHER INPUTS

7.1 The FAP 13 team would require:

Expatriate Specialists

- A Rural Institutions Specialist/Sociologist/Team Leader for 4 years
- An Economist/O&M Institutions Specialist for 8 months in Year 1 and 6 months a year thereafter. The Specialist would have detailed experience of FCD/I O&M in Bangladesh.
- An FCD/I O&M engineer for 4 years - experience in O&M of FCD/I projects is essential - preferably with experience in Bangladesh

- Short term inputs by a Project Director, a Management Specialist, a Financial Analyst, and by specialists to be identified in key fields (possibly fisheries, horticulture and agro-forestry on embankments, resettlement) (Total 24 months over 4 years)

- Short inputs by a high level advisory team comprising Senior experienced specialists in O&M Engineering, Management, Finance and Social Anthropology. (18 months over 4 years).

Local Specialists

- A senior O&M engineer for 4 years
- A junior O&M engineer for 4 years
- A senior social scientist/institutions specialist for 4 years (with experience of NGOs in Bangladesh
- A junior social anthropologist for 4 years
- A junior Women in Development specialist for 4 years
- Short term senior Consultants in Management, Financial Analysis, Law, Fisheries, Agro-Forestry, Institutions (48 months over 4 years)

Vehicles (4)

Office (1500 sq ft) and Support Staff

Equipment - minor requirements only for office and training equipment, as most requirements could be met by transfer of equipment and materials from FAP 12

Resources for the organisation and management of the training activities to be undertaken.

FAP 13 Operation and Maintenance Study

Staffing inputs for Phase II (person months)

ORIGINAL TERMS OF REFERENCE	Years (April to March)						
Position	1990/91	1991/92	1992/93	1993/94	1994/95	1995/96	Total
Expatriates							
- Rural Institutions Specialist	1	2	1	1	1	1	7
- Engineer	1	2	1	1	1	1	7
Local Senior							
- Rural Institutions	3	5	1	1	1	1	12
- Engineer	3	5	1	1	1	1	12
Local Junior							
- Rural Institutions	6	10	2	2	2	2	24
- Engineer	6	10	2	2	2	2	24
Total	20	34	8	8	8	8	86

As PROPOSED ON 25TH JANUARY 1992

Position	1990/91	1991/92	1992/93	1993/94	1994/95	1995/96	Total
Expatriates							
- Rural Institutions Specialist	1	2	10	10	10	10	43
- Economist/O&M Specialist			8	6	6	6	26
- Engineer (O&M)	1	2	10	10	10	10	43
- Short Term Specialists			6	6	6	6	24
- High Level Specialists			6	4	4	4	18
Local Senior							
- Engineer (O&M)	3	5	12	12	12	12	56
- Rural Institutions/Social Scientist	3	5	12	12	12	12	56
- Short Term Specialists			12	12	12	12	48
Local Junior							
- Rural Institutions/Social Anthropology	6	10	12	12	12	12	64
- Engineer	6	10	12	12	12	12	64
- Women in Development			12	12	12	12	48
Total	20	34	112	108	108	108	490

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Annex A

Main Projects with which FAP 13 Phase II would liaise over improved O&M

The following Non-FAP projects are the most important in the water and earthwork sectors with which FAP 13 would collaborate/liaise. Obviously FAP 13 would also work closely with a number of other FAP Projects and other specialised projects in fisheries and forestry and NGOs would also need to be consulted.

Abbrev	Name	Donor	Impl	Timing
CDSP	Char Development and Settlement Project	Netherlands	BWDB	1992-
	Continuation of Land Reclamation Project concentrating on reclamation and settlement of chars. Experience of integrated development and working with NGOs.			
DDP	Delta Development Project	Netherlands	BWDB	Ongoing
	Long term development of polders in Khulna area, organising sustainable irrigator groups and routine embankment maintenance by teams of poor women.			
EIP	Early Implementation Project	Netherlands and Sweden	BWDB	Ongoing
	Implementation of small-medium size FCD Projects, experience in earthwork construction using labour contracting societies, planned improvements to O&M through routine maintenance programme.			
GKRP	Ganges-Kobadak Rehabilitation	Asian Development Bank	BWDB	1990-92
	Rehabilitation of major FCDI project, strengthening farmer participation through water user associations in gravity distribution system.			
LGEB	Local Government Engineering Bureau	Swedish Tech Assistance	MLGRDC	Ongoing
	Provides engineering support to Upazilas. Specific programmes of relevance are small water management projects where there is a programme for beneficiary participation, also infrastructure maintenance programmes (such as earth roads) where routine maintenance is carried out by teams of women.			
O&MCC	O&M Cost Cell	previously Canada	BWDB	1990-91
	Developing monitoring system for prioritisation of repair works, data bases of project infrastructure, unified costing systems, may be continued with support under SRP.			
RMP	Road Maintenance Programme	CARE	Local Govt	Ongoing
	Routine maintenance of earth roads by poor women in much of Bangladesh, also experience of CARE in earthworks and in management of tubewells by the landless.			
SRP	System Rehabilitation Project	Netherlands, EC, World Bank	BWDB	1991-97
	Developing improved O&M of major FCDI projects, on farm irrigation development, and FCD management; rehabilitation of major FCDI and other FCD projects, design of O&M for large number of rehabilitated FCD projects; cost recovery and training/institutional strengthening for O&M.			
SSSFCDIP	Second Small Scale Flood Control Drainage and Irrigation Project	Canada and World Bank	BWDB	Ongoing
	Construction of structures in small FCD/I Projects, also component for local participation in project planning and management through local committees and pilot work on intensive organisation of O&M groups.			

ANNEX A

ACTION PLAN FOR FLOOD CONTROL

TERMS OF REFERENCE FOR OPERATION AND MAINTENANCE STUDY

1. BACKGROUND

1.1. The disastrous floods of 1987 and 1988 stimulated the Government of Bangladesh to carry out a comprehensive review of flood policy. A number of studies were undertaken and, in June 1989, the Government of Bangladesh requested the World Bank to coordinate the development and implementation of a five year Action Plan (1990-95) as the first of several stages in the Government's long term flood control program.

1.2. The need for coordinated international action, in support of the Government of Bangladesh to find solutions to the flood problem that are technically, financially, economically and environmentally sound was endorsed at the G-7 Summit in Paris in July, 1989.

1.3. The Action Plan supporting activities (Items 12 to 17 of the Action Plan) aim to review the agricultural, social and environmental experience with existing flood control and drainage (FCD) and flood control, drainage and irrigation (FCDI) projects in order to guide the design of new projects under The Action Plan. The Operation and Maintenance Study is once of these studies. It would involve an assessment of the present situation and an annual review of on going operation and maintenance projects and an effective operation and maintenance system would be developed for introducing into the projects under the Action Plan.

2. REGION

The study would cover all the regions identified for planning purposes in the Action Plan.

3. SCOPE OF WORK

3.1. Over the years, considerable experience has been gained in the planning, implementation and operation of FCD and FCDI projects. Such projects account for about half the investments in the water sector. Despite large investments, FCD/I projects are often not operated effectively and the full benefits of flood control, drainage and irrigation are not achieved.

3.2. The ultimate success of an FCD/I project depends on having an operation and maintenance system which is effective throughout the life of the project. This is imperative if the full benefits of projects are to be realised. It is likely to become even more important in the future since the projects envisaged under the Action Plan (embankments with regulators along the major rivers and controlled flooding through

a scries of compartments) will require higher levels of management than existing FCD/I projects.

3.3 A number of reasons have been identified for the weaknesses in the operation and maintenance of existing FCD/I projects. These include the following :

- inadequate budget allocations: allocations from the revenue budget in recent years have fallen short of requirements resulting in deferred maintenance, deterioration in project infrastructure and difficulties in effective operation. At the same time, cost recovery from beneficiaries has been limited.

- insufficient participation by beneficiaries: beneficiaries are insufficiently involved in the planning, operation and maintenance of projects.

- inadequate attention to O & M : inadequate attention to operation and maintenance in project planning and design, and potential conflicts between different interest groups (e.g., lowland and highland farmers), which in many cases have reduced project effectiveness, are not taken into account.

- ineffective organizational set up : organizational and procedural arrangement for O & M need strengthening. Present procedures for O & M are often ineffective due to lack of trained staff and because local councils (especially upazilas) are insufficiently involved in the process.

3.4 The O & M problem is a major concern of Government and donor organizations, and a number of projects (e.g., the BWDB Systems Rehabilitation Project) are experimenting with different institutional approaches to O & M. These include ways of involving:

- beneficiaries in project planning, design and operation (e.g., through the establishment of beneficiary committees to operate sluices and regulators);

- the rural poor in project implementation (e.g., using Labour Contracting Societies for earthwork) and maintenance (e.g., groups of poor women being given the right to cultivate embankment sides in exchange for carrying out routine maintenance);

3.5 There are also efforts underway to improve the training of BWDB staff in operation and maintenance; to improve procedures for O & M in BWDB projects; to devise new approaches to the assessment and collection of water levies; and to gradually transfer the responsibility for the O & M of small-scale flood protection, drainage and irrigation schemes to local councils (Upazilas) and farmer groups.

3.6 The Operation and Maintenance Study would review the experience gained so far in the operation and maintenance of FCD/I projects and would result in formulation of guidelines for the effective operation and maintenance of projects under the Action Plan.

3.7 The objectives of the Operation and Maintenance Study would be to :

- identify the main constraints of the effective operation and maintenance of FCD/I projects;

- draw up guidelines for ways in which these constraints can be overcome in existing projects and in projects under the Action Plan;

- recommend ways of ensuring the maximum possible participation of beneficiaries in, and mobilization of local resources for the operation and maintenance of projects.

4. TERMS OF REFERENCE

The Consultant shall carry out the study as indicated below:

4.1 Year 1(1990-90)

(a) Review the experience gained in the operation and maintenance of FCD/I projects in Bangladesh based on case studies, field investigations in other selected projects (including those where experimental O & M Systems have been introduced) and published reports. The Consultant would take up some field investigations as members of the teams undertaking the Rapid Project Evaluations (Action Plan Item No.12) and would evaluate the O&M systems of these projects. Through the field investigations (involving discussions with farmers, labourers, fishermen, elected representatives, NGOs, BWDB officials, and other engineering investigations), case studies and the review of other available studies, the Consultant will:

review the present and possible future technical requirements for operating and maintaining FCD/I projects;

review present O&M practices, regulations, procedures and institutional arrangements used in different types of FCD/I projects and assess their overall effectiveness;

identify the main reasons for deficiencies in the O&M of Projects (e.g. poor planning and design, poor construction, conflicts between different social groups inside and outside the project area, lack of beneficiary involvement, poor condition and ineffectiveness of project infrastructure) and assess the potential for overcoming these problems;

assess the extent to which the beneficiaries, the rural poor, and upazilas and other elected bodies are involved in the planning, implementation, operation and maintenance of projects;

- recommend ways to increase local resource mobilization and collection of taxes to meet the costs of operation and maintenance;

- recommend a division of responsibilities between the operating authority (BWDB at present), LGEB, upazilas and beneficiaries in O&M and recommend ways of strengthening such programs;

- recommend guidelines for cost estimating of O&M works;

- review the new and experimental approaches to the operation and maintenance of projects to identify constraints to their effective implementation and to recommend possible other approaches that could be tried in tackling O&M problems.

b) Undertake a brief review of the operation and maintenance procedures used in FCD/I projects in other countries in the region. The review would be based on secondary sources and would focus on the management systems that could be relevant to the Bangladesh situation.

c) Produce a report detailing the O&M problem; recommend guidelines to be used in the design of operation and maintenance systems for projects under Action Plan and more generally; make proposals for ensuring that recommendations are implemented by institutions involved in O&M;

d) Organize a national workshop on O&M at which the report would be discussed.

e) make proposals for scope of work and activities to be undertaken in years 2-5.

4.2. Years 2 to 5

Subject to the findings of a program review at the end of year 1, the Consultant will:

(a) undertake an annual review of progress in the operation and maintenance of FCD/I projects, including experimental projects such as those under the BWDB Systems Rehabilitation Project, the Early Implementation Projects and Action Plan activities such as the Compartmentalisation Pilot Project (Item No.20). The review would involve extensive fieldwork and discussions with beneficiaries, BWDB and Upazila officials, and others in project areas, and with specialists in Dhaka and elsewhere.

(b) Organise an annual workshop at which progress in O&M would be reviewed. These workshops would focus on one or more specific themes (e.g., beneficiary participation; ways of involving the rural poor in project maintenance; project planning and design for effective project operation). The Implementation Committee, Panel of Experts, professionals taking part in other projects under Action Plan and other projects of government, and local specialists (e.g., from NGOs) would be invited to participate in the workshops.

(c) Produce an annual report summarising the results of the review and the discussions in the workshop and recommendation for future O&M activities.

(d) Prepare a detailed work plan for the following year.

(e) Other activities (e.g. special research projects) as may be considered necessary in consultation with the FPCO, Government of Bangladesh and Donor(s).

4.3 Relationship to Other Studies

Throughout the study, the Consultant would work in close consultation with the FPCO and with the teams undertaking other Action Plan activities (especially, Item No.12: FCD/I Agricultural Study, and Item No.20: Compartmentalization Pilot Project), and with BWDB.

The O&M study will be undertaken in parallel with the FCD/I Review (Action Plan Item No.12). Both studies will be financed by the same donors (United Kingdom and Japan) and the expatriate consultancy inputs to the O&M study will be provided by the Irrigation and Drainage Engineer and Sociologist/Rural Institutions Specialist from the FCD/I Study.

5. REPORTS

The following reports would be produced:

Year 1 :

Inception Report (Month 2)

Draft Report reviewing Bangladesh and regional experience in the operation and maintenance of FCD/I projects (Month 7), followed by the Final Report (Month 8).

Year 2 - 5

Annual Report summarizing the results of the annual review mission on progress in the O&M of FCD/I projects and of any special studies or activities carried out.

6. STUDY DURATION AND SCHEDULE

The study would take place intermittently over five years (1990-95). In Year 1, project activities would take place over an 8-month period. In Years 2 to 5, the Annual Review would last one month. Other activities (e.g. special studies) might also be undertaken in years 2 to 5. The schedule of activities is shown in Figure 1.

7. STAFFING AND OTHER STUDY INPUTS

Staffing

The study would be undertaken by the following Teams:

A. Foreign consultant

- A Rural Institutions Specialist with experience in water resource development projects in Bangladesh and overseas (Team leader)

- A Water Resources Engineer (Irrigation and Drainage Engineer) with experience in the operation and maintenance of water resource development projects in Bangladesh and overseas. The Government of Japan has agreed as the appointment of a UK expert as the Team leader.

