People's Republic of Bangladesh
Ministry of Irrigation, Water Development and Flood Control

Flood Plan Coordination Organisation

Southwest Area Water Resources Management Project

United Nations Development Programme
(BGD/88/038)

Asian Development Bank
(TA No 1498-BAN)

FAP 4

FINAL REPORT

Volume 9

Impact Studies

August 1993

Sir William Halcrow & Partners Ltd.

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Environmental Studies

SOUTHWEST AREA WATER RESOURCES MANAGEMENT PROJECT (FAP-4)

ENVIRONMENTAL STUDIES

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ACRONYMS AND ABBREVIATIONS

ADB	Asian Development Bank
Aman	Main Monsoon Paddy
Aus	Late dry season/early monsoon Paddy
BADC	Bangladesh Agriculture Development Corporation
B. Aman	Broadcast Aman
BBS	Bangladesh Bureau of Statistics
BIWTA	Bangladesh Inland Water Transport Authority
BIWTC	Bangladesh Inland Water Transport Corporation
Boro	Winter (dry) season Paddy
BRAC	Bangladesh Rural Advancement Committee (NGO)
BWDB	Bangladesh Water Development Board
CARE	Cooperative for American Relief Everywhere (NGO)
CEP	Coastal Embankment Project
CERP II	Second Coastal Embankment Rehabilitation Project
DOE	Department of the Environment
DOF	Department of Fisheries
DPHE	Directorate of Public Health Engineering
DSSTW	Deep Set Shallow Tube Well
DTW	Deep Tube Well
FAO	Food and Agriculture Organisation of the United Nations
FAP	Flood Action Plan
FCD	Flood Control and Drainage
FCD/I	Flood Control, Drainage and Irrigation
FFYP	Fourth Five Year Plan
FPCO	Flood Plan Coordination Organisation
GB	Grameen Bank
GDP	Gross Domestic Product
GIS	Geographical Information System
G-K	Ganges - Kobadak
GOB	Government of Bangladesh
HTW	Hand Tubewell
HYV	High Yielding Variety
IEC	Important Environmental Components
EIA	Environmental Impact Assessment
IEE	Initial Environmental Evaluation
Khariff	Summer, monsoon cropping season
LAD	Least Available Depth
LLP	Low Lift Pump
MOSTI	Manually Operated Shallow Tubewell for Irrigation
MPO	Master Plan Organisation
NEAP	National Environmental Management Action Plan
NGO	Non - Government Organisation
O & M	Operation and Maintenance
ODA	Overseas Development Administration (U.K)
PU	Planning Unit
Rabi	Winter (dry) season crop
RB	Right Bank
RWRMP	Regional Water Resources Management Plan
SC	South Central
SCR	South Central Region
STW	Shallow Tubewell
SW	South West
SWA	South West Area
SWR	South West Region
T. Aman	Transplanted Aman
UNICEF	United Nations International Children's Emergency Fund
Upazila (Now Thana)	Administrative Unit above Union and below Zila
WFP	World Food Programme
WHO	World Health Organisation

1 INTRODUCTION

1.1 Background to the Study

In November 1989, a five year Flood Action Plan (FAP), coordinated by the World Bank, was initiated by the Government of Bangladesh. The initial phase of studies is directed towards the development of a comprehensive system of long-term flood management and drainage works, through 26 main and supporting projects comprising the FAP during the plan-period 1990-1995.

The FAP provides additional focus on the central objectives for water management development planning. Set within Government's overall strategic framework, FAP defines eleven Guiding Principles for implementation of a comprehensive system of flood control and drainage for the entire country (Table 1.1). These principles have the twin aims of:

- protection of urban, rural, commercial, industrial and public utility centres and communication networks.

- controlled flooding, wherever possible and appropriate, to meet the needs of agriculture, fisheries, navigation, urban flushing, soil productivity and recharging the surface water/ground water resource with minimum dislocation of the environment.

The Principles stress the need for effective land and water management through a variety of measures which include engineering interventions, coordinated planning of other infrastructure developments, flood forecasting and warning systems, an enhanced disaster management capability and beneficiary participation in all phases of planning, implementation and subsequent operation and maintenance.

The objective of the Southwest Area Water Resources Management Project (FAP-4) as part of the FAP is to assist the Government in formulating a comprehensive regional water resources development and management plan for the Southwest Area (both the Southwest and South Central Regions). The main component of the study is a planning exercise, where water and land resources are critical elements for planning, and agricultural growth the main indicator. Other economic activities, including navigation, fisheries and forestry, together with the possible impact on the Study Area's delicate environment would also be taken into account.

Within the broad framework a strategic plan has been produced for water resources development in the Area. This section of Volume 9 examines the possible environmental impacts of the plan components, and suggests measures for the mitigation of negative impacts.

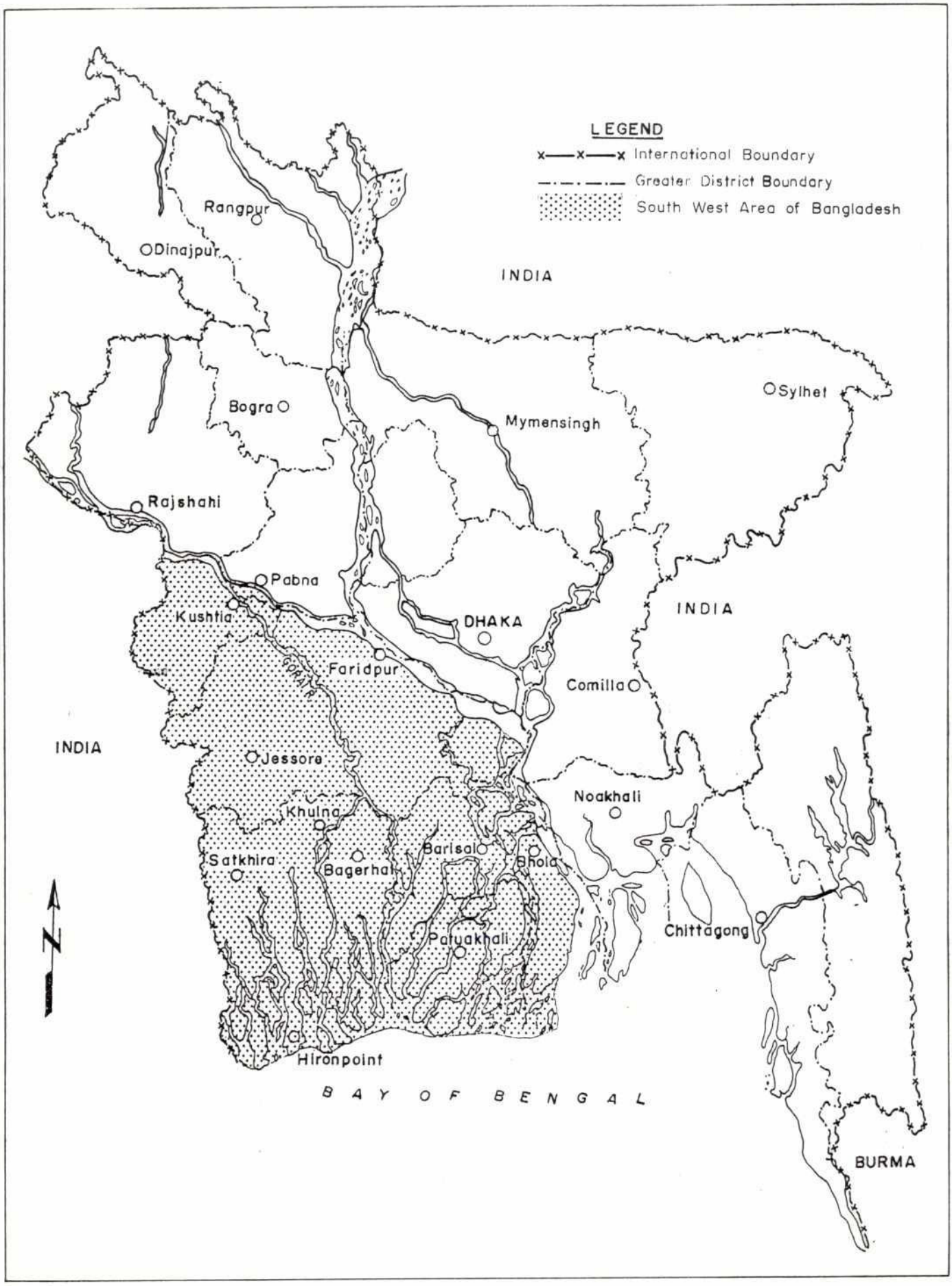
1.2 Assessment Methodology

1.2.1 Data Collection and Analysis

The project area for the Study covers the entire Southwest and South Central Regions of Bangladesh, an area of approximately 40,450 km² (Figure 1.1). The elements of the plan have included water resources, river morphology, coastal processes, river flow dynamics, forestry, agriculture, fisheries, sociology, environment and economics.

The scale of the project area and the sectors covered, has not been matched by either timescale or resources for in-depth investigations on every aspect. Priorities have been established with regard to the objectives of the Study, and the requirement to use agricultural growth as the critical indicator.

Figure 1.1



South West Area Location Map

TABLE 1.1

THE ELEVEN GUIDING PRINCIPLES

1. Phased implementation of comprehensive Flood Plan aimed at:

   - protection of urban, rural, commercial, industrial and public utility centres and communication networks;

   - controlled flooding, wherever possible and appropriate, to meet the needs of agriculture, fisheries, navigation, urban flushing,soil productivity and recharging the surface water/groundwater resource with minimum dislocation of the environment.

2. Effective land and water management of protected and unprotected areas, involving compartmentalisation, drainage, irrigation, drainage decongestion, land use, cropping patterns, environment, ecology, erosion/sedimentation control etc.

3. Strengthening and equipping the disaster management machinery including building infrastructure for quick and effective communication and transmission during disasters.

4. Improvement of the flood forecasting system and establishment of a reliable and comprehensive flood warning system with adequate lead times and at the same time evolving techniques for dissemination.

5. Safe conveyance of the large cross-boundary flow to the Bay of Bengal by channeling it through the major rivers with the help of embankments on both sides.

6. Effective river training works for the protection of embankments,infrastructure and population centres, linked wherever possible with the reclamation of land in the active river flood plain.

7. Reduction of distribution of load on the main rivers through diversion of flows into major distributaries or interception of local runoff/local rivers by channeling through major tributaries or special diversions.

8. Improvement of the conveyance capacity of the river networks to ensure efficient drainage through appropriate channel improvements and ancillary structures to provide regulation and conservation.

9. Development of flood plain zoning as a flexible instrument to accommodate necessary engineering measures and allocate space for habitation patterns, economic activities and environmental assets.

10. Coordinated planning and construction of all rural roads, highways and railway embankments with provision for unimpeded drainage.

11. Encouraging maximum possible popular participation by beneficiaries in the planning, implementation, operation and maintenance of flood protection infrastructure and facilities.

Thus a large part of the data collected in many of the fields has been secondary data from previous and related studies. This has been supplemented by extensive site visits by the team members, by the knowledge of local specialists, and by modelling aspects of the data to predict future conditions. Although some primary data collection covering the socio-economic factors was undertaken, much of the ecological and social data has been drawn from secondary sources, the majority from the FAP supporting studies and the regional studies.

The environmental assessment is an analysis of the data on the present situation, and a projection of the probable impacts that the elements of the plan may impose on this existing situation. Data has been collated from the many different components of the project, from which environmental data has been isolated and analysed. Analysis has been subjective, as there is considerable variance and large gaps in the environmental database.

This evaluation concentrates on impacts to the natural environment and the food/health concerns of the human populations, together with sectoral impacts. The social and cultural impacts are given in a separate section in this volume.

To provide confirmation that information taken from secondary sources is both relevant and up-to-date, some field observations have been made by the environmental specialists and anecdotal data gained from discussions with local groups in the affected project areas, as well as Government officials, other FAP and project workers, and interested parties.

At this stage of planning, and with the scale of the project, the primary requirement of the environmental evaluation is to identify the main environmental issues, isolate the major negative impacts of proposed actions, and recommend general mitigation measures. It is not feasible to consider in-depth, quantitative analysis at this stage. What the evaluation has done is to highlight problems, and possible mitigating solutions, together with the detailed investigations that should take place in future planning stages.

1.2.2 Assessment and Evaluation

To arrive at an assessment of the positive or negative value of an impact it was important to define the criteria for assessment (scoping). Initially these criteria were divided into four broad elements:

PHYSICAL/CHEMICAL

Covering all physical and chemical aspects of the environmental, including finite (non-biological) natural resources, and degradation of the physical environment by pollution.

BIOLOGICAL/ECOLOGICAL

Covering all biological aspects of the environment, including renewable natural resources, conservation of bio-diversity, species inter-actions, and pollution of the bio-sphere.

SOCIOLOGICAL/CULTURAL

Covering all human aspects of the environment, including social issues affecting individuals and communities; together with cultural aspects, including conservation of heritage, and human development.

ECONOMIC/OPERATIONAL

To qualitatively identify the consequences of environmental change, both temporary and permanent, within the context of the project activities; and to assess the degree of complexity of operations and/or maintenance which might affect the successful running of the project.

Within these elements and from the data obtained by the surveys and field visits, together from consultations with the interested authorities in Bangladesh, and the donor agencies, it was possible to identify important issues, and define important environmental components (IECs) that could be examined against project options. The separation of the important/less important issues was done subjectively; and evaluation of project options took into account the importance of each component; its spatial magnitude; the permanence of the impact; reversibility and whether there were cumulative effects. This allowed qualitative assessments to be made, which were then given values on a ± 5 scale, thus allowing comparison between options. Further details of the IECs and the qualitative values on the scales are given in Appendix 1.

Coupled with this was a detailed consideration of the possible linkage and consequences between plan elements. This allowed a full understanding of the changing environment of the Study Area, and to suggest mitigation measures where these could be effected. More importantly, gaps in the data were identified and future studies recommended, either as separate components or as part of the Environmental Impact Assessments (EIAs) recommended at feasibility study stage.

1.3 FAP Environmental Guidelines

In the course of this study another project (FAP-16) produced Environmental Guidelines and an EIA Manual to be followed by FAP studies. The Guidelines underwent a number of revisions before being approved, whilst the Manual is still in an incomplete, draft form. These guidelines are designed for schemes involving active intervention measures aimed at flood control and drainage, such as the construction of new flood embankments and polders, and as such are not directly applicable to the strategic planning required of FAP-4.

The Guidelines/Manual require very extensive and detailed investigations to produce IEE and EIA. Such resources were not available in this study, neither were they required at the time of contract. Inputs changed during the course of the project, as did the direction of strategy development after consultation with the client and donor at interim stages.

The database from which evaluations had to be made is extremely poor. This is reflection of the relatively poor facilities available for monitoring at present. Project time had to be spent in cross-checking data, before its reliability was assured. Quantitative data is available in many areas, particularly when relating to production, population or economic aspects. Much of the necessary linking data is not yet available, even from other FAP projects (which is a problem of the phasing between projects).

As a result it has not been possible to execute the evaluation in strict accordance with the present Guidelines/Manual. Nevertheless, the spirit of the principles that underpin the Guidelines has similarly been used in this study and, within project resources and timetables, the concepts behind these documents have been adhered to as closely as possible.

2 PROJECT OBJECTIVES AND CONCEPTS

2.1 Development Objectives

Future development of the Southwest and South Central Regions' water resources are set against objectives that fall into principally four categories:

- conformity with Government policy
- satisfying socio-economic needs of the people of the Regions and ensuring that development is sustainable in the long term
- recognition of and harmonisation with the natural and physical changes occurring within the Regions
- ensuring that best use of resources is made in support of the goals above

The first two objectives provide the background to the project, whilst the latter two provide direction to strategy development.

2.1.1 Government Policy

Government policy is embodied within the current Fourth Five Year Plan (1990-95) which sets objectives for development within the water resources sector. The central strategy of this policy is to make use of irrigation and water control for the purposes of improving agricultural productivity and employment. Emphasis is given in the plan to minor irrigation and to flood control and drainage (FCD) as the principal means by which to achieve these goals. Priorities are established relating to maximising the benefits from existing facilities and where new projects are required, selecting those which have a short gestation period. Allied to these priorities are strengthened operation and maintenance and water management capabilities as well as involvement of the private sector in developing new areas and in providing support services to existing schemes. Other strategies are also recognised as being important. These include augmentation of surface water resources from the main rivers and basin-wide integrated development of both surface and groundwater resources.

These policies are reinforced in the Flood Policy Study and the National Water Plan and these documents broadly state how the Nation's water resources are to be developed and the goals which are to be aimed at. Within this overall framework it is nevertheless essential to define a sub-set of objectives by which the relative impact of policy options may be assessed. These definitions require an appreciation of the specific needs of the people in the Southwest Area (SWA) and of the overall environmental considerations when devising the means by which to best satisfy these needs.

2.1.2 Socio-Economic Needs

Estimates of food sufficiency indicate that overall food production falls some 33% below overall requirements for the Area and that, with development only of groundwater resources, by the year 2020 this will have increased to about 48% given the expected population increases.

Self-sufficiency is presently achieved only in areas where widespread irrigation is practiced, either by existing surface schemes such as the G-K project or where groundwater is heavily utilised. Nevertheless by 2020 even these areas are forecast to go into deficit.

Similar deficiencies are experienced in fuel energy and fodder whereas overall protein levels are generally adequate at present except in the lower producing areas in the southern half of the Southwest Region. However, even overall protein levels are expected to go into deficit by 2020 except in one or two areas.

Fishing is an important source of protein to the area as well as income. Capture fisheries as practiced in the rivers and flood plains is vital to the livelihood of many, particularly those amongst the most disadvantaged groups. Culture fishing and shrimp farming are high value uses of land which bring benefit directly to those concerned. These are worthy of encouragement where the benefits may be fed directly back into the community.

Domestic water supplies are almost exclusively drawn from groundwater resources, most of which is by hand-operated tubewells. The expected continuing rapid increase in groundwater development by both shallow and deep tubewells poses a threat to domestic supplies, both from the perspective of lowered water tables and, where relevant, increased risk of saline intrusion. Security of potable water supplies is thus of paramount importance.

Diarrhoea and water-associated insect vector diseases represent a major health problem, which are aggravated by unsafe water supplies, poor sanitation and hygiene. The impact of flooding can be particularly severe causing severe health problems within the affected communities.

Transportation is an important community need both for maintaining communications as well as major and minor trading links. The Southwest Area, whilst modestly well served by road and rail links is considered to be substantially dependent upon river transport. Maintenance and improvement where possible of the waterways for both formal and informal river craft is important to the Area.

Thus, in the context of this study, the needs of the people within the Area, and especially the majority in the rural areas, require the development of agricultural productivity with the aims of growing more food and producing more protein and of generating more employment with higher incomes. Allied to this are requirements to secure potable water supplies and facilitate public health and to maintain and promote fisheries and transportation facilities. To these general needs may also be added the concern for equitable distribution of benefits within the community as a whole.

2.1.3 Sustainability of Development

The dynamic situation of the evolution of the topography and of the rivers within the Area requires special attention to ensure that current, and indeed future, resource levels are maintainable. In the event of no further development, deterioration of resources can be expected even if the absolute rate of decline is difficult to predict, as is the case in many instances. Positive steps are required to counteract this deterioration and the measures employed have to be in a form which themselves can be sustained either through harmonisation with the long term physical changes in the area and/or through the availability of sufficient financial resources to maintain whatever is done.

Development should bring benefits which will be available for future generations to come, and should not, without widespread public consent, create irreversible disbenefits which in the long term will deny opportunities for those in the future. The measures introduced also must themselves generate adequate funds to ensure that maintenance is possible.

Sustainability demands that developments proceed in sympathy with environmental requirements. The present institutional framework, based on mainly sectoral and sub-sectoral interests, is not well-placed to ensure the coordinated use of all natural resources

in a manner which is sustainable. Interactions exist between water management measures and a wide variety of other important sectors, and these must be reflected in institutional responibilities and actions.

The Sundarbans are an important natural resource of the Southwest Region and of the nation as a whole. Given the current limited knowledge of how its ecosystem works and should be best managed, it remains essential that flow conditions at its boundary are tampered with as little as possible until such time as the potential impacts are properly understood.

In a broader context sustainability also requires that the quality of life be at least maintained in the future. The Area's flora and fauna are assets which should not be adversely affected without reasoned justification. Similarly, existing levels of satisfaction of human needs should be strived to be maintained and where possible improved upon in a manner which can be sustained in the long term. Given the expected population increases this is a major undertaking which will require the continued efforts and essential coordination of the many agencies concerned, directly or indirectly, with human needs.

2.2 Development Concepts

2.2.1 Choices and Linkages

A holistic approach to development is clearly needed by which all of the Area's resources and natural advantages are utilised to the benefit of the population. Water management is a central issue, but is far from being the only issue. Great opportunities exist to develop the sectors of agriculture, fisheries, forestry and rural and urban industries as well as to enhance social welfare and economic activities through water supply and sanitation programmes, cyclone and flood protection, improved transportation and energy supplies, housing and education.

In the context above the key components to the development of the Area as a whole are increases in agricultural and aquacultural productivity in a manner which increases and equitably distributes rural wealth; provision of secure rural and urban water supplies; reduction in loss of life; physical and economic damage and opportunity costs caused by cyclones and flooding; promotion of forestry as both a source of local income as well as timber, pulpwood and fuel; maintenance of an adequate transportation network and strengthening of public and private institutional capability to plan implement and manage these activities in a constructive and coordinated manner that takes full account of the public's needs.

2.2.2 The Main Problems

The initial process of strategy development is to understand the problems and the options available to be considered for solution to these problems.

With respect to water resources, the main problems that face the Southwest Area can be summarised:

(i) Acute shortages of dry season surface water flows in the Southwest Region which severely limit the prospects of irrigation development

(ii) The progressive siltation of channels within the coastal polder areas reducing the effectiveness of the drainage and consequently the productivity of the polders themselves

(iii) Widespread flooding in the areas adjacent to the Padma and Lower Meghna areas

(iv) The high risk that the Gorai mouth will be permanently closed by siltation in the short to medium term future and the severe consequences that this would have on salinity intrusion and channel stability in the coastal areas as well as the loss of opportunities for irrigation development

(v) The limited potential of further groundwater development in the context of meeting the Area's future needs and the risks associated with saline intrusion if exploitation is allowed to continue unchecked in certain areas

(vi) The supply of freshwater to Khulna city given its size and importance and that both surface and groundwater resources are critically placed with respect to saline intrusion

(vii) The currently unsatisfied demand for water given the marginal degree of food sufficiency and the expected growth in demand with population increasing nearly 50% by the year 2020.

There are many other problems which the Area faces. These include the concerns expressed over the changing river flows affecting the ecological balances within the Sundarbans area, maintenance of adequate waterways for Mongla Port and navigation routes generally, the impact of saline intrusion upon agricultural communities, the particular and general concerns over the management and social impacts of shrimp farming, the importance of capture fisheries particularly to low income groups, and the concerns for maintaining adequate base flows in the Lower Meghna to ensure the right bank spill rivers stay clear of saline intrusion.

In addition a further major problem is that of cyclones which periodically cause devastation and widespread loss of life. This particular issue is being separately addressed by the ongoing Cyclone Protection Project which is directed at the strengthening of coastal embankments and provision of shelters as places of refuges during cyclones. Whilst consideration has been given to the linkages between these works and proposals set out in this report, the measures and investments necessary for cyclone protection are not incorporated in detail within the Project.

2.2.3 The Main Development Options

The main water management development options that have been identified to address these key issues are as follows:

- Securing the Gorai mouth as a priority measure and related to this progressive augmentation of the surface water resources of the Southwest Region to meet future demands

- Improvement of drainage within the coastal polders for which a range of alternative measures have been investigated from which a policy focussed on a controlled transition to tidal equilibrium is preferred

- Strengthening and extension of embankments protecting the Area from the main boundary rivers and provision of upgraded and new flood control and drainage facilities where appropriate within the Area

- Development of irrigation within the area through exploitation of both surface and groundwater resources to the extent that may be permitted with or without augmentation.

Accompanying these principal measures are a range of ongoing and proposed interventions in sectors directly related to water management, including:

- Strengthening of the agricultural sector with an emphasis on improved productivity and crop diversification facilitated by better input and credit supply, research, extension and marketing;

- expansion of fisheries production through similar measures including support for artisanal shrimp farming, growth of culture fish ponds and efforts to support dwindling capture fishing;

- support for the forestry sector to encourage the growth of homestead groves (social forestry);

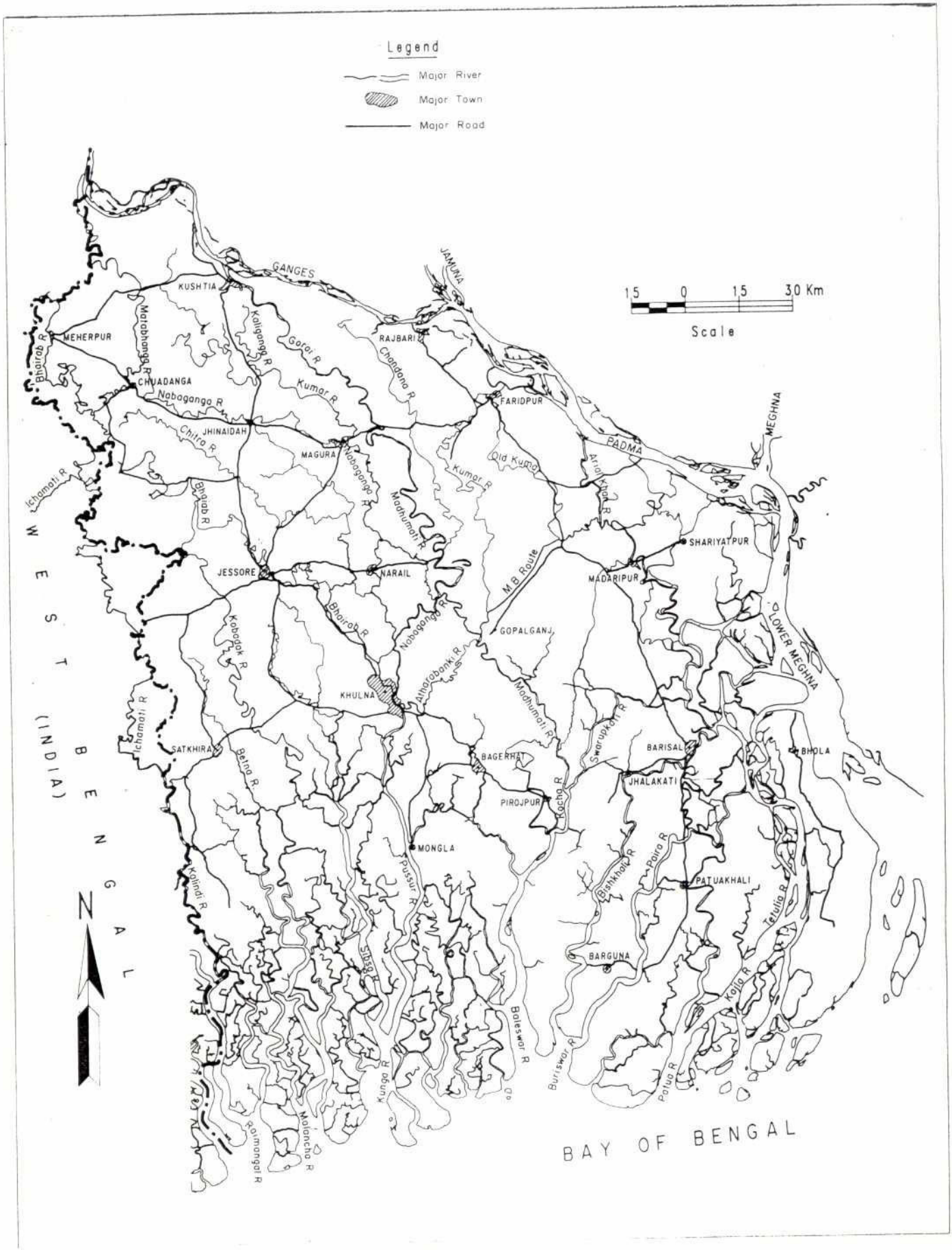
- to mange the Sundarbans as a complete ecosystem from which sustainable exploitation of forest products (as well as fish resources, wildlife and tourism) would be possible;

- to continue development of coastal plantations as a means of cyclone protection and as a source of timber;

- support and investment in the transportation sectors, particularly the navigation sub-sector and the maintenance of navigable access to Mongla Port.

These options form the basis from which a final development strategy has emerged. Many of the objectives of the study have complimentary goals, but the options require conflicting strategies. The overall strategy has thus been a process over step-wise development, with development constraints forcing trade-offs between choices to arrive at a composite management plan that best meets the primary objectives.

Figure 3.1



South West Area

3 DESCRIPTION OF THE PROJECT AREA

3.1 The Physical Environment

3.1.1 Introduction

The project area is approximatey 40,450 km^2, comprising the areas of the Southwest and South-Central Regions of Bangladesh that lie on the right banks of the Ganges, Padma and Meghna rivers, which form the northern and eastern project area boundaries. The western boundary is set by the Bangladesh-Indian border, the southern limit by the Bay of Bengal (Figure 3.1). The area is low-lying land of gentle relief on the edge of the river delta; more than half of it less than 5m above sea level. About 10% of the area is coastal mangrove forest (Sundarbans); about 17% consists of permanent open water, including rivers and beels; and approximately 62% is cultivated.

Human interventions have contributed to the present environment, through FCD and FCDI schemes, urbanization and resource exploitation. These activities have modified areas into predominantly rice-cultivation landscapes, with horizons of village groves of varying sizes and densities. Homesteads are generally protected from flooding by village embankments or are located on the highest land (therefore least vulnerable to flooding), in which instance the homesteads may be several meters higher than the surrounding agricultural land. Only in the coastal areas of the southwest Sundarbans do primarily natural landscapes remain.

3.1.2 Geology

The project area is located on the south western part of an extensive alluvial plain of Quaternary sediments laid down by the Ganges - Brahmaputra - Meghna river system, known as the Bengal Basin. These Quaternary sediments in the SW Area consist of fresh water sands and silts and are intercolated with marine silts and clays. It is probable that as much as 15,000 - 18,000 m of mainly unconsolidated sediments of Tertiary - Recent age exist beneath the central parts of the project area. The Basin is bordered to the north by the Shillong Massif and the Himalayas, to the west by the Indian shield, and to the east by the Arkan Chin Massif.

Sediments in the Area consist of freshwater sands, silts and clays intercolated at depth with marine silts and clays. Surface deposits are variable with the alluvial sands of the Ganges flood plain being replaced by deltaic sands in the eastern area of the Padma but west of its junction with the Meghna. Most of the moribund delta deposits consist of deltaic silts, which pass into tidal deltaic deposits and then mangrove swamp deposits adjacent to the coast south of Khulna. Where the Sundarbans have been removed by man, mangrove deposits have become tidal deltaic deposits.

Marsh clay deposits are present in pockets throughout the Area, but in the north are smaller, representing lower areas in the moribund delta. Further south the areas covered by these deposits are relatively large and it is possible that these beels are structurally or sedimentarily controlled. Deposits in the Meghna estuary consist in the main of estuarine deposits with accreting tidal muds at the seaward ends of the Islands.

The presence of Chandina alluvium at the mouth of the Padma where it joins the Meghna is thought to have influenced the development of the Ganges. Its presence in the north, assisted by seismic activity and structural movement, may have influenced the re-routing of the Brahmaputra some 200 years ago. These deposits are also thought to have controlled the distribution of the deltaic sands on the right bank of the Padma.

Seismic activity appears to be of two distinct type of event: (i) very large, disasterous ones such as those in 1897, 1934 and 1950 and (ii) smaller, more frequent events. The most obvious effect of seismic events is the impact of the energy being released. However, events can have significant consequences, even outside the area of event. For example, in the Chittagong earthquake in April 1762 large areas of land were submerged while other areas were raised. What was particularly significant was that the earthquake also generated a tidal wave (tsunami) which caused deaths in Dhaka and would have swept through the rivers in the Study Area.

However, the Southwest Area can be considered a zone with a relatively low risk of seismic activity and rapid crustal movement. According to the MPO Report (1986) risk zoning puts the entire SW Area into the Zone III - Low Risk Class. It is unlikely that seismic events would have a direct impact within the area, but could significantly influence the Boundary Rivers i.e. Ganges, Padma and Meghna. Tsunami could also affect the area, but their impact would be temporary.

The SW Area appears to lie in a general area of subsidence, which is greatest in the east and southeast of the Area, in the area of the present Meghna delta. This may in part explain why the Ganges river courses have gradually moved northwards and eastwards and become linked to the Brahmaputra in the Padma and then the Meghna. The depth of sediment above the basement appears to be greatest in the east rather than the west of the Area. This may help to explain the differences in subsidence rates and the presence of moribund and active deltas. Indications are that while the western side of the Area is relatively stable, the south-eastern corner is an active sedimentary area and is subsiding with accretion and subsidence being in balance.

The northeasterly movement of the Ganges has meant that most of the Southwest Area now consists of a moribund delta. However, if the Area is subsiding due to both geological activity, the compaction of sediment and the rise in mean sea level, then the Ganges and perhaps the Brahmaputra could resume more southerly routes sometime in the future.

3.1.3 Hydrogeology

In the project area only those units of Pleistocene - Holocene (Recent) age are important hydrogeologically. Older units are too deep (ie below 200-300m) to warrant consideration, given the groundwater resources available in the younger sediments (though deeper aquifers are exploited for water elsewhere in Bangladesh). In particular the Southwest Area has the potential for salinity problems due to its coastal location and uncontrolled deep drilling increases the risk of bringing in saline groundwater.

Major regional structural features of the Bengal Basin have been investigated as part of oil/gas and minerals exploration, and various troughs, saddles and faults can be identified within it. However there are no apparent major structures within the Pleistocene to Holocene sediments of project area, such as faults and folds, which would be hydrogeologically significant.

The study area is covered entirely by Holocene river alluvium comprising deltaic, terrace, meander, interstream and swamp deposits. These sediments continue to accumulate from detritus deposited by the main rivers, particularly on the floodplain of the Meghna.

The lithology of the various sediments referred to above varies from clay, through silt, to fine, medium and occasionally coarse sand. The geometry of individual sedimentary units is inevitably complex and there is a general lack of horizontal continuity on a local scale. Also, there is an upward fining of the sequence, while the degree of sorting decreases with depth.

A fairly broad correlation between lithology and depth has been established for the youngest sediments in Bangladesh and its principal characteristics are thought to apply to the project area. The three uppermost units, each of which is important hydrogeologically, are as follows:

(a) an upper, surface layer, of mainly clay and silt, (which in parts of Barisal, Khulna and Faridpur contains peat layers) characterised by high porosity but low permeability.

Due to its extensive thickness in parts of the study area it effectively precludes major groundwater development because it is unable to support tubewells itself and makes the lower aquifers too deep to be economically exploited on a large scale for irrigation. In most parts of the study area its main importance is the extent to which it controls downward percolation to the deeper units below.

(b) an intermediate layer of mainly fine sand and clay referred to as the Composite Aquifer, characterised by high porosity and moderate permeability. Where it is shallow enough to be exploited it is capable of providing water to HTW and MOSTI.

(c) a deeper layer, containing mainly fine to coarse sand and known as the Deep Aquifer, which is separated from the Composite Aquifer sequence by a clay layer. This aquifer layer is characterised by high porosity and moderate to high permeability. Where it is accessible it is an important aquifer which provides large quantities of water to DTW and STW/DSSTW.

In general in the south west and south central area the upper clay layer is comparatively thick, and this is particularly true in southern Barisal District when it may be up to 150m thick. In such areas the composite and deep aquifer sequences are probably found in the 150-300m depth range.

The local variation in land height and use is important hydrogeologically because it is related to the depth and duration of flooding during the wet season, and hence has a bearing on recharge. MPO (1987) produced a land classification for the whole of Bangladesh based on depth of flooding. The distribution of the various land types within the project area is given in Table 3.1.

3.1.4 Climate

The area has a typically sub-tropical monsoon climate with high temperatures and humidities throughout the year (Tables 3.2 & 3.3), although low winter temperatures have been recorded in certain years (Table 3.2).

Within the Area the rainfall shows a distinct pattern of increase (in banded zones) from northwest to southeast (Table 3.4). This rainfall pattern imposes constraints on the natural surface flows and drainage into the southwest corner of the project area. Coupled with the reduction of flows in the Ganges during the dry season, together with the river's meandering planform, low rainfall has brought additional problems in respect of dry season flows in the Ganges distributaries. The Gorai river intake has been identified as a major problem.

Whilst winds are generally moderate in the area, Bangladesh suffers from major cyclonic storms, with accompanying tidal surges in the coastal zone. Although the general track, and impact of cyclones, is histocially to the east of the project area, some major cyclones have, in recent time, been concentrated along tracks that affect the islands and distributaries of the Padma/Meghna estuary, though the Sundarban forest has been remarkably clear of major cyclones (Figure 3.2).

TABLE 3.1

Distribution of Land Type by Planning Units in SWA

PU CODE	F0 km²	F1 km²	F2 km²	F3 km²	F4 km²	Total km²
SW1	621	599	232	27	0	1479
SW2	597	658	227	33	0	1515
SW3	224	458	237	55	0	974
SW4	756	543	191	51	0	1541
SW5	126	212	120	31	0	489
SW6	57	116	59	16	4	252
SW7	172	452	582	337	131	1674
SW8	719	555	152	34	0	1460
SW9	455	341	196	60	0	1052
SW10	200	251	450	137	0	1038
SW11	354	1881	89	9	0	2333
SW12	88	334	41	11	0	474
SW13	146	693	358	171	46	1414
SW14	159	877	53	8	0	1097
SW15	1	7	0	0	0	8
SC1	147	410	406	67	5	1035
SC2	78	300	148	30	0	556
SC3	49	209	161	52	18	489
SC4	53	220	202	103	43	621
SC5	148	376	91	32	13	660
SC6	69	242	89	21	2	423
SC7	171	421	3	0	0	595
SC8	293	1070	57	1	0	1421
SC9	104	430	16	0	0	550
SC10	72	369	3	0	0	444
SC11	154	614	0	0	0	768
SC12	67	281	8	0	0	356
SC13	77	281	14	0	0	372
Total	6157	13200	4185	1286	262	25090

Source: Consultant's calculations from MPO (1986) data base.