The services of the two foreign consultants in year 1 will be provided from the FCD/I Apt (Action plan Item No.12) and will not be charged to the O & M project.

B. Local Consultant

- A Senior Water Resources Engineer with extensive experience in the operation and maintenance of the FCD/I projects in Bangladesh.

- A Senior Rural Institutions Specialist with field policy level experience in governmental and non-governmental rural development projects in Bangladesh.

- Junior Specialists in the same disciplines would assist the Senior foreign and local consultants.

C. Support Staff :

Surveyors (2), Draftsman (1), Secretary/Word Processor (1) Drivers (2).

Indicative estimates of total consultancy inputs required are as follows :

		Year					
		1	2	3	4	5	Total
		person month					
	Expatriates						
-	Rural Institutions	0*	1	1	1	1	4
-	Engineer	0*	1	1	1	1	4
	Total	0	2	2	2	2	8
	Local-Senior						
-	Rural Institutions	8	1	1	1	1	12
-	Engineer	8	1	1	1	1	12
	Total	16	2	2	2	2	24
	Local-Junior						
-	Rural Institutions	16	2	2	2	2	24
-	Engineer	16	2	2	2	2	24
	Total	32	4	4	4	4	48
	Grand Total	48	8	8	8	8	80

* Services of these Consultants (6 months and 3 months respectively) provided without charge from the FCD/I Review (Action Plan Item No. 12)

Other Inputs

The following other inputs would be required :

Vehicles	1 X 4WD, 1 X Car for 8 vehicle-month each in year 1: and for 1 vehicle month each in years 2 to 5.
Office	1000 sq.ft. including necessary equipment (computer, printer, photocopier) and utilities.

Other funds for special activities in years 2 to 5 (yet to be determined).

It is envisaged that all the Bangladeshi staff and other facilities (including transport) would be provided under a contract with a local organization.

ANNEX B METHODOLOGY

B1. METHODOLOGY ADOPTED

FAP 13's findings are based on two study methods:

- reviews of existing literature, reports and experience on O&M practice and innovative initiatives in Bangladesh and other countries in the region; and
- case studies of actual O&M practice and problems using Rapid Rural Appraisal (RRA) methods at completed FCD/I projects.

The first method requires no further explanation, except to note that extensive discussions were held with projects and agencies involved in new approaches to O&M in Bangladesh and short field visits were made to some of the sub-project areas.

The experience of the case study assessments of O&M is elaborated in more detail here. The selection of the 17 case study projects has been outlined in Section 1.3.1, and is discussed in detail in the FAP 12 Methodology Report. The five PIE projects were purposively selected to represent major FCD/I project types, the RRA projects were selected at random from lists of projects categorised by type, age, and location. The general RRA methodology and checklists for other disciplines are also covered in detail in the FAP 12 Methodology Report.

For the combined engineering and O&M assessments, and social-institutional assessments of O&M a checklist was prepared (Section B3). This covered: cost details (implementation, establishment, and other O&M costs); identification of O&M related problems encountered in the project; the annual performance of the project in terms of damages, breaches and cuts; the physical status of the infrastructure; and questions concerning the institutional arrangements for O&M (to be asked of BWDB officials and local people).

To collect this information field visits to all major structures were made (including all the embankments, except where these were eroded or under water), discussions were held with BWDB officials, and group discussions were held with local people at most water control structures. In the five projects where Project Impact Evaluations were carried out return visits to collect more information were made.

B2. ASSESSMENT OF METHODOLOGY

The checklist reproduced in Section B3 proved to be too detailed for some of the information required. The main limitation is the availability of data in the BWDB field offices. Record keeping is not geared to systematic assessment of project performance and O&M condition. Hence the data collected depended on those documents held by SDEs and XENs and hence on the duration of their service in the project being studied.

Construction cost details are normally held in Project Completion Reports or recast Project Proformas, and hence a form for this is unnecessary. Only current establishment details are normally available. Historic information is unlikely to be of use, and may not have changed over the project life. However, more comprehensive details of the numbers of staff

of staffing for normal O&M. It is normally possible to collect details of FFW resectioning carried out in recent years (in terms of length of embankment and quantity of wheat). Where funds under the various flood damage repair programmes have been used records of the cost and work done are normally available, but other O&M costs are likely to be unrecorded or non-existent.

No records are available of the annual performance of projects - in terms of flood peak, drainage performance, erosion, breaches or cuts. Only from notes of the work done in repairing cuts and breaches can any data on these problems be collected. Hence in the case studies details of these problems could only be collected for recent years. This is a serious gap in O&M record keeping.

Direct observation of embankments and water control structures was sufficient to assess the maintenance condition (but not the adequacy of design for operating needs), and in Volume 2 tabulated details of water control structures' condition are given for the PIE projects. However, drainage channel conditions could not be assessed during the monsoon, due to access difficulties, time limitations, and the amount of water in the channels.

While the questions concerning operating practice and institutional aspects are appropriate for officials (of BWDB and Upazilas), for beneficiaries a less structured approach evolved. Where khalashis were present they were questioned concerning their normal operating practice and any conflicts encountered, any problems with the regulator, the maintenance history of the structure, and any supervision and training which they might have received. An attempt was made to meet members of any committees set up to advise or operate regulators to discuss the same issues. Additionally group discussions with local farmers at different points in the project area (as part of the general RRA) helped to identify drainage problems and conflicts over operation - although the technical implications of the problems reported could not be verified during the fieldwork.

FAP 13 would recommend the same type of data collection approach to others investigating O & M, but simplifying the checklist and forms in Section B3 as indicated above, developing a short checklist concerning operating issues and conflicts, and making additional visits in the post-monsoon season to assess drainage channel condition. Ultimately post-evaluation of O&M is limited by the lack of documentation from previous years. A very simple reporting format for an annual O&M report on a project basis would overcome this problem and enable BWDB to better monitor the performance of its projects.

B3. ENGINEERING AND O&M CHECKLIST

1: PROJECT SUMMARY

From BWDB Division

1. Name of the Project : _____

2. Location :

   a) District _____

   b) Upazilla _____

   c) Water Board Circle _____

   d) FAP Region _____

3. Type of Scheme : _____

4. Gross Area: _____

5. Net Benefitted Area: _____

   (Attach Index map showing all the important infrastructures of the project)

6. Aims of project

7. Feasibility study : date of starting _____

   : date of completion _____

8. Project proforma : date of 1st proforma _____

   : date of revised proforma _____

9. Detail design : date of starting _____

   : date of completion _____

10. Subsequent modifications/additions to project:

    dates of re-assessment _____

11. Agencies involved :BWDB/BADC/FFWP/EIP/CIDA/CARE etc._____

    _____

    _____

2 IMPLEMENTATION AND COSTS

1. Construction period : Date of starting _____

: Date of completion _____

2. CONSTRUCTION

YEAR	COST ITEM* AND QUANTITY	LOCAL COST TK	FOREIGN COST US$

* Separate earthworks, land aquisition, structures, salaries etc.

2. ESTABLISHMENT COSTS SINCE OPERATION COMMENCED

YEAR	ENGINEERS NOS/FRACTIONS	RATE	TOTAL TK	OTHERS NOS	RATE	TOTAL TK

3. OTHER O&M COSTS

YEAR	REPAIR QUANTITY/ITEM	TK	MAINTENANCE QUANTITY/ITEM	TK	REHABILITATION QUANTITY/ITEM	TK

3 PROJECT PREFORMANCE

1. Problem Identification (Pre/Post Project Conditions :

	Pre-Project	Post Project
Drainage congestion by siltation of drainage channels		
Damage of land a) sand deposition		
b) erosion		
Early flood		
High flood in nearby rivers		
Highest flood level		
Flash flood		
Slow fall in flood water		
Wave action		
Rapid drainage		
Drainage impeded by existing structure/embankment		
Breach in embankments a) Normal(for weak section)		
b) Public cut		
c) Over topping		
Failure of structure		
Damage of structures		
Inadequate O + M		
Salinity		
Drought		

2. DESIGN CRITERIA

Flood elevation _____

Flood frequency _____

Drainage capacity _____

Drainage event _____

3. LOCATIONS OF GAUGE STATIONS

River _____

Project water level _____

Rainfall gauges _____

Frequency of transmission of data to Officer responsible for Operating project

_____

4. AREA ELEVATION CURVE

5. ANY IMPACTS ON AREAS OUTSIDE PROJECT

5. ANNUAL PERFORMANCE OF PROJECT SINCE OPERATION/BENEFITS COMMENCED

YEAR	FLOOD PEAK DATE	LEVEL	%AREA FLOODED	DRAINAGE PERFORMANCE G/AV/P	AREA	DAMAGE TO STRUCTURES NO	CAUSE	BREACHES NO	LENGTH	REASONS	AREA AFFECTED

4 FIELD ASSESSMENT OF PROJECT FACILITIES

1. EMBANKMENT

a) Total Length _____ km

Top width, Design _____ m

Side slope design C/S 1 : _____

R/S 1 : _____

Date of Survey _____

b) O&M organisation:

Local Committee Headed by? Maintenance Operation/patrols/guard

Other Agencies

BWDB

None

c) Over all Project Conditions

Condition	Good	Need Minor Repair	Need Major Repair
Embankment Top	km	km	km
Side Slope C/S	km	km	km
Turfing	km	km	km

Soil of Embankment : Clay/Silt/Sand

d) Condition in details. (indicate reasons)

Reach	Embankment top Level	Topwidth	Side Slopes		Turfing	Misc. (Berm)	State of repair	Other uses (Cultivation, housing etc.)
			C/S	R/S				

2. STRUCTURES

Regulators/Sluices (No)	
Other structures (No)	
Date of Survey	

a) Over all project condition

Condition	Good	Needs Repair
Civil Construction		
Gate		
Aprons: U/S		
D/S		
Wing walls:		
U/S		
D/S		

b) Details of state of major Sluice/Regulators and other structures

Sluice/ Reg./ Others	Location	Vent No.	Water Level		Civil works	Gate	Apron.		Wing Walls		Operating Agency	In use/Out of action/ unintended
			C/S	R/S			U/S	D/S	U/S	D/S		

3. DRAINAGE CHANNELS

a)

	Design		Actual (est.)	
Total length		km		km
Bed width		m		m
Side slope	1 :		1:	

b) Overall Project Conditions

Condition	Good		Need improvement	
Channel/ canal bed		km		km
Side slope		km		km
Others		km		km

c) Conditions in details (indicate reasons)

Reach	Bed	Side slope	Misc.

4. IRRIGATION CANALS

a)

	Design		Actual (est.)	
Length		km		km
Bed width		m		m
Date of Survey				

b) Over all Project Conditions

Condition	Good		Need improvement	
Channel/ canal bed		km		km
Side slope		km		km
Others		km		km

c) Conditions in details (indicate reasons)

Reach	Bed	Side slope	Misc.

5 O&M ORGANISATION

BWDB Officials/Upazillas/Beneficiaries as appropriate

1. Are there any standard procedures spelled out for O&M in the approved project document or O&M Manual?

   If yes, are they been fully followed?

   If not, why not?

2. Who controls the present O&M system?

3. Do you think that the present system of controlling O&M is effective?

   Yes No

   If not, what are the reasons behind this?, how might it be more effective?

   a).....

   b).....

   c).....

4. What are the source of fund for O&M?

   a)

   b)

   c)

5. Are there any O&M committees?

   Yes No

If yes, who are the members of the committee?
how did they become members?

a)

b)

c)

d)

6. If O&M committee exists, how active is it?

7. What are the requirements for routine operation and management?

Are they all available on time?

Who is specially responsible for operation and maintenance?

8. What is the extent of cooperation from the local administration especially at District and Upazila level in terms of providing fund, supervision, etc.

9. What is the actual extent of participation from the beneficiaries local people in operation and maintenance?

10. What coordination and other problems exist regarding the O&M of this FCD/I project?
(as experienced by the administration/beneficiaries)

11. What are the major benefits of the project?

12. What are the obstacles in the operation and maintenance of it?

a).....

b).....

c).....

13. What services or changes are needed to achieve greater benefits out of the project?

14. Do you think, increased local participation in the operation, management and maintenance of the project will increase its effectiveness?

Yes No

How might it? (examples)

i) through cooperative society

ii) through any other organisation

iii) any other (specify).....

15. Which one of the following management system do you prefer for O&M?

a) Complete control by upazila

b) Shared management by Upazila and beneficiaries

c) Full responsibility by the beneficiaries but with support by upazila

d) BWDB only

e) BWDB + Upazila

f) BWDB + beneficiaries

16. Any other comments about O&M :

ANNEX C JAPAN

C1. COUNTRY DESCRIPTION

C1.1 Scale of River Basins

Japan consists of a series of four major islands with an area of 378,000 km^2 and population of 123 million people.

Forested mountain ranges with an altitude of 2000-3000 m run through the centres of the islands of Japan. A number of river basins, different in size and shape, extend from the mountain ranges toward the surrounding seas. This contrasts strongly with the geography of Bangladesh which is a major river delta.

Alluvial plains formed by river deposits have also developed in Japan along the coastlines and are the major sites for farming and manufacturing industries.

C1.2 Type of Flood Problem

Amounts of rainfall differ considerably from place to place. The average annual rainfall is 1600 mm. The rainfall is concentrated during the pre-summer rainy season (July), the typhoon season (September) and the snow-melt season (March).

There is a wide range of variation in river discharge due to short river courses and steep river slopes. These characteristics of topography and meteorology constrain water use conditions, and also cause recurrent floods and droughts in the river basins.

A typical flood in Japan follows the following process. Unforeseeable heavy local rainfall hits a river basin with steep topography, a sudden rise of river stage overtops the crest of the river embankment causing a breach, and finally floods wash away fields and houses in densely populated urban area. Therefore, flood damage is intense and confined within a certain area, and not extensive and widespread as seen in Bangladesh.

Japan is known as a country of natural disasters. In addition to floods, tidal waves caused by earthquakes and high tides due to low pressure frequently threaten the coastal zones. A combined occurrence of river floods and the extraordinary rise in sea level can bring about a catastrophic calamity in the low lying areas located in river mouths.

C1.3 Type of Project Considered

Flood control (FC) and drainage and irrigation (DI) are distinguished in Japan. The Ministry of Construction (MOC) and Ministry of Agriculture, Forestry and Fisheries (MAFF) are the responsible authorities respectively.

Major civil engineering structures relevant to FC are dams, retarding basins and river embankments. Flood forecasting systems have also been introduced for improvement of operational procedures of the above structures. Associations for flood fighting activities have been organised for a long time by local people living in the flood prone areas.

Meanwhile, major engineering structures pertinent to DI are dams, diversion weirs, irrigation canals, land consolidation and drainage canals. Pumping plants and regulators

(sluice gates) are also sometimes incorporated in the irrigation/drainage systems where necessary.

Coastal embankment projects have been implemented to protect the country from calamity brought about by sea flooding in certain sections of the coastline. The Ministry of Transport (MOT) participates in these projects, in addition to the above two Ministries, because MOT is responsible for sea navigation and port facilities.

C1.4 Complexity of Systems

Development projects in Japan corresponding to FCDI tend to be large in scale, complex in system, and advanced in level. This comes from social requirements in terms of an effective use of water resources and safety measures. A deployment of maintenance specialists to each key structure is a compulsory requirement under relevant regulations.

Improved criteria for safety measures have been enforced according to the accumulated social capital in the basins.

In brief, current water sector issues in Japan involve establishment of an overall management system covering safety, resources and environment under an integrated engineering and institutional arrangement. It is noteworthy that these aims are identical to Bangladesh O&M implications currently being discussed.

C1.5 Agriculture

Land use in Japan is summarized in Table C1.

Table C.1 Land Use in Japan

Land Type	million ha	Per cent
Total National Land	37.0	100%
farm land	6.1	16%
(paddy field	2.9	8%)
pasture land	0.9	3%
forest land	25.4	69%
residential land etc.	4.6	12%

Japanese agriculture in the context of land use can be characterised as follows:

- most of the national land (69 per cent) consists of forest land;
- half the farm land is used as paddy fields with irrigation/drainage systems;
- paddy cultivation is the most certain and advantageous choice for farmers all over the country under the current agricultural policy of the Government; and

the previous cropping pattern was paddy-wheat/barley but now paddy-fallow is commonly practised.

Japanese agriculture could be characterised as being excessively dependent on paddy cultivation and the associated rice price support policy. It is currently facing difficulties in this connection and because of the high rate of economic growth in Japan.

Economic development has resulted in increasing wages and escalation of farm land prices, while consumption of agricultural products and their market prices are stagnating. In addition to such declining profitability found in the farm economy, there are increasing overseas demands to further open the domestic market in agricultural products.

Agricultural support has been justified on non-economic grounds to maintain national food security, to maintain the rural community and to maintain traditional landscapes and environment.

C2. ADMINISTRATION/INSTITUTIONS

C2.1 Government

The framework of the state regime in Japan is as follows:

- constitutional monarchy under symbolic Emperor system;
- respective independence of the three powers (administration, legislation and judiciary);
- parliamentary democracy under universal suffrage;
- nomination of the prime minister (cabinet premiership) by the legislature; and
- presidency of the prime minister over the administration.

There are three hierarchies in Japanese administration. These are a central government, 47 local governments named prefectures, and local autonomous bodies.

The prefectural governor is elected and local autonomy has been propagated for a long time. However, most decision powers are concentrated in each ministry in the central government. In this sense Japan is a centralised country.

C2.2 Development Policy

The Agency of Economic Planning is the responsible authority for formulating Economic Plans in Japan. Ten Economic Plans have been established since the war. Government's roles are defined in the Plans as follows:

- clearly indicate perspectives on desirable and possible status of economic society;
- set up basic direction of economic operation for medium and short terms by clarifying policies to be addressed; and

- indicate guidelines for economic activities of households and enterprises.

The new Economic Five Year Plan staring from 1992 is now under contemplation by the Government. The parts of the plan relevant to FCDI O&M system can be summarised as follows:

- to work out the desirable status for maintenance of overall social infrastructures by sector;
- to establish the renewal or improvement plan for realization of the above; and
- to estimate investment costs with alternatives to achieve the above goals.

C2.3 Responsibility for Water Management

The Ministry of Construction (MOC) and the Ministry of Agriculture, Forestry and Fisheries (MAFF) are the authorities responsible for the overall water sector and for water management in Japan.

MOC was set up by branching out from the Ministry of the Interior after the war. MOC is accountable for maintaining social order and public welfare by protecting human life and property from natural calamities. FC projects in Japan have been exclusively controlled under MOC's initiative.

The River Bureau under MOC is the agency responsible for river management. The Bureau undertakes its duty at its own cost under the legal basis of the "River Law" (enacted in 1964).

MAFF is the authority answerable for stable supply of foodstuffs to the people and for improvement of farmers' livelihood through materialisation of agricultural policies. In this context, DI projects in Japan have been managed under MAFF's instruction and supervision.

The Agricultural Structure Improvement Bureau (ASIB) under MAFF is the agency responsible for DI projects (called land improvement projects) in Japan.

The land improvement projects comprise:

- Irrigation and Drainage Projects;
- Farmland Consolidation Projects;
- Farmland Development Projects;
- Integrated Rural Development Projects;
- Farm Road Improvement Projects,; and
- O&M of Irrigation and Drainage Facilities Projects.

The "Land Improvement Law" (enacted in 1952) provides a legislative basis for the land improvement projects and its major characteristics can be summarized as follows:

- projects shall be arranged for farmers who are actually cultivating and not for absentee land owners;
- projects shall be initiated upon the request of beneficiary farmers themselves;

project costs shall be primarily borne by the beneficiary farmers. The Government can subsidise a part of project costs when it is deemed to accord with public benefit;

"Land Improvement District" (sometimes called Association) shall be organised by application of more than 15 beneficiaries and shall be accountable for overall project implementation, including collection of project dues;

projects shall be implemented with the consensus of two thirds of the beneficiaries in the District; and

projects shall be profitable enough for beneficiaries to pay the project dues and shall be proved to conform with Governments' agricultural policy and guidelines.

C2.4 Role of local/national Government

There are three types of project operating body in the land improvement projects in Japan. These are state-operated, prefecture-operated and group-operated projects, relevant to different sizes and social implications of the projects.

The Water Resources Corporation can implement particular large scale projects entrusted to it by the Ministries. This is due to a separation of powers as the Government concentrates on the water policy formation and leaves implementation to the Corporation. The Corporation is similar in many ways to BWDB in Bangladesh.

The responsibilities for water management in Japan are outlined in Table C2.

Table C2 Establishment of Water Management in Japan

Project Scale	Planning	Construction	O&M
Very large	Group/State	Corporation	Corporation
Large	Group/State	State	Group
Medium	Group/Pref.	Prefecture	Group
Small	Group	Group	Group

The above project stratification is based on project size which implies the larger the size, the more public; and the smaller in size, the more private responsibility.

A salient feature found in the establishment of water management in Japan rests on the participation of the local body or group during the stages of planning and O&M. It is natural that the group nevertheless entrusts construction to the operating body.

Hence the main water management issues in Japan are as follows:

- the operating bodies differ by locations from upstream to downstream (in case of irrigation projects);

- the responsible bodies also differ by timing from planning stage to O&M stage;
- consistent water management is a hard task under such recurrent takeover procedures;
- negative aspects of local participation have emerged in respect to water resources management and environmental conservation; and
- a system (both engineering and institutional) which enables integrated basin water management is expected to be formulated.

C2.5 Liaison With Other Agencies

Horizontal liaison between governmental agencies is difficult because the administrative channels in Japan are in most cases divided in vertical directions only. Shortcomings of this lack of inter-agency coordination are that sometimes agencies delay decisions or duplicate services.

However, on the other hand, several ways exist to coordinate government operations such as cost allocation procedures in multi-purpose projects. The Agency of Economic Planning is responsible for coordinating inter-ministry negotiations for smooth implementation of multi-purpose projects.

C3. O&M

C3.1 Organisation of Water Sector for O&M

As previously stated, the Land Improvement Association (LIA) is the accountable body for O&M in Japan under instruction and supervision of MAFF.

An LIA can be set up with the consensus of more than 15 eligible members. The members of LIA are under an obligation to pay membership dues, while they can share in various privileges.

LIA revenue depends on the members dues, and expenditure can be classified into project dues, O&M costs and overhead costs of the LIA. However, it is difficult for LIA's to realise their cost burden out of general public or social activities particularly in the case of drainage projects. The fact that LIA projects are accompanied by external benefits, or internal disbenefits results in controversy and conflict, and calls for overall review of the current institutional system.

C3.2 Resource sources

Subsidy systems are commonly used to support the projects. Subsidy rates differ from project to project in response to location, size, nature of works, public involvement and social implications. Table C3 indicates the shares of project cost by project type and operating body.

Despite this subsidy system, the project cost share borne by the beneficiaries is too heavy for most of the farmers. Some privileges are given to the farmers to alleviate their burden.

Table C3 Share of Project Cost between Government and Beneficiaries

Project Type	Operating Body	Areal Criteria for Approval	Share of Project Cost (%)		
			State	Pref.	Beneficiary
Irrigation and Drainage	State Prefecture Group	B.A.>3000 ha B.A.> 500 ha B.A.> 20 ha	60 50 45	20 25 -	20 25 55
Farmland Development	State Prefecture Group	D.A.> 400 ha D.A.> 40 ha D.A.> 10 ha	75 65 55	12.5 17.5 -	12.5 17.5 45.0

Notes: B.A. ... Benefited Area. D.A. ... Development Area

Source : "Land Improvement Projects in Japan". The Japanese Institute of Irrigation and Drainage

C3.3 Beneficiary Participation in Operation

Beneficiary participation in operation in Japan has been realised through LIA. Decisions for operation are made at LIA board meetings. The actual works are done based on the Operation Manual by the LIA staff or on a contract basis.

C3.4 Beneficiary Participation in Maintenance

Beneficiary participation in maintenance follows the same procedures as in operation. Since O&M activities are undertaken within the framework of LIA management, it is required to keep accounting books in conformity with forms and terms specified by the supervisory authorities.

C3.5 Monitoring

Periodic monitoring of project facilities and hydro-meterological data is a prerequisite for proper O&M. Detailed monitoring procedures are specified in O&M manuals according to the significance of the structures and sites.

Collection of monitoring data is necessary not only for O&M purposes but also for renewal of structures or future rehabilitation projects.

Facilities inventory and O&M manuals form fundamentals for O&M activities. However, maintenance of the facilities inventory is not satisfactory, resulting in bottlenecks for proper O&M in Japan as in most countries.

C3.6 Training

Training of relevant staff in O&M has been periodically programmed. Exchanges of views and experiences are an important part of training. Innovatory comments for O&M can be proposed to relevant authorities through training and feedback mechanisms.

C.4 LESSONS

1. Projects are initiated at the request of local people. Inevitably there is, therefore, a local interest in seeing that they work once implemented.

2. Construction is subsidised but farmers contribute. Cost realisation is a problem.

3. Management of smaller projects is by beneficiaries, under a prescribed system.

4. Beneficiary management of complex systems is difficult and requires technical assistance.

5. The above points refer to irrigation and agricultural development. Flood control mainly concerns urban areas and is publicly funded.

6. Projects are handed over between different bodies which results in differences in water management.

7. Local control can be to the detrimental of other wider objectives (environmental and basin-wide integrated management).

REFERENCES

The Japanese Institute of Irrigation and Drainage (no date). **Land Improvement Project in Japan**.

ANNEX D THAILAND

D1 COUNTRY DESCRIPTION

D1.1 Scale of River Basins

The Kingdom of Thailand is located in the middle part of the Indochina Peninsula facing the Gulf of Thailand in the south. Thailand is bounded to the west by Myanmar, to the north by Laos, to the east by Kampuchea and to the south by Malaysia. The population has reached 54 million people and the land area comes to 513,000 km^2 with a length of 1640 km north-south and 770 km east-west.

It is common practice in Thailand to divide the nation into the following six regions based on geographical features:

- **North East Region:** Plateau, covered with sparse forest, less rainfall, salinity affected area;
- **North Central Region:** High land covered with forest;
- **South Central Region:** Fertile alluvial plain formed by the Chao Phraya river and the Mae Klong river;
- **East Region:** Coastal plain along the Gulf;
- **West Region:** High land densely covered with forest, plentiful rainfall; and
- **South Region:** Northern half of the Malay Peninsular.

There are two seasons in Thailand, a rainy season (May-October) and a dry season (November-April). Annual rainfall amounts to 1450 mm concentrated in the rainy season. The seasonality of rainfall affects water stages of the rivers. The amount of water that flows through the rivers in Thailand is nearly 130,000 million cubic metres (25 per cent of the annual rainfall).

The rainfall on the north central mountain ranges is drained by the Ping, Wang, Yom and Nan rivers. These rivers join together and form the great Chao Phraya river. In the central plain at Ayuthaya, the Chao Phraya river is joined by the Pasak river and it finally empties into the Gulf of Thailand passing through the Bangkok metropolitan area.

In the north-east plateau, the undulating land forms several small watersheds that drain into the Chi and the Mun rivers finally flowing into the Mekong river. On the western side, the rivers that drain into the Gulf are the Mae Klong and Petchburi rivers. The Mae Klong river rises in two tributaries, Quae Yai and Quae Noi. The combined stream then flows towards the Gulf. Traversing down south, the mountain ranges extending from the north as a backbone of the peninsula form continuous watersheds from which rivers flow eastward and westward towards the Gulf of Thailand.

D1.2 Type of Flood Problems

The flat topography and heavy wet season rainfall (1200-1500mm) cause annual flooding over large parts of the South Central Region (the Central Plain). These annual floods

are mostly of an inundation type, gentle in flow and shallow in depth, providing preferable water conditions for paddy cultivation but not for other crops.

Severe local floods frequently brought about serious damage over the country in recent years. The low-lying Bangkok metropolitan area suffered from urban floods in 1980 and 1983. A flash flood accompanied by severe land slides attacked the South Region in 1988.

D1.3 Type of Projects Considered

It is possible to distinguish four sequential groups of water sector development projects in Thailand:

i) A series of drainage/irrigation canal development projects implemented in the Central Plain during 1900 - 1950s.

ii) A number of large scale dam projects constructed during 1950s to 1980s such as: Chainat Dam (1957), Bhumipol Dam (1964), Vajiralongkorn Dam (1970), Sirikit Dam (1972), Srinagarind Dam (1980), Khao Laem Dam (1984) and Narusuan Dam (1985).

iii) On-farm development projects or small scale development projects including Ditch and Dike Project (1949), Projects under Land Consolidation Act (1973) and Small Scale Irrigation Project (1977).

iv) A sequence of planning and O&M related studies (non-structural projects) represented by the Chao Phraya Basin Study (1976-1982) and the Water Management Study (1987-1989).

Hence, the type of projects considered comprise canal, dam, on-farm facilities and O&M (through which the objectives of the former three groups of projects are expected to be realised as originally intended).