TABLE 3.2

Average maximum and minimum temperature at selected stations in SWA (1985-89)

(oc)

Name of stations	1985		1986		1987		1988		1989	
	max	min	max	min	max	min	max	min	max	min
Faridpur	38.0	11.0	40.0	10.5	31.1	21.6	33.1	18.5	34.1	17.8
Barisal	36.7	9.7	38.4	10.0	31.0	21.3	32.8	18.0	32.9	17.4
Bhola	36.3	10.5	36.5	10.2	31.1	21.8	32.6	19.4	30.1	21.4
Jessore	40.6	9.5	40.2	9.4	31.6	21.5	33.3	19.8	34.6	16.7
Khulna	38.8	8.3	38.7	8.0	32.4	21.6	33.1	17.9	31.2	21.1
Patuakhali	36.0	12.2	36.5	11.1	31.0	22.5	32.3	18.4	30.0	21.9

[vp\vol9\tab3-2]

Source : Bangladesh Meteriological Department
BBS 1991

TABLE 3.3

Monthly average humidity percentage at selected station during 1988-89 in SWA

Name of Stations	Period	January	Feburary	March	April	May	June	July	August	September	October	November	December
Faridpur	1988	76	70	67	70	80	84	86	86	83	81	81	83
	1989	75	68	63	72	81	85	87	84	87	84	78	77
Barisal	1988	85	76	75	75	80	87	89	92	88	87	86	85
	1989	79	76	71	80	84	88	90	89	91	91	84	82
Jessore	1988	73	71	72	62	79	82	82	88	84	78	76	80
	1989	74	68	61	67	77	84	87	85	88	85	76	76
Khulna	1988	76	72	68	70	79	83	85	88	88	82	81	81
	1989	73	78	64	74	80	85	86	84	87	86	81	77
Salkhira	1988	80	76	54	70	75	85	82	85	84	75	69	72
	1989	73	68	65	72	87	83	86	86	88	86	80	77

[vp\vol9\tab3-3]

Source : Bangladesh Meteorological Department
B.B.S 1990 & 1991

TABLE 3.4
Annual Rainfall at selected stations of South West Area

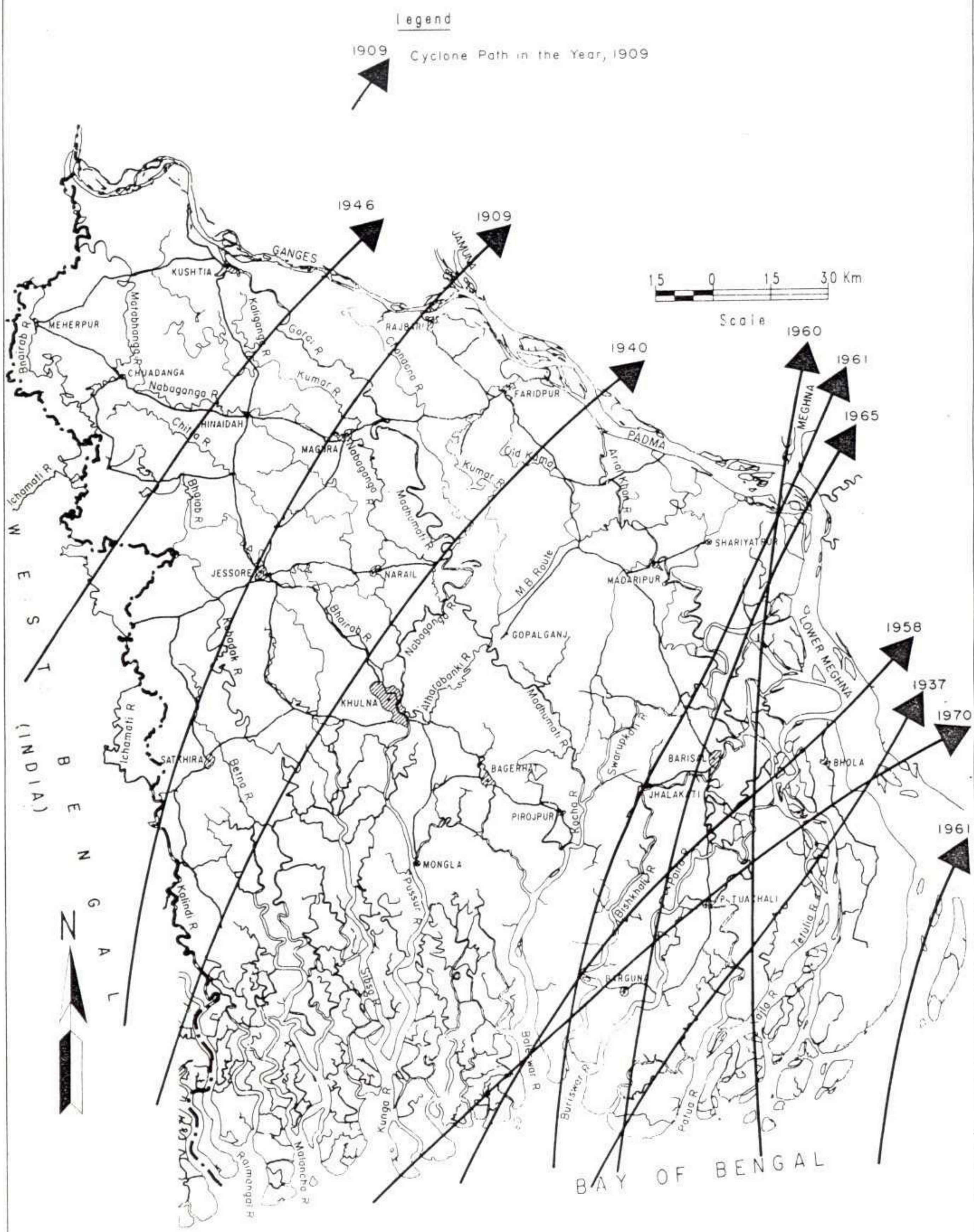
(in millimeter)

Name of stations	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
Faridpur	1809	2072	2324	1376	2108	2480	1489	2316	1981	2242	1629
Barisal	2325	1921	2322	1863	2186	2858	1458	2110	1650	2364	1990
Bhola	3002	3172	2621	2159	3148	2635	1801	2597	2310	2337	1955
Jessore	1601	1407	1752	1277	1672	1881	1573	2099	2059	1805	1344
Khulna	2035	1822	1981	1608	-	2107	1312	2416	1922	1780	1418
Patuakhali	2034	-	3000	3411	4006	2313	1701	2590	2446	2089	1769

[vp\vol9\tab3-4]

Source : Bangladesh Meteriological Department
BBS 1991

Figure 3.2



Source Cyclone Protection Project (1992)

Major Cyclone Tracks Over South West Area

3.2 Water Resources

3.2.1 The River Systems

The surface water drainage of the Southwest Area involves a complex system of interconnected rivers, transfer canals and drainage ditches. Three major rivers form the northern and eastern boundaries of the Area. The Ganges crosses the Indian border near Rajshahi and flows southwest for approximately 260 km to its confluence with the Brahmaputra (Jamuna) River to form the Padma River. This river flows southwest for about 100 km to its confluence with the Meghna River. The Lower Meghna River flows almost due south to the Bay of Bengal.

The combined annual flow of the Ganges, Brahmaputra and Meghna rivers is of the order of 1-1.5 x 10^{12} cubic metres. In addition, the distributaries drain the rainfall, which averages between 1,200 - 3,000 mm/year, greater than 80% falling during the summer monsoon. Thus the water inputs to the region are both large and highly seasonal.

The Gorai - Madhumati is the principal distributary of the Ganges in Bangladesh. The Arial Khan is the principal distributary from the Padma.

The Gorai formerly played a dominant role in supplying fresh water to the tidal zone, and it is the key to surface water resource development in the region. Several former distributary systems in the west of the region have become entirely disconnected from the Ganges and now only receive internal drainage; their channels are now vestigial traces of their former sizes. Rivers so affected include the Bhairab, Mathabanga, Chitra and Nabaganga.

The channels of the boundary rivers sweep back and forth across active meander belts, several kilometres wide; creating and destroying bars and chars, and constantly form and reform their active channels. The Ganges appears to be largely confined within its meander belt and the extremes of its position can therefore be predicted with some confidence.

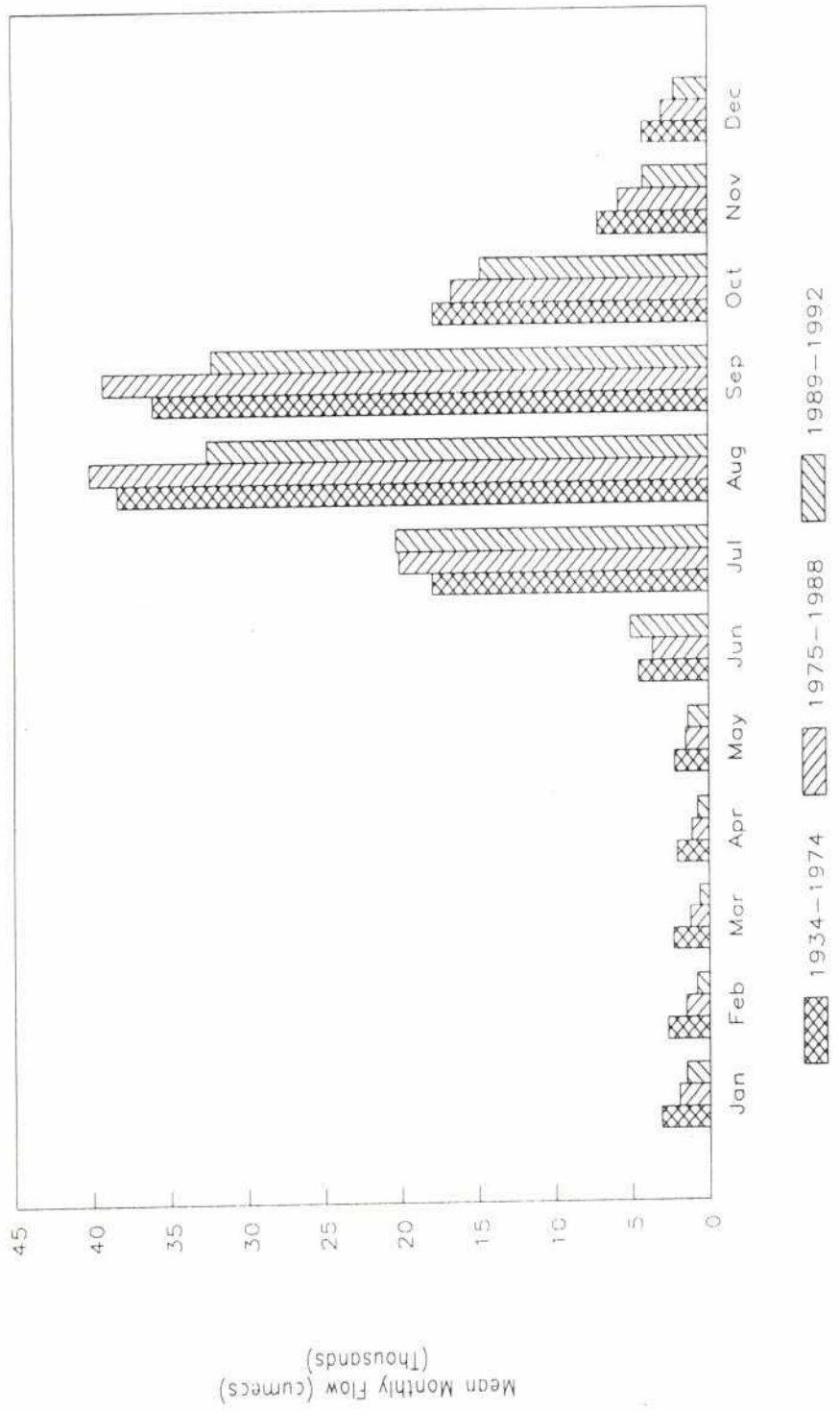
The lower reaches of the Padma are in the active delta building area and changes of course and form are more likely. The reach from Kushtia to Faridpur has undergone major changes since the confluence with the Brahmaputra and is still highly active.

The distributaries fed by the Padma and Lower Meghna Rivers receive considerable volumes of fresh water which have shown no obvious decrease in recent years. In the north the Arial Khan system is highly active geomorphologically with rapid channel shifting due to meandering; causing erosion related problems where embankments and settlements are threatened, notably at Madaripur.

In the southern part of the region the rivers are affected by tidal flows, and saline water penetrates deep inland especially in the central and western parts of the region in the Khulna - Gopalganj peat basins.

There is clear evidence that dry season flows in the Ganges have been seriously depleted due to upstream abstractions (Figure 3.3). This demonstrates that even during the period of the Indo-Bangladesh agreement on water sharing (1976-1988) dry season flows in the Ganges were nearly halved. Since the expiry of the agreement minimum flows have practically halved again dropping below 450 m^3/s in 1989 which is well below the minimum flow in the agreement (approximately 800 m^3/s) and flow is again reported to have dropped below this level in 1992.

Figure 3.3



Mean Monthly Flow in River Ganges at Hardinge Bridge

Examination of the flow records for the River Gorai at the Railway Bridge gauging station just downstream of Kushtia reveal that dry season flows have decreased markedly in recent years in the Gorai (Figure 3.4). The dependable flow for April is effectively zero. The indications are that the Gorai is diminishing as a distributary of Ganges water and that in the dry season it is increasingly isolated from flow in the main stream.

Historical observations reported by authors such as Fergusson (1863), Gales (1917) and Addams Williams (1919) illustrate that the distributaries have a finite lifespan which is associated both with the deterioration of the mouth of their offtake and the planform and conveyance of their channel. Offtakes are observed to become overly wide and funnel shaped and then to build bars and become detached from the main river during the dry season. Eventually, either a new mouth is opened somewhat upstream of the decaying one, or the distributary is permanently closed and becomes an inland river.

The build up of sediment is acceleratng the isolation of the Gorai. Pre-Farakka low flows transported significantly higher percentages of the load than those post-Farakka; higher flows post-Farakka transport greater sediment loads. These changes in dominant and sedimentary distributions indicate that the Gorai's morphological response to Farakka may be significant.

3.2.2 Groundwater Resources

Groundwater observation wells monitored by BWDB and other organisations concerned with groundwater development show a pattern which is characteristic of other alluvial areas in Bangladesh.

The distribution of the aquifer units is such that the most favourable hydrogeological conditions exist in the northern part of the project area (planning units SW1-SW7, and north of SW8).

Hydraulic continuity exists between the aquifer layer units which, function as a locally confined or semi-confined storage system; as well as between the layers and surface water. There is a relatively small volumetric transfer of water between the units and surface water, due to low hydraulic gradients, and a generally low permeability in the surface layers. Most natural groundwater movement is vertical, either downwards in response to infiltration of rainfall or floodwater, or upward, in response to capillary rise.

The characteristic hydrograph pattern is:

(i) A variation in groundwater levels corresponding to the wet and dry seasons;

(ii) Lowest water levels at the end of the dry season in April/May;

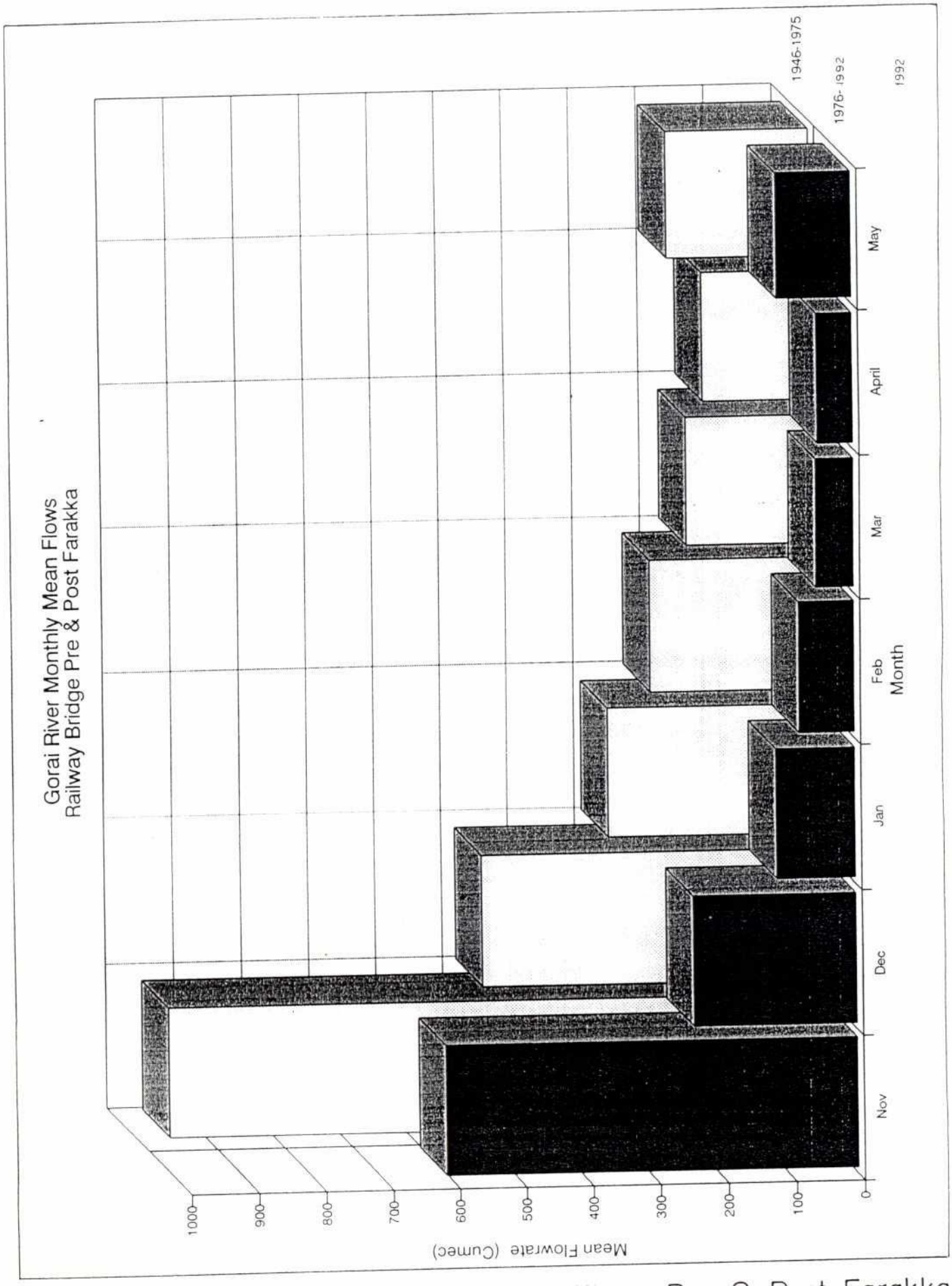
(iii) A rapid rise following the onset of the rain, to field capacity (aquifer-full conditions) in the wet season;

(iv) A dry season recession, to complete the cycle.

3.2.3 Water Quality

Many of the project area rivers are tidal and the waters are sometimes saline, both for considerable distances inland. The Padma, for example, is tidal as far upstream as Faridpur. Salinity distributions vary in accordance with the volume of freshwater flowing southwards in the rivers, though in general the drainage between the Gorai and Lower Meghna rivers produces a tongue of low salinity in surface waters.

Figure 3.4



Gorai River Monthly Mean Flows, Pre & Post Farakka (Railway Bridge)

The relationship between fresh and saline groundwaters in the coastal regions of Bangladesh is understood at a conceptional level only and not in detail. The principal components and relationships in the southwest study area are probably as follows:

(a) The presence of a saline front and lenses of freshwater in the upper aquifer;

(b) The presence of a the saline wedge in deeper aquifers;

(c) The existence of hydraulic continuity between groundwater and saline river waters.

However groundwater abstraction has the potential to cause adverse change. Over-abstraction of groundwater for irrigation upstream, for example, in the unconfined aquifer parts of the Kushtia/Jessore area, will tend to cause movement of the saline front inland, resulting in more southerly wells beginning to pumping brackish and saline groundwater. Similarly, over abstraction or badly planned abstraction of water from the freshwater lenses - usually for potable water supply purposes - will cause up-coning of saline water, again with the effect of making wells go saline. This problem has already occurred in Khulna; no major town supply is now understood to be available from the lens, which has become saline.

The freshwater lenses are a useful water resource in otherwise saline groundwater areas, which can be exploited if, properly managed. The appropriate technique is to 'skin off' freshwater by using numerous small- capacity wells, thereby avoiding excessive drawdown which will cause up-coning. In any event, the depth and extent of the lens needs to be thoroughly understood prior to its exploitation.

The general risk to groundwater as a result of saline intrusion is a real one, and it is a problem which needs to be taken seriously as unplanned development can lead to the catastrophic loss of fresh groundwater resources.

Actual recharge occurring under natural conditions can be enhanced by lowering the water table; this leads to the concept of potential recharge, which is the maximum recharge which could take place for given soil and hydrometeorological conditions. Usable recharge is generally taken to be 75% of the potential recharge to allow for errors in estimation of physical processes and parameters. The available recharge is some percentage of usable recharge, to allow for base flow losses and planning constraints.

3.3 The Coastal Areas

The coast of the study area comprises the delta region of the Ganges-Padma, and the estuary of the Lower Meghna, with its numerous islands. It would appear that the coastline has not changed markedly along the western part, and the accretion is generally confined to the seaward island shores to the east.

Apart from the Sundarbans, and in plantations on new-accreted land, the coastal and estuarine areas have been cleared for agriculture, and are heavily populated. To provide flood protection a series of coastal embankments was started in the 1960s and 1970s (the Coastal Embankment Project (CEP)).

The CEP polders have provided the means to improve production through security from flooding; prevention of saline intrusion and leaching of soils; use of groundwater irrigation; and the use of HYV. However, restrictions in channels and tidal flooding has brought problems of sedimentation.

The restriction of tidal flows has caused the deposition of sediments at the upper end of confined channels. As these points are often the outlets of drainage sluices, sediment deposition has contributed to blockage of structures. As smaller streams sedimented, their carrying capacity has reduced, placing further constraints on drainage.

The success in preventing flooding has confined rainfall within the polders. Had drainage been adequate, such inundation would not be a problem. But the rapidity of sediment deposition, leading to the inadequate performance of drainage outlets, had resulted in confining inundation in the polders for longer periods than designed.

In some cases this confinement has lead to a complete change in the environment of the empoldered area (eg: Beel Dhakatia); where inundation flooding has extended the permanent water body, forcing a change from agriculture to fishing as a local livelihood.

3.4 Forestry

3.4.1 The Sundarbans Ecosystem

The Sundarbans are a unique and valuable ecosystem dominated by mangrove swamp forests. The present Bangladeshi Sundarbans cover 580,000 ha, and are confined to the south-west corner of the coast of Bangladesh, with a small remnant of the Chakaria Sundarbans in Chittagong district.

The Sundarbans of Bangladesh have been subject to continuous human destruction over the last 200 years. The area of the South-Central Region became available for agriculture with the movement of the Bramhaputra River (producing the present river alignments) and the resulting large freshwater flows that now pass through the Region. The present forest in the Southwest now occupies about 25% of the forest area in 1779 (Figure 3.5).

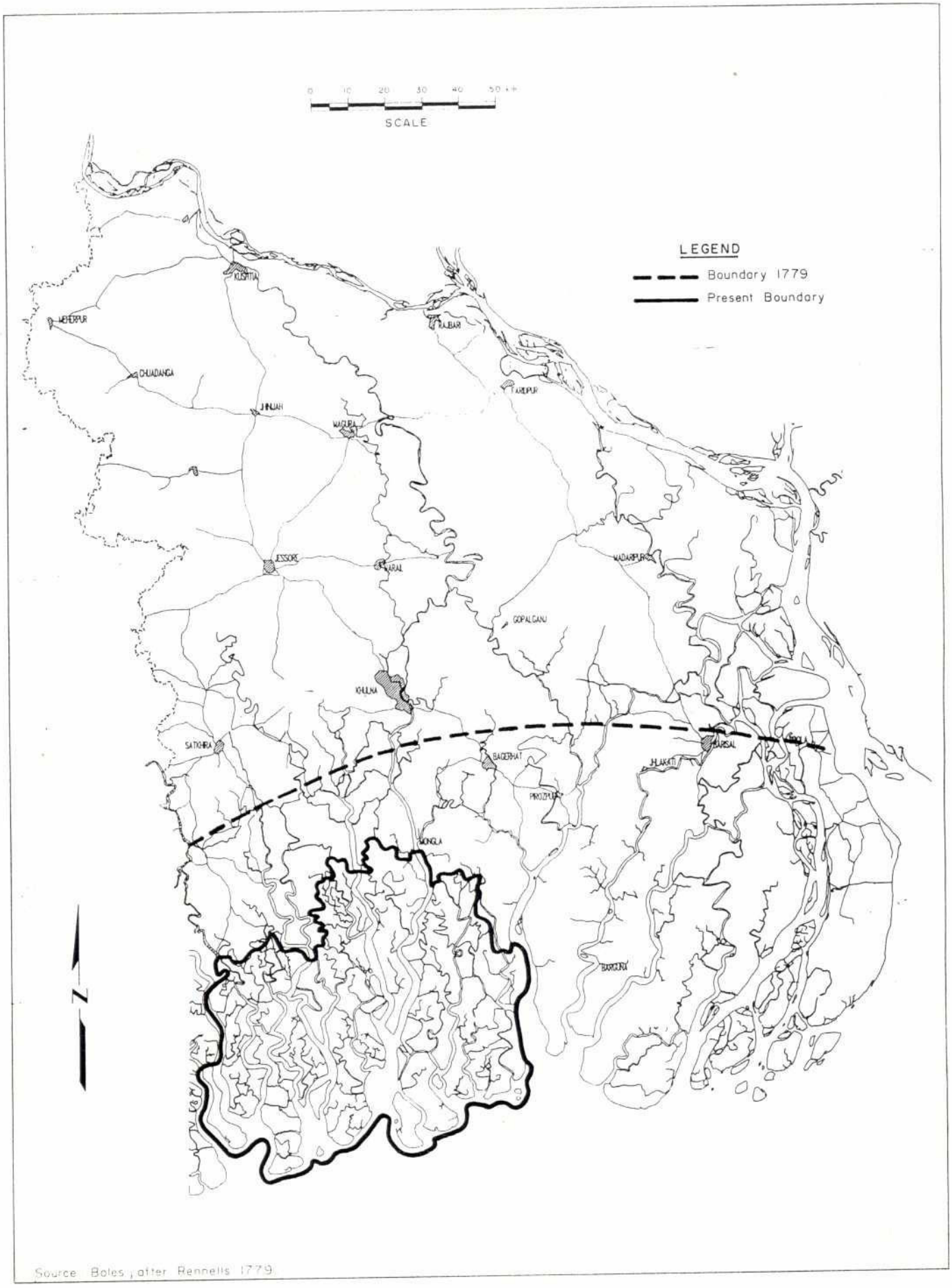
Such are the variety of resources dependent on this ecosystem, that the Sundarbans represent the single most important resource area in the South West Area. The Sundarbans represent a store of bio-diversity, being a complex mosaic of unique and changing wetlands, that can be managed to produce a combination of direct and indirect benefits from their natural productivity. The resources dependent on the Sundarbans include the timber and forest products, finfish and shrimp fisheries, and wildlife. The forest area provides coastal protection for the inland developed areas.

Mangrove is a collective term used to describe tropical tree species that have developed a tolerance for saline, temporarily inundate conditions. Less common tree species, and some saline tolerant shrubs, are considered as mangrove associates (Tomblinson 1990). Mangrove species are adapted to colonise tropical coastal and tidal zones, where variations in salinity tolerance, together with drainage and sedimentation patterns, determine the local distribution of species. The Sundarbans are predominately mangrove forest, with only about 2% of the land area comprising scrub and bare flats (pans).

In the Sundarbans, the extensive nature of the deltaic rivers and streams, together with small, local drainage channels within the forest (coupled with individual species tolerance to saline conditions and hydrological requirements), develop a patchwork of micro-communities, which collectively form the mosaic structure of the forest. The continuous, dynamic, tidal driven processes of sedimentation and salinisation, mean that the Sundarbans forest cannot be considered in terms of plant successions leading to climax communities.

The main mangrove species, and mangrove associates, in the Southwest Area Sundarbans include the Sundri (*Heriteria fomes)*, Gewa (*Excoecaria agallocha*), Keora (*Sonneratia*

Figure 3.5



Source Boles, after Rennells 1779

Changes in Sundarbans Forest (1779-1992)

apetala) and Goran (*Ceriops decandra*). Additionally *Lumnitzera racemosa, Xylocarpus* and *Avicennia spp* are found; and further members of the *Rhizophoraceae* are represented by *Rhizophora mucranata, Bruguiera gymnorhiza* and *Kandelia candel.* Two palm species are common: *Nypa fruticans* and *Phoenix paludosa*.

The Sundarbans forest mosaic is extremely difficult to quantify, varying as it does according to salinity and local drainage levels, with seasonal changes imposing a further set of conditions on the development of individual species. A simple zoning has been attempted, using salinity as the boundary condition, which provides some indication of species succession (Figure 3.6), though it cannot define the mosaic of communities.

In the upper, freshwater areas *Heriteria fomes* provides a dominant, timber species. These areas also contain marginally salt tolerant forest species, including *Euegnia fructicosa, Diospyros peregrina* together with *Bruguiera gymnorhiza* and *Xylocarpus mekongensis.* The tiger fern (*Acrostrichum aureum*) is common in the understorey. The middle zone is generally characterised by *Excoecaria agollacha*, in varying combinations with *Ceriops, Xylocarpus* and *Lumnitzera spp*. The dominant species continue into the saltwater zone, where stands of *Sonneratia, Avicennia* and *Rhizophora spp*. are found, with riverine fringes of *Nypa* and *Phoenix* palms.

3.4.2 The Value of the Sundarbans

The direct and indirect economic value of the Sundarbans should be fully appreciated. The area is not merely a repository for bio-diversity in terms of wildlife, or an exploitable timber reverse; it directly affects the viability of the fish and shrimp industries in the Bay of Bengal and the Southwest Area; it provides storm protection to inland areas, including Mongla Port; and is potentially a major area for tourism development in Bangladesh.

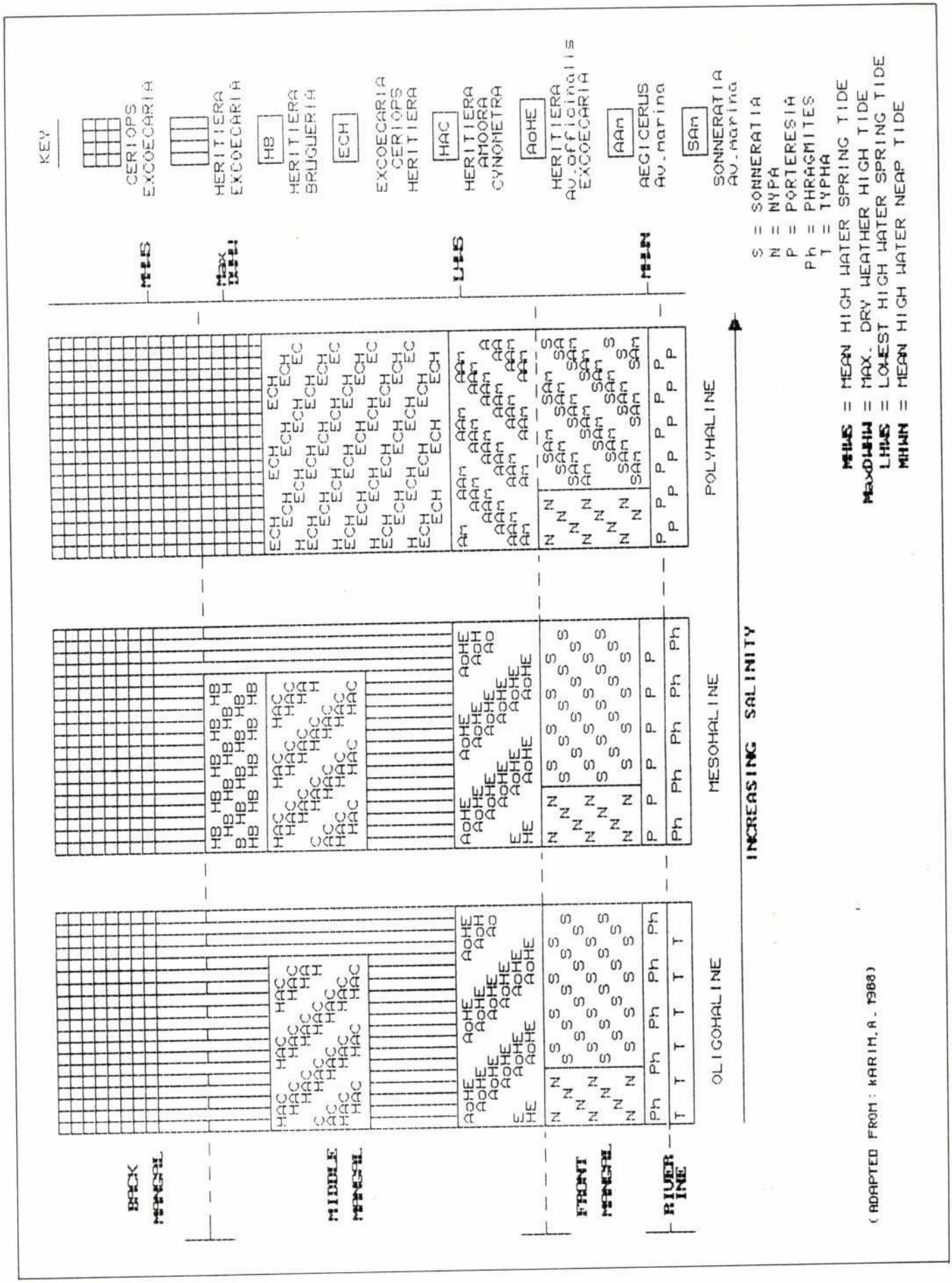
The timber and forest products of the Sundarbans represent the main tangible sources of income. Dominant trees that have commercial value include the Sundri (*Heriteria fomes)* which is a valued sawlog species, and Gewa (*Excoecaria agallocha*), felled for matchwood and paper pulping. Fuelwood species are commonly Keora (*Sonneratia apetala)* and Goran (*Ceriops decandra*).

The most productive Sundarbans area for commercial timber is the eastern region fed by the Gorai-Madhumati river system. In this area the dominant species is Sundri (*Heriteria fomes)*, or a varying combination of *H. fomes*, Gewa (*Excoecaria apetala*), *Brugueria gymnorhiza, Avicennia officinalis, and Xylocarpus spp.*

Felling is managed on the selection system with a rotation of 100-135 years (50 years for *Sonneratia*), and felling cycles of between 20-30 years (species/site dependent). Due to overcutting of all age classes, which will affect the recruitment to future harvest, the mean annual increment of the forest is less than 1 m^3/ha/year. The ODA Forest Inventory (1984) suggested that timber exploitation had exceeded the sustainable cut by about 40%. Future predictions indicate that, despite a logging ban (except for Gewa (*Excoecaria agallocha*), even *Excoecaria* will not be able to sustain industrial supplies at present rates of extraction.

In addition to over-felling, saline stress and the phenomenon of Sundri (*H. fomes*) 'top-dying', has further depressed the availability of this valued timber species. The previous view that salinity was the cause of 'top-dying' is now discredited as the tree grows in high saline conditions. Recent studies suggested that the cause may be a synergistic effect of a number of factors including: salinity, sedimentation, waterlogging, cyclone damage, and accumulation of toxic elements from agricultural wastes and port discharges.

Figure 3.6



Succession Model for Sundarbans Mangal

The Sundarbans support a number of other forest products, as well as providing fish breeding protection (for sea fish juveniles as well as shrimp), and a measure of coastal protection. Conservation of bio-diversity is a major function of the Sundarbans, and include areas designated as wildlife reserves.

The Sundarbans are essential to the survival of the shrimp-culture industry in the South West Area, which relies on the capture of post-larval shrimp found in the brackishwater areas of the delta, requiring the mangroves for shelter and food. Shrimp and prawn exports have consistently accounted for 20-22% of total Bangladesh export income (BBS). The total life-cycle of shrimp are dependent (at the post-larval stage) on the mangrove ecosystem, and loss of this ecosystem will result in a reduction in post-larvae, and a commensurate loss in shrimp-culture and catches in the Bay of Bengal (Figure 3.7).

The Sundarbans provide a considerable barrier to storm surges and cyclone damage to the agricultural lands to the north. In this century only two major cyclones have had paths over the Sundarbans (in 1904 and 1940). The forest does itself suffer from damage during these storms, and estimates of wildlife casualties are high. Nevertheless the forest ecosystem has survived.

As a measure of the value of the mangrove areas in coastal protection, artificial defences necessary to provide a similar length of protection (2200 km) could cost an estimated 16,000 million Taka with an annual maintenance cost of 320 million Taka.

The importance of considering the total value of the direct and indirect resources of the Sundarbans ecosystem is demonstrated by the summary of production and ecological value given below (Table 3.5). These figures are low estimates for some products: the harboard mills receive a Government subsidy and pay only 20% of market price for timber; whilst the estimates for shrimp, and for cyclone protection, are conservative estimates.