D1.4 Complexity of Systems

Because rainfall in Thailand is generally scarce (1250 mm per annum except in the west and south), a great deal of effort has been concentrated on maximising the utility of water resources.

Repetitive use of the water resources in a basin is being developed. Repetitive use involves shifting water for use through the system from upstream areas to downstream areas by combining local rainfall, return flow (groundwater replenished through percolation from paddy fields located upstream) and water released from dams.

This type of water operation can significantly increase the effective use of water by converting the local flood into irrigation water within a reasonable investment. However, it is subject to several severe constraints. The compartmentalisation project under FAP 20 would use a similar concept. However it will be applied where the seasonal differences and volumes of flow are much greater.

D1.5 Agriculture

The agriculture sector inclusive of forestry and fishery has kept the leading position in gross domestic product (GDP) for a long time, but the contribution of this sector dropped to

16 per cent of GDP in 1987, because of rapid expansion in the manufacturing and commercial sectors.

The phenomena does not imply a decrease in growth of the agricultural sector, but is due to stagnation in development of the rural economy, which absorbs about 70 per cent of the national population.

While agricultural sector products occupied about 60 per cent of total export earnings in 1987 and have supported the Thai economy by gaining foreign exchange, the share of agriculture has been decreasing in recent years. Paddy cultivation accounts for 54 per cent of agricultural sector production.

D1.6 Agriculture Benefit of Systems

The land use pattern in Thailand is shown in Table D1. Figures for the Central Plain, which is similar in physical conditions to Bangladesh, are included.

Table D1 Land Use in Thailand as of 1986 (million ha)

Land Type	Thailand	Central Plain
Total Area	51.3 (100%)	10.4 (100%)
Farm land	20.8 (40%)	4.7 (45%)
Paddy	11.9	2.4
Upland	5.1	1.5
Others	3.8	0.8
Forest land	14.7 (29%)	2.5 (24%)
Others	15.8 (31%)	3.2 (31%)

Source: Nukool Thongtawee (1987).

Agriculture in the central plain has been developed under the following sequences or phases:

- areal expansion of farm land;
- irrigation development;
- extension of dry season paddy; and
- crop diversification.

These phases have been closely connected with the four groups of projects listed in D1.3.

The reasons why the farmers, as in Bangladesh, are so eager to cultivate dry season paddy are as follows:

- guarantee of stable cultivation environment, provided irrigation water is available;

- use of off-season labour force and under utilised farm implements;
- more yield than rainy season paddy (4 tons/ha compared with 2 tons/ha); and
- similar farming practices to familiar rainy season ones.

However, the government is now promoting a shift toward crop diversification, because it expects more profit (added value) out of the same water consumption from other crops than from dry season paddy cultivation. Along this line, vegetable cultivation, orchards and shrimp culture have been extensively introduced in the Central Region where the Bangkok metropolitan area is located and urbanisation is rapidly progressing.

D2 ADMINISTRATION/INSTITUTIONS

D2.1 Government

Due to a long history of independence, the administrative organization is well established and highly centralized. The central government is composed of a prime minister's office and 13 ministries under which there are about 80 departments. The local administrative system comprises, from top down, Changwat, Amphoe, Tambon and Muban. In the whole of Thailand there were 73 Changwats as of 1986. These local organisations are under direct supervision of the central government. The previously mentioned regions are the conventional demarcation of the territory but differ from agency to agency.

D2.2 Development Policy

The overall framework of economic planning in Thailand, inclusive of the development policy, is given by the National Economic and Social Development Plan. The Plan started in 1961 and the Sixth National Economic and Social Development Plan (1986-1991) is currently effective.

The basic policy of the Sixth Plan in the water sector and agriculture is identical to that of the Fifth Plan but is characterized as an adjustment one to solve accumulated problems from the former five Plans.

The guiding principle of the water resources development policy in the Fifth and Sixth Plans is to emphasise maximising the utilisation of both medium and large-scale projects, for which the government has invested substantially in developing the associated infrastructure. This will ensure that these projects are able to yield full economic benefits as well as assist in the planning of long-term water projects. For the small-scale projects, the stress on meeting basic water requirements and the stress on improving operation and maintenance by the water users should be continued.

Some guidelines have been drawn up in line with the above mentioned policies:

- increasing the efficiency of water utilisation by water resources development projects;
- establishment of water user organisations in order to maximise the utilisation of resources;
- issuing of regulations regarding water rights; and

formulation of water resources development policy by regions.

D2.3 Responsibility for Water Management

Administration of water management has been conducted by many government agencies in the respective fields. However, the largest agencies are the Royal Irrigation Department (RID) belonging to the Ministry of Agriculture and Cooperatives and the Electricity Generating Authority of Thailand (EGAT). Other than these two major agencies, many ministries and departments take part in water management and water resources development according to their respective duties and purposes.

The major concerned agencies are Agricultural Land Reform Office (ALRO), Office of Accelerated Rural Development (ARD) and National Energy Administration (NEA).

RID is the sole and largest agency specializing in integrated fields of irrigation and drainage and other related activities. It is accountable for:

- water resources development primarily for agriculture, but also for industry, domestic water, hydroelectric power, and navigation;
- flood protection and flood area improvement;
- master planning for water resources development in Thailand;
- geographic, hydrographic, soils, geologic, and economic surveys for preparing feasibility reports;
- planning and design of irrigation projects;
- construction of diversion dams, storage dams, and water distribution systems; and
- operation and maintenance of irrigation and drainage systems.

The organisation chart for the Irrigation Department is shown in Figure D1.

D2.4 Accountability in Water Management

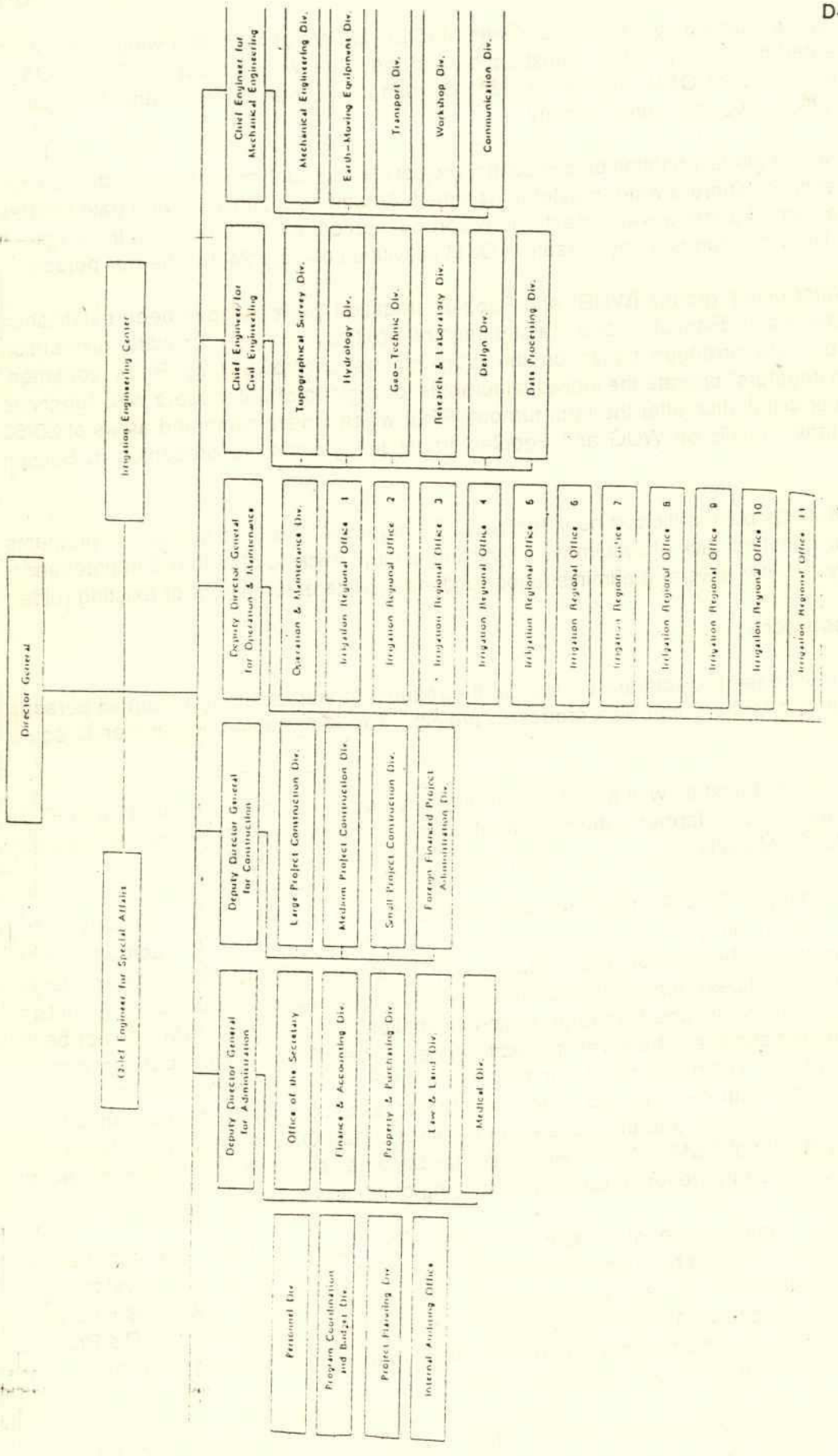
There is a lack of local or regional accountability in the running of RID which is responsible to a line ministry. However, small projects have developed local involvement through water user groups.

D3. O&M

D3.1 Organisation of Water Sector for O&M

Water use facilities are operated and maintained by the concerned agencies and beneficiaries. Hydro-power facilities are solely managed by EGAT while irrigation facilities are managed by RID.

Figure D1 Organisation chart of RID, Thailand



RID represented by the Director General (DG) consists of two major wings. One wing is represented by Deputy DG for construction and the other wing by Deputy DG for O&M. Under Deputy DG for O&M there is an O&M Division in RID headquarters and 12 regional irrigation offices over the entire territory.

These regional irrigation offices control project offices. Each project area is divided into several sections, where a water master is assigned. A number of zonemen and gate tenders are also assigned under a water master to report on crop conditions and to control irrigation facilities. The zoneman is a key person in O&M activities covering 24-160 ha per person.

Water users' groups (WUG) and Peoples' Irrigation Systems have been established for equitable water distribution and maintenance of facilities. Requests for water distribution in the areas are arranged based on the crop information provided by RID's zonemen. "Common irrigators" operate the individual turnouts for a group of water users who supervise actual water distribution after the farm turnout (FTO) which covers command areas of 20-50 ha. Further details on WUG and Peoples' Irrigation Systems are presented in Section D3.3.

O&M has been criticised as inadequate (Thongtawee, 1987), a number of problems have been identified: lack of systematic inspection, a large backlog of deferred maintenance, complexity in water laws and administration, and inadequate enforcement of existing rules.

D3.2 Resources

In most case projects are initiated at the request of statesmen or influential persons in the area, but farmers can also request a project. The King himself recommends some projects.

The project cost as well as O&M cost, are fully borne by the Government up to FTO, as a rule without any farmers' dues. About 25 per cent of the RID budget is regularly allocated for O&M costs.

According to ESCAP (1989) the average O&M costs in 1984, were 232 baht/ha for operation, 176 baht/ha for maintenance, and 224 baht/ha for rehabilitation, this compares with capital costs of 2810 baht/ha for small irrigation projects and 12,790-242,290 baht/ha for large projects (in 1984 prices) hence O&M costs may be a substantial proportion of construction costs, although these figures hide large regional variations. Funding of O&M has not been directly from beneficiaries, however indirectly irrigation beneficiaries contribute to central government taxes. The rice export tax indirectly taxes the benefits from projects, since most of the incremental output is exported. The proportion of tax to farmgate price has varied from 22 per cent to 6 per cent, and this covered three times actual O&M costs in the late 1970's but only 40 per cent of O&M in 1984. Hence the tax base has declined and there is no direct relationship between the revenue raised and funding of improved O&M.

Regular maintenance of irrigation, drainage and relevant water use facilities is programmed and practised by each responsible project O&M office from on-farm level to main system level (in the same hierarchy as operation). The common irrigator maintains FTO and on-farm facilities in coordination and cooperation with water users. Above this RID's Project manager, water master and zoneman are responsible for programming and performing regular maintenance of facilities in their responsible areas.

At main and lateral system levels, regular maintenance is steadily performed using RID's own annual budget even though the budget allocation may not be as sufficient as the

field office wants. On the other hand, accomplishments at FTO and on-farm level differ much from one area to another, since they depend on water availability, quality of farmers' unity and ability of RID's field staff. Generally speaking, in land consolidation areas irrigation systems are better maintained than in other areas.

D3.3 Group Formation

In connection with water use organisation at the farmers level, Water Users Groups (WUG) exist in the large scale projects and Peoples' Irrigation Systems in the upper basin. The main objectives are equal distribution of water as well as proper maintenance of irrigation facilities. While the People's Irrigation Systems have been well managed as organisations contributing to rural society and have a historical tradition, WUGs are generally not well organised and operated, and some of them have already been dissolved.

One WUG covers about 1,000 rai (160 ha) and 20 to 30 farm households. A group of this kind is organised in the areas in which the irrigation system is well consolidated as in the Chao Phraya Delta. However, the group's are not so active, due to negative collaboration among members and lack of understanding on efficient use of irrigation water. Formation of WUGs was decelerated in 1973 in order to concentrate RID efforts on improving the performance of existing WUGs.

An organisation chart indicating the set up of RID main irrigation system is given in Figure D2, a shows a lack of a formal role for WUGs.

In the Chiang Mai valley, there exist traditional water use organisations (Peoples Irrigation Systems) with nearly 700 years' history, which are organised for every weir or diversion structure. At present there are about 2,000 of these organisations, with command areas ranging from 3,000 to 5,000 rai (480 ha to 800 ha). Benefiting farmers contribute 7 to 20 kg of paddy per rai when they achieve good yields in the irrigation command area to the local chief for the project. Member farmers themselves are obliged by the traditions of rural society to maintain turn-outs and canals and rules for water allocation and structure repairs have been historically established. In comparison with the WUG mentioned above, the People's Irrigation Systems are being quite successfully operated and managed.

An organisation chart showing the RID Peoples' Irrigation System relationship is shown in Figure D3. In this case RID has superimposed some of its structure within an existing institution, the advantages of which have been preserved.

D3.4 Training Provided

At present, RID organises several O&M related training programs and workshops for RID O&M staff and also for members of water use organisations. However, since Thai agriculture is currently facing a turning point, more intensified training programs are required to disseminate new technologies for improved O&M.

For the main systems it has been proposed that a cadre of trainers be developed and that these give field training to existing staff, enabling them to collect data to monitor their systems and then to improve operation based on this information. At the tertiary level the need for greater participation by WUGs is recognised, it is hoped that they can bear some of the costs through a loan and repayment system, and a "think tank" of social scientists and engineers was proposed to determine ways of strengthening farmer water organisations (Thongtawee, 1987).

D4 LESSONS

Although little information on flood control management could be gathered, some lessons can be drawn from Thailand's experience in O&M of irrigation systems.

1. A high proportion of national water sector resources go to O&M.

2. The emphasis is on making the existing system work more efficiently.

3. Achievements in local participation in new systems have been low and there is a lack of local involvement and accountability in the management of these large systems.

4. Irrigation systems in smaller catchments have evolved over a long period and traditional institutions play an important role in achieving local involvement and resource mobilisation.

5. Resource mobilisation has not been directed to local O&M. Although projects do create an expanded tax base, reliance on indirect taxes fails to provide any link between benefits and improving O&M of the systems.

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Figure D2 Organisation Chart for RID Main Irrigation Systems, Thailand (note the lack of local representation)

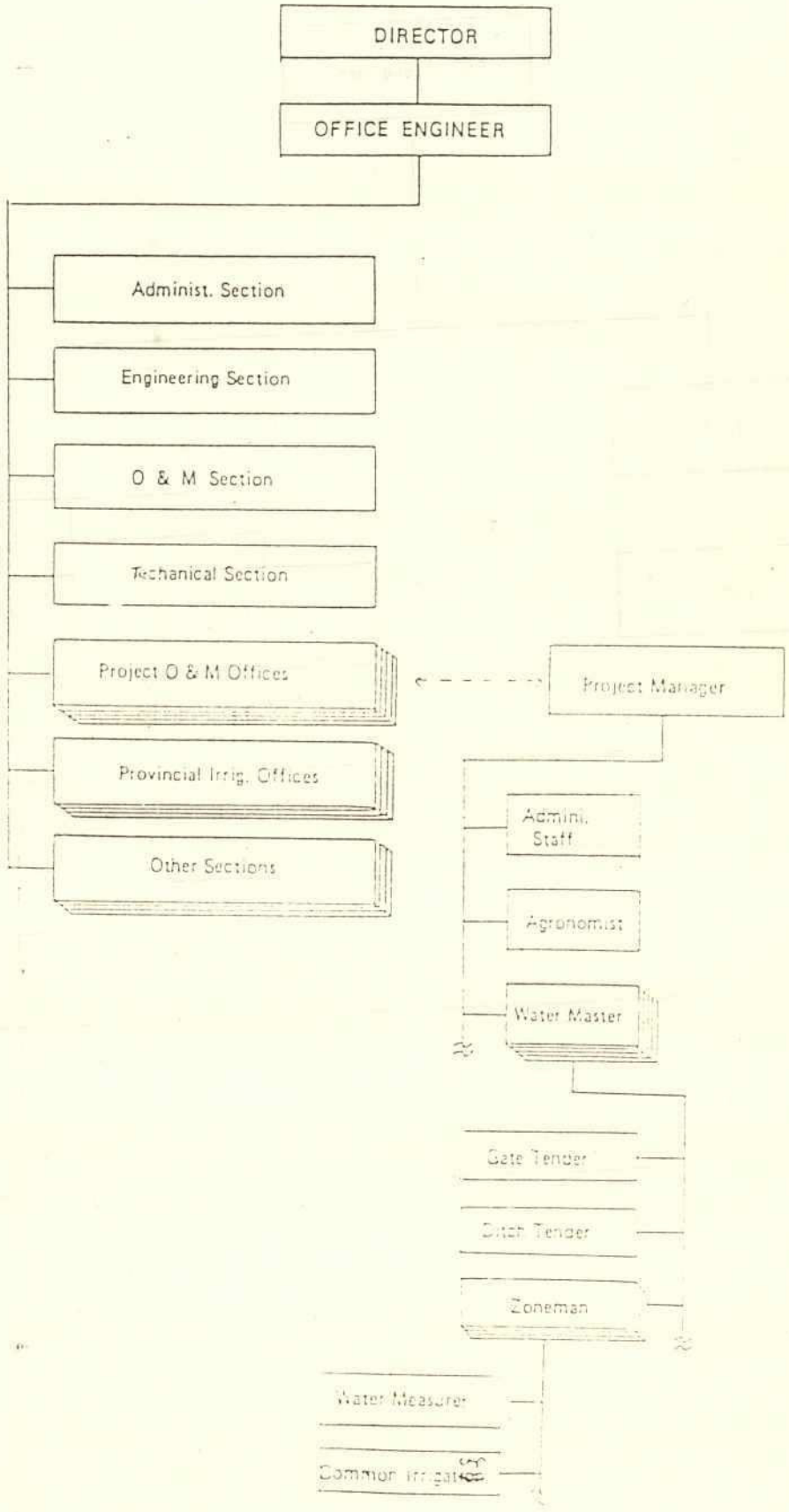
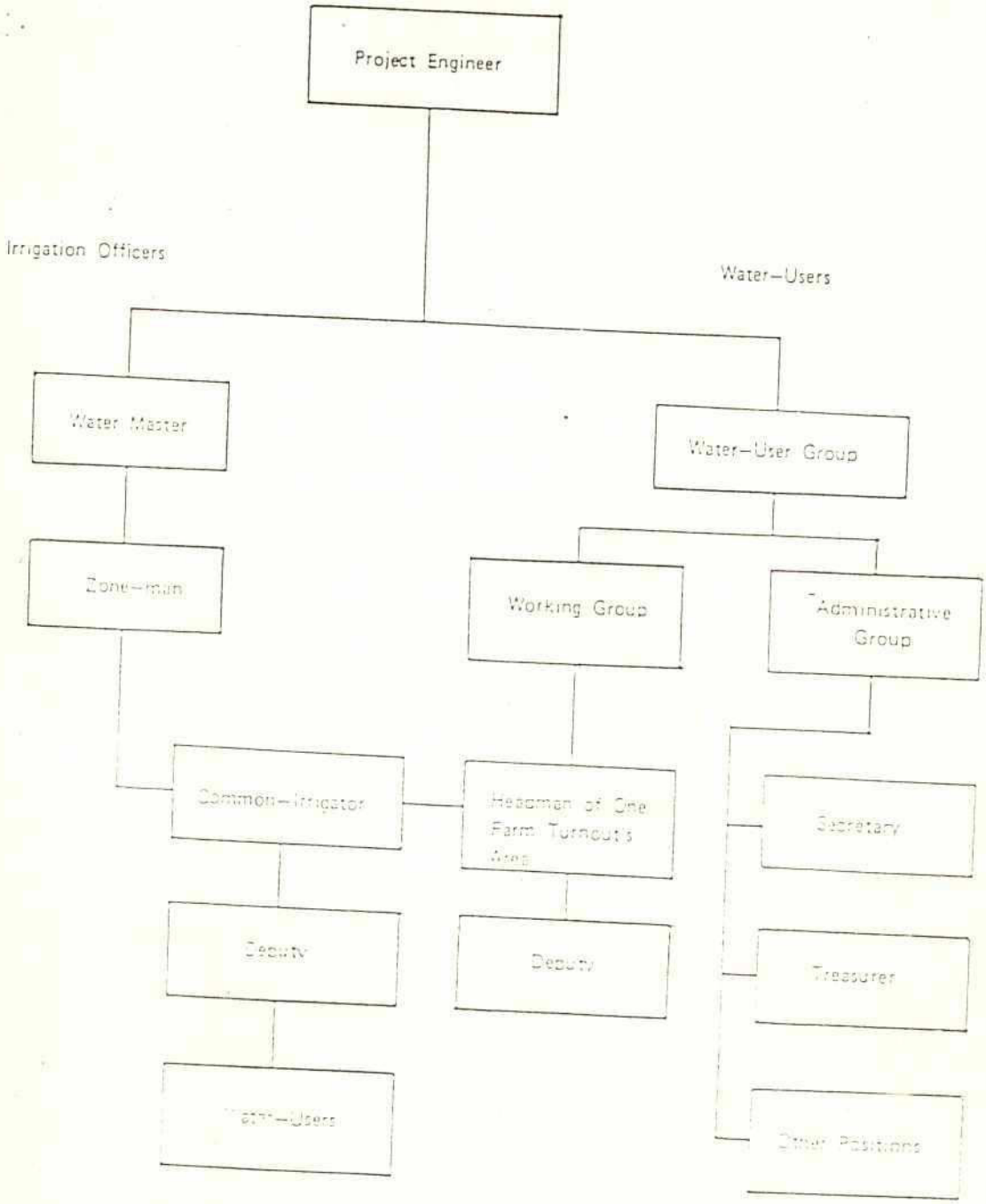


Figure D3 Organisation Chart (RID - Peoples' Irrigation System)



ANNEX E INDIA

E1 COUNTRY DESCRIPTION

India is too large and varied a country to follow the same presentation headings as the other country reviews. It is sufficient to note that river basins range from much of the catchments of the rivers flowing through Bangladesh, down to smaller regional basins. Likewise all types of floods occur, including major riverine floods similar to those of Bangladesh. Although embankments are widely used in the lower parts of the Ganges and Brahmaputra flood plains, dams are also used in several catchments where India has upper riparian control.

Additionally there are a wide range of irrigation systems, but large gravity flow projects are found in a number of regions. Large irrigation systems tend to be complex, and to have complex implications for drainage and floods where they cut across flood plains. The detrimental impacts of irrigation on drainage have themselves required further projects.

Agriculture is likewise varied. The eastern gangetic states are of most relevance to Bangladesh. Paddy and wheat are the most dominant crops. Most of the remainder of this section is concerned with illustrative examples from Bihar.

E2 ADMINISTRATIVE - INSTITUTIONAL FRAMEWORK

India is a federal system with considerable power vested in the state governments. Agricultural self-sufficiency and self-reliance have had prominent places in the sequence of five year development plans. The (Federal) Central Water Commission provides some technical assistance and coordinating functions (for example in flood forecasting), while in the Ganges system much of coordination is taken up by the Ganga Flood Control Commission. However, most responsibility for water management rests at the state level, usually with the Irrigation Department (ID) or Water Resources Department (WRD).

Below the state level, decentralisation of water functions to Districts is non-existent. A similar hierarchical water sector is found to that of Bangladesh. Liaison with the local administration is unclear, but CD Blocks (analogous to Upazilas in Bangladesh) do at least, through their relief and disaster monitoring role, have some idea of the floodprone areas under their administration. In the North Bihar flood plain the CD Blocks prepare a Block sketch-map indicating (however generally) flood proneness. However, there appears to be a lack of local administrative control over flood plain development, and the same is true for the adverse consequences for surface water of irrigation canals (seepage and cutting off natural drainage flows) and of embankments on unprotected areas.

There is now a growth in small scale ground water irrigation under the control of farmers. Otherwise water management is under the control of the ID with minimal direct public participation in decision making. Hence most projects have been identified by officials and ID's, except for some traditional and small scale irrigation systems. Local bund systems have in general been replaced by public embankments.

E3 O&M

E3.1 Organisational Set-up (Bihar)

The Water Resources Department (Bihar State Government) is responsible for large and medium projects: while minor irrigation such as state tubewells is under the Agriculture Department. However for some major irrigation projects there are also Command Area Authorities under the Agriculture Department. The structure of the WRD or ID is essentially the same as in Bangladesh (a Chief Engineer in each of a series of 16 zones, with Superintending Engineers, Executive Engineers and Sub-Divisional Engineers/Assistant Engineers below them). The difference lies in the top hierarchy being directly under a Minister and Commissioner; rather than being semi-autonomous, and hence there is a direct link to a politically accountable figure.

E3.2 Resourcing

New projects are frequently subsidised with Federal Government of India funds. However O&M is the responsibility of the State government. In Bihar realisation of funds is less than in other states, and is reportedly about 10 per cent of the water tax per ha of other states. In fact it is something of a standing joke that 80-90 per cent of canal taxes pay for the collection system, and nothing goes back into maintenance.

E3.3 Flood Protection

Bihar has some 3,400 km of embankments. North Bihar comprises the flood plain of seven major tributaries of the Ganges flowing from the Himalaya. Building of new embankments is currently limited. Reportedly Rs 30-40 crores per annum are needed for protection work because of the unstable nature of the rivers (erosion, shifting and rising bed levels). River levels also back-up from high stages in the Ganges causing drainage congestion. There is probably little new for Bangladesh to learn from the FCD experience. Local participation is lacking, except that in general what funds there are come from within India, although not directly from "beneficiaries".

E4 PUBLIC PARTICIPATION: SONE CANAL SYSTEM

E4.1 The system

The Sone Canal System dates back to 1874 and provides gravity irrigation water from a barrage to a large area south-west of Patna. It was originally designed to prevent famine. The main aim is monsoon season irrigation for paddy.

E4.2 Previous Management System

During the pre-independence period the system reportedly functioned well, and involved a form of participation, if somewhat formalised and paternalistic. The key person in project management/participation was the "Sattedar", effectively a paid farmer's representative and link person with the canal authority. There was one Sattedar appointed per village (a local, literate person with land in the command area); he kept the canal authorities informed of the state of the system and any unauthorised irrigation, and collected water taxes. His return was 2 per cent of the collected water tax. Additionally he facilitated an annual written agreement between the village and canal authority for the supply of irrigation water. This agreement was conditional on the payment of the previous year's dues and satisfactory

maintenance of the village level distributaries (the responsibility of the farmers, usually through one day of voluntary labour by all). This ensured that the water delivered would be used, but also meant that the canal authority was responsible for keeping its part of the contract.

This system had the legal backing of the Bengal Irrigation Act, 1876. A village could be debarred from receiving water if it did not maintain its channels, while irrigating without authorisation led to a doubling of the tax. A further incentive to paying taxes was that the receipt for the tax was customarily recognised as equivalent to the right to that plot of land.

E4.3 Decay

After independence there were increasing problems of malpractice among the lower functionaries of the Canal Authority, but the system still functioned. However, in 1974 the Sattedar system was abolished. The system was then managed by bureaucrats, and the link with farmers was lost. The Canal Authority could no longer form courts to punish offending farmers, nor was it able to ration and distribute water. Access to water went to head-end irrigators who placed unauthorised structures to gain more water, creating severe tail-end problems. Communication between farmers and officials disappeared and the officials lost credibility.

E4.4 Action Research

The Bihar state Water and Land Management Institute (WALMI), a semi-autonomous part of the state WRD combining government and academic posts took up an (externally funded) action research programme for a 16 mile long distributary in the Sone system in 1988.