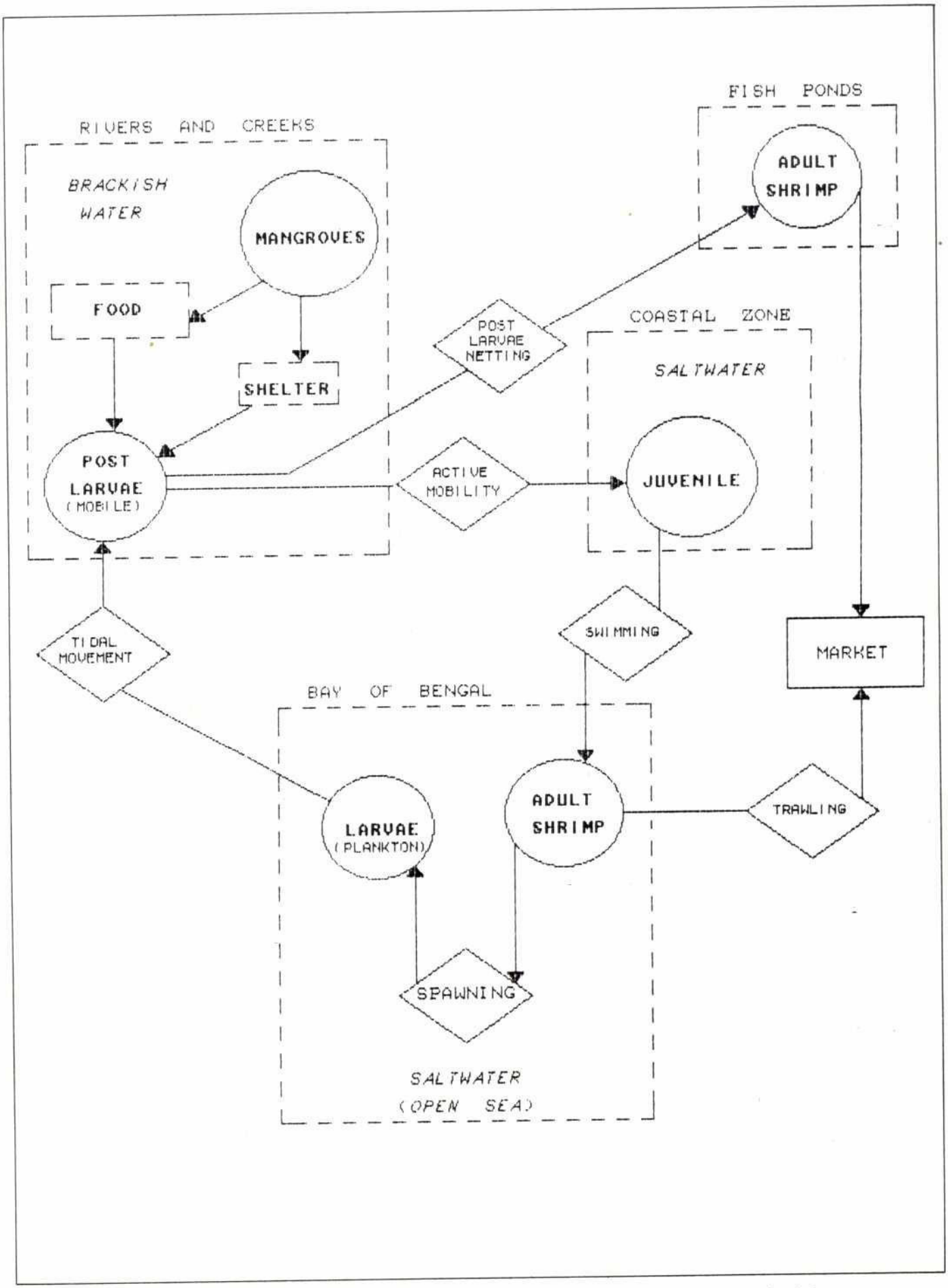
TABLE 3.5

Production/Financial Value of Sundarbans

Product or ecological value	Annual production (units)	Financial value (direct/indirect) million Tk/year
Sawlogs	20,000 m^3	300
Fuelwood	50,000 m^3	44
Pulp/hardboard	130,000 m^3	70
Transmission poles	21,000 nos	27
Nypa fronds	80,000 tons	78
Phoenix fronds	6,573 tons	2
Honey	208 tons	8
Wax	52 tons	2
Shell	2,382 tons	1
Grass	13 tons	<1
Fish	6,000 tons	195
Fish breeding protection		3553
Coastal protection		320
Wildlife reserves		40

Source: Consultant's Assessment (based on records 1986-91)

Figure 3.7



Diagramatic representation of Importance of Mangroves in the Life History of Penaeus Monodon in Bangladesh

The Sundarbans ecosystem is under considerable threat from natural and human interventions, both within and external to the forest boundaries. The value of the Sundarbans may dramatically reduce if further human development within the area, or unsustained exploitation of resources, continue.

3.4.3 Social Forestry

Social forestry is applied to the developmnet of village groves, roadside verge plantings, and coastal planations. These treed areas represent the main wood resource of Bangladesh, and a major timber resource (though scattered) outside of the Sundarbans.

The primary objective with respect to the forestry sector in the Fourth Five-Year Plan (1990-95) will be to expand the area under tree cover, with a view to increase the supply of forest to improve the overall environmental condition of the country.

The main constraints to the development of the forestry sector, for traditional forest exploitation are:

- Competing uses for land and water
- The limitations on land availability
- Over-exploitation of the existing forest resources
- Increased area of high salinity (with respect to certain commercial species)
- Silviculture methods incompatible with the long-term forest landscape changes

Over-exploitation constraints will require enforcement of existing regulations, both by the Forestry Department in respect to logging activities; and by the other appropriate authorities with respect to timber use (particularly in brick making and paper industries).

Social forestry issues are best be addressed through specific NGOs. Present initiatives do consider the involvement of poor and landless people in such schemes, though it is important that all sections of the rural community be involved to expand the homestead/social forestry reserves.

Forest development for village homesteads on marginal and F_0 land, represents the best possibility to increase both the area and production of the Southwest Area's forests. Current productivity is about 15 m^3/ha/year, which could be increased up to 25 m^3/ha/year within 25 years on 0.1 m.ha of homesteads.

Expansion of FCDI in the Southwest Area would increase the crop production, with a commensurate increase in the demand for fuelwood. Improvements in general income; associated with increased population growth, will extend the demand for forest products (furniture, building materials, etc.). Where housing needs compete for agricultural land, the homestead groves are likely to increase where new homesteads are established.

In the polder areas where seasonal saline flooding is carried out for shrimp culture, repeated inundation is affecting the established homestead trees. If this practice is maintained, these groves will require re-afforestation with saline tolerant species.

The available land in the coastal areas of the Southwest Area has become limited. New plantations can be considered on degraded coastal land, where pioneer species are being reduced by increasing siltation and elevation of the land. Research and development is rapidly required to find the correct successional species to underplant or replace these pioneer species.

The plantations are managed primarily as a cyclone protection belt, but with a secondary wood production function that should not impair their primary use. Such production can be sustainably managed (apart from cyclone damage) and be used to supplement the industrial wood supply.

3.5 Conservation

The main area for wildlfie is in the Sundarbans, where reserves areas have also been created.

The Sundarbans support a wide variety of wildlife. 32 mammal species have been recorded in the Sundarbans, but two deer species: the hog deer (*Axis porcinus)* and the swamp deer (*Cervus duvauceli*), the Java rhinoceros (*Rhinoceros sondaicus*), and the wild buffalo (*Bubalus babalis*) have become extinct in the area since the turn of the century. Existing, important species include a single primate, the Rhesus macaque (*Macaca mulatta*); the Bengal tiger (*Panthera tigris*); spotted deer (*Axis axis*) and barking deer (*Muntiacus muntjact)*; wild boar (*Sus scrofa*); the smooth Indian otter (*Lutra perspicillata*); the flying fox (*Pteropus giganteus*); three species of wild cat (*Felis*): *F. bengalensis, F. viverrina,* and *F. chaus*. The Gangetic dolphin (*Platanista ganetica*) is seen in the larger rivers.

Of the 35 reptile and 8 amphibian species recorded, the marsh crocodile (*Crocodylus palustris*) is said to be extinct in the area, and the estuarine crocodile (*Cricetulus porsus*) is heavily exploited by hunting. Other reptiles include 3 species of monitor lizard (*Varanus)*: *V. flavescens, V. bengalensis*, and *V. salvator*; 18 snake species, including the king cobra (*Ophiophagus hannah*), monocellate cobra (*Naja naja*), Russell's viper (*Trimereserus gramineus*) and rock python (*Python molurus*). Within the coastal areas 5 species of marine turtle have been recorded, including the Olive Ridley (*Lapidochelys olivacea*); and freshwater species include the roofed turtle (*Kachuga tecta*), and the estuarine terrapin (*Batagur baska*).

The area is rich in avifauna, including many species of waterfowl. Kingfishers, herons, bitterns, storks, egrets, cormorants, snipe, terns, gulls, plovers and sandpipers are all represented. Other birds include varieties of fish eagles, parakeets, woodpeckers, shrike, drongos, shrikes, bulbuls, warblers, flycatchers and other seed and insect eating species.

Equally extensive are the numbers of fish species (about 120) recorded in Sundarbans waters, including important commercial species such as Hilsa (*Ilisha spp*), Rui (*Rohita spp*), Katla (*Wallago attu*), Bhekti (*Leiognathus edentula*), and Koi carps. The crustaceans, especially the shrimp populations (*Penaeus, Metapenaeus* and *Parapenoeopsis spp.*) are dependent on the ecosystem within their life-cycle (Figure 3.7). There are numerous representatives of other invertebrate phyla, including the molluscs, decapods, and lower orders.

Elsewhere in the region wildlfe has been reduced by the intensity of land development. The fish bio-diversity is not known, although the Fisheries Study and Pilot Project (FAP-17) is investigating certain aspects. No data has yet been made available from this study on Southwest species, in particular the migrating species and the favoured migration channels.

Only about 20 individuals of the Gharial (*Crocodylus gangeticus*) are reported to remain in Bangladesh, in the Ganges near Khustia. Given that in the wild only about 300 are reported in the Mahandi, Girwa and Chambal rivers in India, with a further 50-100 individuals in Nepal, the species is endangered in the wild.

3.6 Agriculture

The agricultural development policy of GOB, as set out in the Fourth Five Year Plan (FFYP) has the following objectives:

- achievement of food self-sufficiency
- increase in the production of minor crops, and
- continued increase in growth of other crops.

The means to achieve this will be through a strategy focused on the following areas:

- crop diversification
- minor irrigation
- input delivery; fertiliser, seeds, pesticides and mechanisation
- research and extension
- marketing, and
- area development and targeted programmes.

The FFYP also stresses that the programmes to stimulate agricultural development are complementary to FCD. Although they can in some instances be seen as alternatives, the benefits from FCD can be enhanced through such complementary programmes.

The climate of the Area dictates that there are three distinct seasons each influencing crop production in a different way. The depth of inundation/flooding is a limiting factor to crop production. Although cropping patterns have developed in response to the seasonal pattern of flooding, benefits accrue from the changes in land use that occurs when land types change. Land types in Bangladesh are classified according to flooding depths (Table 3.1).

The kharif period, whilst it generally reflects an excess of rainfall which can lead to accumulation of runoff and inundation, is also marked by dry periods which can retard crop growth and reduce yields. The end of the kharif period is variable and this can lead to problems of water shortage during the grain filling period of Aman rice unless irrigation is provided.

The rabi season is when crops are dependent on stored soil moisture for the majority of their growing period. Delays in harvesting the Aman crops or an early end to the kharif period can reduce the residual soil moisture and limit the opportunities for rabi cropping. Farmers will not invest in inputs for a low output crop unless irrigation is provided. Without irrigation, cropping is confined to lower lying areas which dry out later than the ridge soils.

The pre-kharif period is also marked by variability in rainfall which can lead to yield reduction in the crop and also in boro rice.

The soil of the SWA presents a number of constraints to crop production, in particular the coastal districts where dry season soil salinity limits rabi season cropping and delays kharif production until rainfall is sufficient to reduce salinity below a threshold which varies with the crop grown.

The texture and drainage of soils present problems. Lower lying, fine textured soils of poor drainage status remain wet into the dry season. They are sticky and plastic when wet but very hard when dry which restricts the period when the soil is at a suitable moisture content for cultivation. Further, they dry quite rapidly, limiting rainfed rabi crop production. Soils on ridges are often of coarser texture with higher permeability. They are easier to cultivate but moisture retention also limits rainfed rabi production. Such soils are often in land type F0 which may be above normal flood/inundation levels and do not provide a receding water table for crop growth.

The north of the Southwest Area is an important pulse producing region. In 1991 the SWA, and particularly the central and northern districts, produced 65% of the national output of lentil and 61% of the output of chickpea. Pulses are an important source of dietary protein and at a national level production is declined, on average, by 2.67% annually between 1979-80 to 1987-88. In the SWA production has in fact increased.

The climate of the region identifies three periods when irrigation is required. The first period is the rabi season, the second is the pre-kharif transition to benefit the latter half of the boro crops and/or the beginning of the aus crop and the third period(s) is during the kharif when dry periods can occur at almost any time but are particularly damaging at transplanting of aman rice and during grain fill.

The intensity of cropping during the rabi period is generally low with an overall intensity of about 50%. There is scope for increasing irrigation as only about 32% of the suitable land in the SWA is currently irrigated.

3.7 Fisheries

The main policy objectives for fisheries as stated in the Fourth Five-Year Plan are:

- to increase fish production and improve nutritional standards;
- to expand employment opportunities in fisheries and ancillary industries;
- to improve the socio-economic conditions of the fishing communities, fish farmers and others engaged in the sector;
- to increase exports;
- to improve environmental conditions and public health; and
- to increase GDP.

Before there can be any overall increase in fish production, it will first be necessary to halt and reverse the ongoing catastrophic fall in river fish stocks and catches, and the decline in beel and floodplain fisheries.

Recruitment of floodplain fisheries is dependent on the downstream drift of spawn in the early floods, the beels and depressions that provide refuge for the developing fingerlings and juveniles, and the subsequent ability of adult fish to migrate out into the rivers during later floods. Embankments and present control structures have prevented this spawning pattern. The problem is cumulative, as year on year recruitment losses have lead to rapid and significant decreases in populations and catches.

The river fisheries and the floodplains cannot be divorced, they are integrated in the life history of the migratory river fish of Bangladesh. The increase in fish culture, welcome though it is as both a development sector capable of further expansion, and a means of substituting a protein source for the losses in river fish, will not provide a solution to the fisheries problem. The poorest sections of the community will not be able to afford cultured fish. Their protein requirement was traditionally provided by river fish, and even at the greatly reduced levels of stock, the river fisheries must still be regarded as the protein source for most of the rural poor. The possibilities exist, within the region, to improve the siting of embankments, design of control structures, and integrating fisheries and crop production programmes.

The fisheries sector in SWA has been characterised in recent years by a drastic fall in inland capture fisheries production, which is still continuing but is partly offset, in terms of volume of fish, by an expansion in cultured fish and in value terms by a rapid growth of shrimp farming.

The principal constraints to fisheries development and in fish production in SWA, include:

(a) low social status of fishermen versus farmers and other land users competing for resources;

(b) pressure for converting floodland into FCD protected rice-land;

(c) institutional weakness in DOF, especially with regard to law enforcement, fisheries statistics, extension service and fisheries management;

(d) deteriorating environmental conditions, especially in rivers, for fish reproduction and growth;

(e) human population pressure and escalating demand for fish, leading to over-fishing already depleted stocks;

(f) non-availability of formal low-cost credit to fishermen and most small scale fish farmers, forcing recourse to local moneylenders (mahajan) at very high interest rates.

Capture fisheries in SWA comprise the coastal artisanal capture fisheries, and the inland open water capture fisheries in rivers, estuaries, beels and floodplains.

The fisheries of the inland freshwater rivers, beels and floodplain are the most vulnerable to the effects of FCD developments, and the network of associated road embankments because of the obstructions caused to fish spawning and feeding migrations, the draining of many formerly productive beels, the consequent reduction in floodplain area and production and the enforced concentration of artisanal fishing effort onto the depleted river fish stocks. In the six years to 1988/89 the combined riverine and estuarine annual catch has fallen by about 31%, whilst the Padma River fishery has suffered an 85% loss. To halt this collapse and to rejuvenate the river fish stocks, efforts must be made by enforcing all necessary controls, restocking as and whenever feasible and retaining or restoring as many open links between rivers and beels as is possible so that natural regeneration may occur.

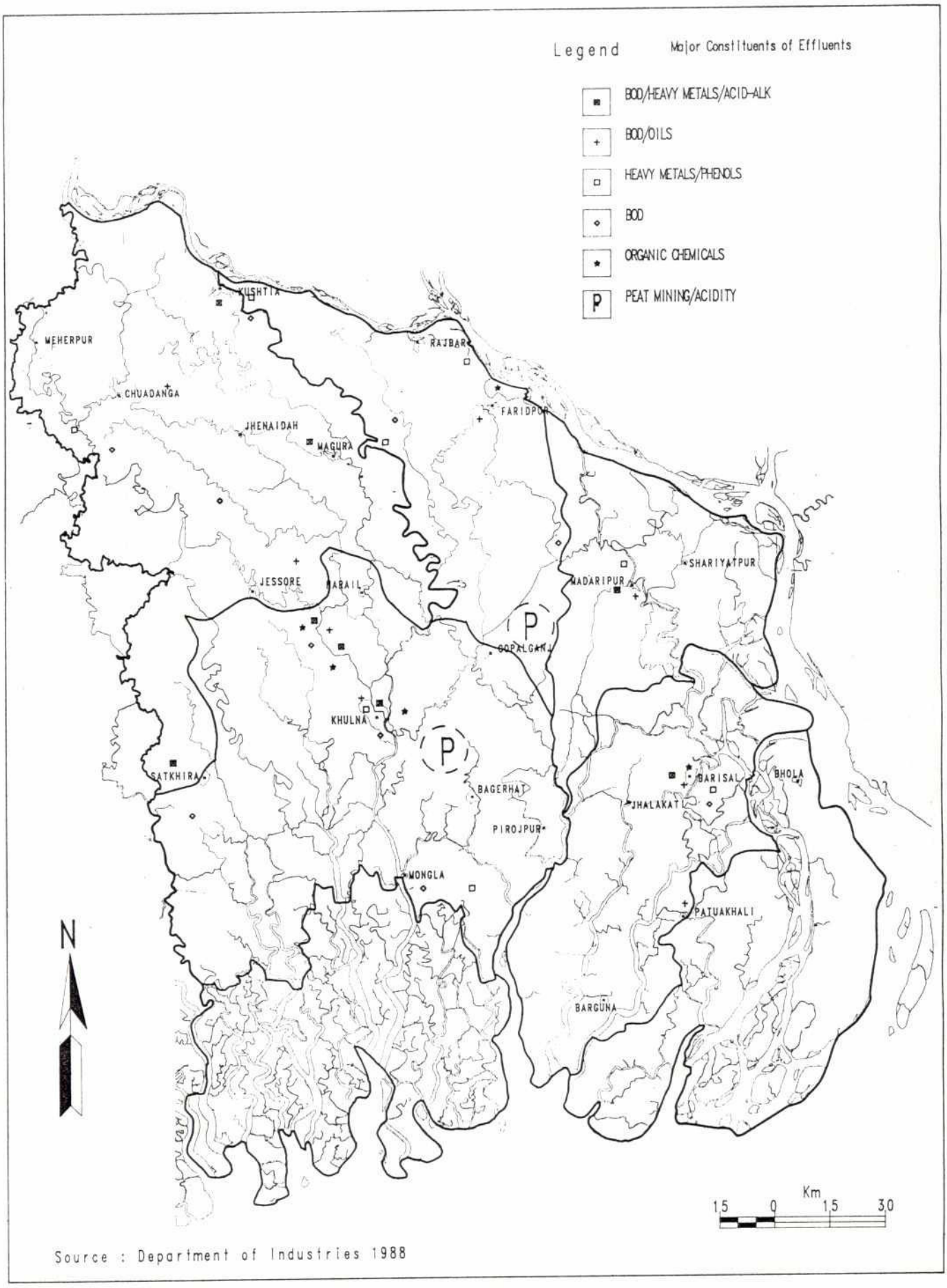
Within the region there is potential for expansion in fishculture, both finfish and shrimp. The development of the shrimp industry will however face a natural limit, dependent as it is on catches of post-larval shrimp for growing-up. The pressures on this wild stock from sea trawling and river catches of adults, together with loss of habitat from siltation and pollution of rivers, and destruction of the mangrove swamps, means that recruitment is being reduced, and consequentially that the shrimp culture industry will be limited by these reducing wild stocks. The area is not ideal for Penaeid shrimp hatcheries, though hatcheries could be developed elsewhere in the country (Cox's Bazar area) to support shrimp culture in the Southwest Region.

3.8 Industry

Industry in the Southwest Area mainly comprises of small industrial units (10-20 persons employed). Only in the larger towns, and especially in Khulna, are there large manufacturing operations. The region provides about 13% of industrial output for Bangladesh (1988-89 BBS). The main industrial centres are Khulna, Kushtia, Jessore, Barisal and Patuakali.

Factories require large quantities of water, for both cooling and process purposes; and discharge effluents which can place both oxygen and trees at risk on the river/coastal environments as well as being highly toxic.

Figure 3.8



POTENTIAL SOURCES OF INDUSTRIAL WATER POLLUTION

At present the industrial demand for water is a problem mainly in Khulna, where the northward ingress of the saline wedge has reduced the ability for certain industries to use river water for cooling during parts of the dry season.

Of more concern is the discharge of industrial effluent without any form of treatment. The lack of a water quality monitoring programme has meant that the makeup, concentrations and impacts of industrial effluent in the region's surface waters is unknown. Coupled with the lack of data on the concentrations of agrochemicals in these waters, there might be cause for concern. Baseline data on water quality in the region's rivers is urgently needed.

The study has attempted to isolate the major areas of concern with respect to industrial effluent, and Figure 3.7 shows the location of industries classified by their type of effluent discharge.

3.9 Human Development

3.9.1 Nutrition

Nutritional requirements for a country are generally compared with recommended intakes from FAO/WHO. For Bangladesh these figures are given in Table 3.6; which shows a decline in nutrition since 1962-64.

TABLE 3.6

Average Energy, Protein and Micronutrient Requirement

FAO/WHO Standard (Average)		Per Capita Intake		
Nutrients	Quantity	1962-64	1975-76	1981-82
Energy (kcal)	2273 (kcal)	2301	2094	1943
Protein (gm)	45.3 (gm)	57.9	58.5	48.4
Calcium (mg)	450 (mg)	73	305	260
Iron (mg)	7.6-18.6(mg)	10.3	22.2	23.4
Vitamin A (IU)	2013 (IU)	1870	730	763
Thiamine (mg)	0.9 (mg)	1.5	1.65	1.38
Ribo fl (mg)	1.35(mg)	0.50	0.87	0.68
Niacin (mg)	14.84 (mg)	23.20	22.21	13.15
Vit C (mg)	26 (mg)	48	9.51	13.26

Source: Institute of Nutrition and Food Science, University of Dhaka, Bangladesh.

Food energy has been used as a measure of the developmnet in planning units, and Table 3.7 shows the decline in food energy intake over nearly thirty years.

TABLE 3.7

Food Energy from 1962 to 1989

Average Energy (all ages, sex, activity) in taka kcals/p/d						
1962-64	1975-76	1981-82	1983-84	1985-86	1988-89	FAO/WHO
2301	2094	1943	2102	2191	2215	2273

Source : BBS and Institute of Nutrition and Food Science, University of Dhaka, Bangladesh.

The BBS Household Survey 1988-89 reported that in urban areas the intake of rice and fish increased substantially in 1988-89 compared to 1985-86, while matched figures for rural areas slightly declined. For the same period wheat consumption in rural areas substanitally increased (suggested as a result of Food for Work programmes).

The survey reported that national urban populations averaged an intake of 2183 Kcals/p/d of food energy, against 2217 Kcals/p/d in rural areas, and a national average of 2215 Kcals/p/d. All these values are lower than the suggested FAO/WHO standard of 2273 Kcals/p/d.

Figures developed through the planning model indicate that there are shortfalls in diet in certain areas. Of particular interest is the fact that shotfalls in protein and energy are not matched, which may be indicative of the use of replacement foods (such as cereals) in areas where protein is less available.

3.9.2 Health

More than 80% of all disease in Bangladesh is water related, principally malaria, dysentry, dengue fever, cholera, filaria, and hepatitis.

Many of the problems relate to poor sanitation and personal/communal hygiene. One major problem is the use of open surface waters for drinking, bathing and laundry. This brings people into contact with waters often contaminated with faeces from poorly sited latrines or washed into watercourses after open defecation.

The problem is increased where water supplies have depended on hand pumps, but the level in the aquifer has fallen reducing the suction height. This can occur in the dry season where tube wells are used for irirgation, and draw down the groundwater.

Vector diseases are associated with still water bodies such as old borrow pits, village ponds, slow/still canals and drains. Increases in aquatic weeds will, in some cases, increase the water surface available for insect breeding, and hence increase the risk of vector-borne disease.

4 ENVIRONMENTAL TRENDS

4.1 Introduction

The environment of the Southwest Area will inevitably undergo certain changes as a result of the existing situation; although it is not possible to provide accurate time scales for changes within the resources available to this study. This section considers the possible environmental trends in the absence of any strategic water resources development.

Environmental changes impact on each other. Thus a change in one local area may have a consequential change in another. Over a region, considerable distances may geographically lie between the events of cause and effect. It is therefore important to attempt some estimate of the linkages between environmental trends, albeit at a general level at this stage in planning.

Trends will either be natural: that is, a continuation of events that have been put in place (whether or not these events were initiated naturally or by human intervention); or may be human: that is to say, changes brought about and continuing by human development. The latter have the ability to be more easily controllable, although they are often constrained by cultural, political and economic factors.

Long-term environmental changes are either irreversible, or become increasingly more difficult to alter (both technically and financially) with the passage of time. Thus any assessment of trends must be taken as an early-warning guide, to allow decisions to be considered and made to prevent negative trends developing or to have mitigation ready where changes are irreversible.

4.2 Natural Environmental Trends

4.2.1 Surface Water

The Southwest Area, is presently facing a grave situation in terms of its natural environmental harmony and the preservation thereof. The effect of reduced water levels in the Ganges river, and its principal tributaries such as the Gorai, has disrupted fishing and navigation, brought unwanted salt deposits into rich farming soil, allowed greater saline intrusion northwards, affected agricultural and industrial productions, changed the hydraulic characteristics of the rivers, and caused changes in the ecology of the delta.

The natural harmony of the study area has been severely disrupted by massive diversion of the Ganges waters upstream by India during the dry seasons. The increasing diversion in the upper reaches has led to progressive decline of water availability at the Ganges, and hence all her tributaries in Bangladesh.

The impacts of Ganges water withdrawal have been disastrous and all pervasive in the Ganges dependant Southwest Area, affecting about a third of the country's area.

The damage to the agricultural sector has been multitudinous. The largest irrigation project (The Ganges-Kobadak project) suffered such a setback that its pumping capacity reduced by over 60 percent due to non-availability of water. This led to a substantial reduction in the command area for irrigation, and depleted soil moisture, consequential losses were suffered in the total crop yield.

The damage to the fisheries sector has also been discernible. Flow reduction has severely affected the historical river regime, and allowed the ingression of the saline front, thus leading to severe dislocation of the life cycle of the fish population. Changes in the river

regime affected the spawning ground, and the required water was not available at the time of spawning. This led to substantial reductions in the inland open water capture fishery, and the salinity ingression affected the sweet water species.

The impacts on the forestry sector has been apparently less obvious. The lack of upland flow and consequent depletion of soil moisture, and the increase of salinity have severely affected the Sundarbans, which is the principal supplier of timber. Natural regeneration of mangrove forests have remarkably retarded, while evidence of top-dying of the commercially alternative sundri trees has become pronounced.

Low flows, causing sedimentation, have also caused drainage problems in many areas. Water-related diseases have increased, since the habitants use the stagnant and stale waters of the wetlands for multiple purposes.

Inland navigation is another hard hit sector where communication has suffered severely. The Ganges has become difficult to negotiate with by big boats during the dry months, and the offtake of Gorai becomes completely choked by February every year.

Damages done to the physical and hydrological characteristics is rather difficult to quantify directly, but it yields subsequent losses to various sectors indirectly both in the short and the long run. For example, increased salinity renders potable water unfit for human consumption. The vast majority of the population, however, are not served by municipal water supplies. They are exposed to and affected by various diarrhoeal diseases. Similarly, increases in soil salinity not only affects agriculture but also the natural vegetative cover and pasture lands.

Reduced flows in the Ganges during the dry period has caused a deterioration in the hydraulic efficiency of the channel so much that even the monsoon flows do not drain out as smoothly as it previously used to. The principal distributary the Gorai has also undergone severe changes. Reduced upland pressure has allowed tidal ingress northwards leading to shoaling and heavy sedimentation of the estuarine creeks. The severe drainage congestion in most polders of the Coastal Embankment projects, Polder 24, and Beel Dakatia in particular, was partly due to the reduction of upland flows.

The most disastrous impact of the flow reduction has been caused by the increase in salinity in both surface and groundwater, leading to marked increases in soil salinity. The saline front through the Passur river has moved from 135 km inland to over 200 km northwards. The impact has been enormous affecting agriculture, forestry, public health, and water supplies in the Ganges dependant areas.

Surface water supplies from the Ganges in the dry season will continue to diminish if the present trend continues. This diminution of dry season flows will have inevitable, long-term consequences, although a timetable for these situations cannot be suggested on present data:

(i) the dying of the distributary streams from the Ganges as sediment bars increase at the offtakes;

(ii) the northward movement of the saline wedge, as tidal movements meet less and less resistance from dominant freshwater flows;

(iii) increased sedimentation;

(iv) increased monsoon flooding from inundation and poor drainage in sedimented channels.

A further result of the lack of Gangetic dry season flow, will be the difficulty in providing (and in extending) surface water irrigation from existing schemes in the Southwest Area. Agricultural production will inevitably suffer.

In the South Central Region, surface water flows from the Padma and Meghna will not be affected. However, the continuing decrease in the overall contribution to the Lower Meghna from the Ganges may, in turn, tend to increase the northward movement of the dry season saline wedge within the Lower Meghna and its distributaries. This would have a severe negative impact on crop production in the lower parts of this region.

4.2.2 Groundwater Development

One factor that is generally perceived to mitigate against the loss of irrigation and domestic water supply, is the development of groundwater in the Southwest Area. However, the groundwater resource is limited and many factors will affect the sustainability of the resource.

The groundwater resource in the Southwest Area must serve two main purposes (in order of priority):

(a) provide sustainable water supplies for domestic purposes in all rural areas, and additionally in urban areas lying within the transitional saline zone, including the demands of industry that cannot be met by surface waters due to poor water quality (even on a seasonal basis);

(b) provide irrigation water to all areas, in particular those without access to surface supplies.

Groundwater development alone will not provide for the water supply and irrigation needs of the Southwest Area. Figure 4.1 shows that, although groundwater is allowed to fully develop (assumed completely developed by year 2000) the benefits of improved food production will be lost by 2020 as the population increases in all areas.

The denial of surface water flows has a further impact on the groundwater resource. In time the loss of surface flows will extend development of groundwater, particularly in the southern part of the Study Area, and the following factors are then likely to affect the sustainability of this resources:

(i) the degree to which the loss of freshwater flows, and seasonal flooding, will affect recharge;

(ii) the destruction of small freshwater lenses in the transitional zone by over-pumping and abstraction, to make up for a denial of surface supplies;

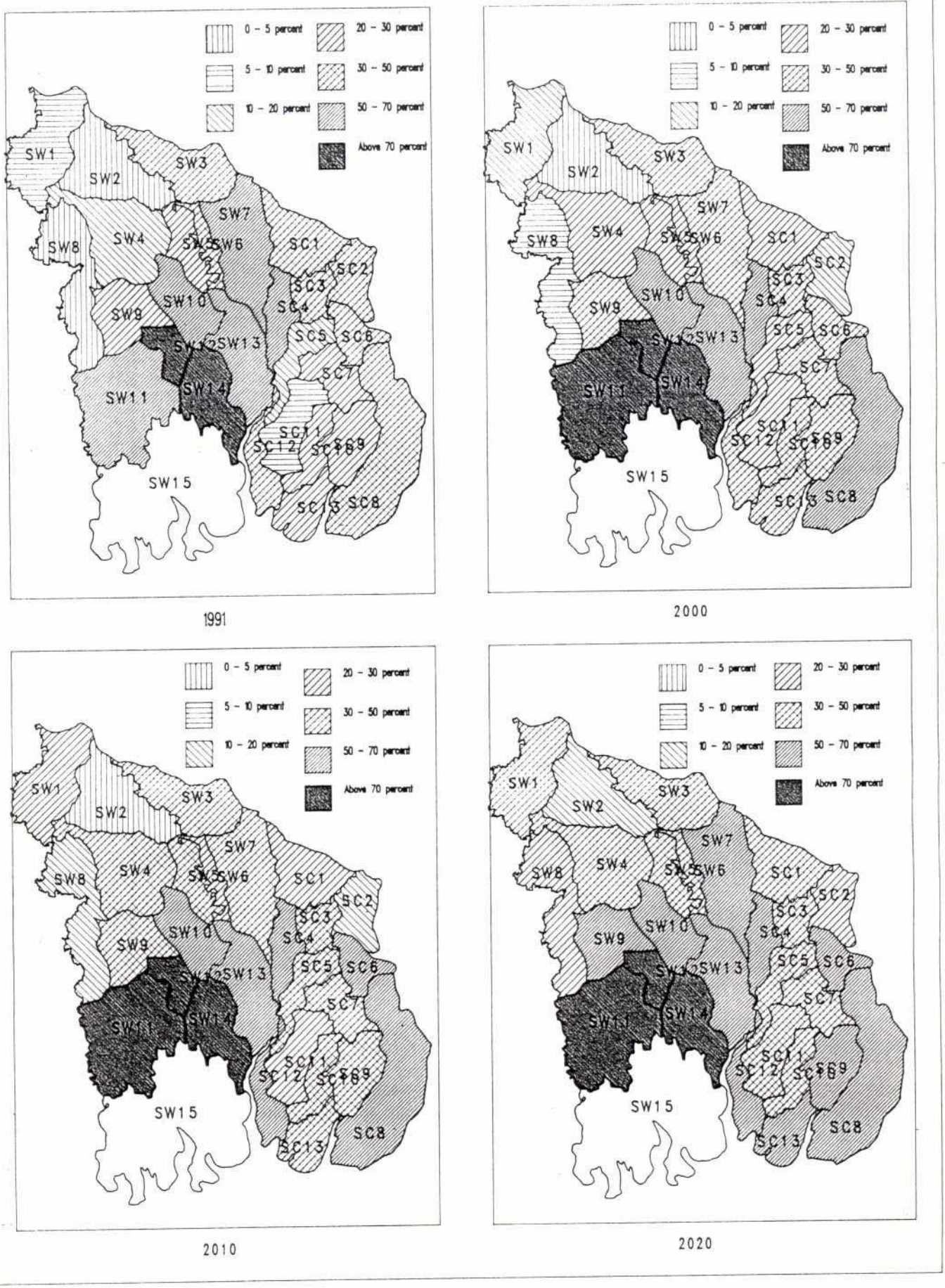
(iii) the economic costs of tapping the deep aquifer.

4.2.3 Fisheries

The fisheries of the Study Area will be adversely affected if there is a continuing sedimenting and drying up of channels. As there are no data on present migration routes, or river populations in this Area, predictions on the fisheries are difficult to quantify.

Further sedimentation, and more importantly any trend for the total dying out of the Gorai river, must adversely affect the fish spawn industry that serves the Kushtia market. This in turn will reduce the fish culture sector.

Figure 4.1



Food Energy Shortage

The reduction in river flooding, including that provided by an extension of FCD schemes, may reduce stock replenishment in transient and perennial beels and baors in the Area.

As surface water flows become less certain, farmers may be reluctant to accept any risk, small farmers may refuse to lease land to large operators for shrimp farming. There may be a move into artisanal shrimp culture; increasing the trend away from large shrimp culture operations dependent on land leasing.

4.2.4 Forestry

The major impact on the sustainability of the Sundarbans is felling, including the over-exploitation of timber for the Khulna paper, pulp and hardboard industries, and illegal felling.

It is expected that the forest composition will change continuously; and the community patterns within the Sundarbans mosaic, will alter. This in turn will affect the local ecosystems in each forest community, altering the productivity in local areas.

If sedimentation rates increase, at the northern end of the Sundarbans there will be degradation of the forest as flushing regimes are lost. Lagooning and salt pan development will destroy the trees, resulting in bare, salt-grass areas with minimal productivity.

Changes in the Sundarbans, brought about by a combination of over-felling, sedimentation and dynamic community changes, will alter the resource value of the forest. It is probable that sensitive, though valuable, species such as Sundri (*Heriteria formes*) are likely to be reduced in number. Salinity stress will result in more stunted, less commercially attractive, growth.

Loss of riverine tree cover within the Sundarbans will seriously reduce the shelter and food required by shrimp larvae and fish species. As these represent a major part of the stock recruitment for the Bay of Bengal fishery, as well as the basis for shrimp culture in the Southwest Region, protection of the Sundarbans from further degradation is important to the fisheries sector.

The Sundarbans can be expected to continue to provide protection against major storm damage in the Southwest Region. In the South Central Region little natural forest remains, and this part of the Study Area is most frequently visited by major storms and cyclones. There is relatively little accretion along this part of the Bangladesh coast where some afforestation is being practiced, and forest depth will need to be extended for protection to be significant over the coast of this region.

The demand for fuelwood is expected to increase with an increasing population. As a result felling within village groves will continue. This may result in severe deforestation, unless there is a commensurate increase in social forestry. In the short-term there is likely to be a depletion of timber stocks, until new plantings mature; and it is difficult to predict the long-term situation in this sector. Field observations in Kushtia, Jessore, Khulna and Barisal districts in March 1993 indicate that the prohibition on the use of timber for brick making is widely disregarded in this industry. Unless enforcement is effective, deforestation within the village and communal groves will set back stock replenishment by new plantings for some considerable time.

4.3 Human Development Trends

4.3.1 The Coastal Zone

The natural processes of sedimentation have been discussed above in their linkage with reduced freshwater flows. But the CEP which will rehabilitate the coastal polders, will itself cause changes in flow conditions in some areas. The success of agriculture, and the link with human development, will largely depend on the effectiveness of drainage in these poldered areas.

In the east of the coastal zone, the process of accretion can be expected to continue slowly. Some natural colonisation of these areas may occur, but it is more likely that afforestation programmes will produce the main coastal forests in these areas.

The success of such programmes will not merely depend on the degree of investment and management, but also on survival from cyclone damage. The trend to 1:5 year storms may continue at least in the short term, and most damage can be expected in the relatively exposed South Central coast zone.

4.3.2 Social Trends

The population of the Southwest Area is set to grow by about 50% within the next 20 years. This will place considerable pressure on the resources of the regions, as no area is likely to be able to provide self-sufficiency in food production.

The pressure that will be placed on food sustainability, to meet a growing population, may cause social and cultural changes. Nutritional standards can be expected to fall, especially in communities unable to purchase additional food. This in turn will affect public health, by a general lowering of the disease resistance of individuals.

To purchase food, in many areas especially in the south of the Study Area, new forms of income generation will be necessary. At present the lack of forward planning and institutional structures, suggests that these initiatives are unlikely in the short term.

If conditions become too severe, there may be a steady migration out of parts of the region, to other parts of the country (which also have severe population pressures). Such patterns of movement may be accelerated by catastrophic damages due to cyclones and floods, particularly in the absence of mitigation measures.

Industry is likely to expand, in the Southwest Region as elsewhere in the country, mainly around the existing centres (a function of existing markets, infrastructure, work force, etc). This points to a linear expansion between Khulna-Jessore and north to Kushtia. The Bhairab river is therefore likely to become the main artery receiving water for industrial effluent. A smaller degree of development is possible in Barisal and Patuakhali.

5 REGIONAL WATER RESOURCES MANAGEMENT PLAN

5.1 Introduction

The Regional Water Resources Management Plan (RWRMP) has been produced to meet the objectives of the study. The RWRMP has been developed as an integrated strategy document, and should be seen as a major planning tool rather than a project devlopment portfolio. Whilst individual components of the RWRMP represent development projects, they are enhanced by their inclusion and phasing within the Regional plan.

The project concepts have been discussed in section 2.2. This section will consider the background to the strategy, the development choices and the final form of the RWRMP.

5.2 Background to Strategy

The strategy developed for the water resources management of the two Regions has to take account of the changing resources setting.

Major evolutionary changes are taking place in the rivers of the Southwest Area of which perhaps the most significant is the channel planform changes occurring in the main boundaries which is affecting both banklines and spillage into the area through right bank distributaries. These distributaries play fundamental roles in sedimentation transport, salinity control, flooding, land drainage and surface water supplies for irrigation, domestic and industrial use.

Of similar importance are the coastal processes involved which have a major impact on the generally low-lying topography. Tidal action and saline intrusion, which are felt 275 km and 150 km inland respectively, have great influence on the manner in which the rivers and surrounding land may be developed.

Whilst accurate predictions of the future behaviour of such complex systems is difficult, there are good indications that resource setting of the area will continue to evolve over many years to come.

Whilst the Ganges is broadly in a state of dynamic equilibrium, its main right bank spill channel, the Gorai - Madhumati, is predicted to disconnect itself from the Ganges in the same way as other spill channels have done before. The timing of such an event is impossible to estimate with any accuracy but indications are that it will occur in the short to medium term rather than long term. If this is allowed to happen, major changes would occur to the regime of downstream channels and to the inward movement of salinity from the coast each year. Such changes would accelerate the deterioration of the existing patterns of polder drainage, would exacerbate salinity conditions particularly at Khulna and could lead to significantly increased dredging costs for the river navigation routes and at Mongla Port.

The Padma river, whilst still adjusting to the avulsion of the Brahmaputra River, is nevertheless unlikely to undergo major changes other than possible widening of its active corridor. The Arial Khan and Lower Meghna Rivers are both still very active stages and can be expected to continue to evolve over the next 50 - 100 years before reaching equilibrium. The spill from the Padma into the Arial Khan, whilst expected to continue in the near future, is at risk to changes in the Padma in the medium to longer term. Sedimentation in the Lower Meghna is expected to exceed overall erosion enabling the delta to pro-grade slowly. However subsidence and the continued loss of sediment to the sea will limit the rate of new land building.

Stabilisation of the left bank of the Lower Meghna against its general trend of eastwards movement could cause a significant change in the meander pattern which might cause erosion on the right bank south of Chandpur and lead to the closure of some of the right bank rivers further downstream. Such an event would lead to a major change in the character of the water resources of the South Central Region, which due to these spill rivers, enjoys a relative abundance of supply and a low level of saline intrusion.

The Southwestern coastal zone is in a state of transition from an actively developing delta to a semi-moribund delta sustained only by local rivers of which the Gorai is the most significant. This transition has been accelerated by polderisation and reduced inflows to the region as a result of deteriorating conditions at the Gorai mouth and reduced Ganges flows following construction of the Farakka Barrage. The consequence of these changes is most felt in the progressive siltation of many of the channels leading to drainage problems in the formerly productive polders. Polderisation has interrupted the land building processes within the embanked areas which might otherwise have kept pace with the changing nature of the river systems. A further consequence of reduced freshwater inflows to the region compounded by the siltation process has been the steady northward movement of the saline front each year, creating major influences on land use potential. This transition and continued siltation are expected to be a long term feature of this part of the Southwest Region. In this context, sea level rises due to global warming represent a further potential problem especially for those areas within the polders where land building has been arrested and subsidence can continue. It is very clear that the long term outlook for the polder areas is bleak if nothing is done.

In the coastal areas of the South Central Region the problems are far less acute as a result of the Lower Meghna spill rivers which sustain the main drainage channels. As indicated, however, if these spill rivers were to lose their connection to the Lower Meghna, then a similar pattern of events to the Southwest Region would commence.

Thus overall the quality of the land and water resources of the Southwest Region are expected to decline if nothing is done. The key issues are the closure of the Gorai mouth and the continuing and worsening congestion of the drainage in the coastal areas. The South Central Region by contrast appears to have no major underlying trends but this is at risk if major changes in the Lower Meghna occurred which caused the spill rivers to be disconnected. Whilst the two Regions, other than in the coastal areas of the Southwest, are nearly capable of supporting their current populations in terms of food, forecast rises in population will exert continued pressure on the water resources of both Regions. Surface water augmentation is a necessity in the short to medium term in the Southwest Region and most probably in the medium to long term for the South Central Region.

5.3 Development Choices and Interactions

The Southwest Area is a complex area in water resource management terms. Great care has to be taken to ensure that interventions perform in the way intended and do not adversely affect other parts of the Area. Careful consideration has been given to this point in formulating an overall strategy for development of the two Regions. The consequences of the individual interventions has been discussed in Section 4 and a regional perspective is given below.

Overall Requirements

In response to the perceived needs of the area and Government's general development policy, the water resource development options are focussed primarily on facilitating growth of agricultural production and rural incomes in the context of a socially equitable and environmentally sound approach. Further key issues relate to securing potable water supplies, particularly for rural households and for Khulna city, the latter being judged to

being critically vulnerable to saline intrusion. The opportunities for significantly improving water-borne transport are generally restricted to securing existing routes through more stable rivers and discharges and further dredging.

The further development of agriculture requires better management of the water resources whereby water is available for crop growth but not in excessive quantities which cause damage. Thus the key components are flood control, adequate drainage and access to irrigation.

Groundwater Development

Since 1985 groundwater development has been substantially in the hands of the private sector and large increases have been observed in the numbers of shallow tubewells for irrigation as a result. Estimates of future development potential of groundwater are known to be conservative, but prudently so. Nevertheless there is clearly a limit which, in relation to the estimates made, has been reached in a number of areas, particularly in the north western part of the Area. In the southern half of the Area aquifer conditions are less favourable and salinity risks are high. In the areas to the east and west of Khulna, conditions are in transition from those favourable for groundwater to the north and less favourable to the south. It may be anticipated that with growing demands from agriculture further exploitation of groundwater in this transition zone will occur. This is not desirable given the risks of drawing the saline interface further north and it is considered necessary that a buffer zone be established to minimise the likelihood of this happening. Monitoring of groundwater in the buffer zone over a number of years would provide data to establish whether it should become a permanent feature. Enforcement of a buffer zone in a de-regulated situation is likely to be difficult, but which would be much less of a problem if alternative surface water resources were made available, especially since at a local level these are likely to be less expensive for the farmers to develop. At present however, other than in certain parts of the South Central Region there is virtually no potential for further development of dry season irrigation in the Area.

Nevertheless, opportunities do exist for further groundwater development, primarily in areas to the east of the Gorai and to the north and east of Gopalganj in the South Central Region. These areas are however, subject to widespread flooding from the Ganges/Padma, Lower Meghna and Arial Khan systems and flood protection in these areas would greatly enhance the value of tubewell irrigation.

Overall, as has been indicated, groundwater irrigation alone will not meet the long term needs of the area and other parallel developments are required.

Surface Water Augmentation

The studies undertaken of options for surface water augmentation conclude that the most valuable choice is that which makes use of the Gorai. Other routes exist of which transfers along the Hisni and through the Arial Khan/MB route are clear second choices.

The Gorai River is very important to the Southwest Region. There is a strong probability that if nothing is done to secure it then it will cease to become connected to the Ganges. How soon this would happen is impossible to predict given the cyclical nature of its decline but what is clear is that, if allowed to happen, it would have a major impact on downstream conditions. Since there are effectively no opportunities at present to exploit the minimal dry season flows to irrigation, the principal outcome of the loss of these would be a marginal northward shift of the maximum intrusion of the saline front. This small movement would nevertheless be significant with regard to maximum salinities at Khulna. The greater impact however would be the loss of wet season inflows from the Ganges through the Gorai. This would again affect saline intrusion but would more importantly encourage even greater siltation problems in the coastal area.

Augmentation of the dry season flows in the Gorai would present a major opportunity to expand irrigation within the Gorai/Nabaganga corridor which would have the effect of substantially enabling food security to be achieved through to the year 2020 in the benefitted areas. Expansion of surface irrigation in these areas would greatly assist enforcement of the groundwater buffer zone, particularly in the critical area north of Khulna.

Amongst the choices for securing the Gorai mouth, the favoured one includes provision of an intake structure to control wet season flows. This will benefit downstream reaches in two ways. Firstly, it will reduce flooding along the Gorai and increase the drainability of this land. Secondly, by controlling the rate of recession of wet season inflows siltation and the volume of maintenance dredging can be reduced. These are both significant benefits. The amount to which wet season inflows are limited is constrained however by the possible impacts that reductions in Gorai discharges would have on regime conditions in the coastal area. Options have been considered which limit the reduction to somewhere between just below bank full (to maximise drainage benefits) and dominant discharge (to minimise downstream regime changes). It will be prudent that design of the structure accommodates a reasonable range of discharges so that any future adverse impacts can be minimised.

Maintaining a controlled discharge in the Gorai will have benefits beyond irrigation. Opportunities exist, if Ganges flows are available, to release additional amounts for the purposes of controlling intrusion of the saline front. In addition year-round discharges will enhance measures proposed for the coastal polders by increasing flows in those rivers which are targeted as the main drains, thus increasing their sustainability. The Gorai will also function better as a navigation route notwithstanding that structures on the river will impede progress at those points.

The two main problems with the Gorai Augmentation project as outlined above are the necessary long term commitment to maintenance dredging and the limited discharge that is attainable. Analyses undertaken indicate that a peak dry season abstraction from the Ganges of about 180 m^3/s for irrigation is optimal which combined with the approximately 120 m^3/s taken by the G-K project amounts to a total abstraction of some 300 m^3/s. Given a further commitment to 100 m^3/s minimum flow to meet downstream requirements in the Ganges, this leaves only a very small margin between the total commitment and the minimum flow recorded in the Ganges since Farakka was built in India.

The lowest recorded flow in the Ganges since the construction of Farakka is 400 m^3/s, and the 80% reliable flow is 663 m^3/s. Comparison with the figures above, and acknowledging that without a control structure in the Ganges it would be impossible to abstract all of the available flow, underlines the limitations upon future development in the Southwest Region beyond the development of approximately 180,000 ha of surface water irrigation associated with the 180 m^3/s abstraction. Furthermore, development of irrigation to that extent precludes any reliable allocation of base flow in the Gorai to salinity control, particularly as the latter to be significant, needs to exceed 100 m^3/s. It is not considered sensible to set aside water for salinity control unless that flow can be maintained with a high degree of reliability, given the consequences to future developments which would have been based on the assumption of fresh water availability.

Ganges Barrage

Whilst augmentation of the Gorai as described above offers a worthwhile investment and addresses the immediate risks associated with closure of the Gorai mouth, at a regional level the impact is limited to a relatively small proportion of the Southwest Region. To maximise opportunities for long term development it is necessary to both control water levels in the Ganges to maximise abstraction capability and to provide storage within the water resource system, over and above the areas which could be otherwise developed in the South Central Region without augmentation.

The Ganges Barrage through control of the Ganges flows enables transfers to be made into the Hisni river, which, given the priority afforded to the Gorai, could not otherwise be implemented. The Hisni transfer has a major impact on the dry northwest of the Area to the west of the G-K project. The Barrage will also have other advantages. It will reduce the pumping head required at the G-K intake. Depending upon when the Ganges Barrage is implemented, it could also reduce capital dredging works at the Gorai also. Thus, in investment and maintenance cost terms, construction of the Barrage should proceed with the minimum of delay providing its construction is consistent with parallel investment in downstream irrigation facilities.

The viability of the Ganges Barrage is nevertheless dependent on the adequacy of dry season releases downstream of Farakka. A total irrigated area in both the Southwest and South Central Regions of about 1.1 million ha could be achieved (requiring a maximum abstraction upstream of the Barrage of about 1000 m^3/s, consistent with a minimum flow of about 700 m^3/s in the Ganges. Still higher flows would be required if positive measures are taken for salinity control. Establishment of a new agreement over the sharing of Ganges flows is therefore a vital issue.

Arial Khan - Madaripur Beel Route Transfer

The Arial Khan - MB Route was identified at an early stage as an alternative means of augmenting the surface water resources of the Southwest Region. Its particular attractions are that its main source of water is drawn from the Jamuna/Padma system (which with Farakka is more reliable than the Ganges), its importance as a navigation route (which would be reinforced if flows were increased) and its comparative effectiveness at achieving salinity control at Khulna. Its main disadvantages are that the degree of augmentation is limited to about 50-100 m^3/s by the head available, its incompatibility with a Gorai augmentation (which reduces the head and thus the Arial Khan - MB route discharge further) and the susceptibility for the Arial Khan intakes to be silted up. There are three possible intakes and their history indicates that at least one is usually working. However it would be extremely expensive to secure all three to account for this.

The Arial Khan - MB route transfer is thus not suited as a prime means of salinity control and it is limited in ability to expand irrigation within the Area. It is possible to consider it as a supplementary source to the Gorai but even in this instance the benefits are marginal. An alternative use for this transfer is to augment surface flows into the Bagerhat area to help sustain the main drainage channel for this area.

Ganges - Padma Right Embankment

The Ganges - Padma Right Embankment, together with works on the Arial Khan, would provide flood protection to the east of the Gorai in both the Southwest and South Central Regions. These are areas where further groundwater development potential is at its greatest and clearly such works would enhance the future value of tubewell irrigation in this area.

Embanking of the Padma was originally conceived in a plan drawn up in the 1960's, but its construction has been implemented in a series of discontinuous reaches and at present continues to allow Padma spills into the Area. Providing future works continue to permit these spills to enter the river systems (as is the intention) then there should be no significant effect on the regional channel morphology.

The sizing of the Ganges - Padma RB is dependent on conditions upstream. FAP25 has indicated that with full embanking of the main river systems there would be rises of 0.23m to 0.5m for a 1:100 year flood. The construction of a barrage on the Ganges would not significantly effect these figures it is believed. Embanking of the Jamuna in particular would increase discharges at peak events, and increase velocities by 5-10%. Whilst this is

significant, its impact on embankment design is small in so far as the major factor is the immaturity of the river and its likely range of lateral movement.

The Flood Policy Study in 1989 indicated that works on the Padma RB should be postponed to 2010 to enable account to be taken of upstream works. It is reasoned in this Report that this is not the major factor in the design and that, given that the embankment is substantially in place already, the further modest investment to complete the works to a full 1:100 year standard should proceed within the short term.

Lower Meghna Right Bank

The right bank of the Lower Meghna is dissected by a number of spill rivers. A number of areas individually have some flood protection embankments. In contrast to the Ganges and to a lesser extent the Padma, the Lower Meghna is still a young river exhibiting episodic erosion and accretion rates which can be braised by extreme floods. Chars within the river move with a periodicity of 10 - 20 years and overall the river is showing a net eastwards movement. Whilst this movement favours protection of the right bank it is nevertheless considered that the river should be allowed a further 50 - 100 years or so to stabilise itself. It is noted however that works on the left bank at Chandpur to reinforce the bank they are in conflict with these trends and that the possibility exists that these might force a crossing to develop and shift the meander by, say, half a wavelength (approximately 15 - 30 km). Thus while the right bank will come under threat, the flow downstream could be directed further away from the right bank allowing accretion to take place and threatening the existence of the spill rivers. Loss of these spill rivers would have a major impact upon the freshwater supply of the South Central Region.

Thus for the Lower Meghna Right Bank, no embankment is recommended. Individual poldering could be possible but considerable forethought is necessary. Careful monitoring is necessary.

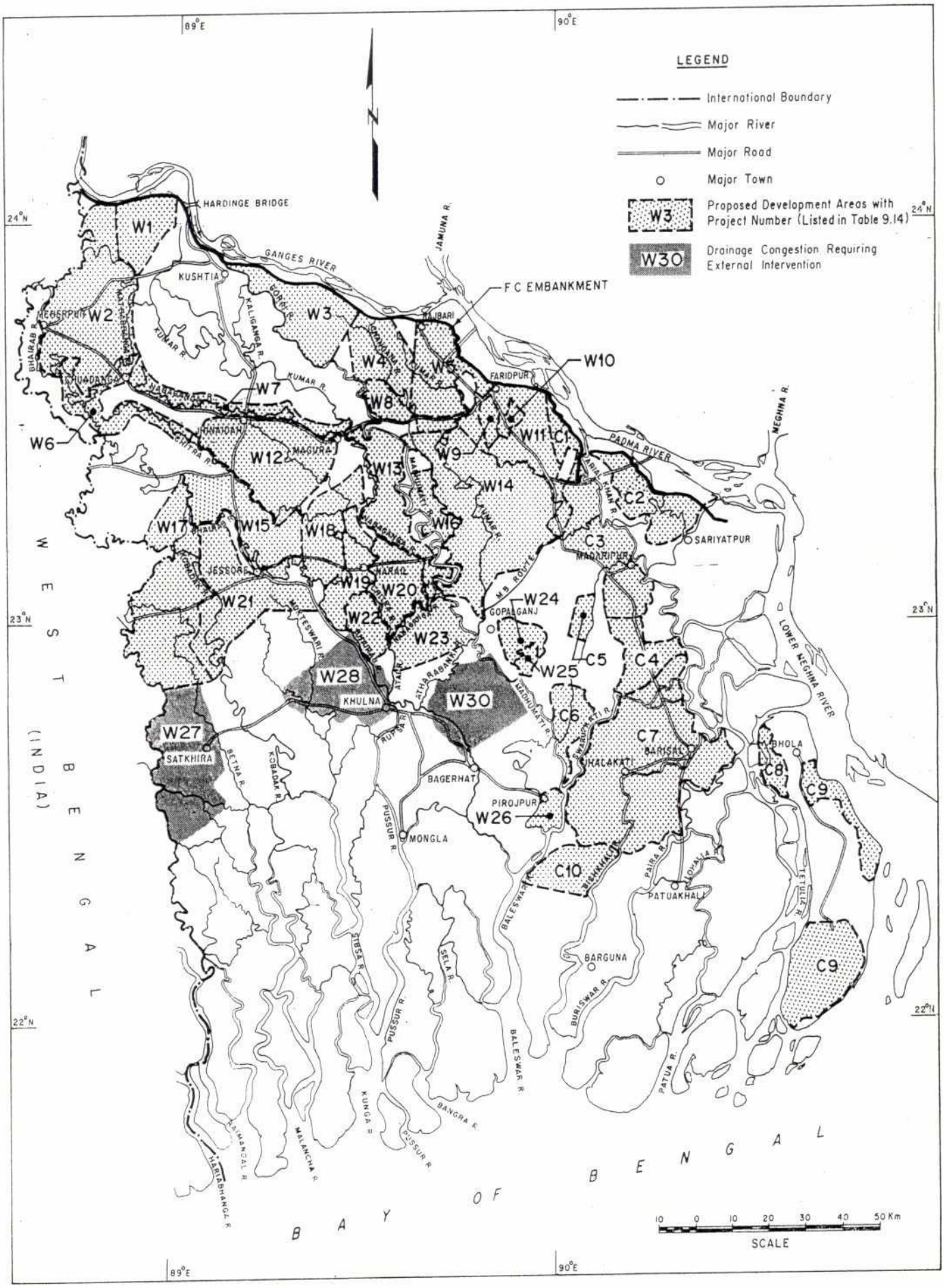
Coastal Polder Rehabilitation

Three basic options have been considered to address the problems of drainage congestion in the coastal polder areas. The first of these is the "do-nothing" situation which would permit the delta to progress itself to a new equilibrium based on interventions within the polder area in the near and medium term past and the effects of agreed actions inland, such as on the Gorai. This would not preclude investment within polders to improve water management and promote appropriate land use and would allow land building to continue in un-poldered areas.

The second option would require massive investment programmes over a period of 30 - 50 years to create a non-tidal coastal zone by construction of tidal barriers and major water control measures. Such a solution would have enormous impacts on the coastal area, much of which would be positive but accompanied by substantially unpredictable changes to the rivers morphology and to the environment.

The third option, which is favoured, is an intermediate solution in which a controlled transition to tidal equilibrium is advocated. Areas where deterioration of drainage either has or is expected to occur would be targeted first and the programme of works could be expected to continue in a progression thereafter towards eventual equilibrium. In this manner, in contrast to the third option, early returns on investment could be achieved accompanied by positive social impacts. The three main areas for early attention are near Satkhira, Khulna and Bagerhat. The solutions proposed focus on identifying outfall channels which can be expected with appropriate interventions to remain stable with reasonable calamity in the future. These interventions which include some dredging and for Khulna creation of macro-polders, are favoured over the alternative of setting aside land as tidal surge basins to enhance cubuture.

Figure 6.1



Regional Plan

6 INITIAL ENVIRONMENTAL EVALUATION

6.1 Introduction

This section considers the potential impacts of the Regional Water Resources Management Plan, as shown in Figure 6.1, as well as the two priority projects: (i) the Gorai River Augmentation Project, and (ii) the Chenchuri Beel FCD Project (which have been taken to pre-feasibility level).

The Regional Water Resources Management Plan (RWRMP) is a broad strategy for the development of water resources in the Southwest Region. The components that make up the plan consist of elements that have been modelled to provide solutions to the main water resources problems of the Study Area, and to meet the main evaluation criterion of agricultural improvement.

The RWRMP is a strategic plan and its individual components will require further studies, at pre-feasibility and/or feasibility level before any development can proceed. At this stage of planning the environmental evaluation can only define broad environmental issues, highlighting potential problems in the knowledge of similar situations elsewhere, and suggesting broad mitigation measures where appropriate.

6.2 Scoping and Evaluation Method

To provide some continuity in the evaluation between the different elements of the RWRMP, the evaluation has adopted the same Important Environmental Components (IECs) throughout. These have been selected to reflect the main issues in the Study Area as a whole. The list of IECs used is given in Appendix 1.

The elements of the RWRMP have been assessed by considering each IEC and ascribing a value to each component on a scale of ± 5. The evaluation has been subjective (due to the paucity of data and resources available in the study); but has taken into account the impact that the project would have on the environmental component in terms of importance; spatial magnitude; the permanence of the impact; reversibility and whether there are cumulative affects. It has not been possible at this stage to attempt to weight values or rank the IECs.

The FCD and FCD/I projects, together with the beneficial areas from augmentation have been defined into 5 types. For each of these types a range of positive/negative values that may be expected is shown in a comparative matrix (Table 6.1), to allow the pattern of beneficial/negative effects to be simply demonstrated. The issue relating to the coastal polder strategy, have been discussed. In all cases appropriate mitigation studies, to be affected in future development planning have been suggested.

6.3 Impacts of the Water Resources Strategy

The overall strategy should follow a sequence and the projects therein will impact each on the other as development proceeds. All projects should be subjected to feasibility studies including an EIA. Many baseline studies are needed, and important studies are identified in the recommendations in this report.

6.3.1 Impacts of Augmentation Strategies

A primary objective of the RWRMP is to ensure that both dry season and wet season flows are passed down the Southwest Region. The former will provide freshwater for irrigation, as well as holding the saline wedge; the latter will flush down salt and sediments, and ensure the viability of river channels.

TABLE 6.1

TABLE COMPARATIVE IMPACT MATRIX FOR DEVELOPMENT TYPES IN RWRMP					
ENVIRONMENTAL COMPONENT	IMPACT ANLYSIS : MULTI-CRITERIA VALUE RANGES				
	TYPE 1	TYPE 2	TYPE 3	TYPE 4	TYPE5
PHYSICAL/CHEMICAL					
PC1.Erosion of river banks	+ 1/2	+ 1/2	+ 1/2	0	0
PC2.FCD works	+ 1/2	0/+1	0/+1	0	0
PC3.Containment of flod	+ 1	0/+1	0/+1	0	0
PC4.Intervention land loss	- 1/2	- 1/2	- 1/2	- 1/0	0
PC5.Change in salinity	0	0	0	0	0
PC6.Change in water quality	- 1/2	- 1/2	- 1/2	- 1/2	0
PC7.Dredging impacts	0	0	0	0	0
BIOLOGICAL/ECOLOGICAL					
BE1.Floodplain fisheries	- 2/3	0	0	0	0
BE2.Spawn/shrimp capture	- 1/2	0	0	0	0
BE3.River fisheries	0/-1	0	0	0	0
BE4.Shrimp/fish culture	- 1	0/+1	0/+1	0/+1	0
BE5.Social forestry	- 1	- 1/0	- 1/0	- 1/0	0
BE6.Sundarbans	0	0	0	0	0
BE7.Wildlife/bio-diversity	0	0	0	0	0
SOCIOLOGICAL/CULTURAL					
PC1.Security of homesteads	+ 1/2	+ 1/2	+ 1/2	+ 1/2	0
SC2.Agriculture livlihoods	+ 3/4	+ 2/3	+ 2/3	+ 1/2	0/+1
SC3.Fishery livelihoods	- 1/3	0/+1	0/+1	0/+1	0
SC4.Artisanal transport	0/+1	0	0	0	0
SC5.Commercial transport	0/+1	0	0	0	0
SC6.Nutrition	+ 1/2	+ 1/2	+ 1/2	+ 1/2	0/+1
SC7.Water supplies	- 1/0	0	- 1/0	0	- 1/0
SC8.Water related disease	- 1/2	- 1/2	- 1/0	- 1/2	0
ECONOMIC/OPERATIONAL					
E03.Operational complexity	- 2/3	- 1/2	- 1/2	- 1/2	- 1/2

The key to this strategy is ensuring such flows down the Gorai river. To this end a project has been proposed to undertake works to build a structure at the Gorai offtake that will secure the river channel. Further downstream a barrage would be built at Mohammedpur to control levels and assure storage for irrigation. This project is assessed in greater detail in Section 6.8.

Whilst the objectives of this course of action are understood and desirable in principle, particularly in the long-term, the project raises important environmental issues:

(a) there is no prediction as to when the Ganges/Gorai confluence might close in the wet season, and so securing the Gorai offtake is an intervention set for the long term, which will still require maintenance dredging;

(b) the large amount of capital dredging, and the annual maintenance dredging, will impact on the existing river fishery (up to 30 km downstream of Kushtia), though with present data it is not possible to quantify the effect;

(c) the Gorai intervention alone will do little to transfer water to the west of the Area.

6.3.2 Value of a Ganges Barrage

The alternative to a 'stand alone' Gorai intervention, that has been proposed by the RWRMP is the linkage of the Gorai intervention with a Ganges Barrage. This has considerable environmental advantages:

- significant reduction in dredging (about ten-fold) in the Gorai, and a consequential lessening of damage to the river environments.
- the Gorai river would be able to scour, thus obviating the need for maintenance dredging.
- water transfer by link canals to the drier regions in the west of the Study Area.
- opens options for eastward water transfer to control salinity and/or to support expansion in the South Central Region.

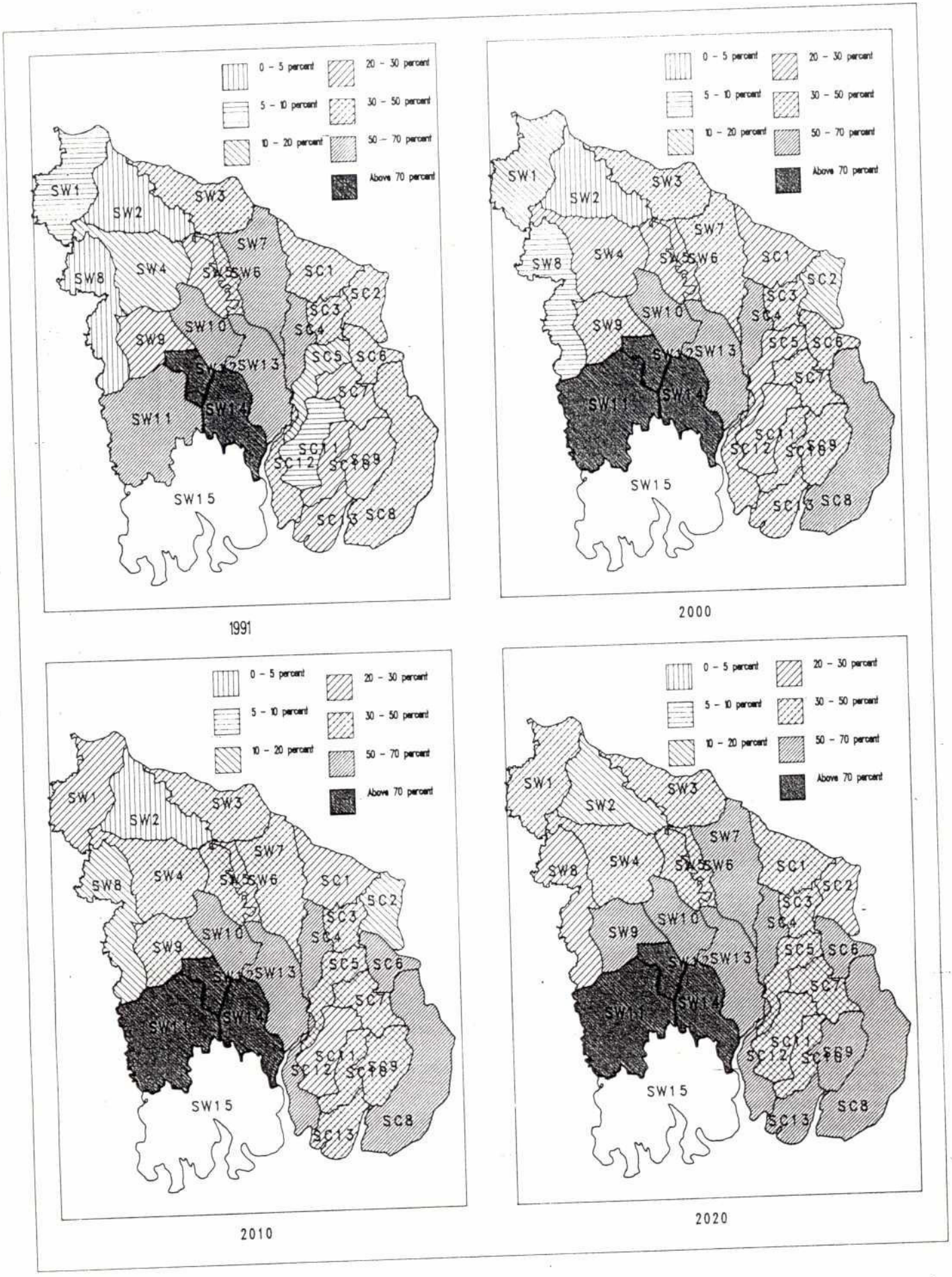
These advantages allow the distributaries of the Ganges, now dying or died out, to be re-vitalised, and ensures not merely dry season flows down the Gorai-Madhumati, but also further west down the Bhairab-Rupsa-Pussur, and the Kobadak. In environmental and development terms this is a desirable long-term strategy.

In terms of damage to river environments the Gorai intervention is considered as acceptable if linked as the first phase of Ganges Barrage, and not as a 'stand alone' project. However, Ganges Barrage itself will have very serious environmental consequences.

This conclusion is supported by the considerable improvement to food shortages that the Ganges Barrage would bring, even over a 'stand alone' Gorai intervention. These are summarised by the food energy shortages (Figures 6.2; 6.3; 6.4).

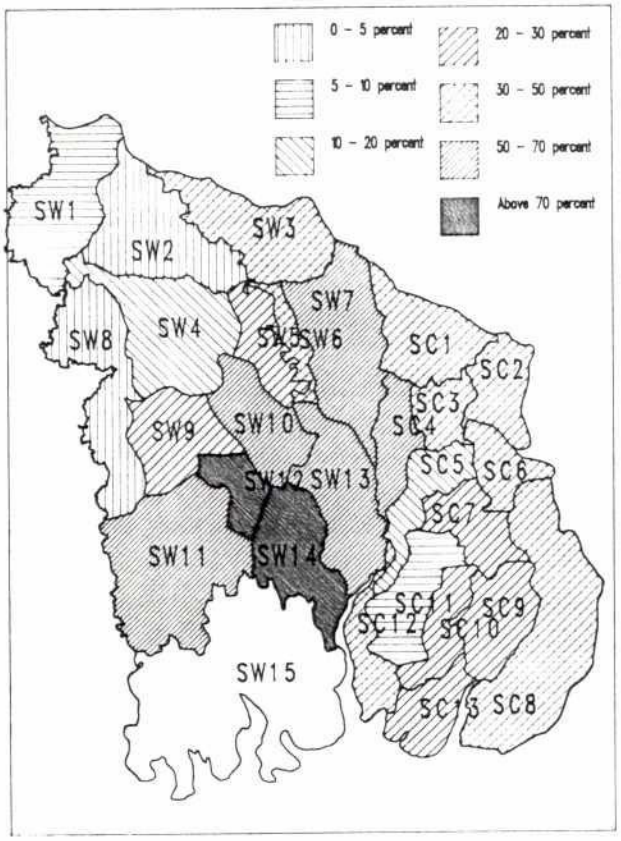
Against these benefits is the knowledge that important environmental issues would be raised by the construction of a Ganges Barrage. These require full investigation and EIA, but should be seen in a context of the Southwest Area as a whole and not simply within the project area of any barrage site.