To avoid local hostility it distanced itself from the WRD and concentrated for 9 months on monitoring the water supply - measuring flows and arousing the farmers interest in canal management. This was followed by familiarisation visits to villages and handouts concerning the project, and identification of some key local people. A public meeting with invited villagers was then held to explain the project and solicit views. The result was a fairly typical account of the problems of the management system: unresponsive officials, bungling and corruption, indifferent contractors, and declining profitability of agriculture. Hostility to the project was met by requesting constructive suggestions of possible improvements.

The WALMI then needed the backing of the official agencies, which depended on a positive response from the top officials of the relevant agencies/departments. This gained, it made meetings with field officials possible. The aim of the project was then to have a small Canal Operation Committee of farmers, but this was rejected by the farmers who wanted wider representation.

Gradually 20 villages (out of 80 served by the distributary) were identified by the farmers as being representative. In each an irrigation committee was to be elected, with one representative going into the Canal Operation Committee. Attendance at the meeting by the senior officials responsible (Directors CA and WALMI, and Chief Engineer WRD) assisted, but the key point in convincing farmers to take part in the experiment was the argument that it was the farmers' system and the losses and benefits are the farmers'. O&M personnel get their salaries and get posted on irrespective of system performance.

The committee meets fortnightly (since there is a 2 week operating rotation for the canal). Head-end villages are no longer trying to take the maximum water possible - water now reaches the tail-end. An operation plan for 1990 was developed with the farmers, following meetings in all villages, and walk through surveys of the whole distributary by the

farmers with the research team. Farmers have also received training from WALMI in water management. The WRD has been reluctant to participate, but water reached the tail-end (which it previously did not do), and they were able to talk with farmers.

So far this is an experiment, and the gains have come from improved operation, not maintenance. Farmers have now prioritised maintenance for this part of the system, but external funding for some work will be needed. There is also a plan to give the irrigator groups status as registered societies with a legal status, which would enable them to take over devolved responsibility for parts of the command area. There has not yet been any attempt to link water charges with the improvements.

E5 LESSONS

The evidence presented comes from only one irrigation system case study. However, much of the experience in O&M of FCD projects is very similar to that of Bangladesh and hence there are few lessons to be learnt.

1. Even in irrigation systems, where the private benefits of improved O&M are clear, improvements are difficult when duties have decayed.

2. The action research team benefited from an independent academic-official problem solving role, and was able to act as a mixture of catalyst and intermediary.

3. Continued external support for the groups is likely to be needed for some time if maintenance improvements and resource mobilisation are to be achieved.

4. The experiment does not yet provide a sustainable model for irrigation O&M, but is clearly an important step in changing the attitudes of both sides in this particular system.

5. The previous system highlights the importance of a fair legal basis for water management, in which both farmers and the project management agency have rights and responsibilities to ensure that the aims of the project continue to be achieved.

6. There is no substitute for contact, within such a framework, between the project agency and its clients (the farmers).

ACKNOWLEDGEMENTS

L.P. Shrivastava of Bihar state Water and Land Management Institute (WALMI) kindly provided details of the Sone canal system, both of its history and of his recent work there.

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ANNEX F VIETNAM

F1 COUNTRY DESCRIPTION

F1.1 Type of River Basins

Vietnam is situated along the Eastern coastline of the Indochina Peninsular facing the South China Sea. It covers an area of 332,000 km^2 with population of 64.23 millions.

The Mekong river delta and the Red river delta are major rice cultivation areas. However, the ground elevation is as low as 2m above mean sea level in the deltas causing such natural water hazards for agricultural production as inundation and flooding if the water is not properly controlled.

F1.2 Type of Flood Problem

The climate in Vietnam is very unstable and irregular being influenced by a variety of monsoon winds. The rainy season is May-November, and the dry season is December-April. The annual rainfall is 1800 mm on average, concentrated in the rainy season. The rainfall ranges from 1000 mm to 5000 mm.

The peculiarities of each part of the country result in different storm and flood characteristics.

In the north, the Red River system has a large catchment mainly located in the mountainous regions. The tributaries join close by the plain. The flood water from the rivers concentrates in rather a short time, and the mean spate level is much higher than the flood plain. The flood spate of the Red River, as a result, often causes great losses; high embankments have been built along the Red river.

In the central region, the rivers are all short and steep. Here, the plain is narrow and low while the mountains are high and steep. The forests were seriously damaged by the war. Sweeping floods, storm-surges and storms usually come all of a sudden to the regions near the central coast, causing great loss of life and property. Embankments have not been used in this region.

In the South, the delta is comparatively flat. Storms are rare. The spates of the Mekong River are relatively mild. Nevertheless, the Mekong River annually inundates a vast area of hundreds of thousands of hectares of the Cuu Long Delta between 2m and 3m in depth.

The total run off reaches 763,000 million cubic meters, averaging 2300 mm in depth. However there is no run off in the medium and small rivers during the dry season.

F1.3 Type of Project Considered

Irrigation canals, drainage canals, river embankments and coastal embankment are the major structures in Vietnam. A number of water management projects for improvement of irrigation efficiency have been implemented since 1972.

So far as flood control is concerned, both structural and non-structural measures are employed.

Dykes are the main structural measures for flood control in Vietnam. The dyke system of the Red River was built many years ago, the original dykes being built in the 11th century. Through heightening, widening and lengthening of the dykes year by year, the river dykes in the north of the country are high enough to control flooding with the maximum water levels. There were by 1987 5,700 km of river dykes and 2,000 km of sea dykes in Vietnam, much of them built during the last century. There also exist several multi-purpose reservoirs which are used for flood control, such as Hoa Binh reservoir on the Da river.

In addition to such structural measures, several non-structural measures have been taken in Vietnam. It is considered that improvements in the forecasting of rain, floods and typhoons giving due information to people, are very important measures to help mitigate the effects of floods and typhoons.

F1.4 Complexity of systems

Water management systems in Vietnam are not structurally complex. However complex solutions may be required for leaching water applications in saline affected areas in order to reclaim agricultural land.

F1.5 Agriculture

Vietnam is predominantly agricultural and 80 per cent of the population are farmers. The total land area is 11 million ha of which 6 million ha are annually cultivated (Table F1).

Table F1 Land Use in Vietnam (1000 ha)

Classification	Area	Percentage
Annual cultivated area	6,006	86%
Land for paddy	4,667	67%
- Two crop	(1,744)	-
- One crop	(2,377)	-
- Others	(546)	-
Land for upland	1,339	19%
Perennial plants	947	14%
Total farm land	6,953	100%

F2 EXAMPLES OF PARTICIPATION IN WATER MANAGEMENT

F2.1 Irrigation

In gravity flow irrigation systems, even though there is a socialist system, problems with drainage and poor repair of facilities are higher where there is no formal institutional body within a cooperative for O&M. Hence the Cooperative Irrigator Teams (CIT) have been formed. These are responsible for small command areas. Farmers, through the cooperatives, pay directly for O&M at a rate of about 160 kg paddy/ha, (assessed in the range 4-8 per cent of production). Part of this goes to funding O&M of the main system (in gravity irrigation systems 70-80 per cent of O&M costs are covered, the remainder being central government subsidy). However 30-40 per cent of the water service fee levied goes to the CIT for local

O&M - including the payment of one skilled person to manage the local irrigation system. In pumped irrigation systems only 20-30 per cent of routine O&M can be covered in this way since running costs are (presumably) much higher.

F2.2 Flood plain management

In structural projects attention is focused on management of embankment systems, not just building them. Management in this case amounts to finding and repairing in time likely damage (preventing failures and serious damage). There are several elements to good management:

i. an annual pre-flood season inspection to identify weak points, plan a repair programme, and take corrective action;

ii. for main river embankments "dyke control teams" are formed by the government comprising engineers and technicians to make and supervise important repairs;

iii. monitoring teams are stationed at watch posts every 3 km along embankments in the flood season. Thy receive annual training in checking, identifying and repairing embankment damage. They receive payment in rice from the co-operatives;

iv. dyke protection brigades (of 50-100 people) are formed in each commune along an embankment before the flood season. They are provided with implements, given some training and practice in dyke repairing and they are then on standby while doing their normal work. In an emergency must report to the monitoring team captain to carry out repairs. They can also receive direct orders from the embankment sub-committee formed by the district administration.

Non-structural measures are also taken - in particular adjusting cropping patterns to ensure that paddy is harvested before damaging floods occur, moving families from floodways and levelling these to improve flow and reduce risks to people, and issuing warnings so that local authorities can help evacuate people to embankments and roads when high floods are anticipated. In this connection there is a hierarchy of flood and typhoon "control committees" (national, provincial, district) which form plans each year for emergency management and general flood plain management.

F3 LESSONS

No doubt some of the means of involving local people in O&M in Vietnam are facilitated by the political system, however there are some important lessons:

1. A formal local body for O&M is necessary.

2. O&M resources, for irrigation, come from dues paid in paddy.

3. There is local direct involvement in embankment maintenance, mainly through voluntary labour when needed. The system of local trained embankment guards working for the local community for the flood season only, and paid by them, is clearly attractive. The idea of involving local communities in monitoring their embankments

and carrying out emergency repairs under technical supervision is attractive - it could solve the problems in sanctioning funds for emergency repairs which BWDB encounters.

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ANNEX G MYANMAR

G1 COUNTRY DESCRIPTION

G1.1 Type of River Basins

The Union of Myanmar is situated on the western edge of the Indochina Peninsular facing the Andaman Sea in the south. It is bounded to the west by Bangladesh and India, to the north by China, and to the east by Laos and Thailand. It covers an area of about 677,000 km^2 with an estimated population of 40 million people.

The Irrawaddy river flows through the central part of the territory forming a deltaic plain in the lower reach. The river runs about 2090 km with a catchment area of 376,200 km^2.

The mean flood discharge at Prome, which is located 250 km north of Yangon (Rangoon), is 35,000 m^3/sec with a maximum discharge of 64,000 m^3/sec. The Sittang river flows down the eastern side of the Pegu Yama, also emptying into the Andaman Sea.

G1.2 Type of Flood Problem

When the water level in the Irrawaddy river rises, inundation occurs in half of the area where the elevation is below 15m. There are embankments downstream from Kangin along the right bank of the Irrawaddy, but overflows or embankment breaches have occurred in many places during floods.

The inundation lasts from June to August every year and the water depth ranges from 0.3-3.0 m.

G1.3 Type of Projects Considered

River embankments, irrigation canals and dams are the major structures in Myanmar. Irrigation projects in Myanmar started at the end of the 19th century, mostly concentrating in the Mandalay Division.

G1.4 Complexity of Systems

Water sector projects in Myanmar are at a relatively initial stage, therefore systems are not so complex.

G1.5 Agriculture

Agriculture holds the most important position in Myanmar's economy. This is illustrated by the facts that agricultural production accounts for 28 per cent of the gross national product and 60 per cent of the employed population is engaged in the agricultural sector.

Paddy cultivation is extensively practised in the Irrawaddy Delta, and upland crop cultivation in the semi-arid zone in the middle of the country.

Previously, the government directed to the farmers every agricultural activity, such as production and marketing, in detail. However, there has been some shift towards aspects of a market economy and hence such agricultural activities are being transferred to the individual farmers.

G2 ADMINISTRATION/INSTITUTIONS

G2.1 Government

The Government is highly centralised under military control due to an unstable political situation lasting from 1988 to the present.

G2.2 Development Policy

The Twenty-Year Plan (1974/75 - 1993/94) was the primary national plan designed to establish Burmese-style socialism. The plan was divided into a series of four-year plans and provides guidelines relating to:

- long-term objectives;
- actions to be taken; and
- general frameworks.

The major targets of the Plan can be summarized as:

- to establish the union's economic, social and political foundation by 1993/94 by doubling per capita GDP and by shifting to an agro-based industry economy from an agricultural economy; and

- to strengthen the state and cooperative owned production sectors.

The Five-Year Development Programme was formulated to achieve the targets set out in the previous plan.

No agricultural policy or guidelines are indicated by the Government. However a report published by the Ministry of Planning and Finance indicates the following targets for the agricultural sector:

- increase major foodgrain production for domestic consumption;
- increase cultivated area of industrial crops to satisfy the demand of factories;
- increase crop production for export;
- increase cultivated land by reclamation;
- increase yield by increasing agro-inputs; and
- construct small scale irrigation facilities.

G2.3 Responsibility for Water Management

The Irrigation Department (ID) under the Ministry of Agriculture is the responsible authority for water management in Myanmar.

G2.4 Role of Local/National Government

Myanmar is administratively divided into seven States and seven Divisions. Each Division and State is subdivided into Townships.

G2.5 Types of Project

Two types of project are distinguished in Myanmar. One type is large scale irrigation and drainage projects with components of dams, diversion weirs, irrigation/drainage canals, and embankments for flood control. The other type is rural scale irrigation and drainage projects. These can include the same components as large scale projects but are on a smaller scale.

In the case of large scale projects, ID local offices conduct surveys and formulate project plans for head office approval. The proposed projects are implemented after evaluation. There are nine on going large scale projects among which seven projects are being implemented with external resources.

In the case of rural scale projects, farmers' groups apply for the project to ID. The ID investigates the projects based on their own criteria for implementation. In both cases, budgets are the main constraints to implementing projects.

G3 O&M

G3.1 Organisation of Water Sector O&M

The Irrigation Department is the sole organisation responsible for project implementation and O&M.

G3.2 Resources: sources and level

In the case of large scale projects, the Government bears all necessary costs without any farmers share. In the case of rural scale projects, the Government bears two-thirds of the project cost and the rest is funded by farmers.

In the case of large scale projects, ID undertakes most O&M activities from its own budget, but, it also collects a water tax from beneficiary farmers of ten Kyat per acre per annum (1US$ = 6.5 Kyat as of 1989). Project dues are also collected in flood control projects but at half of the rate for irrigation projects.

In the case of rural scale projects, the beneficiary farmers themselves organise O&M committees for O&M of the completed projects, which is their responsibility.

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ANNEX H NETHERLANDS

H1 COUNTRY DESCRIPTION

H1.1 River basins

The Netherlands show a number of similarities to Bangladesh: most of the country is low and flat comprising either delta, coastal plain or reclaimed land. Hence the river basins are large and mostly lie outside the national boundary, yet localised water management is very important.

H1.2 Type of flood problem

The major flood risk is from storm surges associated with depressions in the North Sea. A disastrous flood of this type occurred in 1953. Much of the country is below sea level, so if embankments breach or overtop in such circumstances losses to life and property are high. Riverine flooding is also a risk, while the flat landscape means that fine tuning of drainage and water level control is critical.