Figure 6.2



Food Energy Shortage (No Development)

Figure 6.3



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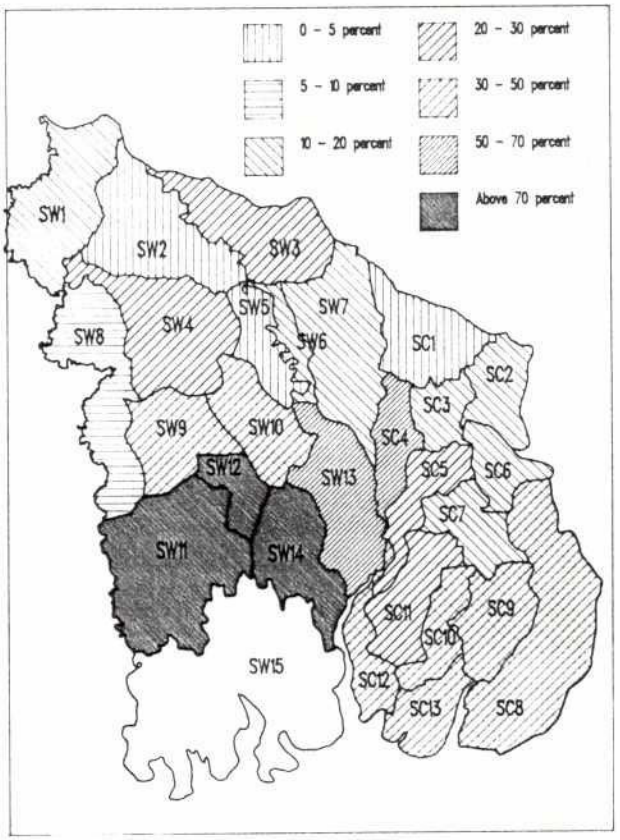

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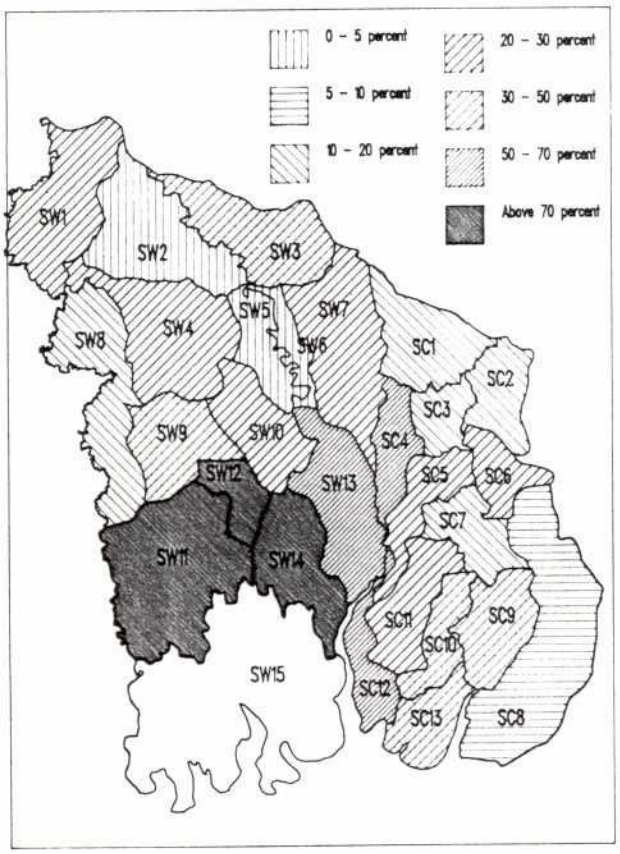

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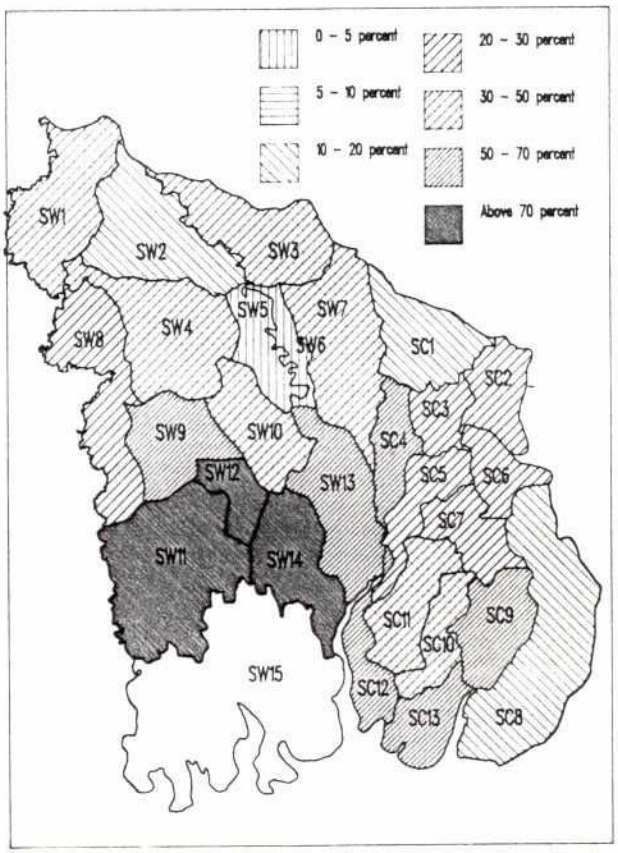

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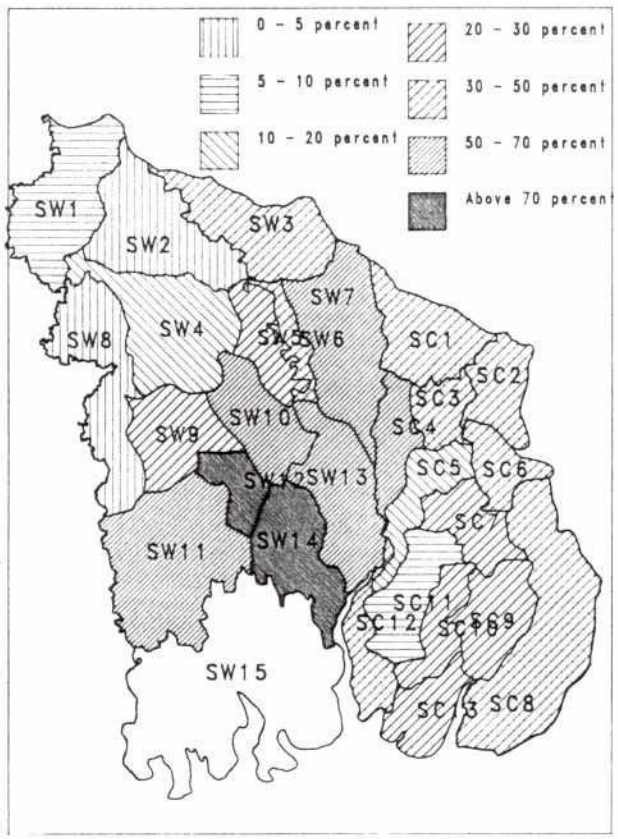
Food Energy Shortage(Augmentation No Barrage)

Figure 6.4



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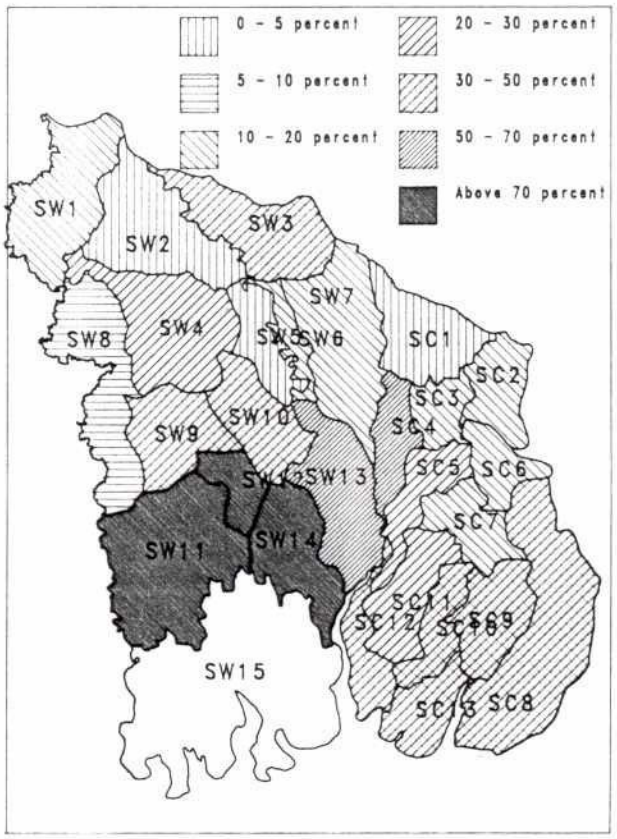

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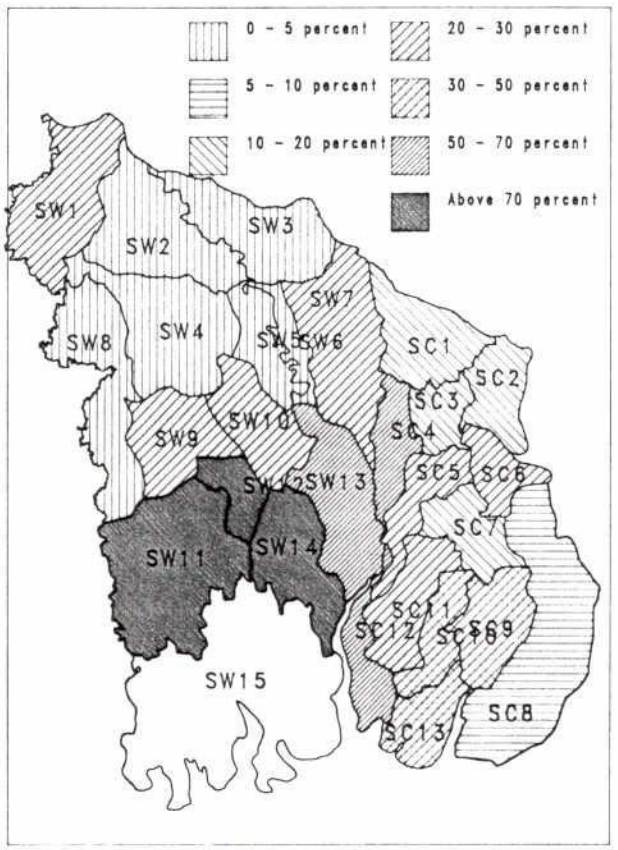

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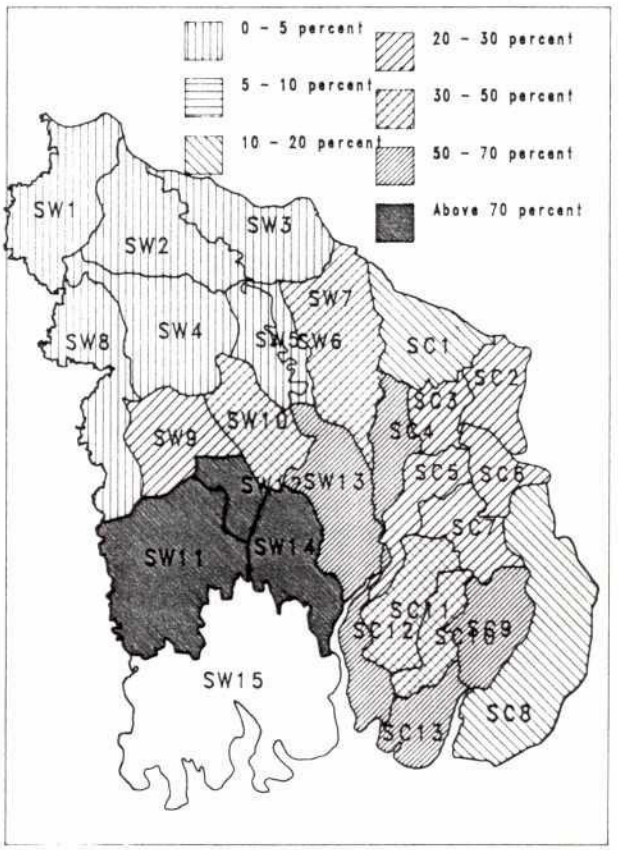

2020

Food Energy Shortage (Ganges Barrage Development)

The expansion of irrigation brought about by transfer schemes may give rise to problems associated with FCD and FCD/I projects. These impacts are discussed in the following sections, as well as other problems that are common to development in the areas as a whole.

The westward water transfer will be continued in the longer term by the extension of link canals and the Hisni pump project, which will add flows into the extreme west of the Study Area. Extra flow down the Bhairab will be beneficial, as this river is likely to be the main artery receiving water for industrial effluent in the Area.

6.3.3 Mitigation

Most of the mitigation against negative impacts of augmentation will relate to the overall impact of the Ganges Barrage, and to the channel, FCD and FCD/I works that will follow in the wake of water transfers. At this stage, it is possible only to highlight general means of mitigation and these are given in Sections 6.7 and 6.8.1.

In Section 6.8.1 recommendations are made for studies to be included at feasibility level for the EIA conducted on any Ganges Barrage development.

6.4 Impacts of FCD & FCD/I Elements in the RWRMP

The RWRMP has a number of FCD elements linked to the augmentation of the Gorai river, future augmentation after construction of a Ganges Barrage, and the rehabilitation of the flood embankments along the Padma, and Arial Khan rivers. These schemes have certain common features, and they have been classified into 5 types. The schemes are shown in Figure 6.1 and the types that they represent in Table 6.2.

6.4.1 Classification of FCD/I Project Types

The following represent the project development types used to classify the schemes in the RWRMP. Evaluation of the environmental impacts of these schemes have been made against these four types. Table 6.2 shows the range of impact values suggested for each type of scheme, and this range can be used as a guideline for future feasibility study EIAs on each project.

Detailed IEEs for the seven projects studied to pre-feasibility level are shown in Volume 13 and are not repeated here.

Type 1 (New Areas)

The proposed development comprises of:

- embankment(s) along unprotected boundary rivers(s) with appropriate inlet/outfall gates for controlled flooding and controlled drainage of the project area;
- compartmentalisation of the area using the existing access/rural road network;
- networks of low level canals/drains and associated water control structures for the effective distribution and management of irrigation/drainage flows. Navigation locks would be incorporated in the outfall gates that serve major khals of watercourses.

TABLE 6.2
Proposed Development Types

Southwest Region

Planning Unit	Ref. No.	Project	Development Type
SW 1	W 2	Hisni Scheme	2
SW 1	W 1	G K Extension Phase 2	2
SW 1	W 6	Mathabhanga - Upper Bhairab Scheme	2
SW 2	W 7	G K Extension Phase I	2
SW 3	W 3	Khoksa Scheme	2
SW 3	W 8	Madhukhali - Balia Kandi Rehabilitation	3
SW 3	W 4	Chandana Scheme	2
SW 3	W 5	Rajbari, Phases I & 2	1
SW 4	W 18	Salika Scheme	2
SW 4	W 12	Jhenaidah Scheme	2
SW 4	W 15	Kaliganj Scheme	2
SW 5	W13	Madhumati - Nabaganga Scheme Rehabilitation	3
SW 5, 10	W 20	Chenchuri Beel Scheme Rehabilitation	3
SW 6	W 16	Alfadanga - Boalmari Project Rehabilitation	3
SW 6, 7	W 14	Padma - Kumar, Phase I	1
SW 7	W 11	Padma - Kumar, Phase 2	1
SW 7	W 9	Sakunia Beel Drainage Scheme Rehabilitation	3
SW 7	W 10	Baramanikdi Project Rehabilitation	3
SW 7	W 25	Tarail - Pachuria Project (Polder 3) Rehabilitation	3
SW 8	W 17	Betna Irrigation Project	2
SW 9	W 21	Harihar - Kobadak Irrigation Project	2
SW 10	W 22	Singia - Nebugati Project Rehabilitation	3
SW 10, 13	W 23	Barnol - Salimpur - Kolabashukhali Project Rehab	3
SW 10	W 19	Narail Project	1
SW 13	W 24	Tarail Pachuria Project (Polders 1,2,4,5&6) Rehab	3
SW 13	W 26	Pirojpur project	2

South Central Region

Planning Unit	Ref. No.	Project	Development Type
SC 1	C 1	Sadarpur Scheme	1
SC 1	C 2	Palong - Padma Scheme	1
SC 1, 3	C 3	Arialkhan - Bisarkandi Scheme	1
SC 3, 5	C 4	Tarki - Gournadi - Bamrail Scheme	1
SC 4	C 6	Swarupkati Scheme	1
SC 4	C 5	Ramsil Kafulbari Project	1
SC 5, 6, 7	C 7	Barisal Irrigation Project Rehabilitation	5
SC 8	C 9	Bhola Irrigation Project Phase 2	4
SC 8	C 8	Bhelumia - Bheduria Scheme	4
SC 11, 12	C 10	Bishkhali Scheme	1

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Both groundwater and surface water have been considered available for irrigation, but probably in separate areas (sections); furthermore it would be the responsibility of the farmers to abstract and use the available water.

Material excavated during the canal/drain construction will be mainly used for improving the existing road network (and compartmentalisation) and for constructing new 3m wide roads along canals/drains.

Existing beels within the project area will be improved for possible fisheries development and for conserving extra water (including rainfall runoff) for subsequent irrigation use.

Type 2 (New Areas)

As for Type 1, but with the use of only surface water for irrigation.

Type 3 (Improvement of Existing FCD Areas)

As for Type 1, but excludes any new flood control embankments. Furthermore, existing khals, drains and outfall gates are incorporated into the proposed network of canals/drains.

Type 4 (Improvement of Existing FCD Areas)

As for Type 3, but with the use of only surface water for irrigation.

In addition to the above a further project is identified: the Barisal Irrigation Rehabilitation Project (BIRP-Type 5).

6.4.2 Possible Impacts of Development Types

The comparative impact matrix for these development types is shown in Table 6.1. All Type 3 projects are linked with Type 1 projects in the RWRMP.

In general all types of development show positive benefits in the Physical/Chemical category, with the exception of land loss by intervention.

Construction of embankments requires the acquisition of land for embankment and borrow areas. These, in the past, have been excavated with little thought for their future use. This land loss can be in the order of 3%; which taken over the entire project area represents a considerable impact, unless this land can be returned to some future, productive use.

The incorporation of control structures and revetments in flood protection and irrigation brings about an indirect, but significant impact on the timber resources of the country by the use of bricks.

Social forestry may suffer in two ways: (i) the use of timber in brick making, and (ii) the cutting of treed land for extra agricultural land to expand irrigated crops.

There are impacts associated with all forms of fishery for Type 1 projects, although Types 2-4 are broadly neutral (set against the status quo), as is the only Type 5 project in this instance.

An ongoing requirement in some FCD/I schemes will be to take account of the impact on floodplain fisheries. These fisheries have been severely affected by existing schemes throughout the country, and further FCD/I projects will serve to make a bad situation

worse. It is possible that, at some point in time, the cumulative impact of denial of recruitment may irreversibly damage stocks of certain species, particularly in local rivers.

When considering human impacts, the pattern of agricultural benefit and fishery dis-benefit/neutrality continues. Broadly the projects that are likely to expand surface waters are more detrimental to public health; and those reliant mainly on groundwater for irrigation may affect rural potable water supplies. All projects are considered to have a degree of operational complexity in terms of maintenance and ensuring proper and timely operation of regulators.

Particular problems exist in FCD schemes on the boundary rivers with respect to the dwellers on the char islands. Many of these people are at risk from flood, and erosion of the chars. They may be disadvantaged further if river flows are locally channeled and increased, and their boat transport to inland areas interrupted.

6.4.3 Mitigation

Fisheries must always be considered. It is essential that feasibility studies for FCD/I schemes should include a detailed investigation into local fisheries, and the impact of schemes on local fishing communities. Where possible embankments should be built inland of beel areas, to allow these areas to flood in the monsoon and to retain some of the floodplain recruitment.

With respect to land loss for homesteads this can largely be mitigated by designing embankments that can accommodate 'linear villages'. Whilst increasing land acquisition costs, this concept has the added attraction that the villagers have a vested interest in the maintenance of the embankment, which is essential to ensure flood protection over the long term.

Borrow areas should be kept to a minimum. Wherever possible, either by planned excavation or by later infilling, these areas should be designed for future use as fish ponds and/or small country boat passageways.

The special needs of the char dwellers should be addressed in the cases of the Ganges, Padma and Lower Meghna embankments. Although outside the project area these people's needs should be integrated into these FCD schemes. These needs should be identified by people's participation programmes, and addressed in project design, so as to ensure that they are also able to benefit (or be less disadvantaged) by these particular projects.

6.5 Impact Associated with Alleviation of Coastal Drainage

The alleviation of drainage congestion in the coastal polder has become a major issue, and the suggested strategy seeks to remedy the present situation to make the most beneficial use of the coastal zone.

The recommended strategy would intervene in the coastal zone to revitalise the Coastal Embankment Project (CEP) Area and prevent further deterioration. Interventions would be required progressively as the delta attains a new equilibrium based on augmented flows from the upstream strategies. The strategy presumes that the Southwest Region will remain tidally dominated.

Positive impacts of the strategy would include the achievement of some of the original aims of the CEP programme, and allow realistic future planning of future land use. Open channels may permit long-term strategies for navigation.

The strategy is essentially long-term and would be spread over the period of delta stabilisation (say 50-100 years). This time scale is too long to define major impacts without detailed data collection and modelling.

Consideration of impacts centres on the three development schemes proposed, and on some of the other projects that are on-going in the coastal zone. Figure 6.4 gives the three external interventions CEP polders recommended in the RWRMP.

6.5.1 Impacts of Recommended External Interventions

All three schemes (as recommended) would open up channels which would drain to the Sundarbans. The impact of these flows need to be assessed with particular reference to:

- changes in rates of sedimentation
- possible impact of changes in water quality due to stream irrigated agriculture.

The impacts of the options considered for each scheme are discussed below.

Satkhira

This scheme will bring drainage benefits to polder Nos: 1, 2, 3 and parts of 4 & 5.

The option for dredging brings with it problems of the degree of maintenance dredging that may be required and of spoil disposal. At low levels of maintenance dredging, fisheries are unlikely to be greatly affected in this instance, and indeed may be improved in the post-project situation with the opening and stabilising of channels under natural flows. Some navigation improvement may also be expected.

The alternative development of a tidal basin will bring no navigational improvements, although a reservoir fishery may be developed (though limited to estuarine species). Care must be taken to ensure that sea-marsh plant species do not become established in the tidal basin. Weed growths may reduce basin volumes by increased sedimentation; and reduce fishing potential by denial of access. Some species may encourage greater numbers of insect disease vectors.

Environmental considerations are thus in line with the recommendation to adopt the dredging option over the tidal basin option, if only low levels of maintenance dredging are required. Mitigation can be considered by reference to the common problems discussed in Section 6.7; though a full EIA should be carried out in the feasibility study stage.

Bagerhat

The impacts for this scheme are similar to those discussed for Satkhira. Drainage benefits will be provided to polder No. 36, and (in this instance) there might be a greater benefit brought about by access to the MB Canal, providing a shorter journey time through the Arial Khan to the Padma (in the dredging option). The tidal basin option is likely to provide an improvement to the existing beel fishery.

As with Satkhira the dredging option appears on balance to be the more acceptable in development and environmental terms, if general forms of mitigation are built into the project.

Dumuria

This scheme would provide drainage benefits to polder Nos 17/1, 26; 16; 20; 18/19; 27/2 & 29.

The freshwater diversion option will require considerable earthworks in the form of canals, and subsequently maintenance to avoid the problems of weed growth in the canals. It will also make use of water from the Chitra river, and is thus in conflict with the Gorai intervention proposals to use Chitra flows for Khulna water supply. It is not desirable to remove flow from the Bhairab, as this river is the main industrial effluent artery in the Study Area, and would benefit from maximum flows for dilution.

The tidal surge basin would cause similar impacts to those mentioned for similar schemes above. In this instance, further benefits would accrue by the maintenance of viable river channels to the south.

The recommended macro-polder option is the most disruptive in terms of works. Closure of channels may lead to artisanal and commercial navigation disruption. There is a high level of operational complexity required by the number of regulators and channels. The area includes the present artisanal shrimp/rice project, and areas ear-marked for future such development. With Ganges Barrage in place, and the increased amount of dry season flows and water transfers to the west that will then occur, flow regimes may have to be re-checked. Given the need to ensure maximum income generation in this part of the region, potential impacts on shrimp culture will need careful assessment, as part of an EIA, at feasibility level.

6.5.2 Mitigation

For all three strategies an EIA should be carried out at the feasibility stage, and should include:

- the impact of new channel flows will need to be assessed with particular reference to:

  (a) changes in rates of sedimentation
  (b) possible impact of changes in water quality due to upstream irrigated agriculture

- examination of the shrimp larvae capture fishery, to determine the effects of the change in channel flows

- consideration of means to improve rural water supplies as a part of the project.

For Satkhira and Bagerhat, both of which are essential channel dredging projects, the mitigation suggested in Section 6.7.2 would apply.

The schemes have implications for the wetlands ecosystem of the Sundarbans, and recommendations made in Section 6.6 are reinforced here.

The macro-polder proposal at Dumuria will require additional investigations in the EIA at feasibility stage. This is to ensure that potential negative impacts on navigation, artisanal incomes, shrimp culture, and changes in flows resultant on a Ganges Barrage, are fully taken into account.

It is recommended that the following be included in the EIA at feasibility stage for the Dumuria project:

- full public participation to determine the impacts on artisanal and commercial navigation, internal and external to the polder
- assessment of the income needs with reference to agricultural potential, and alternative income generation such as shrimp culture and social forestry
- assessment of the work on artisanal shrimp and shrimp/rice cultivation, and modifications to project design to maximise benefits from this sector.

6.5.3 Other Coastal Projects

The main project generating concern over environmental issues is the Coastal Embankment Rehabilitation Project-II (CERP-II). This project has suggested drainage strategies for the coastal polders, and the RWRMP has accepted that some (recommended) are in line with the strategy proposed in this study.

CERP-II project has proposed drainage strategies that are broadly in agreement with those recommended by this study, but there is a need for a full EIA before the CERP-II works proceed. The strategies proposed by CERP-II, which involve channel closures and new drainage lines have not been subjected to any preliminary environmental assessment.

The CERP-II works are important, and far reaching. There are immediate concerns as to the possible impacts, and means of mitigation, in the following general areas:

- the impact on artisanal transport due to channel closure
- the loss of access to markets, and associated livelihoods due to closures
- whether changes in channel flows will affect the water flows in the northern Sundarbans
- the impact on the artisanal shrimp/rice developments proposed under the Third Fisheries Project
- whether the proposed channel flows will alter local salinity conditions, and whether this will in turn impact on the capture of post-larval shrimp.

These issues need to addressed, and it is recommended that no CERP-II proposals be enacted without an appropriate EIA that includes the above.

There has been a conflict between the CERP-II proposals for draining Polder 28, and the urban drainage proposals for Khulna under FAP-9A. The latter arrived at its conclusions based on an environmental assessment. It is now proposed (as a compromise) to drain the western part of Khulna into the Lower- rather than the Upper- Solmari river. This will take the drain through agricultural land which was not considered in the FAP-9A environmental impact assessment. Accordingly it is recommended that the FAP-9A EIA be up-dated by further studies, to ensure environmental considerations are fully addressed before design and construction work proceeds.

6.6 The Sundarbans

The main threat to the Sundarbans is over-felling, but the forestry management and development of forest products from the area is under study by the Sundarbans Integrated Management Project.

The proposed coastal strategies should not alter the present channel regimes in the region of the Sundarbans. The existing processes of tidal sedimentation will continue, and local changes in minor channels can be expected. These changes may be influenced by local upstream interventions, and by imbalances resulting from the phasing of coastal intervention strategies.

The problems posed by increasing or changed rates of sedimentation due to changes in channel flows still need to be determined. This will require both data collection, hydraulic and environmental modelling, to develop as an understanding of the hydrology/botany interactions within the mangrove ecosystem. This work is beyond the resources of an EIA and on present information will not be tackled in sufficient depth by the Integrated Sundarbans Management Project.

Accordingly it is recommended that a separate study be initiated to determine the dynamics of the wetlands ecosystem of the mangrove mosaic, with specific reference to determining the interactions between the hydrology, water chemistry, sedimentation rates and structure, and the mangrove community structures. This study should develop from its research a management plan for monitoring and managing the Sundarbans as a wetland ecosystem. This would provide a basis for future EIA work in connection with impacts on the Sundarbans, as well as being complementary to existing projects on the forest resources.

6.7 Impacts of Common Issues and Mitigation Measures

There are some issues common to all the projects, and these are discussed below. It is expected that these issues would be studied more fully, together with project/site specific issues, in any EIA executed during the feasibility study.

6.7.1 Population

The increasing population places considerable stress on the limited resources of the Southwest Area. Figure 6.2 shows that groundwater alone cannot provide adequate water for food sustainability in the region.

The concerns about population growth refer not merely to the Study Area but to the country as a whole. However, if conditions worsen in many areas, there may be a migration out of the region, as people seek work. The problems are then transferred to other parts of the country facing similar pressures.

It is desirable to maintain populations as much as possible within the region by ensuring both home and food security, as well as income generation in poor agricultural areas.

These problems may become particularly acute in planning units SW11, SW12, SW13, SW14, SC9, SC10, SC12, and SC13 (Figures 6.3; 6.4). These areas should be specifically targeted for mitigation measures.

Mitigation

All feasibility studies must consider alternative income generation activities, other than agriculture. In the planning units identified above, alternative use of water resources (other

than for agriculture) may prove to be more beneficial to social development. Artisanal shrimp or shrimp/rice culture, and fuel/pulp wood social forestry, are examples of alternative land uses that may be considered.

Wherever possible the fishing communities should be targeted for income support measures through the development of other trades, or new fishery areas.

Water resources are a necessary part of most industrial development, at any scale, and cottage industry development, together with a secure artisanal transport infrastructure should be encouraged in an integrated approach to planning.

The population growth rate is a serious threat to sustainable development and national efforts in population control through family planning must be given every support. Any project engendered programmes related to public health and hygiene, and involving NGOs, could also include components on family planning.

6.7.2 Dredging

Concerns about dredging operations centre on their possible impacts on navigation and fisheries, particularly in the dry season, and the possible changes in the natural sediment transport and flows in the rivers.

The problems of disposal of dredged material have also to be considered. In general the impacts associated with dredging can be summarised:

(a) The possible impacts to navigation through channel closure by deposition of displaced sediments.

(b) The impacts on fisheries, which are (at this stage) unquantifiable.

(c) Impact on other river-dependent species. This relates to food chain disruption by removal of the surface layers of bottom substrate. The condition may be either permanent or temporary (in the case of capital works).

(d) Impacts related to disruption caused by disposal of spoil.

Mitigation

In general the potential problems arising from dredging operations can be mitigated by:

(a) ensuring that the area affected by the sediment plume is relatively small.

(b) the timing of dredging operations together with the control of the deposition of discharged dredged material by the use of temporary bunds, sediment basins, and other measures.

(c) Considering the problems associated with transport (Section 6.7.5).

(d) Establishment of a local baseline for fisheries and the general ecology dependent on the river in any project area. This should be a required part of any feasibility study.

(e) Local social studies, and people's participation meetings, to determine the least damaging alternative for spoil disposal, including the use of spoil land raising and flood proofing.

6.7.3 Water Supplies, Sanitation and Public Health

Public health is generally a matter of hygiene and disease transmission, mainly by water or vectors. Water related diseases are always more probable with any increases in water surfaces, or freshwater bodies. Thus FCD/I projects, reliant on surface irrigation and drainage channels, are particularly important in this regard.

Insect vector larvae that breed in water can be controlled by chemical means, or by ensuring surface disturbance. Where local hydraulic heads allow, channels should have mini-weirs and riffles to break up the water surface by turbulence. This has the added advantage of increasing dissolved oxygen levels which will aid in the self-purification of dissolved organic pollutants in the water.

The development of some aquatic weeds in standing waters provides further water surfaces (through water retention in leaves and flowers) for vector breeding, as well as shelter for many invertebrate vectors of disease.

Diseases transmitted in water can be avoided by good personal hygiene. Many villagers are forced to use local rivers and khals for drinking water, bathing and laundry purposes. Latrines are often sited over these same water bodies, in many cases within close proximity of bathing and washing areas. Such situations are ideal for the transmission of enteric diseases.

Part of the problem is in the understanding by villagers of the means of disease transmission, and the simple hygiene measures, both personally and within the community, that can reduce the risk of disease.

Mitigation

Projects need to address the concerns of public health, whether or not they are primarily directed towards these issues. FCD/I projects in particularly should consider the implications of increasing surface water areas, and provide (through the projects) systems and services designed to offset potential problems. This may be done by an integrated project approach (as used in the Secondary Towns Integrated Flood Protection Project (FAP-9A), or by parallel development projects executed by other agencies.

Feasibility studies should carefully assess the present water supplies and sanitation existent in the project area. It will then be possible to determine how the project may impact on public health, and what integrated measures should be taken in mitigation.

Ensuring that villages have access to year-round groundwater supplies for drinking will ensure that irrigation and drainage channels are not used for potable purposes. It may also be desirable to develop borrow pit, or create bathing / washing areas for village to ensure public health in project areas.

The concern about water supplies is heightened in areas where groundwater irrigation is practised, and rural supplies placed at risk by excessive draw-down in the aquifer (below suction hand-pump capabilities). The use of piston hand-pumps with greater lift should be considered for all future installations for rural water supplies, to overcome this potential (and actual) threat.

Villages should also have sufficient pit latrines to ensure that open defecation in or near the channels does not occur. These should be sited well away from water bodies, as part of project works.

In addition to these measures, hygiene education should be put in place by suitable NGOs as a part of the project.

6.7.4 Water Quality

The problems of water quality relate to the effects of accumulated chemical pollution from industry and agriculture, and saline intrusion by tidal movement.

Chemical pollution may either be from point sources (industries) or of a diffuse nature (agricultural run-off). Water pollution from diffuse sources can be highly damaging through the concentration and accumulation of toxins in the water, sediments and food-chain; but pollution control in this case is extremely difficult.

Chemical toxins can have synergistic effects, and so it is important to have accurate baseline data for water quality. Concentrations can be expected to increase downstream as more non-point source pollution is added to the flow.

Within the Southwest Area, industrial development is likely to be concentrated along the road infrastructure between Khulna-Jessore-Kushtia. Thus the Bhairab River becomes an important artery receiving water for industrial discharge, and the final fate of such pollutants will need to be measured through the Rupsa and Pussur rivers to well below Mongla Port (another point source of pollution). Pollution levels in the Gorai river, and in the Tetulia (South Central) will require monitoring as industry expands in Kushtia and Barisal.

The concern over agricultural run-off is two fold : the accumulation of nutrients from fertilizers (Nitrogen and Phosphorus) which can lead directly to health problems (for example : methemoglobinemia, a blood condition in infants who ingest large quantities of nitrates) and will contribute to the eutrophication of rivers and beels. The second concern is the toxic effect to the food chain and humans of certain pesticides and herbicides that remain (and accumulate) in the environment. Water is the usual transmission route.

Present rates for agrochemical use are given in Table 6.3 and 6.4. In Table 6.3 a breakdown of fertilizer use is given, but pesticides (Table 6.4) have been amalgamated into a composite figure. The trend is for increasing use of both groups of chemical, and this can be expected to increase as more land is brought under irrigation and a change to HYV rice.

A further water quality concern is the northward boundary of the saline wedge. This is a function of the lack of dominant freshwater flows, and the importance of tidal movements in the delta. The depth of saline intrusion, as well as its ingress upstream is important in ensuring the use of the river water for supply and irrigation purposes.

Mitigation

The immediate requirement is to know what quantities of pollutants are entering the surface water, and groundwater systems. Thus the commencement of water monitoring programme becomes essential for any future mitigation measures.

In the case of agrochemicals, the monitoring of Nitrogen in the riverine environment should be undertaken alongside salinity measurements, as well as in the non-saline areas of the Southwest Area. Monitoring of agrochemicals will require carefully designed monitoring regimes, considerable up-grading of equipment and staff training, and cannot be considered as immediate or short term measures.

The control of pesticides is more simply effected by using controls on the importation and sale of agrochemicals. This could be done by liaison between the Development of Agriculture and the Customs & Excise, by using import licenses to control the types and

TABLE 6.3

Distribution of Fertiliser in the SWA, 1983-84 to 1988-89

Region (Greater District)	Year	Urea	TSP	MP	DAP, HP and Others	Gypsum	Zinc	Total	Net Cultivable Area ('000 ha)	Kg/Ha
		(Tons)	(Tons)	(Tons)	(Tons)	(Tons)	(Tons)	(Tons)		
Faridpur	1983-84	15749	6636	2101	6	-	37	24529	483	50.78
	1984-85	22025	6531	1854	2	-	56	30468	483	63.08
	1985-86	19263	7834	2022	-	93	41	29253	504	58.04
	1986-87	20287	9276	1465	-	25	58	31111	504	61.73
	1987-88	25139	8808	2664	-	25	26	36662	505	72.60
	1988-89	27615	8994	2750	-	-	-	39359	504	78.09
Barisal	1983-84	17952	5867	297	12	-	77	24205	476	50.85
	1984-85	21225	5682	692	7	-	139	27745	476	58.29
	1985-86	20054	4956	238	-	4	20	25272	482	52.43
	1986-87	24585	7628	1237	-	9	30	33489	481	69.62
	1987-88	28205	9969	685	-	28	61	38948	482	80.80
	1988-89	31137	10518	991	-	-	-	42646	483	88.29
Jessore	1983-84	34677	16166	3232	81	-	122	54278	490	110.77
	1984-85	43630	17817	4181	916	-	105	66649	490	136.01
	1985-86	35303	14555	2725	113	191	58	52945	506	104.63
	1986-87	45547	18421	4420	-	207	164	60759	504	120.55
	1987-88	51949	22544	4977	-	99	248	79817	505	158.05
	1988-89	39454	18920	4821	-	-	-	63195	506	124.89
Khulna	1983-84	14806	4234	378	25	-	64	19507	434	44.95
	1984-85	18535	7356	1282	309	-	335	27817	434	64.09
	1985-86	21177	6101	754	308	30	6	28376	438	64.79
	1986-87	22365	5831	1122	-	36	92	29446	438	67.23
	1987-88	38746	11106	992	-	18	157	51019	440	115.95
	1988-89	79088	25293	3843	-	-	-	108224	439	246.52
Kushtia	1983-84	29146	14709	4262	2665	-	49	50831	256	198.56
	1984-85	36693	16510	5074	253	-	76	58606	256	228.93
	1985-86	35349	15636	4148	1	245	57	55436	265	209.19
	1986-87	39255	16154	4391	122	302	66	60290	266	226.65
	1987-88	51941	20530	5781	182	113	70	78617	266	295.55
	1988-89	56255	24321	7073	-	-	-	87619	267	328.16
Patuakhali	1983-84	4209	822	-	-	-	-	5031	300	16.77
	1984-85	4870	1313		4	-	6	6193	300	20.64
	1985-86	4396	471	28	-	1	-	4896	304	16.11
	1986-87	6812	1258	225	-	1	2	8298	317	26.18
	1987-88	8446	1899	38	-	5	1	10389	318	32.67
	1988-89	8240	1019	55	-	-	-	9314	319	29.20
Bangladesh	1983-84	696851	256599	62220	94768	-	733	1111171	8645	128.53
	1984-85	831801	345670	69271	12263	-	1217	1260222	8645	145.77
	1985-86	792567	296265	59793	233	3869	706	1153433	8770	131.52
	1986-87	911581	334352	65803	238	2824	1353	1316151	8857	148.60
	1987-88	1022187	387863	85964	6370	1889	1306	1505579	8890	169.36
	1988-89	1023348	415993	94172	-	-	-	1533513	8890	172.50

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Source : BBS. Statistical yearbook of Bangladesh, 1991 and yearbook of agricultural statisties of Bangladesh, 1987-88.

TABLE 6.4
Regionwise use of Pesticide per ha of Net Cultivated Area.

Region former District	Year	Pesticides used (Ton)	Net Cultivated Area (000 ha)	Kg/Ha
Faridpur	1984-85	34.30	483	0.07
	1985-86	55.80	504	0.11
	1986-87	71.50	504	0.14
	1987-88	106.50	505	0.21
	1988-89	148.25	504	0.29
Barisal	1984-85	175.30	476	0.37
	1985-86	214.80	482	0.45
	1986-87	223.50	481	0.46
	1987-88	244.00	482	0.51
	1988-89	280.50	483	0.58
Jessore	1984-85	186.50	490	0.38
	1985-86	209.00	506	0.41
	1986-87	268.00	504	0.53
	1987-88	243.50	505	0.48
	1988-89	299.85	506	0.59
Khulna	1984-85	119.20	434	0.27
	1985-86	143.70	438	0.33
	1986-87	102.50	438	0.23
	1987-88	113.00	440	0.26
	1988-89	138.00	439	0.31
Kustia	1984-85	73.10	216	0.34
	1985-86	98.50	265	0.37
	1986-87	133.00	266	0.50
	1987-88	131.50	266	0.49
	1988-89	138.75	267	0.52
Patuakhali	1984-85	94.10	300	0.31
	1985-86	94.10	304	0.31
	1986-87	166.50	317	0.53
	1987-88	198.00	318	0.62
	1988-89	207.50	319	0.65
Bangladesh	1984-85	3014	8645	0.35
	1985-86	3701.9	8770	0.42
	1986-87	3928	8857	0.44
	1987-88	4199	8890	0.47
	1988-89	5040.76	8890	0.57

[vp\vol9\tab6-4]

Source : BBS. Statistical yearbook of Bangladesh, 1991.

formulations of pesticides that come on the market. International standards and classifications of these compounds could be used as a basis for this control.

There are already programmes to reduce the use of pesticides on-going (eg: the Integrated Pest Management Project by FAO) and these should be supported and similar programmes initiated in all other areas.

Industrial effluent can be monitored from their discharge points. New legislation should be introduced to require treatment of industrial effluent. To cushion the economic impact of such measures on industry, a phased introduction of such legislation could be contemplated; providing that intermediate discharge concentrations are held within specified limits.

6.7.5 Transport

In many parts of the SWA rural transport is dependent on country boats. These ply both internally within FCD schemes, as well as being the means of transport for both humans and commercial cargo. Whilst increasing mechanisation allows such transport to move cargoes more freely, smaller family craft and trade boats (including small fishing craft) are dependent on oars and/or tidal movements. Interventions that close channels, or deny tidal movements, may severely impact on the ability of local people to move within their areas, or to take their produce easily to market.

The Bangladesh Inland Water Transport Corporation (BIWTC) classify river routes and maintain channel depths by dredging where necessary. Their statutory obligation is to maintain main channels at a Least Available Depth (LAD) of 3.6m - 3.9m, whilst the non-perennial routes are to be maintained at a LAD of 1.5m - 1.8. the possible reduction of local LAD levels may occur by deposition of sediments released in dredging works and natural sedimentation of rivers.

In the northern part of the SWA, embankments may serve to replace artisanal boat transport by the use of cycle, rickshaws and lorries. Motorized vehicles are generally outside the means of rural families, whilst small boats (dinghis) are both affordable and a means of transport and livelihood in many cases.

Mitigation

The acceptance of the role of country boats in the culture of the people in the SWA, and their importance in rural transport should be recognised. The provision of roads as a substitute for access streams is not necessarily a mitigating solution in all areas. Accordingly, after local consultation, and where necessary, provision of locks on barrages and regulators would allow the continuation of the use of rivers by country boats. Small hand-operated locks may be possible for internal channels controlled by structures. On low embankments, haul-overs may be a more economic alternative. In all cases, provision must be made to cover operating coasts, as charging lock fees would recover the benefits that this mitigation measure would bring.

Embankments that can be used for local transport provide a benefit to the communities around them. However, in the southern areas where transport is invariably by country boat, embankments may not substitute for boat traffic, and may increase the problems of transport for local populations.

Consideration should be given to the joining of borrow pits to form a borrow trench, which could be maintained in brim-full condition by controlled flooding from the main embankment regulators. This would be potentially beneficial as a local artisanal fishery, as well as providing internal boat transport channels.

The needs, present and future, of the BIWTC should be incorporated into any dredging operations as part of projects. This will allow suitable LADs to be arrived to as part of capital works, and not become an additional operation (with other potential negative impacts on the river environments) during year--on-year maintenance.

6.7.6 Cyclone Protection

Cyclones are a fact of life along the coastal areas of Bangladesh. The South Central Region traditionally bears the brunt of wind and storm surges, and this pattern may well continue.

Cyclone damage is not an impact of any project, though careful project design can assist in reducing the impact of storm damage.

The Cyclone Protection Project-II (FAP-7) covers the protection measures necessary for 23 polders, most in the Southwest Area. This work may form the basis for future protection measures.

Cyclone shelters are most important, and the RWRMP considers this as a measure to be extended in the study area. Killas should be used to protect livestock.

The use of coastal plantations to reduce wind damage and dampen wave action should be extended. In many areas there is a value in extending social forestry into degraded agricultural land, both as a form of income generation, as well as a further barrier to wind damage.

6.7.7 Brick Making

Brickfields are extensively spread throughout the Study Area, and are developed on rented land close to a source of clay, and are temporary works, operating only in the dry season. The kilns are single or multiple burners, using sectional chimneys, and are constructed of bricks and earth. Discussions with brickfield operators indicate that 100,000 bricks require about 23 tonnes of coal for firing the kiln, whilst 57 tonnes of timber would be required. A kiln with a single chimney can produce on average about 130,000 bricks per firing, and about 5 brick-making firings are averaged in year. Additional burners increase the production by a simple multiplier based on the number of chimneys (kilns).

Whilst in operation, the brick works deny land for cultivation, and often the site is abandoned without complete clearance of debris. Old brickfields are readily identified by both stored bricks and mounds of discarded bricks which are rapidly grassed over, but represent a permanent loss of land.

Where clay is close to the surface farmers will often sell the top few feet for brick making, in order to lower their field levels. Where clay has to be abstracted from depths, deep localized borrow pits are created which have no future use either for crops or artisanal fisheries.

A major concern in environmental terms is the use of timber as fuel in the brick works. The timber would normally come from the village forests (the copses of fruit, shade trees and bamboo planted around the villages). In the southern part of the Study Area the impact is felt through illegal felling in the Sundarbans. There is a national prohibition on the use of timber for firing brick kilns. However, site visits throughout the project period, and as recently as March 1993, show that many brickfields are openly flouting this law. Unless enforcement is effective, timber stocks (particularly from local village groves) could become rapidly depleted.

Mitigation

Bricks will be required (for direct use and in aggregate) in each project, and the full impact of production cannot be offset by mitigation. There will be a degree of land degradation, and localized increase in dust/soot levels during the project/production period.

Possible ways by which brickfield impacts can be reduced include :

(a) to ensure timber stocks, place a ICB contractual obligation on the contractor to guarantee to obtain bricks from specified, coal-only fired kilns, enforced through independent inspection of the designated brick works by the Engineer, as part of project monitoring.

(b) use either stone for aggregate or dumped stone (for cladding and revetments). This option will reduce both the project related impacts and land degradation but involves a lower local employment benefit and a higher cost of materials.

(c) Place conditions on the contractors and sub-contractors in ICB contracts to ensure that any new brickfields developed to supply a project are coal fired, and that the brickfield sites are suitably cleared and rehabilitated to productive use.

6.8 Pre-Feasibility Studies : Initial Environmental Evaluation

6.8.1 Gorai Augmentation Project

Project Boundaries

The Gorai Augmentation project will serve a series of areas in Planning Units SW4, SW5, SW6, SW7 and SW10, as well as supplying water into the Chitra river as a supply source for Khulna. The Gorai river itself, from its offtake at the Ganges to the town of Mohammedpur is also included in the project area. The whole project area is shown in Figure 6.5.

Consideration of Potential Project Impacts

Table 6.5 demonstrates that the beneficial effects of the project are largely due to the irrigation provided to agriculture.

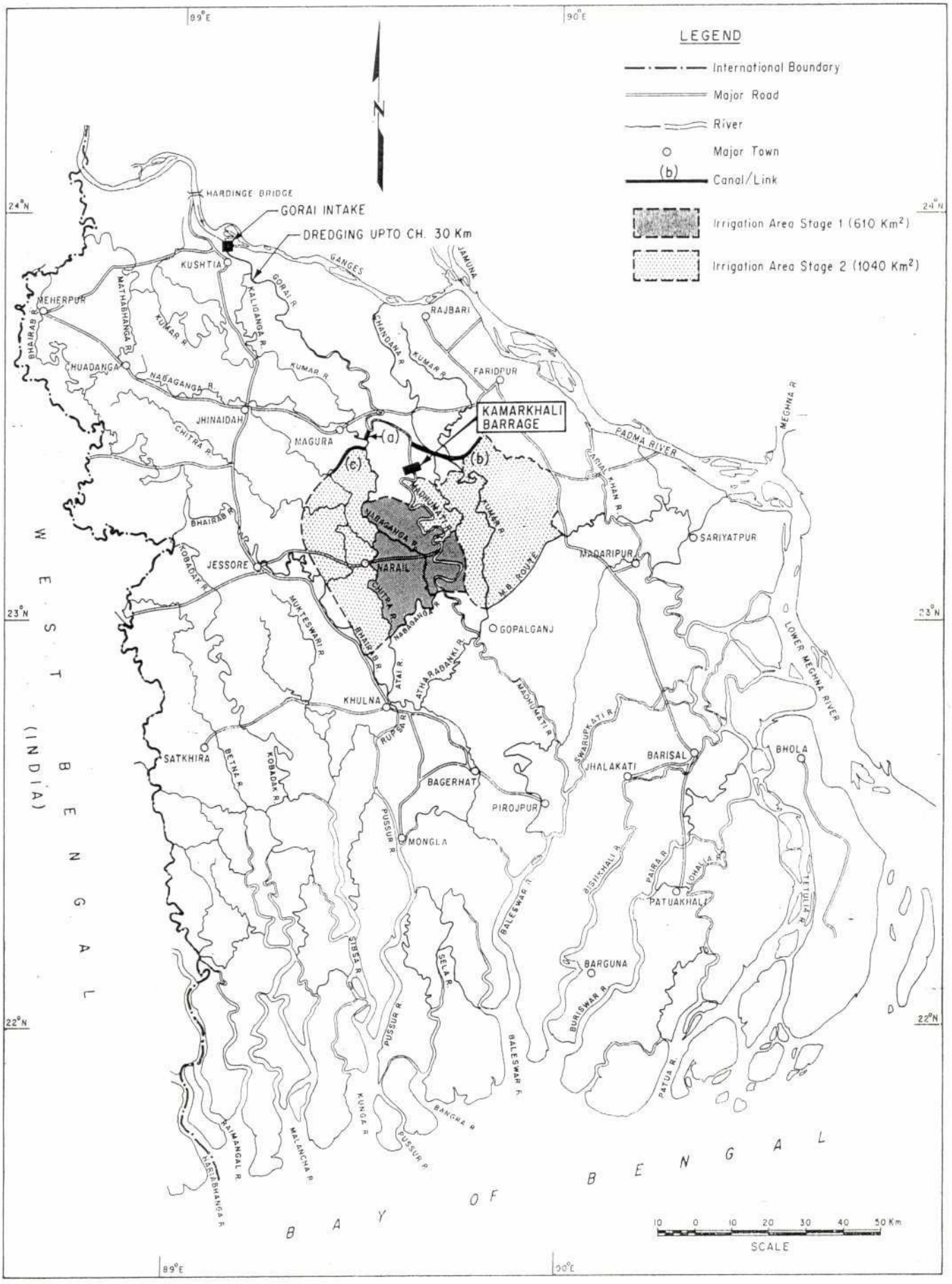
The project will rapidly benefit a number of areas starting with SW5 and SW10. Construction of the Mohammedpur barrage and link canal 6 will allow further irrigation in SW6 and SW7. Finally link 8 will bring in areas in SW4 and further irrigation in SW10. This sequence will provide a greater distribution of agricultural income to farms of all sizes through the benefits of irrigation. During the construction period, local labour will be required for all construction works, which will add to the distribution of income throughout local communities.

With the development of the link canals, a new road network along the berms will be developed, which will most benefit in the transport of produce and goods.

Riverine communities that rely on boat transport will be disadvantaged by the barriers to movement posed by barrages and structures. Isolation of some villages by the river closures and diversions needed for the Nabaganga intake will be a further negative impact.

Improved agriculture should improve the diet of local communities. Conversely, the increase in open water surfaces brought about by the canal network, may increase the risk from

Figure 6.5



Gorai Augmentation Project: Location Map

TABLE 6.5

TABLE GORAI AUGMENTATION (PRE-FEASIBILITY)											
ENVIRONMENTAL COMPONENT	IMPACT ANALYSIS : MULTI-CRITERIA VALUES										
	+5	+4	+3	+2	+1	0	-1	-2	-3	-4	-5
PHYSICAL/CHEMICAL											
PC1.Erosion of river banks					▒						
PC2.FCD works						▒					
PC3.Containment of flood						▒					
PC4.Intervention land loss							▒				
PC5.Change in salinity						▒					
PC6.Change in water quality								▒			
PC7.Dredging impacts									▒		
BIOLOGICAL/ECOLOGICAL											
BE1.Floodplain fisheries						▒					
BE2.Spawn/shrimp capture								▒			
BE3.River fisheries								▒			
BE4.Shrimp/fish culture								▒			
BE5.Social forestry								▒			
BE6.Sundarbans						▒					
BE7.Wildlife/bio-diversity								▒			
SOCIOLOGICAL/CULTURAL											
SC1.Security of homesteads					▒						
SC2.Agriculture livelihoods		▒									
SC3.Fishery livelihoods									▒		
SC4.Artisanal transport							▒				
SC5.Commercial transport					▒						
SC6.Nutrition				▒							
SC7.Water supplies			▒								
SC8.Water related disease							▒				
ECONOMIC/OPERATIONAL											
EO1.Distribution of income					▒						
EO2.Benefit generation rate				▒							
EO3.Operational complexity									▒		

water borne diseases, especially insect vectors. The problems of water related diseases will increase if people use the canals for bathing and drinking purposes.

If the ban on timber in brick-making is not enforced, then it is likely that considerable felling in village groves will occur during the construction phase. In any case, with the availability of irrigation water, more land will be turned over to crops, and tree clearance can be expected.

The main negative impacts relate to the damage caused by capital and maintenance dredging, and in particular to the river environments.

Dredging is expected to be considerable, moving an estimated 12 Mm^3 for the Gorai offtake works, and up to 30 km downstream in the Gorai. This degree of substrate displacement will severely affect the river fishery during construction, with fish either being killed or migrating to other waters. The fish-spawn industry around Kushtia would be particularly affected, which in turn will reduce the economic returns from local fish culture.

Some thought has been given to the use of dredged material, particularly by pumping the spoils into the Ganges, and building up the left bank of the Gorai near the mouth. However, this increase of sediment in the Ganges may cause some downstream problems, particularly for navigation by the reduction of channel depths.

Maintenance dredging will pose considerable problems for spoil disposal,year on year. The sand dredged from the Gorai is an unsuitable medium for agriculture, and is really only of value in raising land for flood proofing. Maintenance dredging is very necessary to the long-term success of the project, and this increases the complexity of the project and the risk of failure (if only temporarily) if maintenance works are not efficiently carried out, for whatever reason.

Whilst land acquisition is small compared to the size of the total irrigated areas, there is an estimated 14 Mm^3 of material that will be excavated during the construction of the link canals and irrigation system.

The diversion of 10 cumecs into the Chitra river, to serve as a take-off point for Khulna municipal water supply, is beneficial, and helps resolve a major problem. However, with the increase in agriculture, and the switch to HYV that irrigation tends to cause, there is likely to be a fall-off in surface water quality due to dissolved agrochemicals. The diffuse nature of the return flows into the lower Gorai and Madhumati is unlikely to alter the extent of the saline wedge. Some concern is also expressed as to the result of further depletion of Gangetic flow on salinity intrusion in the South Central rivers.

Mitigation of Negative Impacts

The project's negative environmental impacts can be offset by some degree of mitigation. Regrettably, the major impacts on the river environment, largely as result of the considerable dredging requirements, do not allow for any significant mitigation.

Dredging Impact on River Environments

Dredging impacts on the River environment in two ways, by

(i) physically disturbing the bottom substrate, increasing suspended solids in localized areas to a level damaging to most fish, and sending a plume of solids downstream which, though not damaging, does disturb fish species and usually encourages migration out of the river stretch;

(ii) removing bed material that has to be disposed of in some other area.

Damage and disturbance to fish cannot be avoided either by the capital dredging or year-on-year during maintenance dredging. There is no mitigation that can be used. As a result the fisheries in the top end of the Gorai will suffer continuously, and fishing livelihoods will be affected.

The only means by which this dredging impact could be avoided would be to have a sufficient flow of water that would scour the bed naturally, and provide volumes that would dilute the suspended solids to a level tolerable to fish.

This solution is unavailable to the augmentation project on its own, and there appear to be only two additional requirements to this project if this mitigation is to be successful :

(a) a long-term water sharing agreement with India, that provided sufficient Ganges water to allow significant dry season flows down the Gorai;

(b) the construction of a Ganges barrage downstream of the Gorai offtake, with a system that guarantees the maintenance of a sufficient head of water behind the barrage in the dry season.

A water-sharing agreement is still the best option if it can be achieved. However, recent experience, coupled with an increasing upstream demand for Ganges water, suggest that there can be little confidence in an effective long-term agreement, and therefore the possibility of constructing a Ganges barrage must therefore be seriously considered.

Disposal of Spoil

Disposal of dredged spoil has been considered in the project design and the following scheme has been suggested, and costed into the project :

- dredged material in the first 8 km of the Gorai offtake would be used in the construction of the offtake embankments and possibly extend housing land on the banks

- material dredged between 8-20 km downstream of the offtake would be pumped, through a pipeline, into the Ganges river. Whilst this removes the material from the Gorai and the surrounding agricultural land, its impact on the Ganges needs further study at the feasibility stage.

- dredged material from up to 30 km downstream of the offtake would be used to in-fill existing borrow bits and widen river embankments.

Material excavated in the course of irrigation and drainage works will largely (about 80%) be used in providing raised banks and roadways along the channels. The remainder would be used for re-sectioning village roads, as part of compartmentalisation within the irrigation areas. Land acquisition costs have been included for this purpose.

Loss of Timber in Brick Making

The problems posed by brick making will be large in a project of this size. The issues and mitigation as discussed in Section 6.7.7 apply here.

Artisanal Transport

This problem primarily relates to the use for small country boats, as the road network is likely to be improved by the project. On the main rivers, incorporation of small locks would provide an adequate technical means of overcoming this problem. There are both maintenance and administrative costs associated with this mitigation as it is probable that a lock-keeper may be required in each case to ensure locks are efficiently used so as to minimize water loss.

Water Quality

The problems and mitigation discussed in sections 6.7.3 and 6.8.1 apply here.

Risks to Project Viability

The project will cause some environmental changes, particularly in the river environments, most of which cannot be fully mitigated. Acceptance of this cost can only be justified if the overall benefits of the projects are great, and there is a guarantee that these benefits will occur.

Surface water irrigation will be required if the Southwest Area is to avoid escalating food shortages, and no alternative can be offered. The benefits of the project are in the provision of irrigation to about 160,000 ha in the north and central parts of the Southwest Region, and in providing a flow to the Chitra river, which can allow a piped water supply to Khulna. The project will also ensure the continued viability of the Gorai river channel which will safeguard negative downstream changes, but will not greatly improve dry season flows to the transitional and saline zones.

The alternative of not intervening at the Gorai mouth may result in losing the wet season flows in the Gorai and the environmental damage that will cause can be colossal. On balance, the project provides the best choice available to arrest total environmental degradation and offers the opportunity to increase agricultural development during the dry season.

The benefits to agriculture by providing irrigation during the dry season however depends on adequate flows in the Ganges in the dry season and therefore at risk.

Environmental Mitigation Through a Ganges Barrage

The arguments for the development of a Ganges Barrage are concerned with providing Bangladesh with a nationally controlled ability to supply water to the Southwest Region. The barrage would ensure storage for a head of water that could provide the hydraulic control down the Gorai for channel maintenance, and possibly sufficient flow to allow some stabilisation of the saline wedge.

A barrage on the Ganges would, in itself pose a number of serious environmental questions, and would require detailed environmental impact assessments before it should be considered as a viable option. Consideration of a Ganges Barrage, as an environmental option for water resource management in the Southwest Region, can only be given serious consideration if it can guarantee the waters at the head of the Ganges in Bangladesh.

Such a barrage should not be considered as an isolated engineering project, for if the Ganges Barrage were in place, and the Gorai intervention constructed as a first stage and linked to the barrage scheme, considerable environmental improvements would accrue. Under such conditions the following improvements would be shown by this initial environmental evaluation:

(a) a ten-fold reduction of capital dredging at the Gorai offtake (12 M m^3 reduced to 1 M m^3)

(b) reduction in maintenance dredging, with the hydraulic control available

(c) reduced long-term negative impacts on fisheries, which may even improve with year-round flows.

Other negative impacts in the scheme would still occur, and the mitigation options (above) still would apply. For comparison Table 6.6 shows the impact matrix for the Gorai scheme as a first phase to a Ganges Barrage/water transfer project.

Recommendations for Feasibility Study

The Gorai Augmentation Project will require a full Environmental Impact Assessment (EIA) at the feasibility study stage. The project has wider implications than simply the provision of irrigation, and so it is essential that the views of local communities in the project areas and adjacent affected areas, be fully taken into account and incorporated into the plan drawn up at the feasibility stage.

It is suggested that environmental evaluations be made at all stages of planning, culminating at the feasibility stage when an EIA should be undertaken and include consideration of the following in addition to the standard assessments made:

- people's participation to determine the communities/groups that will require project modifications to ensure mitigation from negative impacts
- targeting of fishing communities for detailed assessment of impact/compensation
- targeting of the needs and impacts on the char dwellers in the Ganges/Padma
- full assessment of the use of the Gorai river to local communities, and the impact of the project on this value
- detailed studies of the fish capture and culture industries in the area
- modelling of the effects of spoil return into the Ganges river
- modelling to determine the impact of the augmentation on the saline wedge in the Southwest and South Central Regions
- comparative studies to determine the best environmental/economic option for long-term water supply to Khulna
- consideration of viable options for maintenance of river bio-diversity post-project
- incorporation into project, plans for public health measures to include groundwater supplies, sanitation and education on hygiene and vector control
- assessment of the means to maximise transport options in road and water sectors through the project
- consider in detail the means by which dredging and spoil disposal can be carried out in the most environmentally sympathetic manner
- provide an initial baseline for agrochemicals in the upper reaches of the Gorai river, and make recommendations for the control and monitoring of agrochemicals in this catchment
- consider major impacts outside the project area including the impacts and mitigation measures for the peoples and economy of the Ganges left bank.

TABLE 6.6

TABLE GORAI AUGMENTATION (as 1st. stage in GANGES BARRAGE PROJECT)											
ENVIRONMENTAL COMPONENT	IMPACT ANALYSIS : MULTI-CRITERIA VALUES										
	+5	+4	+3	+2	+1	0	-1	-2	-3	-4	-5
PHYSICAL/CHEMICAL											
PC1.Erosion of river banks											
PC2.FCD works											
PC3.Containment of flood											
PC4.Intervention land loss											
PC5.Change in salinity											
PC6.Change in water quality											
PC7.Dredging impacts											
BIOLOGICAL/ECOLOGICAL											
BE1.Floodplain fisheries											
BE2.Spawn/shrimp capture											
BE3.River fisheries											
BE4.Shrimp/fish culture											
BE5.Social forestry											
BE6.Sundarbans											
BE7.Wildlife/bio-diversity											
SOCIOLOGICAL/CULTURAL											
SC1.Security of homesteads											
SC2.Agriculture livelihoods											
SC3.Fishery livelihoods											
SC4.Artisanal transport											
SC5.Commercial transport											
SC6.Nutrition											
SC7.Water supplies											
SC8.Water related disease											
ECONOMIC/OPERATIONAL											
EO1.Distribution of income											
EO2.Benefit generation rate											
EO3.Operational complexity											

6.8.2 Chenchuri Beel FCD Project

Project Boundaries

The Chenchuri Beel FCD project is located in a triangular land area, bounded on the Southeast and Southwest by the Nabaganga and Chitra rivers, and by the upper Nabaganga in the north. The area has already been subjected to FCD works, and these further works will compartmentalise the beel. A map of the project area is given in Figure 6.6.

Consideration of Potential Project Impacts

Table 6.7 shows that the project is largely neutral, with negative impacts in all elements, but these are largely suitable for mitigation or are minor.

The project will rapidly benefit a number of areas starting in SW5 and SW10. During the construction period, local labour will be required for all construction works, which will add to the distribution of income throughout local communities.

Most of the benefits of the project will relate to the safeguarding of homesteads. Some irrigation will be available through LLPs, and the drainage channels may be used for irrigation water in the dry season. With the availability of irrigation, more land will be turned over to crops, and tree clearance in the village groves can be expected.

A new road network along the berms will be developed, which will benefit local communities within the project area. Commercial transport will be largely unaffected. Riverine communities that rely on boat transport will be disadvantaged by the barriers to movement posed by barrages and structures.

Improved agriculture should improve the diet of local communities. Conversely, the increase in open water surfaces brought about by the channel network, may increase the risk from water borne diseases, especially insect vectors. The problems of water related disease will increase if people use the drainage system for bathing and drinking purposes.

The main negative impacts relate to complexity of internal water management, water related disease and concerns over the impacts on fisheries.

The means exist within the project concept to safeguard the beel fisheries. The project seeks to retain many of the beel areas, which will held as reservoirs behind embankments with control structures. it is proposed that the drainage links with the rivers could be used to allow fish spawn and fingerlings into these reservoirs, to maintain the beel fisheries. This degree of water management may be hard to achieve in practice, and adds to the complexity of the project.

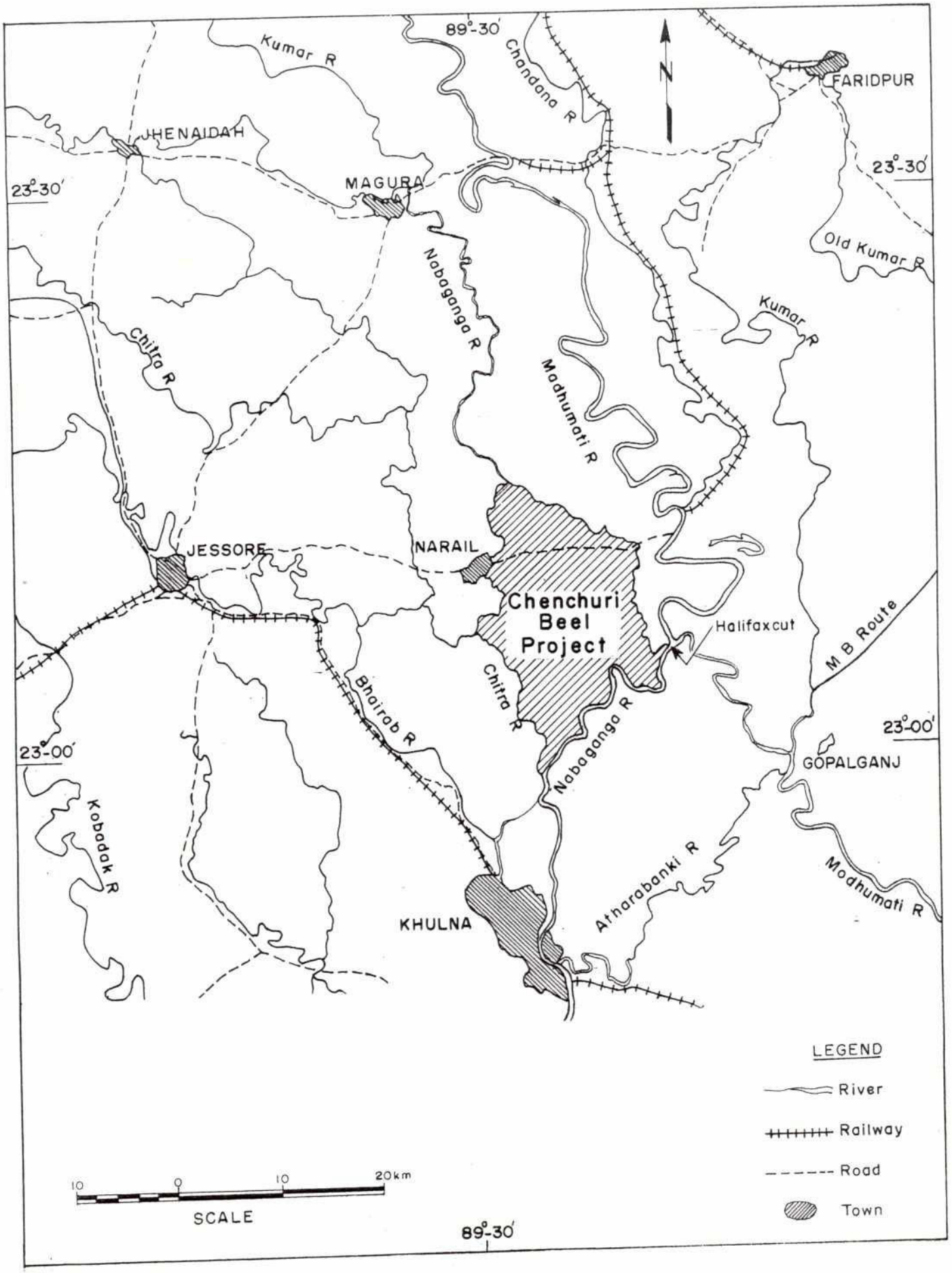
Mitigation of Negative Impacts

Fisheries

Little can be done, other than has already been catered for in project design, to safeguard or improve the river fisheries (and natural floodplain recruitment). The problems generally associated between FCD scheme and floodplain fisheries apply here.

The main worry with respect to the maintenance of the beel fisheries will be the complexity of water management to ensure stock replenishment at the appropriate times. This may need further extension services and public participation/awareness training, and is an aspect that should be covered in more detail in the feasibility studies.

Figure 6.6



Chenchuri Beel Project: Location Map

TABLE 6.7

TABLE	CHENCHURI BEEL FCD (PRE-FEASIBILITY)										
ENVIRONMENTAL COMPONENT	IMPACT ANALYSIS : MULTI-CRITERIA VALUES										
	+5	+4	+3	+2	+1	0	-1	-2	-3	-4	-5
PHYSICAL/CHEMICAL											
PC1.Erosion of river banks						▒					
PC2.FCD works					▒						
PC3.Containment of flood						▒					
PC4.Intervention land loss							▒				
PC5.Change in salinity						▒					
PC6.Change in water quality							▒				
PC7.Dredging impacts						▒					
BIOLOGICAL/ECOLOGICAL											
BE1.Floodplain fisheries							▒				
BE2.Spawn/shrimp capture						▒					
BE3.River fisheries							▒				
BE4.Shrimp/fish culture						▒					
BE5.Social forestry							▒				
BE6.Sundarbans						▒					
BE7.Wildlife/bio-diversity						▒					
SOCIOLOGICAL/CULTURAL											
SC1.Security of homesteads				▒							
SC2.Agriculture livelihoods				▒							
SC3.Fishery livelihoods						▒					
SC4.Artisanal transport					▒						
SC5.Commercial transport						▒					
SC6.Nutrition				▒							
SC7.Water supplies						▒					
SC8.Water related disease							▒				
ECONOMIC/OPERATIONAL											
EO1.Distribution of income					▒						
EO2.Benefit generation rate				▒							
EO3.Operational complexity								▒			

Artisanal Transport

This problem primarily relates to the use of small country boats, as the road network is likely to be improved by the project. On the main rivers, incorporation of small locks would provide an adequate technical means of overcoming this problem. There are both maintenance and administrative costs associated with this mitigation. It is probable that a lock-keeper may be required in each case, to ensure locks are efficiently used to conserve water loss.

Water Quality

The problems and mitigation discussed in Sections 6.7.3 and 6.8.1 apply here.

Risks to Project Viability

The project is essentially neutral. It will make relatively little change to the existing environmental situation in this area of the Southwest Region.

The project does however have a link to the Gorai augmentation proposals. Not only will this provide water down the Chitra river (although this is earmarked for Khulna), return flows from upstream agriculture will flow down the Nabaganga. These flows may reduce the salinity in the lower Nabaganga, which would be beneficial to irrigation from this river using LLPs. Thus there will be a positive benefit to the Chenchuri Beel Project as a result of Gorai Augmentation.

No negative risks to the project have been identified at this stage.

Recommendations for Feasibility Study

A full Environmental Impact Assessment (EIA) is necessary at the feasibility study stage.

It is suggested that the feasibility stage EIA should include consideration of the following in addition to the standard assessments made:

- people's participation to determine the communities/groups that will require project modifications to ensure mitigation from negative impacts
- targeting of fishing communities for detailed assessment of impact/compensation, as well as determining the systems that would ensure a sustainable beel fishery
- consideration of viable options for maintenance of river bio-diversity
- incorporation into project plans of public health measures to include groundwater supplies, sanitation and education on hygiene and vector control
- assessment of the means to maximise transport options in road and water sector through the project.

7 ENVIRONMENTAL MANAGEMENT PROGRAMME

7.1 Introduction

To ensure that development proceeds in an environmentally sympathetic manner, it will be necessary to monitor the impacts of projects as they sequentially develop, and to take steps to mitigate or prevent negative trends or consequences. This requires an inter-active programme of ground monitoring, coupled with feed-back systems from affected communities, interested parties in both the public and private sectors, and the regulatory and development institutions.

Definition of such a programme would come about once the environmental linkages between regulatory and sectoral institutions, and their capabilities, have been set out. Institutional development would then be required to meet the requirements of any programme.

The National Environmental Management Action Plan (NEAP) is presently being drafted, and it is expected that it will take account of these institutional needs. NEAP may have to form the basis for any overall environmental management plan, which would include considerations for the Southwest Area.

This section highlights some of the issues that would need to be addressed in consideration of a future monitoring and management plan defined as a result of implementation of the RWRMP, and the final form of NEAP.

7.2 Institutional Arrangements

The development of the main water resources management components of the RWRMP are likely to be the responsibility of the Bangladesh Water Development Board (BWDB). Similarly other sectoral developments will fall to sector departments and ministries. It may well be that these institutions will provide local or project orientated monitoring.

The need is for a holistic understanding of the environment, as well as monitoring the changes that occur as a result of development. Given the nature of departmental responsibilities, most sectoral institutions will be concerned with the environmental aspects of localities and projects, only in so far as it affects their sectoral responsibilities.

There are no authorities that, at present, have the institutional capabilities or resources, at a local level, to monitor environmental change, or adequately provide a record of environmental and social change at this time. Accordingly a method must be found whereby some records can be presented at regular intervals to allow for independent scrutiny and evaluation of any on-going negative impacts.

The Department of the Environment (DoE), under the Ministry of Environment and Forests, has the national mandate for environmental control. This institution would therefore be the coordinating centre for environmental management, and it should be the agency capable of providing the necessary holistic overview if the elements of the RWRMP are to put into practice in an environmentally sympathetic way.

The DoE is presently a small, young organization that will need considerable support and strengthening to undertake this role and discharge its mandate. In regard to the RWRMP its primary task will be three-fold:

- to put in place an effective water quality monitoring programme in the Southwest Area;

- to develop a coordinating mechanism for information and data exchange with other regulatory and development bodies;

- to develop a data analysis capability that will allow recommendations for actions and regulation enforcement to be executed against reliable technical knowledge.

The DoE will require considerable strengthening to meet its national role. It is possible to make specific recommendations with respect to the objectives of the RWRMP:

(1) The DoE Regional Office in Khulna needs to be improved in terms of staff numbers and training, and especially in its monitoring and analysis capability. The laboratory in this Regional Office requires rapid and extensive up-grading, together with appropriate staff training, in order that the DoE can have a comprehensive water/soil analysis capability.

(2) A water monitoring programme should be designed for the surface and groundwater quality of the region. This programme should take account of major polluting areas (Hot Spots) as well as non-point source pollution (mainly agrochemicals). The programme should assess the required parameters needed at individual sampling stations, the location of stations, frequency of sampling, methods of sampling and analysis, and the required form of data and analysis and presentation. The programme should cover the entire Southwest Area, but may be phased in order to take account of the growing capabilities of the DoE.

(3) The Bairab river can be immediately identified as a major 'Hot Spot', and a baseline study should be made on the water quality of this river, together with the Rupsa and Pusar river, well into the Sundarbans. This baseline would act as the comparative reference point for future monitoring on these waters, as well as a basis for determining standards for effluent discharges along the main industrial development area.

(4) The development of a capability to set conditions for, and evaluate the results of, EIAs carried out on all development projects.

It is accepted that this will require considerable development support for the Department, over a long time scale, but will be an essential first step if an overall environmental management programme is to be successful.

7.3 People's Participation

7.3.1 Public Participation

It is essential that the views of the communities that would benefit or be affected by any project are fully taken into account in the design and execution of the project.

This participation may be done in a number of ways. The form of participation must be considered at the time, and no fixed rules should be set down for this important part of project development.

There are established channels through which the views of a community are integrated into national, regional and local policy. This is through the elected representative of the community, from the thana level up to members of Parliament. This representation is most important in the participatory process, for the representatives are constantly in touch with their constituents and will have knowledge of the local needs and constraints.

Coupled to this is the ability to arrange meetings for local interest groups, where community issues can be raised in respect of project proposals. These may be arranged through the elected representatives, through local workers groups, or local NGOs. In any case the use of public meetings is a valuable tool in ensuring a wide dissemination of the project's aims and objectives, and allows for an immediate (and later a more considered) response from the interested people.

The final form of participation is the sociological surveys, which can be targeted to specific groups or individuals. These studies are becoming more complex as they are used to gather general data as well as specific information on individual issues. There is considerable risk in having a few surveys based on long and detailed questionnaires. Interviewees have a short attention span, particularly when the questions seem irrelevant to an individual's personal situation (however relevant in project terms). Short, directed surveys, possibly with repeat visits are generally more productive in both the quality and range of data collected.