H1.3 Type of project considered

Major coastal embankments are a prerequisite of the Dutch economy. Major water management projects have been based on political decisions and funded by the public sector. Smaller scale land and water management issues are considered here.

H1.4 Complexity of systems

Water management systems are complex to the extent that urbanisation is high and multiple water and environmental management objectives are present, for example a strong emphasis on recreational and nature conservation interests. Water quality is important given high fertiliser use and industrialisation. Water quality and quantity (level) objectives are also inter-related.

H1.5 Agriculture

Agriculture is very intensive, although the contribution to GDP is low, involving intensive dairy farming, arable farming, and high value crops.

H2 INTRODUCTION TO ADMINISTRATIVE AND LEGAL SYSTEM IN WATER MANAGEMENT

The Netherlands provide an example of emphasis on water management, rather than construction or O&M, through democratic and decentralised representation within a complex planning system in which there are overlapping hierarchies of plans. The system has evolved over a long period and reflects the critical nature of water level control, intense use of the land, and multiple and potentially conflicting land uses (so far as water quantity and quality are concerned).

The provinces are authorized to constitute water authorities. Water authorities in the Netherlands are **decentralised** both functionally and geographically. Their boundaries in most cases have long historical backgrounds. The first water authority was constituted in the 13th

century. Provinces were formed much later. Some water authorities operate across provincial boundaries, though not necessarily for reason of a hydrological unit. Over the last decades a vast number of water authorities were merged (1950: 2500 water authorities, 1990: 130). It is now national policy to reorganize water management and have catchment based water authorities, preferably integrating water quantity and quality functions. At the moment these functions are often divided between separate authorities.

All surface waters that are not the responsibility of the State or a province are managed by water authorities (except for a few areas which are still not brought into any authority's area). The provincial water management policy plans deal with national waters as well as provincial waters. The rivers Rijn, Maas, Waal, Oosterschelde and the Ijsselmeer are some of the waters under State control.

The water authorities' tasks have, until now, traditionally been land drainage, flood defence, water level control, and maintenance of river corridors and control works. A water authority can also be assigned the responsibility for sea defence and (some) roads. Although the water authority is concerned with the whole of its area, in urban areas the local authorities are responsible for sewerage works, and are not under a duty to liaise with the water authority.

The key issue of the Third National Document is integrated water management:

i. The aim is to reorganize all water authorities on a catchment basis. This will result in more inter-provincial water authorities and thus require more consultation and liaison between the provinces. Such a liaison structure already exists for various fields of regional government (between town councils for physical planning; and between provinces on physical planning, water management, infrastructure, and recreation).

ii. Quantity and quality management should be integrated and be the responsibility of one ('all-in') water authority instead of being divided between a water authority and a purification board.

Apart from integration leading to the merging of water authorities and purification boards, coordination with ground water management by the province is to be improved.

The area oriented policy, next to the function oriented policy, is complemented in other national plans: the national environmental policy plan and nature policy plan.

H3 REGULATION AND ACCOUNTABILITY

The decision to constitute or dissolve a water authority or to alter its task or area is made by the province and approved by the Minister for Transport and Public Works. All water authorities are subject to the "General Rules for Water Authorities", made by each province and again approved by the Minister.

The elected organization of a water authority (excluding employees such as the manager) comprises a 'Board of Governors', a 'Board of Executives' and a Chairman. The Board of Governors is composed of representatives of categories of parties interested in the execution of the water authority's functions. The Water Authorities Act 1991 gives a limited list of categories; representatives are elected from their respective categories:

- owners/occupiers of non-built real property (land and/or buildings);
- leaseholders of non-built real property;
- owners/occupiers of built real property;
- inhabitants in the area of the water authority and
- owners/occupiers of built real property in use as commercial property.

The Board of Governors elects the members of the Board of Executives. At the moment the typical Board of Governors is composed of landowners with an interest in water level control.

Under the Water Authorities Act one seat in the board is to represent the inhabitants of the town within the authority's area. This member can either be elected indirectly by the relevant town councils or directly by the people. A chairman is appointed by the Crown.

H4 PLANNING CONTEXT

A complicated system of policy plans forms the basis of water management in the Netherlands, placing it in a much broader context. In the plans which the government and provinces make for water management other 'sectors' and 'facets' are integrated: physical planning, agriculture, infrastructure ('sectors'), and environmental protection and nature conservation ('facets'). The various plans and their requirements for appropriate water management are integrated with demands and opportunities. The plans for water management have to take developments in other sectors into account as well as consider the feasibility of such action within the planned water conditions.

At **central government level** the National Document on Water Management explains national policy on all fields of water management. National plans set priorities in each region which provinces then follow in their plans.

At a **provincial level**, again, the water management policy plan should take the present physical planning and land use policy of the province, as well as the town councils, into account. On the other hand it must explicitly define the consequences of the water management policy plan for their physical planning policy. Therefore a constant liaison should take place between the various planning departments within the province.

The **water authorities** draft their management plan according to the provincial policy plans. The province has to approve the plan after a draft plan has been presented to the public for consultation with interested parties and objections have been dealt with according to the appropriate procedure. This procedure, as well as the contents, the preparation and adoption of the plan, is to be prescribed by the province in the General Regulations for Water Authorities.

H5 LEGAL INSTRUMENTS FOR WATER MANAGEMENT

H5.1 Water level decree

Traditional instruments of water authorities reflect the narrow view on their responsibility, fully focused on powers for **water level control and drainage**. The major instrument for water level control is the **decree** to be issued by a water authority stating the aimed water table and level of surface water. **The decree is binding for everyone**. To deviate from the decreed water levels in a polder the land owner or occupier has to apply for the granting of permission from the water authority.

H5.2 Bye-law (Keur)

In compliance with the provincial General Rules a bye-law ('keur') is made, this can by its nature only contain prohibitions.

In the 'keur' maintenance duties for 'main' and 'non-main' rivers are allocated. This distinction is based on the 'major relevance' or 'relevance' of water courses for water level control ('good water management'). Maintenance of main rivers is the responsibility of the water authority; riparian owners have to carry out maintenance works on other water courses.

H5.3 Technical Register (Legger)

It is at the province's discretion to prescribe in the General Rules that the water authorities have to maintain corridors according to standards laid down in a technical instrument ('legger'). It gives the minimum measures for maintenance duty, mentions who is responsible for the maintenance of which stretch of water course and/or the maintenance duties, and shows a cross section for the river corridor.

H5.4 Easement

Riparian owners have to admit workers and necessary material for the construction, maintenance or improvement of a river control work as well as for the measuring or placing of signs for the designing of works for these purposes (Waterstaatswet 1900 s. 9). The owners/occupiers must be notified in writing at least 48 hours beforehand by the executive of the authority that carries out these works or by the mayor.

For works on existing river corridors and for the creation of new ones to improve land drainage the responsible authority (usually the water authority) has the right to alter property and maintenance and access paths, alongside the river corridor. This right exists for those cases in which expropriation is not reasonable. The authority is under a duty to compensate for damages. This decision can not be made before interested parties have had the opportunity to take notice of the proposed works and make objections for a period of thirty days.

H5.5 Water agreement

The water authority diverting surface water from or to an area under the control of another water authority is under an obligation to enter into an agreement with the other authority over the way in which the authorities arrange the deviation in the interest of water management. The area oriented approach has called for a water agreement. In the interest of agriculture, water supply, electricity industry, shipping, fishing, forestry and recreation, water level and quality objectives must be reached and maintained.

H5.6 Model Bye-law provisions

The practical control over land use and water management is achieved through local legal instruments (bye-laws) which are modelled on ones outlined for the nation. The ones of greatest importance are discussed in (a) and (b) below.

a) Water authority zone of influence

Traditionally the water authority was not allowed to interfere in land use alongside the river corridor stretching inland for more than 0.5-1m. However this view has changed, with the Third National Document on Water Management it is accepted that the authority should be able to influence to a limited extent a much wider stretch of land. This results from nature conservation pressures, which may mean that: higher water tables are maintained, or a wider bank zone is used to create a more natural river bank, restricting farming activities in this zone. This view is strongly opposed by farmers. A more **environmentally sustainable** way of water management can entail a **rise in water tables** affecting cultivation possibilities. A slight but significant alteration of the water level and land use is carried out primarily in areas with high nature conservation values.

The Model Bye-laws include a form of rough floodplain zoning. The water authority has maximum control over the "protection zone" which is the bank-side area needed to maintain structural integrity of the bank and any embankment (levée). A "zone of influence" is determined as a wider area over which the water authority can grant permission for land use changes. Included in this zoning is an estimate of future needs to raise the embankment and the resulting area of land which should not be developed (built upon).

b) General prohibitions

These include prohibitions to prevent maintenance problems:

- alteration in direction, form or construction of watercourses, construction of new watercourses, and maintaining the water level at a different level from that mentioned in the authority's decree;
- digging, constructing, renewal or removal works in, on, over or under watercourses and the protection zone;
- damaging, destruction, or removal of plants and trees, or material serving the protection of banks, slopes or the river floor;
- dumping or storing of material or substances in waters and on protection zones (designated sites excepted); and
- to have boats mooring, loading or unloading at sites other than those allocated for this purpose.

Of course there is a general exception from these provisions for maintenance works by the water authority, and a corresponding duty on land owners/occupiers to give access to the authorised persons.

H6 LESSONS

1. **Water management** is decentralised, although the water authorities are being rationalised they retain direct local representation in their boards.

2. Land use planning involves liaison and integration between functional planning agencies (such as water authorities) and general planning agencies (councils and provinces).

3. There are provisions for public consultation both in plans and in detailed changes to water authority objectives.

4. Responsibilities and restrictions are clearly and legally defined, for example in maintaining water levels and in maintaining river corridors.

5. The issue is water management in a wider planning context and not O&M.

6. The water authorities raise local taxes to fund their activities.

7. No specific structure or provision exists to solve conflicts arising between water authorities. The general rules for administrative law procedures apply.

Water management as practised is more complex in the Netherlands than in Bangladesh. However, the planning system and measures to ensure liaison between overlapping agencies and administrative levels indicate changes which could help to overcome this gap in the planning and consultation procedures for FCD/I projects in Bangladesh.

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ANNEX I SRI LANKA

I1. COUNTRY DESCRIPTION

I1.1 Type of River Basins

Sri Lanka is an island country situated at the south-eastern edge of the Indian Sub-continent. The central part of the country is mountainous with an altitude of more than 2000m and is surrounded by coastal plains. The national land area is 66,000 km^2 with a population of 16.4 million in 1987.

I1.2 Type of Flood Problems

There are two monsoon seasons, north-western monsoon (October-March) and south-western monsoon (April-September) in Sri Lanka.

The annual average rainfall reaches 2500mm, concentrated in the two monsoon seasons with peak months in May and November. Floods are local flash floods that cause damage in the low lying river plains.

I1.3 Agriculture

The land use in Sri Lanka is shown in Table I1.

Table I1 Land Use in Sri Lanka (million ha)

Classification	Area	Percentage
Farm Land	2.20	(36%)
Forest Land	2.38	(40%)
Others	1.45	(24%)
Total Land	6.03	(100%)

Rice cultivation and coconut plantation are the major agricultural activities in Sri Lanka. The irrigated area is 500,000 ha out of 2.2 million ha of farm land.

I2. ADMINISTRATION/INSTITUTIONS

I2.1 Development Policy

The Government puts emphasis on the following agricultural policies:

- increase in major foodstuff (rice, dairy products, sugar, fish and pulses) production;
- increase in food self-sufficiency;
- increase in export of agricultural products and crop diversification for export

commodities; and

increase in income levels and employment opportunity in rural areas.

I2.2 Responsibility for Water Management

There are five types of development projects in Sri Lanka:

- Mahaweli Development Project undertaken by a separate Mahaweli Authority for development of the Mahaweli river system;
- Large scale irrigation projects overall project management throughout construction and O&M stages is conducted by the Government ID;
- Medium scale irrigation projects 200-1000 acres, previously managed by the ID but now by the Provincial Irrigation Departments;
- Small scale irrigation projects land owners participate in the project with partial contributions to earthworks, felling and maintenance under the supervision of the Ministry of Agriculture; and
- Plantation projects infrastructural consolidations such as construction of residences, roads and schools are carried out by the Land Development Bureau.

Most water management projects are irrigation projects and by 1988 there were 395 major irrigation schemes (all based on gravity flow) covering 652,995 acres (264,267 ha) (Wijesuriya, 1990), however the area under FCD projects has increased rapidly since the 1960s and in 1988 stood at 108,496 acres (43,908 ha) (Wijesuriya, 1990). Documentation of experience and experiments in O&M is limited to irrigation projects combining recent work by the Irrigation Department and by the International Irrigation Management Institute (IIMI) based in Sri Lanka.

I3. O&M

H3.1 Organisation of Water Sector for O&M

Although irrigation has a very long tradition in Sri Lanka, smaller systems have survived outside the government sphere, but larger systems of ancient times had been long abandoned. The majority of the major irrigation facilities have been constructed in the 20th century and are directly managed by the Irrigation Department (ID) which is reportedly responsible for maintenance of all schemes larger than 200 acres (81 ha). Consequently the ID has had a construction bias, but with the decline in new construction and increasing emphasis on improved performance and more efficient management, the emphasis of the ID has shifted to O&M. Hence, staff have shifted function to O&M, but as elsewhere O&M has low prestige for engineers, and the result has been overstaffing and high overheads (Wijesuriya, 1990). As a result of the increased emphasis on O&M an Irrigation Management Division was set up and has been developing and facilitating ways of improving O&M in a number of systems.

I3.2 Experiments in Improving O&M

A number of initiatives have been tried as O&M gained increasing emphasis. Technical improvements in systems have been adopted to try to improve performance but these did not address user involvement. It is reported that where rehabilitation followed a dialogue with users there were better results but where programmes depended on the existing staff and there were no additional resources or incentives for the initiative there was less success and achievements depended on the personal interest of the staff involved (Wijesuriya, 1990).

An additional problem has been that some large systems involved resettlement and hence there was a lack of social cohesion and institutions among settlers. In this context an Integrated Management of Major Agricultural Settlement Schemes (INMAS) programme was started in 1984 aimed at achieving system sustainability, details of this are based on Gunesekera and Ranatunga (1990). This has two components: efficient use of available central government funds and participatory management and mobilisation of local resources.