It is important that data collected by any form of people's participation should be collated by the overall monitoring organization for the region. This is part of an important feed-back loop in the monitoring system, and such collected data, in its raw state should be made available for alternative forms of analysis by these monitoring organizations, and not confined to the project development bodies.

7.3.2 Liaison

For the full project benefits to be realized, a system of liaison between institutions and groups should be set up and maintained. Such liaison will allow all interested parties to become aware of the progress of the project; allow project decisions to respond to local interests and concerns as they may occur; provide greater public confidence in the purpose of the project; and ensure the efficient and economic execution of the works.

Where water resources management projects are concerned, the BWDB will bear the responsibility for developing the system of liaison in conjunction with the Deputy Commissioners and local authorities, particularly within the localities of the project sites. The Engineer will have an important part to play later in this aspect, and the actual functioning of the system will reflect his judgments on frequency, type and inputs into the liaison process.

Liaison will be required between local administration, other public institutions and utilities, and local public interest groups; all of which will require different degrees of inter-action with the project.

At the national level the FPCO and BWDB will continue to maintain an on-going exchange of information with the national bodies regulating sectors affected by the project, together with the donor agencies and international agencies.

7.3.3 Consultation

The system of liaison will need to take account of the interests of the people who will be affected by the project, as well as the regulatory and planning concerns of the authorities. To this end, the liaison system will need to coordinate a series of consultation activities to obtain public opinions.

There are a number of actions that can be taken in this consultation process; and the use of any, or any combination, will depend on the situation at any period in time.

Direct consultation with affected individuals, households and land owners are needed when land acquisition or displacement activities are planned. This consultation should include group and public meetings, as well as consultations with affected individuals. It is important to include in the consultation process all persons that might be affected in the localities, not merely the persons whose land or homes are to be acquired.

As a part of the consultation process, surveys of interest groups should be undertaken, particularly when a project activity has indicated a possible impact (positive or negative). These may be household or sector groups. To provide data for future decision making, follow-up surveys of these same groups should be undertaken to determine public opinion on the success of the operation.

7.3.3 Role of NGOs

There are a number of active NGOs in Bangladesh in addition to international agencies that have programmes of assistance to rural areas. These bodies can play an important role in the liaison process, as well as in developing public awareness and providing assistance to specific communities.

The need to ensure that local people and officials are made aware of the works that will be undertaken, of the local importance of these works, of the benefits that will accrue to the communities and of how best the people themselves might benefit from these works, can best be undertaken by the pourashavas or thanas, although it may be possible to involve local bodies and NGOs in the programme.

The NGOs have been identified as a group in the liaison process and certain organizations have specialized roles that would be of importance at specific times during the project cycle. Among these organizations are:

ASHA(Hope) - promoting population control, sanitation, social awareness, and rural employment

BRAC (Bangladesh Rural Advancement Committee) - promoting rural sanitation and public health

CARDMA (Coastal Area Resource Development & Management Association) - concerned with the conservation and management of the coastal zone

GANASASTHYA - promoting public health and sanitation awareness

GANA SAHAZYA SANGSTHA - promoting rural self-employment

NIJERA KARI (Work ourselves) - undertaking social work in rural communities, including self-help, kitchen gardens

PROSHIKHA - undertaking rural programmes for irrigation, water supply, rural sanitation, and training on human development

Amongst international agencies that have active programmes in the country in rural situations are:

UNICEF - rural water supplies, sanitation, and public awareness

CARE INTERNATIONAL - rehabilitation and resettlement.

8 SUMMARY AND CONCLUSIONS

8.1 Summary

The balance of the environmental factors in the ecosystem of the Southwest Area is extremely complicated and delicate. Within these complex physical conditions, many factors are interrelated, and changes in one affects the others. Predictions of the effects of man-made changes in its environment are therefore, difficult. In consideration of the potential impacts of the Regional Water Resources Management Plan (RWRMP), a number of important environmental issues are to be dealt with. The most important amongst these are salinity levels, ground and surface water uses, sedimentation, spreading of water-borne diseases, water and soil pollution, impacts on fisheries, agriculture, forestry, land and water transport and population.

The Southwest Area is presently facing a dire state of affairs in terms of its natural environmental harmony and the preservation thereof. The repercussions of reduced water levels in the Ganges river, and its principal distributaries such as the Gorai, Arial Khan etc., has disrupted fishing and navigation, brought unwanted salt deposits into rich farming soil, allowed greater saline intrusion northwards, affected agricultural and industrial productions, changed the hydraulic characteristics of the rivers, and caused changes in the ecology of the delta.

A primary objective of the Regional Plan is to ensure that both dry season and wet season surface water flows are secured for the Area. No formal groundwater development strategy as such is included in the regional plan. However, there are reasons for expecting that groundwater exploitation will inevitably occur, financed by the private sector. Surface water augmentation; and Flood Control, Drainage, and Irrigation (FCD/I) schemes however, are likely to have both positive and negative effects on the environment. The negative effects, however, need to be studied in detail so that mitigation measures can be recommended.

The benefits of the schemes proposed would mainly be to agricultural sector, through increased crop production, cropping intensity and a greater distribution of income. Generally this will bring disbenefits to the fishing community in reduced catch and income, although this could be partially mitigated by expanding and supporting the culture fisheries sector. Augmentation schemes will generally benefit navigation in the form of maintained channel depths etc. However, structures and regulators built on rivers will hinder navigation. This could be mitigated by incorporating suitable locks in the design.

Dredging of the rivers will cause problems for riverine environment and the disposal of spoil should be studied in greater detail during the feasibility study so that the negative impacts could be kept to a minimum.

Land acquisition is small in comparison to other programmes elsewhere, nevertheless, some people will be displaced. These people should be adequately compensated andalternative employment found, if possible, to cushion the effect of disruption to their lives.

Increased income may result from increased food intake in quality and quantity and therefore nutrition of the people will improve in general. However, water related diseases will likely to increase and education in hygiene and health matters is important.

The main threat to the Sundarbans is over-felling. The augmentation projects may result in marginal positive benefit to the Sundarbans. The interventions proposed in the Coastal Embankment Area to improve drainage congestion are not expected to change the present channel regimes in the Sundarbans area.

It is essential that the views of the communities that would benefit or be affected by any scheme are fully taken into account in the design and execution of the project. Local Government and NGOs working with the local people may be used for the people's participation process.

Institutional strengthening of the DoE and other agencies concerned with the environment is a priority for better environmental management.

Existing data in all aspects are very poor and sparse and an extensive data collection programme on all sectors should be launched so that up-to-date data are available. A monitoring programme on water quality and industrial pollution should also be initiated.

8.2 Conclusions

The SWA presently facing environmental and social degradation due to denial of dry season flows to the Southwest Region. The Gorai river is terminally declining and the effect of the Gorai detaching from the parent river and becoming an inland river would be catastrophic not only for the region but also for the country as a whole. The intervention proposed to rejuvenate the Gorai may have some negative impacts but the alternative of doing nothing and allowing the environment, both physical and human, to slowly deteriorate is not acceptable. On balance, therefore, the proposals offer the best choice for survival and sustaining the environment.

Appendix

APPENDIX 1

ASSESSMENT AND EVALUATION METHOD

1 Introduction

In conducting any impact assessment where reliance has to be placed on incomplete secondary data, and where no possibility exists for independent confirmation, or for primary data collection, assessment will tend to be subjective, which nevertheless will provide a competent analysis of the probable changes and effects.

The system is based on the definition of important assessment components and ascribing a value for each component. These values reflect a judgement made for the component in each instance, and are compatible with the FPCO multi- criteria analysis scale of $\pm$ 5 (Table A1).

2 Criteria for Assessment

The criteria used to make these judgements were:

IMPORTANCE OF CONDITION

A measure of the importance of the condition, and is assessed against the spatial boundaries or human interests it will affect.

MAGNITUDE OF CHANGE/EFFECT

Magnitude is defined as a measure of the scale of benefit/dis-benefit of an impact or a condition.

RATE OF ACHIEVEMENT

This provides a measure of the time taken for the effect of a benefit/dis-benefit to be fully realised.

COMPLEXITY

This is a measure of the degree of complexity or difficulty that is required by a condition to be enacted or maintained.

PERMANENCE

This defines whether a condition is temporary or permanent, and should be seen only as a measure of the temporal status of the condition.(eg: an embankment is a permanent condition even if it may one day be breached or abandoned; whilst a coffer dam is a temporary condition, as it will be removed).

REVERSIBILITY

This defines whether the condition can be changed and is a measure of the control over the effect of the condition. It should not be confused or equated with permanence. (eg: (i) an accidental toxic spillage into a river is temporary condition, but its effect (death of fish) is irreversible; a town's sewage treatment works is a permanent condition, the effect of its effluent can be changed (reversible condition).

CUMULATIVE

This is a measure of whether the effect will have a single direct impact or whether there will be a cumulative effect over time, or a synergistic effect with other conditions. The cumulative criterion is a means of judging the sustainability of a condition, and is not to be confused with a permanent/irreversible situation. For instance, the death of an old animal is both permanent and irreversible, but non-cumulative as the animal can be considered to have already passed its breeding capabilities. The loss of post-larval shrimp in the wild, is also permanent and irreversible, but in this case cumulative, as all subsequent generations that the larvae (as adults) may have initiated will also have been lost.

The judgements made for each project are necessarily subjective, based on the available data, the level of project devlopment, and the experience and concerns of the environmental specilists. These criteria allowed some standardisation in considering each option, and a basis for comparative judgements.

3 Environmental Components

The environmental components are generally considered as four primary components. However, in the Regional Plan, conceptual strategies are considered, and so each primary element has been further reduced to identify specific environmental components that better demonstrate the possible impacts of each strategy.

3.1 Primary Environmental Elements

The four primary environmental components are defined as follows:

PHYSICAL/CHEMICAL

Covering all physical and chemical aspects of the environmental, including finite (non-biological) natural resources, and degradation of the physical environment by pollution.

BIOLOGICAL/ECOLOGICAL

Covering all biological aspects of the environment, including renewable natural resources, conservation of bio-diversity, species inter-actions, and pollution of the bio-sphere.

SOCIOLOGICAL/CULTURAL

Covering all human aspects of the environment, including social issues affecting individuals and communities; together with cultural aspects, including conservation of heritage, and human development.

ECONOMIC/OPERATIONAL

To qualitatively identify the economic consequences of environmental change, both temporary and permanent, as well as the complexities of project management within the context of the project activities.

3.2 Important Environmental Components

Within these four primary components the following issues have been identified as the important environmental components for this environmental assessment.

PHYSICAL/CHEMICAL

PC/1. Erosion of river banks

This component forms an on-going condition of considerable importance.

PC/2. FCD works

This component considers the changes involved by FCD works.

PC/3. Containment of river floods

This condition is linked to embankments, but should also be seen as a wider component, allowing alternative strategies to be better assessed.

PC/4. Land loss to interventions

This component takes account of the impact on productive land of strategies that rely on embankments as a major form of intervention, as well as the problems posed by the disposal of dredging/construction waste material.

PC/5. Change in salinity

This component considers the value of salinity changes with respect to the use of water/affected land. In general, freshwater has been considered more beneficial than saline water.

PC/6. Change in water quality

This component provides a means of assessing pollution through changes in water quality (other than salinity).

PC/7 Dredging impacts

This component takes account of the damage to aquatic ecosystems from dredging operations required by the project.

BIOLOGICAL/ECOLOGICAL

BE/1. Floodplain fisheries

This component assess the impact of interventions in preventing the effective use of the floodplain for natural growth within the life-cycle of the river fishes.

BE/2. Spawn-fish and shrimp post-larvae capture

Although localised, this form of fishery is very important to the economy of these localities, and hence is a major fishery component.

BE/3. River and esturarine fisheries

Though linked to the production of the floodplain fishery, these fisheries form the main remaining artisanal exploitation of the fish resources and are directly affected by some forms of intervention.

BE/4. Shrimp and fish culture/inland fisheries

Shrimp and fish culture, and artisanal beel/baor fisheries, are recognised as providing very important cash crops, though not as a primary food source in the project area.

BE/5. Social groves

These resources are indirectly linked to forms of intervention, such as the continuing use of timber for fueling brick kilns. Mitigation is possible in some cases, but the fragility of the resource requires its inclusion in any impact assessment.

BE/6. Sundarbans forest

This component considers the forest element of the Sundarbans, and includes other forest products from this area.

BE/7. Wildlife/bio-diversity conservation

Whilst the major part of this component will be reflected in actions that impact on the Sundarbans forest, endangered species in other areas are also considered.

SOCIOLOGICAL/CULTURAL

SC/1. Security of homesteads

This component is linked to the impacts brought about by erosion along the river, and flooding in and adjacent to breaches in the river defenses, as well as displacement by the project itself.

SC/2. Change in agricultural livelihood

This component seeks to assess the overall impact on agricultural development brought about by individual strategies.

SC/3. Change in fishery livelihood

This component considers fisheries in a similar manner to the preceding component.

SC/4. Artisanal transport

This component considers the value of strategies in providing access routes between villages and communities, which is a valuable by-product of some forms of intervention.

SC/5. Commercial transport

This component recognises both land transport by rail and truck, as well as river transport, including larger forms of country boats.

SC/6. Nutrition

This component seeks to combine the overall potential for long-term change in nutrition brought about by changes in agriculture and fisheries as a result of any strategy.

SC/7. Potable water supplies

This component assumes the majority of rural supplies to be from the shallow aquifer, and dependent on hand pumps.

SC/8. Water related disease

This is considered as the primary health concern, and includes water-borne diseases as well as vector-borne diseases where the vector is water-dependent in its life-cycle.

ECONOMIC/OPERATIONAL

EO/1 Distribution of income

This component is used to assess the potential expansion and improvement of income over all earning groups.

EO/2 Rate of benefit generation

A measure of the benefit/dis-benefit with respect to the time taken for full achievement/effect. Dis-benefit can only occur if losses are considered more important that benefits for target groups.

EO/3 Operational complexity

A measure of the operational requirement for technical inputs/skills and inter- and intra-institutional coordination, as well as the complexity of the O&M needed.

TABLE A.1

Conversion of Ranges to FPCO Environmental Values

Evaluation Score (ES) range	FPCO Environmental Guideline value	FPCO Environmental Guideline value Description
+72 to +108	+5	Highly positive
+36 to + 71	+4	Very positive
+19 to + 35	+3	Moderately positive
+10 to + 18	+2	Positive
+ 1 to + 9	0+1	Slightly positive
0	0	No impact/status quo
- 1 to -9	-1	Slightly negative
-10 to -18	-2	Negative
-19 to -35	-3	Moderately negative
-36 to -71	-4	Very negative
-72 to -108	-5	Highly negative & irreversible

Social Studies

SOUTHWEST AREA WATER RESOURCES MANAGEMENT PROJECT (FAP-4)

SOCIAL STUDIES

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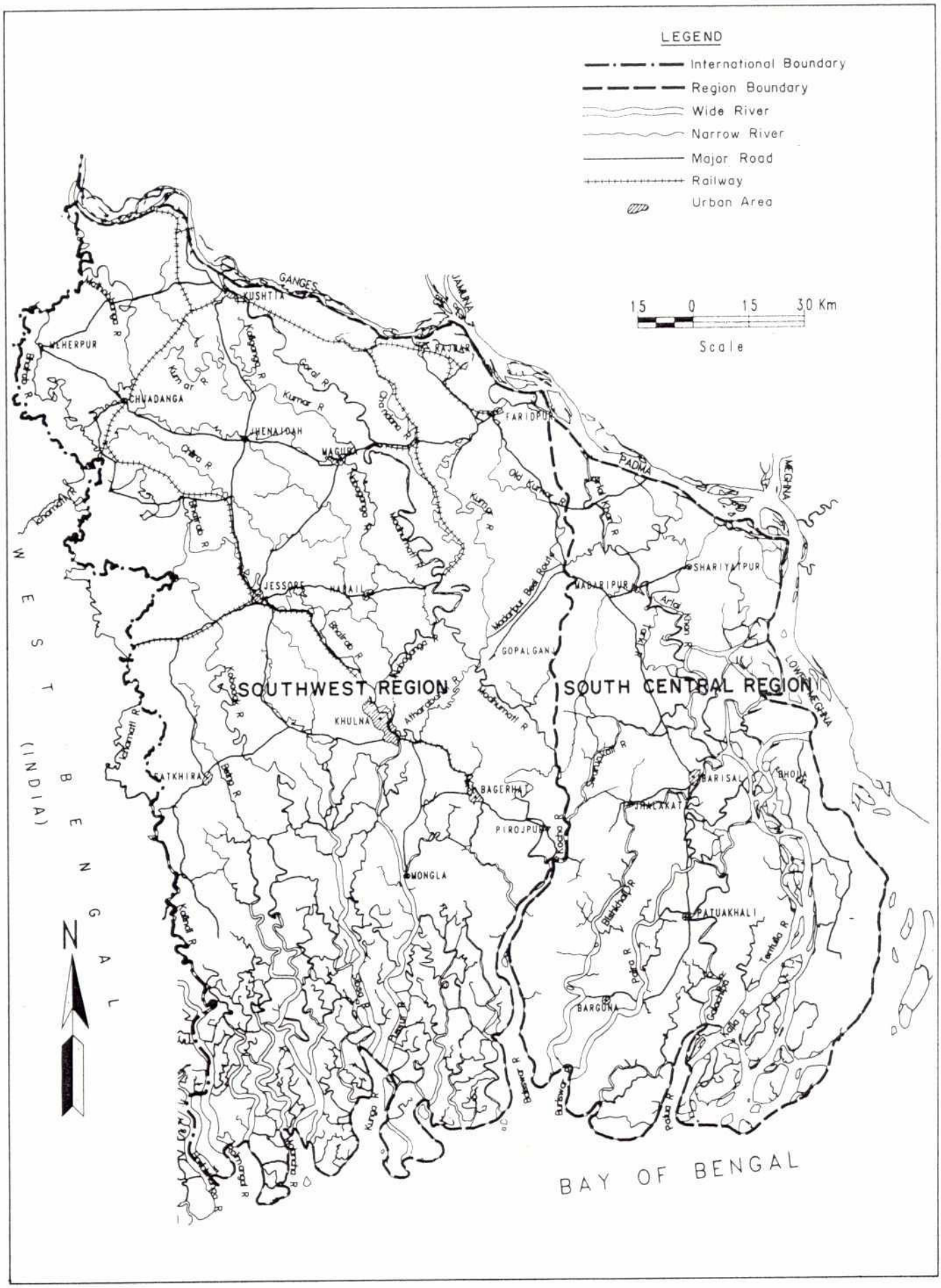
ACRONYMS AND ABBREVIATIONS

ADB	Asian Development Bank
BADC	Bangladesh Agriculture Development Corporation
BARC	Bangladesh Agricultural Research Council
BARI	Bangladesh Agricultural Research Institute
BAU	Bangladesh Agricultural University
BBS	Bangladesh Bureau of Statistics
BFDC	Bangladesh Fisheries Development Corporation
BFRI	Bangladesh Forest Research Institute
BINA	Bangladesh Institute of Nuclear Agriculture
BJRI	Bangladesh Jute Research Institute
BKB	Bangladesh Krishi Bank
BLRI	Bangladesh Livestock Research Institute
BMD	Bangladesh Meteorological Department
BRAC	Bangladesh Rural Advancement Committee (NGO)
BRDB	Bangladesh Rural Development Board
BRRI	Bangladesh Rice Research Institute
BSS	Bhumiheen Samabay Samity (Landless Cooperative Society)
BWDB	Bangladesh Water Development Board
CARE	Cooperative for American Relief Everywhere (NGO)
CEP	Coastal Embankment Project
CIDA	Canadian International Development Agency
DAE	Department of Agricultural Extension
DOE	Department of the Environment
DOF	Department of Fisheries
DPHE	Directorate of Public Health Engineering
DSSTW	Deep Set Shallow Tubewell
DTW	Deep Tubewell
FAO	Food and Agriculture Organisation of the United Nations
FAP	Flood Action Plan
FCD	Flood Control and Drainage
FCD/I	Flood Control, Drainage and Irrigation
FFYP	Fourth Five Year Plan
FFW	Food for Work
FHH	Female Headed Households
FPCO	Flood Plan Coordination Organisation
GB	Grameen Bank
GOB	Government of Bangladesh
HYV	High Yielding Variety
IDA	International Development Agency (World Bank)
KSS	Krishi Samabya Samity (Farmers' Cooperative Society)
LLP	Low Lift Pump
LGED	Local Government Engineering Directorate
LGRD	Local Government and Rural Development
MIWDFC	Ministry of Irrigation, Water Development & Flood Control
MLGRDC	Ministry of Local Government, Rural Development and Cooperatives
MPO	Master Plan Organisation
NARS	National Agriculture Research System
NCA	Net Cultivable Area
NFC	National Flood Council
NGO	Non - Government Organisation
NMIDP	National Minor Irrigation Development Project
NWC	National Water Council

O & M	Operation and Maintenance
ODA	Overseas Development Administration (U.K)
PCC	Project Coordination Committee
PDEU	Population Development and Evaluation Unit
PEP	Production Employment Programme
PIC	Project Implementation Committee
PP	Peoples' Participation
PU	Planning Unit
PWD	Public Works Department
RESP	Rural Employment Sector Programme
R & H	Roads and Highways
SC	South Central
SCR	South Central Region
SRI	Sugarcane Research Institute
STW	Shallow Tubewell
SW	South West
SWA	South West Area
TA	Technical Assistance
TIP	Thana Irrigation Programme
TNO	Thana Nirbahi Officer
TK	Taka
SWR	South West Region
UCCA	Upazila Central Cooperative Association
UNDP	United Nations Development Programme
Upazila	Administrative Unit above Union and below Zila (now Thana)
WFP	World Food Programme
WARPO	Water Resources Planning Organisation
WHH	Women Headed Household
WSS	Women's Cooperative Society
WUC	Water Uses Committee

Figure 1.1



Southwest Area Map

1 INTRODUCTION

The institution and sociology components of the Southwest Area Water Resources Management Project are presented in this part of the volume. In terms of resources these two study components formed a relatively small part of the whole study. Indeed as originally envisaged there was no position of sociologist in the study team.

The size, almost 30% of Bangladesh's area, complexity and variety of communities in SWA mean that the social studies are to be considered preliminary. Much detailed area specific detailed work, particularly in the fields of benefit distribution, public participation and institutional linkages remains to be carried out during the feasibility studies for specific projects that may be selected as a result of this report.

It was immediately after the Inception Report in January 1992 that the Consultants, aware of the gap in social studies, requested ADB for the inclusion of a locally based sociologist. Approval was given in June and the sociologist started work in the following month.

The Report is divided into five chapters. This first chapter gives an introduction to the report outlining the background. The overview, the present situation of the socio-economic features of the Southwest Area together with the impacts of the proposed interventions are described in chapter two. Chapters three and four deal with the two specific projects, namely the Chenchuri Beel Improvement Project and the Gorai Augmentation Project respectively. Institutional aspects are given in chapter five.

This sociological section is also later utilized in determining the positive and negative impacts on human populations for environmental analysis. The value placed on these impacts can be found in the matricies in the environmental impact assessment given in the Environmental Studies Annex of the same volume.

The SWA is shown in Figure 1.1.

2 SOCIAL STUDIES

2.1 Outline of the Social Studies

As noted in the introduction to this part of Volume 9 the study resources available for social investigations were limited. As a result the work carried out was limited. Three specific studies were undertaken. Two were directed to specific areas as part of the pre-feasibility work on the Chenchuri Beel Rehabilitation Project and the larger scale Gorai Augmentation Project. The results of these are presented, respectively, in Chapters 3 and 4 that follow. In addition there was a preliminary field survey in the more flood prone north west of SWA. The results of this survey, together with a range of information and observations drawn from secondary sources and the Consultants' wider ranging work throughout SWA, are given in these sections.

2.2 Preliminary Social Studies and SWA Overview

2.2.1 Scope and Objective of the Preliminary Socio-economic Study

The main objectives of the preliminary study are :

- to provide a preliminary assessment of the impacts of existing interventions - FCD, FCD/I and Polder Schemes on different segments of population; landless, farmers, women and fishermen;
- to identify and assess the possible positive and negative impacts of the water management options;
- to identify the factors responsible for popular participation by the beneficiaries for the maintenance of the embankments, regulators, sluice gates and other compartments;
- to assess the prevailing socio-economic conditions;
- to identify the actual beneficiaries and their expectations out of the project;
- to identify rural social institutions, both formal and informal and government and non-government (NGO).

2.3 Method

Data for the study were collected both from primary and secondary sources. The secondary sources are from existing reports, BBS, MPO and other organisations.

2.3.1 Primary Sources

Data were collected from the greater Faridpur area with the help of interview schedules which were administered to the beneficiary respondents by a team of enumerators under the direction of the study sociologist.

The Sociologist also maintained a field diary covering specific field observations. Data were also collected from NGO offices and local officials.

A sample of the Questionnaire used in the survey is given in Appendix 1.

Data for the survey were collected from more flood prone areas in the north west of SWA. The areas are Vedorganj thana of Shariatpur, Char Vadrasan of Faridpur, Goalando of Rajbari and Kalkini Thana of Madaripur district. The respondents are classified as follows:

Category	Total	FCD/I	Non FCD/I
Farmer	178	107	71
Fish (culture)	25	18	07
Fish (capture)	55	19	36
Women head	60	33	27
Landless	62	36	26
Total	380	213	167

2.3.2 Secondary Sources

Data were collected from other studies in the Southwest Region of Bangladesh. These included the following:

- The district gazetteers of Greater Faridpur, Barisal, Patuakhali, Kushtia, Jessore and Khulna districts.
- Previous studies on Flood and Water Management such as FAP-12/13.
- Flood Action Plan - proceedings of the second conference
- Report of National Water Plan 1986
- Southwest Regional Plan - Supplement Sociology and Economics December 1980 of BWDB
- Population Censuses
- Bangladesh Statistical Year Books
- Other related books and literature.

2.4 Socio-Economic Profile of the Area

2.4.1 Demographic Profile of the SWA

Population data and characteristics for the SWA study were derived from a mixture of preliminary, adjusted 1991 Population Census results and earlier studies including the 1981 census and the 1983/84 census of Agriculture.

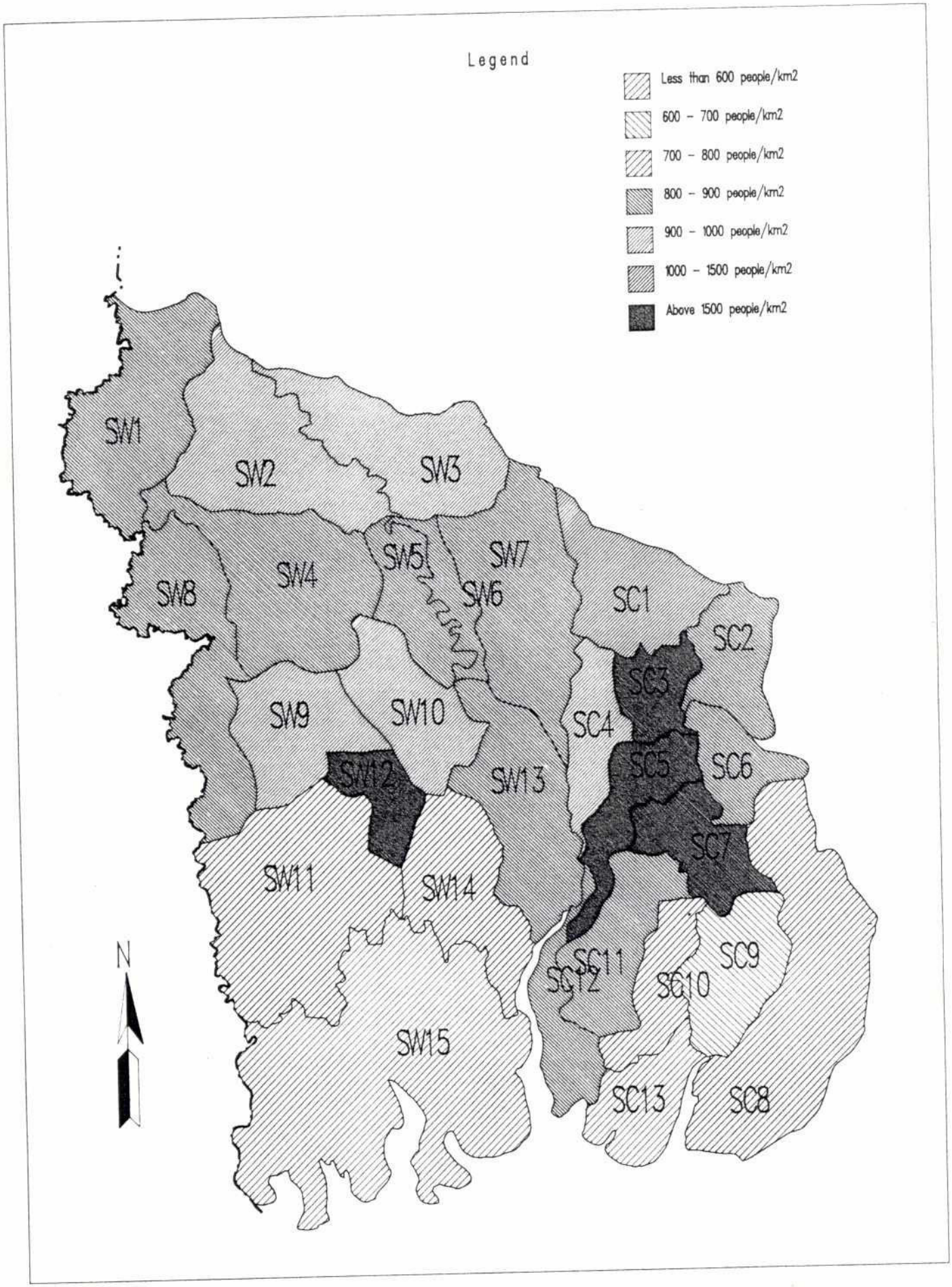
Present Population

Selected population indicators for SWA are given in Table 2.1. Key population data are presented in Table 2.2 by the Planning Units that have been used as the framework for the SWA Project investigations. The PU figures were converted from the Thana level data published by BBS.

Preliminary 1991 Census data found the SWA population to be 26.1M, almost one quarter of the national total of 109.9M.

Figure 2.1 shows the population density (1991) by Planning Units.

Figure 2.1



POPULATION DENSITY 1991

TABLE 2.1

Selected Population Indicators 1991

Indicator	Selected Unit	Southwest Region	South Central Region	Southwest Area
Population	#m	16.72	9.39	26.11
urban	%	11	5	9
rural	%	89	95	91
Male/Female	ratio	1.06	1.03	1.05
Households	#m	2.97	1.75	4.72
urban		0.34	0.07	0.41
rural		2.63	1.68	4.31
Household size	pp	5.64	5.35	5.53
urban		5.45	5.99	5.55
rural (1)		5.51	5.32	5.44
Literacy	%	na	na	24.8
Density				
Total	pers/km²	674	757	702
With Sundarbans		784	757	774
Without Sundarbans				
Rural		599	722	640
With Sundarbans		695	722	705
Without Sundarbans				
Dependency ratio (2)		2.54	2.35	2.41
		2.97	1.75	4.72
Households	#m	15	16	15
landless	%			
farming		21	22	21
marginal	%	24	23	24
small	%	24	20	23
medium	%	8	6	8
large	%	7	12	9
fishing (3)	%			

Source: 1991 Statistical Yearbook of Bangladesh, BBS Supplement No 1
Preliminary Report on Population Census 1991, June 1992, BBS.

(1) Excluding the Sundarbans for which household data were not available.
(2) Dependents = 0-9 and 55+ years of age
(3) Data for fishing households uncertain. Estimate taken from BBS data for landless households.

Sixty four percent of the population were found in SWR. In 1991 population density in SWA 702 pp/km² was compared with 820 pp/km² for Bangladesh as a whole. If the sparsely peopled Sundarbans are excluded overall density rises to 774 pp/km². There were significant variations in density within SWA. Planning Unit SW12, which includes most of

TABLE 2.2

Population Data (1991) in Planning Unit (PU)

Planning Unit	PU AREA km² (a)	RURALHH (b)	RURALPOP (c)	URBANHH (d)	URBANPOP (e)	TOTALHH (f)	TOTALPOP (g)	MALES (h)	FEMALES (i)	Person/HH (k=g÷f)	Total Density (No/km²)	Rural Density (No/km²)
SW1	1807	238,856	1,297,108	11,665	61,714	250,518	1,358,819	696,207	662,612	5.42	752.02	717.87
SW2	1892	266,679	1,511,950	26,270	148,874	292,944	1,660,820	863,360	797,460	5.67	877.94	799.24
SW3	1653	218,825	1,227,292	15,905	94,797	234,726	1,322,084	681,263	640,822	5.63	800.03	742.67
SW4	2047	238,296	1,368,582	39,340	217,585	277,633	1,586,163	816,137	770,025	5.71	774.92	668.62
SW5	719	91,664	501,497	2,406	13,953	94,068	515,448	261,061	254,387	5.48	717.22	697.81
SW6	415	56,444	313,246	298	1,855	56,740	315,099	158,899	156,201	5.55	760.06	755.59
SW7	1950	281,425	1,511,574	7,186	44,133	288,605	1,555,702	786,457	769,245	5.39	797.87	775.24
SW8	1815	219,460	1,226,457	14,142	77,339	233,599	1,303,792	666,748	637,068	5.58	718.34	675.73
SW9	1163	176,394	951,659	5,670	30,998	182,060	982,653	503,858	478,796	5.40	844.97	818.32
SW10	1094	112,626	632,583	49,299	256,521	161,923	889,102	460,003	429,099	5.49	812.84	578.32
SW11	2710	303,003	1,679,928	4,902	27,057	307,897	1,706,977	866,801	840,190	5.54	629.93	619.94
SW12	585	53,358	289,977	128,915	661,391	182,272	951,366	509,502	441,865	5.22	1625.04	495.31
SW13	1626	215,472	1,147,009	14,672	120,553	230,139	1,267,558	624,536	606,011	5.51	779.36	705.24
SW14	1342	154,916	811,571	19,536	97,425	174,448	908,993	468,990	440,003	5.21	677.27	604.68
SW15	4010	0	402,756	0	0	0	402,756	206,492	196,264	0.00	100.44	100.44
Sub-Total	24,827	2,627,418	14,873,191	340,206	1,854,193	2,967,571	16,727,332	8,570,312	8,120,046	5.64	673.76	599.08
SC1	1276	209,391	1,101,406	10,920	58,744	220,308	1,160,146	585,048	575,098	5.27	909.10	863.07
SC2	851	116,692	601,153	0	0	116,692	601,153	304,619	296,534	5.15	706.58	706.58
SC3	543	103,775	545,171	1,661	8,925	105,433	554,094	281,227	272,867	5.26	1019.68	1003.26
SC4	713	117,977	606,225	1,247	6,695	119,221	612,917	309,889	303,028	5.14	859.08	849.70
SC5	817	156,000	804,184	1,997	15,589	157,992	819,768	412,900	406,869	5.19	1002.89	983.82
SC6	712	91,458	483,028	5,759	37,126	97,215	520,152	270,526	249,626	5.35	730.50	678.36
SC7	823	126,952	691,915	23,405	152,295	150,356	844,208	435,370	408,838	5.61	1025.26	840.30
SC8	2680	302,849	1,676,354	12,952	76,516	315,795	1,752,863	902,632	850,231	5.55	654.07	625.52
SC9	867	87,385	489,545	4,214	23,769	91,597	513,312	257,926	255,386	5.60	591.98	564.57
SC10	677	73,221	393,746	5,978	32,513	79,198	426,258	214,128	212,130	5.38	629.36	581.36
SC11	1053	156,323	811,549	4,619	25,023	160,937	836,567	419,028	417,540	5.20	794.48	770.72
SC12	592	79,395	418,823	1,413	6,888	80,808	425,709	215,143	210,566	5.27	718.71	707.09
SC13	783	58,350	319,139	0	0	58,350	319,139	161,697	157,442	5.47	407.76	407.76
Sub-Total	12,389	1,679,770	8,942,238	74,164	444,082	1,753,902	9,386,287	4,770,133	4,616,154	5.35	757.63	721.79
PU Total	37,216	4,307,188	23,815,429	414,370	2,298,275	4,721,473	26,113,619	13,340,445	12,736,200	5.53	701.68	639.93
Thana Total		4,383,515	23,824,600	416,639	2,311,988	4,800,058	26,136,494	13,350,600	12,748,921			

Source : Derived from 1981 and 1991 Population Censuses, BBS.
Note : The discrepancy between PU total and Thana figures arises from adjustment of data to study areas.

Khulna municipality, has the highest density, 1625 pp/km². SC13 the lowest, 408 pp/km² except for SW15, the Sundarbans Forest Reserve which has a small, supposedly transient population of woodcutters and fishermen and a density of about 100 pp/km².

About 91% of SWA's people live in the rural areas. The rural population is lower in the SWR (89%), in which the city of Khulna is situated than, in the less urbanised SCR (95%).

Final adjusted age group figures from the 1991 Census were not available for all SWA at the time of writing. Final 1991 data for five southern districts, however show that 30% (range 28-32%) are under 10 years of age a further 58% (55-61%) between 10 and 49 years and 12% (10-13%) over 49 years.

The literacy rate of the over five year old population varies from 17.73% in Bhola to 10.73% in Jhalakati according to the latest published BBS figures. Typically women have a much lower literacy rate than men, 11-27% compared to 22-40%.

The average male : female ratio in SWA is 105 in SWR, 102 in SCR and at 104 in the whole area it is slightly lower than the National figure of 106.

The average household size in the study area was 5.53 persons in 1991. In the South Central Region it was 5.35, and in the South West it stood at 5.64. Out of the total number of households in the study area, the distribution of rural and urban households were 91% and 98% respectively. The Sundarbans (SW15) had no permanent inhabitants, and therefore, no permanent households. Its transient dwellers were however, estimated at 402,756 in number, all of whom were considered to be rural. The Sundarbans itself has no urban centres.