So far as resource management is concerned the method adopted has been to treat operation and maintenance costs separately, operation amounts to fixed costs and was calculated as a function of the division's characteristics: area, number and size of schemes and their locations. Some modification appears to have been necessary, although the form is unclear in Gunesekera and Ranatunga (1990); presumably it was difficult to achieve redundancies to match the infrastructure supported in each division. Maintenance resources are determined as the residual of available funds after operating costs (which presumes that operation and staffing are cost effective and may still leave a shortage of funds for urgent needs).

This still leaves a problem of prioritising funds as the basic distribution to systems (on the basis of infrastructure at standard rates per km per type of facility) is lower than demands. Hence public participation has involved joint identification and prioritisation of maintenance needs by the system officials and farmer representatives; the latter must approve the programme through a Project Committee before implementation. The ideal is a partnership between farmers and officials which results in farmers maintaining channels below the turnouts and ultimately providing voluntary labour for parts of the main system, and in return receiving improved supplies of water and hence agricultural benefits. Farmer organisations have been promoted by the agency which has used independent catalysts (such as NGOs) to help farmers organise at the distributary level (200-300 farmers) - how they are represented at the project level is not clear. This appears to have had some success in achieving maintenance of field channels (below turnouts) which had previously been inadequate and in farmers contributing labour to maintenance of distributary channels. Additionally the farmer groups are registered as contractors with the ID and are able to take up small works funded from outside (although they do not have a legal status). Eventually the intention is to hand over distributaries to farmer groups.

One problem in the definition of responsibilities for improving O&M and resource mobilisation in this new approach is that the IMD is responsible both for organising farmer participation and for fee collection, which are seen as conflicting tasks for four reasons pointed out by Gunesekera and Ranatunga (1990):

- farmers are fee payers and not equal partners;
- fees discourage the development of a sense of ownership among farmers;

- fees impede harmony between the government ID and farmers; and

- the fee has no relationship with the amount of water used and so does not encourage efficient water use.

The approach adopted to minimise these problems was that fees raised could only be used in the same system and that farmers were involved in setting the priorities and were given contracts for work wherever possible. However, fee evasion has increased with time. even though farmers now regard O&M as much more of their own responsibility, this reflects failure to achieve sufficient benefits and a free rider problem since it is impossible to enforce fee payment or exclude users. By 1989 only 0.3 per cent of defaulted fees had been collected and 5,065 legal cases were pending, despite most defaults not being taken up as cases (Gunesekera and Ranatunga, 1990).

Hence, the improvements being developed still have problems and room to be improved, not least the problem of bureaucratic apathy which may frustrate farmers who are willing to take responsibility.

I3.3 LESSONS

The idea of an IMD equivalent (a System Management Division) might be considered in Bangladesh as a way of adding staff engaged in farmer and social organisation and improving management without upsetting established staff heirarchies. However, caution should be adopted in combining collection of irrigation or FCD fees with farmer participation, given the poor performance of Bangladesh in irrigation fee recovery, and the lack of a precident in FCD projects for fees, farmer participation and mobilisation of resources in kind may be prefered. The approach adopted in determining O&M costs appears much more systematic than in Bangladesh at present and is an example of making O&M cost effective which could be followed. The management model, which includes Project Managers and accountability to a committee involving farmer representatives, also has attractions in improving the responsiveness of officials to system users.

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J.1 COUNTRY DESCRIPTION

There are some 421 main river basins in the Philippines, ranging in size from very small to in the order of 22,500 km^2. The distribution of rainfall is uneven and as a result both flood protection and irrigation have been necessary. Flooding is a result of either typhoons or flash river floods, since most catchments are mountainous and steep, damage is mostly to urban areas.

Although structural flood control measures, and wider flood loss mitigation programmes have been developed, the experience in irrigation (especially local participation in its management) is of greater relevance for developing a sustainable "O&M model". These irrigation systems are usually small to medium scale and not complex, but involve a variety of structures. The aim of irrigation development has been to raise paddy yield levels and to overcome an annual food grain deficit.

J.2 ADMINISTRATIVE - INSTITUTIONAL FRAMEWORK

The planning and implementation of water resources projects in the Philippines involves a number of agencies, including regional bodies of national agencies and regional agencies, each separated either spatially or functionally. In particular irrigation is the responsibility of the National Irrigation Administration (NIA) while flood control and drainage projects are undertaken by the Department of Public Works and Highways. Problems of separate project development without regard for implications on other projects, and overlapping activities have resulted.

This should be seen in the context of a National Economic and Development Authority, chaired by the President, which coordinates development plans and formulates overall public investment programmes. A link between this level and the water development agencies (which are semi-autonomous but under ministries) has been formed in the National Water Resources Board which is essentially to regulate and review water development and to approve the plans of regions and agencies in the national planning context (hence it forms a final stage in water development planning control). Subject areas covered extend to water supply, sewerage and water quality, and basin development plans.

J.3 IRRIGATION EXPERIENCE IN FARMER PARTICIPATION

J.3.1 History

Because of low productivity in agriculture and persistent flood grain deficits, agricultural development and expansion of irrigated area have been emphasised in the Philippines with the creation of publicly funded irrigation systems. However, sustainability was low: full command areas were not irrigated, and O&M and cost recovery were poor. Whereas indigenous irrigation systems existed which were owned, funded and managed by farmers groups. These were taken as an indication that costs could be recovered, and the newly created NIA in the mid-1970's was given a charter to recover fees to cover both O&M costs and repayment of the costs of construction, and took indigenous irrigation systems as a model.

The aim was to develop communal irrigation systems which could cover O&M costs and pay back construction costs over 50 years (without interest). This required irrigator organisations with a well defined legal basis which could sign contracts with the government and obtain rights to use water: a feeling of ownership among the members of groups; and a way of helping farmers create viable groups.

The approach adopted was to maximise participation by farmers throughout the process from planning, through construction to management of the systems. To this end a separate cadre of community organisers with a social science and rural development background were employed, outside the traditional staffing of engineers. In order to form viable groups there was a long term input from the organisers to understand the physical problems for irrigation and agriculture and the local power structure, and then to encourage poor farmers to form groups aimed at managing and financing small-medium sized irrigation systems.

A number of developments from this approach have occurred. Monitoring of organisers and groups and of the performance and problems in group formation was carried out using simple reporting from the organisers. NIA and applied researchers working on the programme had a keen interest in following the progress of the experiment. A later development has been the use of farmers as irrigation group organisers. The professional organisers were seen as too expensive, so instead local farmers have been used - this requires careful pre-selection of the farmer-organisers, in which their leadership potential but also fairness and awareness of possible biases is assessed, and they are intensively trained in their role.

Figure J1 summarises the objectives of NIA and how it is organised to achieve them, note that implementation and system management are separated, although within the same organisation. Smaller (communal) systems are then handed over to the farmers association, whereas larger systems continue to be managed by NIA.

J3.2 Key points

A number of lessons concerning formation of farmer managed irrigation systems, and which are relevant to water management or drainage by farmers, can be drawn.

1. There was well focused training of the group members to enable them to manage their systems, including both technical water control, agriculture, and accounting and management techniques, as well as intensive efforts to increase social awareness.

2. The groups are founded on some local democratic tradition, but as in Bangladesh there is a strong local power structure. The difference is that the water agency (NIA) accepted that this would need to be changed and small farmers would have to have a voice in their own affairs if they were to manage their systems and pay back the costs, and then invested in doing this.

3. The groups have a legal entity and sign a contract with NIA, they also have a formal structure.

4. The groups are formed during a period of up to ten months before detailed planning of the water management system starts.

5. There is liaison between the social organisers and the engineers, but also a tension because they are largely separate (both organisationally and professionally).

Figure J1 Summary of National Irrigation Association, Philippines

OVERVIEW	NATIONAL IRRIGATION ADMINISTRATION - PHILIPPINES	REMARKS
FUNCTIONS	To investigate, study, construct, repair and improve all irrigation systems as well as to operate and maintain national irrigation systems.	
MISSION	To develop water resources for irrigation and provide social, physical, and technical services in line with the development program of the national government.	
OBJECTIVES	To develop irrigation systems in support of the national food production program. To provide adequate level of irrigation service. To enhance economic and social growth in the rural areas. To maintain the operation of the agency as a stable and autonomous corporate entity.	
SECTORAL ACTIVITIES	Project Development / Systems Operation	National System are constructed, operated and maintained by NIA.
SYSTEMS CLASSES ACCORDING TO O & M	National Systems / Communal Systems / National Systems	Costs are totally shouldered by NIA but farmers pay irrigation fees.
SYSTEMS CLASSES ACCORDING TO WATER SOURCE/ DESIGN	Gravity / Pumps / Gravity / Gravity / Pumps Reservoir / Diversion / Reservoir / Diversion	Communal Systems are constructed by NIA and turned over to farmers association for operation. Irrigators Association (IA) shoulder 10% of direct cost while NIA shoulder the 90% with the IA amortizing it in not more than 50 years at 8% interest.
SCOPE OF WORK	Construction of new irrigation systems Rehabilitation and upgrading of existing irrigation systems Agricultural development - Organization, development and training of irrigators associations - Preparation of Five Year Integrated Agricultural Development Plan for projects - Conduct of water management studies and other agricultural researches - Construction of farm-to-market roads Watershed conservation and development	Operation and maintenance of national systems Organizational, development and training of irrigators associations for the eventual transfer of O & M of systems to them Conduct of research and development activities in support of efficient systems operations and optimum water use Dissemination of appropriate technology on irrigation water and crop management through demonstration farms
FUND SOURCES	Loans (WB, ADB, OECF, IFAD, etc.) Equity from Government Government Appropriation Corporate Fund	Corporate Fund (Irrigation Fees, Equipment Rental, Management Fees, Amortization, etc.)
ACCOMPLISMENTS/ STATUS OF IRRIGATION DEVELOPMENT AS OF DEC. 1986	National - 595,902 hectares Communal - 710,009 hectares Pumps - 152,130 hectares	National level of development - 46.64%

Source: NIA (1989)

6. Group members pay the costs eventually of the project, although the investment is subsidised (no interest charge), hence they take an active interest in planning and check on construction standards and the costs of contractors. Efficiency is increased and accountability is high.

7. The boards of the irrigator associations are elected and accountable to their member farmers. They form sub-committees responsible for planning and overseeing construction work, for example.

8. The association co-funds construction by matching labour inputs to project implementation - this would be feasible even in Bangladesh as it does not require cash payments.

9. The considerable progress in achieving sustainable irrigation development has been separate from flood control projects which remain a largely central government responsibility.

10. There is a problem of coordination among the many water development agencies which have overlapping functions and areas.

REFERENCES

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ANNEX K MALAYSIA

K1 COUNTRY DESCRIPTION

K1.1 Scale of River Basins

Malaysia consists of Peninsular Malaysia (the southern half of the Malaysian Peninsular) and Eastern Malaysia (the States of Sabah and Sarawak on the Island of Borneo). The total national land area is 330,000 km^2 with a population of 16.5 million as of 1987.

K1.2 Type of Flood Problem

An oceanic tropical climate dominates throughout the year with mean temperature of 28°C and rainfall of 2100 mm per annum.

Floods in Malaysia are mostly local flash floods along the major river courses. There are also problems of coastal erosion, blockade of tidal river mouths and surges in the sea level along the coastline.

K1.3 Type of project considered

Water management projects in Malaysia comprise large, medium and small scale schemes, and involve structures such as dams, canals, pumping plants and embankments.

K1.4 Agriculture

Rubber, oil palm, coconut, rice and cocoa are the major crops in Malaysia. Farmers have recently been turning their plantings from rubber to oil palm due to higher profitability.

Important features of Malaysian agriculture include:

- the tree crops mentioned above account for 80 per cent of the crop area in Malaysia;
- tree crops are grown for international markets under estate management, but the prices of these commodities are highly unstable; and
- only 17 per cent of the agricultural land is devoted to food crops for domestic food supply. About 80 per cent of the crop area or 14 per cent of the total agricultural land is allocated to rice cultivation, resulting in imports of many food items.

K2. ADMINISTRATION/INSTITUTIONS

K2.1 Development Policy

In 1985, the Malaysian government adopted a National Agricultural Policy which encouraged farmers to adopt a flexible cropping pattern, and plant high value crops that have a high demand in either the domestic or foreign markets. The major impact of this policy is the tendency of farmers to abandon rice cultivation, since they are now encouraged to focus

on growing crops other than paddy. The new target for rice cultivation in the country appears to be scaled down to meet only approximately 60 per cent of national requirements.

K2.2 Responsibility for Water Management

The Department of Drainage and Irrigation (DID) in the Ministry of Agriculture (MOA) is the main government agency responsible for the planning, construction and maintenance of the country's drainage and irrigation projects of all sizes. Its primary activity is to provide drainage and irrigation facilities for a total of 690 irrigation schemes in Peninsular Malaysia. They cover an area of 310,000 ha.

MOF undertakes Integrated Agricultural Development Projects (IADP) in eight "granary" zones covering 210,000 ha of paddy land. MOF also instructs and supervises Kemubu Agricultural Development Authority (KADA) and Muda Agricultural Development Authority (MADA).

DID's main activities are:

- expansion and improvement of irrigation, drainage and flood control facilities in existing paddy areas for crop improvement and crop intensification;
- planning and construction of major flood control and drainage works such as coastal and river bunds and tidal control gates to prevent flooding and the ingress of saline water into agricultural areas operated by smallholders;
- reclamation of swamp lands and tidal lands by providing drainage, irrigation and flood control facilities for the cultivation of paddy and other crops by smallholders;
- maintenance of rivers and mitigation of flooding in rural areas by carrying out river improvement works such as desilting, clearing, realignment and drainage of rivers, and the construction of major drainage works;
- carrying out coastal engineering and hydraulic model studies to facilitate the planning and design of various structures;
- operation and maintenance of a hydrological network of rainfall stations, river stage and discharge stations, river suspended sediment stations, river water quality stations, evaporation pan stations, and agro-hydrological stations, throughout the country. Data collected from these stations are continuously processed, using an electronic data processing system;
- undertaking basic water resource assessments and providing advice to other government departments and agencies in hydrological design and applications; and
- operation of five telemetric flood-forecasting systems in five river basins, namely, Klang, Kelantan, Trengganu, Pahang and Perak to facilitate river forecasting work.

K3. O&M

K3.1 Organisation of Water Sector for O&M

KADA and MADA undertake O&M themselves. Other than KADA and MADA, DID is responsible for every aspect of O&M.

K3.2 Resources - Sources and Level

Project construction costs are borne by the Government without any beneficiary dues. The O&M of KADA and MADA is financed by those agencies. DID undertakes O&M for DID projects (non-granary zone) at its own cost and for IADP (granary zone) with 50 percent contributions from central Government and local Government respectively.

Water dues are collected from beneficiaries but the rates differ from state to state.

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