Small, medium, and large farmers respectively accounted for 68%, 26%, and 6% of total farm households. Barisal (SC6) had the highest proportion (78%) of small-farm households, and the lowest proportion (2.6%) of large farm households.

Population Growth

The 1981 - 1991 intercensal population annual growth rate in SWA was 1.89%, lower than the national rate of 2.03% pa. Provisional figures indicate that the rural urban drift was lower in the 1980s than during the previous two decades. In SWA the urban population grew at 4.2% pa between 1981 and 1991 compared to 1.58% pa in the rural areas. The national and SWA figures show there to be positive success in curbing population growth through the countrywide family planning campaign promoted actively by government during the past decades.

The Population Development and Evaluation Unit (PDEU) of the Planning Commission forecast continued progress and expect the growth rate to fall to one percent by 2009. The PDEU's forecasts and the lower than expected 1981 - 1991 growth rate result in the following, possibly optimistic, projections for SWA which indicate that the population will be one third higher by 2010 (Table 2.3).

TABLE 2.3

SWA - Population Growth

	1991	1995	2000	2005	2010
million SWA	26.11	28.28	30.77	32.98	34.66
SWR	16.72	18.12	19.71	21.13	22.20
SCR	9.39	10.17	11.06	11.86	12.46
Density pp/km²	702	760	825	885	930

The forecasts are based on the official BBS national rate of 2.01% pa during the first five year period rather than the lower but unofficial SWA figure of 1.89%. In the absence also of officially released growth rates 2.02% has been applied to both the rural and urban 1991 populations.

The projections show that population densities in SWA can be expected to rise from 702 pp/km² in 1991 to 930 pp/km² in 2010. Even if the proportion of farming households remains unaltered at 76% the effect on the farming community will be drastic unless migration to urban centres or out of SWA occurs or, as is most likely the proportion of landless within the rural areas increases very substantially. To retain the same amount of land for each farming household the proportion of landless households (including fishermen) would have to increase from about one quarter in 1991 to 36% in 2000 and 43% in 2010.

2.4.2 Land Ownership

The latest (1983/84) BBS data showed that one quarter of households in SWA were landless; with less than 0.2 ha; and 76% owned land with an average net cultivable area of 0.88 ha, which by 1991 had fallen to about 0.7 ha. Sixty percent of farm households had less than 0.5 ha and only 10% had occurs to more than two hectares. The BBS data showed farm holding to be grouped as shown in Table 2.4.

TABLE 2.4

SWA - Land Holding

	Marginal (0.21-0.50 ha)		Small (0.51-1.00 ha)	Medium (1.01-2.00 ha)		Large (>2.00 ha)		All Holdings
SWR %	27		31	31		11		1.00
Av NCA ha		0.32			1.59		4.35	
SCR %	31		32	28		9		0.78
Av NCA ha		0.30			1.54		4.43	
SWA %	28		32	30		10		0.88
Av NCA ha		0.31			1.57		4.39	
National %	70		25			5		
Av NCA ha		0.38			1.67		4.71	0.92

Three categories of rural land tenure are recognised; owner operators, tenants and owners-cum-tenants. National figures show 63% of holdings to be owner operated, one percent tenanted and 36% farmed by owner-cum-tenants. In SWA the division between the categories was: owner operator 59-70%, owner-cum-tenants 29-41% and tenants only exceeded one percent in Kushtia District.

Most tenancies are under a share cropping system. Government regulations covering tenancy conditions set out the division of output as: 33% to the landowner, 33% to the share cropper who provides labour and draught power and the balance to whoever provides the other production inputs. In practice local customary arrangements often apply and may be altered at short notice even though legislation provides that unless good reason can be shown agreements should not change for a period of five years. In SWA two main share cropping arrangements are found:

	Labour Draught power %	Other Inputs %	Output %
(1) Owner	-	50	50
Sharecropper	100	50	50
(2) Owner	-	-	33
Sharecropper	100	100	67

Seasonal or annual cash rents also occur but on a small scale and mainly in the Southernmost parts of SWA.

2.4.3 Employment

The economically active population in the project area constituted 96.2% males and 3.8% females in 1981. But a growing trend has been the gradual decline in the proportion of males in the active labourforce. In 1985 and 1986, the proportion of males in the economically active category was 91.52% and 90.0% respectively. The national figures are similar to the trend in the project area. For the country, in the years 1981, 1985 and 1986, women's participation rates were 5.7%, 9.2%, and 10.5% respectively. the increasing proportions of females joining the economically active category shows a change in the social structure.

In the project area, out of a total population of 26.1 million, 17 million (59.8%) were classified in the working population, while the rest totaling 9.1 million (40.2%) in the non-working group. Narail district, covered by the planning unit SW10, had the highest proportion of working population (74.6%) with an economic dependency ratio of 34- the best in the region. The lowest proportion of working population (53.18%) was in the Bhola district of the Planning Unit (PU) SC8. It also portrayed the highest economic dependency ratio of 88.

As elsewhere in Bangladesh unemployment and underemployment occur on very considerable scales in the study area, in both the rural areas and the urban centres. Sixty-five percent of the total labourforce of the country is agrarian. For the majority of the labourforce, underemployment is a seasonal and temporary phenomenon. Labour migration occurs in large numbers intra-regionally to wherever harvesting and planting demands additional labourforce.

The population active in the labourforce is conventionally held to be within the age range of 14-65 years. In advanced economies, mostly those that are predominantly industrial in nature, this age classification is appropriate, and the reasons are twofold: a minimum level of literacy and/or skill delaying job entry, and a capital-intensive work place delaying job

retirement. But in the case of a primarily agrarian underdeveloped economy such as that of Bangladesh children begin to work from an early age (8-10 years). The labour-intensive nature of agricultural work, on the other hand, becomes too strenuous after 55-60 years of age. Therefore, the working population in our study constitutes the population within the ages 10-54 years. The dependency ratios have also been calculated based on the same rationale. The economic dependency ratio for the study area is 67.12%.

The Southwest Area has only 126 hospitals, and only 16% of them are in the public sector. The urban centres have 9% of the population but 65% of the total hospitals, therefore the urban population have better access to medical facilities than their rural counterparts. The situation is similar to the other parts of the country. The other health facilities in the area include 92 health complexes, 287 dispensaries and 226 family welfare centres.

Table 2.5 gives the available data on reported communicable disease instances in 1989 in SWA.

TABLE 2.5

Epidemiological Report on Communicable Diseases (1989)

Areas	Dysentery		Diarrhoea		Malaria		Measles		Diphtheria	
	Attacked	Death	Attacked	Death	Attacked	Death	Attacked	Death	Attacked	Death
SWR	359389	43	82888	322	44357	102	1572	9	86	13
SCR	192465	78	80149	401	15150	22	1171	11	36	-
SWA	551854	121	163037	723	59507	124	2743	20	122	13
Bangladesh	1483166	825	360826	1302	289246	587	11043	21	193	13

Source: BBS Statistical Year book, 1991.

Sanitation

The area suffers from poor sanitation facilities. As far as the personal and/communal hygiene is concerned the absence of proper sewerage disposal facilities are affecting the inhabitants adversely.

Data suggests that only 7.5% of the households of the Southwest Area use sanitary latrines as shown in Table 2.6 and most of these are located in the urban areas. Widespread use of open water for defecation poses a very serious health hazard which is reflected in the incidence of dysentery and diarrhoeal diseases shown in Table 2.5.

TABLE 2.6

Sanitation Facility in the SWA (from 1978 to May 1992)

Areas	Sanitary Latrines		Number of Households	Percentage of households using sanitary latrines
	Number Produced	Number sold		
SWR	257246	222293	2881228	7.7
SCR	161148	130635	1854424	7.0
SWA	418394	352928	4735652	7.5

Source: Directorate of Public Health Engineering, Bangladesh.

2.4.4 Health and Hygiene

Access to safe drinking water is considered an important socio-economic indicator. The better the facility, the less is the probability of occurance of different water borne diseases such as diarrhoea, dysentery, malaria etc.

Particularly in the rural areas, the hand/shallow tubewells which lift water from underground is not only the major, but perhaps the only source of safe drinking water among those available. In the Southwest Area, on average, the number of persons and the number of families dependent on each tubewell for drinking water is 144 and 26 respectively. Even though the growth rate (2.7%) of Hand/Shallow tubewells has been able to keep pace with the growth rate of population, the installation of additional tubewells is deemed to be an essential component in the overall improvement of the health sector where large areas of open stagnant water provide ideal breeding grounds for disease vectors and human and animal contamination of surface water is widespread.

Table 2.7 summarises BBS data on the prevalence of hand and shallow tubewells in SWA.

TABLE 2.7

Hand and Shallow Tubewell Situation

Areas	Year					
	1985	1986	1987	1988	1989	1990
SWR	101714	106642	112883	116482	118763	122125
SCR	51109	52590	56164	57321	58226	59712
SWA	152823	159232	169047	173803	176989	181837
Bangladesh	619859	645484	684940	705553	719553	739553
SWA Population (1991)	26.1 million					
Persons per Tubewell	144					
Families per Tubewell	26					

Source: BBS Statistical Yearbook 1991.

2.4.5 Nutrition

Until adequate caloric intake is reached, a correlation exists between the level of income and food intake. Malnutrition is a common feature of Bangladesh with the majority of its population living below the poverty line. A gradual decline in food and therefore the nutritional intake is also noticed from Table 2.8 for data covering the period 1962/64 to 1981/82.

TABLE 2.8

Food Nutritional Intake

Consumption Per Person/day	1962/64	1975/76	1981/82	Reduction in intake 1962/64 - 1981/82
Energy Kcal	2300	2094	1943	15.5
Carbohydrate gm	482	439	412	14.5
Protein gm	57.9	58.5	48.4	16.4
Fat gm	15.8	9.8	9.8	38.0

Source : INFS University of Dhaka, Nutrition Survey of Bangladesh, 1981/82.

It is observed from Table 2.8 that over the period 1962/64 to 1981/82 per capita caloric intake of energy has decreased by 15.5%, there has been a continuous increase in the gap between the required level (appx. 2300 Kcal) and the actual intake. More or less the same rate of reduction is noted in the intake of carbohydrate and protein. Because of the increasing scarcity of fish and livestock in particular, and in addition the worsening economic condition of the poorer section, the per capita fat intake has fallen by the highest percentage (38%). The situation in Southwest Area, however, is not any better in this regard. A detailed assessment of the present gross availability of food energy, carbohydrate, protein and fat within SWA is given in Volume 10, Economics.

2.4.6 Communications

Roads

Most parts of the Southwest Area, are served by reasonable networks of roads. The Roads and Highways (R and H) Department maintains approximately 3000 km of roads of different categories of which about 600 km are National Highways, and 390 km are regional highways. The National Highways link the main district headquarters of the Area to the major ferry ghats (Khulna, Hardinge Bridge, Daulatdia, etc) for onward connection to other Regions of Bangladesh. However, the islands in the South Central Region are not linked by road with other parts of the Area.

Presently, about 145 km of the National Highways (Daulatdia - Faridpur - Jhenaidah - Kushtia) are under major reconstruction work at an estimated cost (revised in 1992) of about 2100M Tk. In addition, the R & H Department is constructing five new bridges on the Bhanga - Mawa National Highway at an estimated cost of about 340 M Tk.

Railways

There are about 400 km of broad gauge railway line in the Southwest Area. The main line runs from Khulna towards the north via the Hardinge Bridge. Another line (Faridpur/Goalanda) connects this main line at Poradah (Kushtia District). A new line from Faridpur to Banga (15 km) is under construction. There is also a proposal to connect Mongla Port with Khulna.

Airports

The Southwest Area is presently served by air from Dhaka to and from Jessore. There is a proposal to construct another airport at Barisal.

Rivers

Bangladesh is a riverine deltaic country. It is criss-crossed by three major rivers (Ganges, Brahmaputra and Meghna) and numerous small rivers and this physical condition has enabled inland transport to become a widespread and relatively cheap means of transport. In certain parts of the SWA inland water transport is the principal mode of transport. There are about 290 km of Class I, 260 km of Class II and over 1500 km of Class III and other minor routes in the SWA.

Mongla, the second largest seaport of Bangladesh is located in the study area on the Pussur river. In addition there are river ports at Barisal, Khulna, Patuakhali and Bhola. There are 89 terminals, ferry, launch ghats in the Area. The river routes connecting these ghats are important to the Area's economy.

A full description of the river transport network in SWA is given in Volume 7.

River transportation is very important to the SWA as this is the only mode of transportation in some areas. However, the riverine systems have suffered severely and are likely to suffer in future due to developments outside the country over which Bangladesh has little or no control. The withdrawal of flows at Farraka Barrage during the dry season has created conditions for abnormal deterioration of waterways which are likely to be aggravated further in the future.

Between 1975 and 1985 the demand for transport has grown at approximately 7.5% and 5.6% respectively for passenger and cargo traffic. Also in this period transport by road expanded substantially at the expense of the railway subsector.

2.4.7 Educational Institutions

The literacy rate in the SWA is almost 25% same as the national average. Data in Table 2.9 show the number of different types of educational institutions in the Area.

TABLE 2.9

Number of Educational Institutions in the Area

	Primary School	Madrashah	Secondary School	Liberal Colleges	Medical Colleges	Eng. Colleges	University
SWR	6834	683	1562	140	00	01	02
SCR	5212	1099	1206	92	01	00	00
SWA	12046	1742	2768	232	01	01	02
%	26.31	41.41	28.18	25.97	0.10	0.25	0.20
National	45783	4206	9822	893	10	04	10

Source: Consultants' estimation based on BBS 1991.

The SWA covers 27% of the area of Bangladesh. The educational institutions are almost proportionate to the area. The number of Madrasha is higher to the proportion of the area. This may be explained as there were some religious leaders in the area from historical times as Haji Shariatullah and later Pirs of Sharshina and Charmonai. Their religious teachings helped grow these religious institutions. The concentration of these Madrashas are in the districts of Barisal, Perojpur, Shariatpur, Madaripur where they have large followers. Though religious educational institutions are large in number the numbers of medical colleges and Universities are small. SWA is less developed in this respect in comparison to central and north central Bangladesh.

2.4.8 Cooperatives

The cooperative movement has been a major component in GOB of rural development policies. The Bangladesh Rural Development Board, an organ of the Ministry of Local Government and Rural Development Ministry is entrusted with the task of organising the rural households on cooperative basis for poverty alleviation. Data in Table 2.10 show the number of cooperative societies in SWA.

TABLE 2.10

Number of Cooperative Societies (BRDB) in SWA

	Krishak Samabay Samity (KSS)	Bhumiheen Samabay Samity (BSS)	Women Cooperatives
SWR	8759	1974	1258
SCR	7765	1719	1117
SWA	16524	3693	2375
%	24%	25%	39%
Bangladesh	67653	14735	6150
%	100%	100%	100%

Source: Consultants' estimates based on BBS 1990 data.

Data in Table 2.10 show that there are large number of cooperative societies in the SWA. The KSS societies are formed to provide access to irrigation facilities, improved varieties of paddy (HYV), fertilisers and pesticides.

The landless are grouped on cooperative basis, and the main objective is human resource development. They provide loans for income generating activities and off-farm activities.

Women are a disadvantaged group. They are organised mostly on the Productive Employment Project (PEP) operated by the Local Government Engineering Directorate (LGED). They are engaged in maintenance works of public construction such as roads and embankments mostly under Food for Work (FFW) Projects. They are provided with skill development training on off-farm activities. The number of women societies (39%) are more in proportion in comparison to Bangladesh as a whole.

2.5 Preliminary Social Study Survey

2.5.1 Background

The preliminary social survey was conducted in late 1992 to compare areas with and without flood control and drainage (FCD) works. The survey was conducted in four thanas in four zillas : Vedorganj thana (Shariatpur zilla), Char Vodrason thana (Faridpur zilla), Goalondo thana (Rajbari zilla) and Kalkini thana (Madaripur zilla). Villages surveyed in Kalkini thana had FCD works provided by the BWDB whilst those in Vedorgonj, Char Vodrason and Goalondo thana had no FCD structures.

Table 2.11 shows that the sample of 380 households was divided between : farmers (47%); households either totally or partially dependant on fishing (21%), households headed by women (16%) and landless families with less than 0.2 ha land (16%).

TABLE 2.11

Distribution of Sample by Occupation Groups

	FCD		Non-FCD		Total	
	No	%	No	%	No	%
Farmer	107	50	71	43	178	47
Fish culture	18	8	7	4	25	7
Fish capture	19	9	36	22	55	14
Women-headed	33	15	27	16	60	16
Landless	36	18	26	15	62	16
Total	213	56	167	100	380	100

Source: SWA Preliminary Social Survey 1992.

Information was collected using questionnaires (see Appendix 1 for sample) comprising a general section applicable for all households and a separate section specifically designed for each of the five groups of respondents. The following comments relate to the analysis of data on selected information. The preliminary nature and spatial distribution of the survey mean that its results should be treated with caution. More detailed social studies were carried out in the two proposed project areas (Chenchuri, Chapter 3; Gorai Chapter 4) and also will be required at the feasibility stage of each individual project that may arise from this SWA regional investigation.

2.5.2 Demographic Characteristics

The characteristics of the SWA population as a whole are described in Section 2.4. The data summarised below relates to the north west of SWA in the Thanas mentioned above.

The sample included 2111 persons; 56% male, 44% female; of which over half, 52%, were aged under 21 years. Table 2.12 sets out the age groups found in the sample.

TABLE 2.12

Distribution of Sample by Sex and Age Classes

	1-5		6-14		15-20		21-40		41-50		50 +		Totals	
	No	%	No	%	No	%	No	%	No	%	No	%	No	%
Male	116	10	310	26	193	16	365	31	83	7	120	10	1187	100
Female	144	16	223	24	121	13	290	31	89	10	57	6	924	100
Totals	260	12	533	25	314	15	655	31	172	8	177	9	2111	100

Source: SWA Preliminary Social Survey 1992.

The figures are very similar to the overall population age classes determined for the SW Area from the 1991 census figures. The sample households were predominantly (88%) nuclear families. The data for family sizes are shown in Table 2.13. With the exception of female headed households (FHH) over 40% had 5 to 6 persons. There to four persons were the most common size group for FHH and 28% only had one to two persons.

TABLE 2.13

Household Size Distribution (% Households)

	Family size			
	1-2	3-4	5-6	6 +
Farmer	1	17	44	38
Fish culture	-	28	48	24
Fish capture	5	24	47	24
Women-headed	28	45	22	5
Landless	3	39	47	11
Sample average	7	31	42	20

Source: SWA Preliminary Social Survey, 1992.

The survey obtained some supporting data on education within the sample groups. The lower levels of illiteracy among farmers and households which in addition practice culture fish production probably reflects the greater affluence of these groups, arising from a combination of a greater level of security than the other, less advantages groups, and better access to production facilities (Table 2.14).

TABLE 2.14

Distribution by Group and Education Level of Household Heads

Education Level	Farmer		Fish Culture		Fish Capture		Women		Landless		Total	
	No	%	No	%	No	%	No	%	No	%	No	%
Illiterate	64	36	4	16	41	75	55	92	49	79	213	56
Up to Class-V	52	29	9	36	12	22	3	5	6	10	82	22
Up to Class-X	41	23	8	32	2	3	2	3	7	11	60	16
SSC/Equivalent	10	6	3	12	-	-	-	-	-	-	13	3
HSC/Equivalent	8	4	-	-	-	-	-	-	-	-	8	2
Graduate & Above	3	2	1	4	-	-	-	-	-	-	4	1
Total	178	100	25	100	55	100	60	100	62	100	380	100

Source: SWA Preliminary Social Survey, 1992.

2.5.3 Land Ownership and Agricultural Practices

Households with less than 0.2 ha of agricultural land are considered to be functionally landless (BBS). In the sample 44% were landless (Table 2.15).

TABLE 2.15

Distribution of Respondents By Group and Land Ownership

Land Owned	Farmer		Fish Culture		Fish Capture		Women		Landless		Total	
	No	%	No	%	No	%	No	%	No	%	No	%
No Land					3	5	11	18	13	21	27	7
Only Homestead			1	4	37	67	27	45	46	74	111	29
Up to 0.20 Ha	7	4	4	16	8	15	8	14	3	5	30	8
0.21 - 0.50 Ha	22	12	6	24	5	9	6	10	-	-	39	10
0.51 - 1.00 Ha	41	25	-	-	1	2	5	8	-	-	47	12
1.01 - 2.00 Ha	49	28	6	24	1	2	3	5	-	-	59	16
2.01 - 5.00 Ha	40	22	6	24	-	-	-	-	-	-	46	12
Above 5.00 Ha	19	11	2	8	-	-	-	-	-	-	21	6
Total	178	100	25	100	55	100	60	100	62	100	380	100

Source: SWA Preliminary Social Survey, 1992.

Most farmers[1] cultivate their own land, representing more than 75% of all sample farmers, 22% of these owner-cultivators also lease-in land and about 16% lease-out land. Pure tenant cultivation is almost non-existent in the study areas, representing only 1% of all cultivators. These figures show a slight variation with national averages of 63% for owner-cultivators, 36% for owner-cum-tenant and 1.4% for pure tenants; and with regional figures of 64% for owner cultivators, 36% for owner-cum-tenants and 0.7% for tenants[2]. Specific terms and conditions of sharecropping or leasing-in of land in the study areas were not collected.

A majority of farmers in the survey use hired labour from time to time to support family resources for different agricultural operations. Only a small percentage of farmers rely entirely on hired labour. Female wage labourers are hired to perform post-harvest operations of rice.

Land preparation is done mainly by draught animals with limited use of power tillers by the large farmers. Some larger farmers hire out draught animals and power tillers for land preparation.

Rice is the main crop in the study area. Farmers mainly grow traditional long-duration varieties and local HYVs. Wheat and pulses seem to be the main rabi crops with limited boro rice where access to water permits. Limited use of LLPs and STWs for irrigation was reported in both FCD and non-FCD areas.

A majority of the respondents mentioned non-institutional sources as their main sources of credit. Only some of the larger farmers reported obtaining loans from the Krishi (agricultural) Bank. Grameen Bank and BRDP have programmes in some of the survey villages, but only 4 out of a total of 60 female headed households reported getting credit from these sources.

2.5.4 Fisheries

In the preliminary survey areas, two groups of people are involved with fishing: (i) culture fishermen who have their own ponds; and (ii) capture fishermen who catch fish from the rivers and the inundated flood plains. This division of fishermen into culture and capture groups leaves out part-time fishermen and fishing by women and children (for whom the survey provided no figures). However, fishing by this category of people is commonly an important source of protein especially for the poor landless households, and an important source of supplementary income during the slack employment season.

Fishery income represented 40% of the culture fishermen's total income, whilst 55% came from agriculture and non-agricultural sources. For capture fishermen, selling fish made up more than 82% of their total income. Both categories of fishermen reported having their own fishing nets, boats and gear.

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(1) Farmers in this context includes all respondents involved with agricultural cultivation regardless of their categorisation in to other groups in the survey.

(2) Regional average includes Faridpur, Barisal, Jessore, Khulna, Kushtia and Patuakhali (Source: Bangladesh Census of Agriculture and Livestock: 1983-84, BBS, 1989).

TABLE 2.16

Reasons for Reduction in Fish Catches

Reason Given for Reduction in Catch	FCD		Non-FCD		Total	
	No	%	No	%	No	%
Reduced availability of Fry/fingerlings	3	10	13	16	16	14
Use of Current nets	3	10	22	26	25	22
Fish disease	4	13	16	20	20	18
Shortage of water	13	44	18	22	31	28
Over fishing	1	3	8	10	9	8
Polluted water	3	10			3	3
Fertilizers/Pesticides			3	4	3	3
Interference from embankments/sluices	3	10	2	2	5	4
Totals	30	100	82	100	112	100

Source: SWA Preliminary Social Survey 1992

A significant reduction in fish production (as represented by fish catches) in recent years was reported by capture fishermen. Asked to provide reasons for a fall off in fish production (Table 2.16), the major cause given (in both FCD and non-FCD areas) was a shortage of water. The causes of such water shortage were not determined; and it is not possible to judge the effects of FCD/I schemes on changes in the water patterns and hence the fisheries, from this study. Anecdotal evidence from discussions with respondents, though not recorded as such in the answers to specific questionnaire sections, indicated that a number of capture fishermen in FCD areas complained that embankments have reduced both their earnings and their own fish consumption, by creating a situation of inadequate availability of fresh water. In non-FCD areas similar comments were made as an anticipated adverse impact of embankment construction.

2.5.5 Female Headed Households (FHHs)

In this survey, 46% of FHHs fell into the functionally landless category (Table 2.15). Although the functionally landless FHHs are in the same economic situation as their male counterparts, women are more vulnerable to adverse socio-economic pressures due to their less favoured position in Bangladesh society. The main source of income for women in FHHs was post-harvest work in rice. 'Food for Work' programmes are also an important source of income, especially in the slack-employment season. Many of the FHHs earn a small proportion of their total income from selling poultry products, making bamboo mats and fishing nets.

2.5.6 Landless Households

These households (male-headed), are among the poorest households in the survey villages, and include functionally landless people (Table 2.15). Landless households depend almost entirely on wage labour work for their livelihood: in this sample 90% of the total income for the landless households came from this source. More than 33% of total income came from agricultural labour, whilst more than 55% came form non-agricultural work. A substantial proportion of the non-agricultural income came from 'Food for Work' programmes. Cottage industry, hawking, selling poultry products and fish provided about 10% of the total income of these households.

2.5.7 Participation in FCD Schemes

The respondents were asked about their willingness to participation in project activities. The results are summarised below:

Percent	FCD/I	Non-FCD/I	Total
Willing	71%	84%	77%
Unwilling	11%	9%	10%
No response	18%	7%	13%

It is difficult to make any firm statement about attitudes towards FCD schemes from the preliminary survey data. In the FCD areas more than 71% of the respondents expressed a willingness to participate in planning issues, and in providing labour or money for implementation and O&M in future FCD/I works in their area. 11% expressed negative attitude towards participation, whilst 18% made no comment.

In areas without FCD facilities 84% of the respondents expressed willingness to participate in future FCD/I schemes in their area; 9% expressed a negative attitude to participation, with 7% expressing no opinion.

Respondents' willingness to participate was further assessed in terms of the nature of anticipation. Table 2.17 clearly shows that people are willing to participate in the construction of earthworks (35%) and re-excavation of drainage lines etc (38%). The figure was similar for both the FCD and non-FCD area respondents for earthworks but over half (51%) expressed interest in re-excavation work in non-FCD areas compared to only a quarter (25%) in areas that already have FCD works - might this be an indication of a feeling that maintenance is a BWDB not a community responsibility ?

Respondents willing to part with land for FCD development was much higher where no FCD had been implemented, (36%) than in the areas with no FCD works (16%). However in general Table 2.17 indicates a reasonable level of willingness among both survey groups to participate, particularly in activities where payment might be made; few expressed willingness to participate in the planning and design of such schemes.

TABLE 2.17

Distribution of Sample by FCD/non-FCD and Participation in Planning

Participation (Planning)	FCD/I		Non FCD/I		Total	
	No	%	No	%	No	%
Plan, Design etc	2	2	1	1	3	2
Land Acquire	15	16	26	31	41	23
Water Distribution	19	20	22	26	41	23
Rehabilitation	9	9	9	11	18	10
Earth work etc	33	34	30	36	63	35
Land preparation	21	22	19	23	40	22
Re-excavation	24	25	43	52	67	38
Managing Samity	10	11	15	18	25	14
Directing site	8	8	15	18	23	13
Water share Samity	12	13	14	17	26	15
Total Respondents *	95		83		178	

Source: SWA Preliminary Social Survey 1992.
* These are not column totals, rather total No. of respondents.

Table 2.18 summarises the survey findings related to participation after FCD scheme construction. The greatest interest expressed was for guarding against cuts in embankments (31% all respondents), the operation of sluice gates (25%) and canal digging or clearing (40%). Eleven percent were willing to pay money for O&M activities - not a high enough proportion to justify faith in levying FCD O&M charges.

TABLE 2.18

Distribution of Respondents Participation in Implementation

Participation (Implementation)	FCDI		Non FCDI		Total	
	No	%	No	%	No	%
Member Advisor body	10	11	9	11	19	11
Canal Digging	28	29	44	53	72	40
Operate Sluice Gate	19	20	26	31	45	25
Inlet/Outlet Perare	6	6	7	8	13	7
Offer Money	10	11	9	11	19	11
Watch against cuts	34	36	22	27	56	31
Others	2	2	7	8	9	5
Total Respondents *	95		83		178	

Source: SWA Preliminary Social Survey, 1992.
* These are not column totals, rather total No. of respondents.

The results of enquiries concerning selected further specific O&M activities are given in Table 2.19.

TABLE 2.19

Distribution of Respondents Participation in O&M

Participation (O & M)	FCD/I		Non FCD/I		Total	
	No	%	No	%	No	%
Operating Pump irrigation	1	1	10	12	11	6
Collect Water Tax	15	16	22	27	37	21
Water Sharing	15	16	15	18	30	17
Plantation	62	65	63	76	125	70
Direct work on Embankments	8	8	24	29	32	18
Samity Building	16	17	20	24	36	20
Direct samity	13	14	17	20	30	17
Total Respondents *	95		83		178	

Source: SWA Preliminary Social Survey, 1992.
* These are not column totals, rather total No. of respondents.

Operation and maintenance of FCD structures and involvement of communities in their management is a major problem in Bangladesh. Respondents were asked to indicate their willingness to participate directly in O&M activities. The replies are summarised in Table 2.19. A full 70% said they would plant trees to protect embankments though only 18% expressed willingness to work on a continuing basis on FCD embankments.

Some willingness to form (20%) and participate in the direction (17%) of relevant societies (samity) were shown but as shown in Table 2.19 this was rather more pronounced in the non-FCD sample, 24% and 20% compared to 17% and 14% in the FCD sample.

Though there has been no direct suggestion that FCD beneficiaries pay a levy just one fifth said they would be willing to collect water charges. While there may have been a mixture of matrices for this the reply together with the response to participating in societies relevant to FCD activities indicates that a significant number of respondents, even in established FCD schemes, would if given the opportunity actively take part in FCD O&M and by doing so relieve GOB of a number of responsibilities. However the survey further indicated that farmers and culture fishermen, who with one exception were also farmers were the most interested in being involved in FCD based societies when compared with the landless, women headed households and capture fishermen - ie the sections of the community with more resources and interest in production conditions that can be improved by FCD/I projects. The results below illustrate this:

	Samity building	Samity office holding
Percent each category		
Farmers (0.2 + ha)	43	36
Capture fishermen	12	4
FHH	9	-
Landless (under 0.2 ha)	2	-

TABLE 2.20

Proportion of Respondents Willing to Collect FCD/I Levies Directly and to Participate in FCD/I Based Cooperative Societies

Percent

	Land holding Area (ha)				
	Landless 0 - 0.20	Marginal 0.21-0.50	Small 0.51-1.00	Medium 1.01-2.00	Large 2.01 +
Collect charges	19	12	23	24	33
Samity building	4	16	23	59	63
Samity direction	2	-	23	47	71

Source: SWA Preliminary Social Survey 1992.

Within the landowning groups the expressed willingness to participate in levy collection increases with holding size from 12% for marginal farmers to one third into case of large farmers with over two hectares. The figure for the functionally landless (upto 0.2 ha) was 19% as shown in Table 2.20. The table also shows very clearly that expressed interest in active involvement in samity activities increases significantly with landholding size. Whether this is an experience of desire to be involved or expectation of opportunity related to position in society was not clear from the survey results however.

2.5.8 Position of Women

Survey information from women headed households (WHH) confirmed that their major activities, as with women in other households, predominantly center around the household. A wide range of categories were defined and the results are in the household and on-farm sectors for WHH were similar for both FCD and non-FCD respondents : family care (41%), kitchen or homestead gardening (19%), paddy husking (77%) and winnowing (15%). Livestock raring and washing clothes were more commonly reported as significant activities that appear to decline when a FCD is implemented with the exception of milking cows which appears to increase (Table 2.21).

Significant activities outside the family sphere without FCD works were reported to be labouring, 20%; livestock, 15%; other small businesses, 35%; within FCD areas these altered to labouring, 0%; livestock, 35% and small businesses, 26%. Work or duties within cooperatives increased with FCD from 12% to 19%.

WHH involvement in the off-farm sector changed significantly with a reduction from 61% to 27% in working with livestock and increased work for other households, from 17% to 33% of respondents, as field work demands increased with the improved cultural - including irrigation - conditions together with some improvement in opportunities for maintenance of infrastructure.

2.6 Social Impacts

Rural development schemes are seldom designed to impact all segments of the population equally. FCD/I projects primarily benefit families with land, mainly the farming community. Such projects spatially affect all within their boundaries; farmers usually benefit, fishermen and boatmen typically are affected adversely and households outside FCD embankments may also be adversely affected by increased flooding and drainage congestion that can lead to inter-community conflicts have also occurred in some FCD schemes between those with highland and low land. Such conflicts as well as those between farmers and fishermen often arise through inappropriate physical FCD design and over the management, particularly the timing of gate and sluice operations. In SWA significant conflicts have arisen between rice growers and shrimp farmers in the coastal areas which, at least in part have arisen from FCD works.

FAP-12

As part of the FAP-12 programme a number of FCD/I projects in SWA were evaluated. These covered four schemes: Kolabashukhali (Khulna and Jessore District); Polder 17/2 Dumuria (Khulna); Sukunia Beel Improvement (Faridpur) and Sonamukhali - Bonamander Beel (Jessore). Other FCD/I studies and reviews in SWA include seminars and workshops organised by BWDB, MIWDFC, FPCO and other have also been concerned with FCD/I and related developments and their effect. Overall the general impacts fall under the following headings.

Positive Impacts

- protection from unusual flood events and a general improvement in conditions for cultivation but this has been most pronounced where year round irrigation has been included;

TABLE 2.21

Women Headed Households : Activities in FCD and Non-FCD Area

	Women Headed H/Holds (Percentage)		
	FCD	Non-FCD	Combined
A Present Involvement within On Farm Sector :			
(i) Paddy Husking / Threshing	78.7	74.0	76.6
(ii) Winnowing	12.1	18.5	15.0
(iii) Par - boiling	-	3.7	1.66
(iv) Seed drying	3.0	-	1.66
(v) Seed storing	-	-	-
(vi) Seedling Planting	3.0	3.7	5.0
(vii) No Response			
B Involvement within Off Farm Sector :			
(i) Cottage Industries	6.0	4.3	5.0
(ii) Egg/Milk selling	3.0	4.3	3.3
(iii) Livestock	27.2	60.8	38.3
(iv) Working : Other H/Holds	33.3	17.3	25.0
(v) RMP - Works	15.1	8.69	11.6
(vi) FWP - Works	15.1	13.0	13.3
(vii) Labour	-	8.69	3.3
(viii) Canal Digging			
(ix) Other Works			
(x) No Response			
C Activities within Family Sphere :			
(i) Taking care of Family	42.1	38.4	40.8
(ii) Kitchen gardening	17.54	20.0	19.1
(iii) Livestock rearing	5.26	13.8	10.0
(iv) Milking cows	14.0	1.5	0.83
(v) Washing clothes	3.5	13.8	12.5
(vi) Fuel collection	1.7	3.0	3.3
(vii) Fish catching for Home consumption	-	4.61	3.3
(viii) Food/Vegetable Collection from bushes/Other place	5.7	4.61	10.0
D Activities Outside Family Sphere :			
(i) As Labour : Fish Farm Factory or Agrifield	-	20.5	11.6
(ii) Duties of Co-operative	19.2	11.7	15.0
(iii) Livestock business	34.6	14.70	23.3
(iv) Selling Egg & Milk			
(v) Other small business/Hawkery	26.9	35.2	31.6
(vi) Cottage industries	19.2	17.6	18.3
(vii) Other Activities			
E Opportunity of Work On Farm as expressed by Female H/Holds :			-
(i) Direct work in field	42.4	58.6	96.8
(ii) Post Harvesting	30.3	31.03	33.87
(iii) Other Crop processing	3.0	-	1.61
(iv) Field preparation for cultivation / plantation	24.2	10.34	14.5
F Opportunity of Work Off Farm as expressed by Female H/Holds			
(i) Rural Road Maintenance Works	60.6	55.1	60.0
(ii) Working : Labour	12.1	6.89	10.0
(iii) Fuel Making	3.0	6.89	5.0
(iv) Animal Vaccinator	9.0	13.89	11.6
(v) Apprenticeship to fish breeding Farm	-	6.89	3.33
(vi) Cottage industries	9.0	-	5.0
(vii) Livestock Farming	-	-	-
(viii) Sluice gate Operator	-	3.70	1.66
(ix) Social Forestry upon Roads/Embankments	6.06	-	3.33
(x) Other Works		-	-
(xi) No Response			-

Source : SWA Preliminary Social Survey, 1992.

wkin\fcd-wp

- agricultural and other sector employment increases, though in many cases the latter is temporary during project construction and seasonal thereafter;

- non-form activities including petty trading, rice-husking etc increase;

- income levels within FCD/I boundaries increase. In the Kolabashukhali Project the rise was small however : Tk 3767 within the project boundary, Tk 3486 in a similar, control, area with daily wage rates rising from Tk 26 to Tk 30. Land prices that reflect the increased opportunities and security within FCD boundaries were also found to rise as shown in Table 2.22.

TABLE 2.22

Kolabashukhali Project-Change in Land Values

Taka/decimal

Irrigation States/Period	Impacted, Protected			Control		
	H	M	L	H	M	L
Irrigated						
Pre-project	200	125	70	150	175	150
Post-project	500	300	188	480	300	225
% Change	+150%	+140%	+168%	220%	+71	+50
Non-Irrigated						
Pre-project	292	202	148	381	269	265
Post-project	604	431	320	570	393	358
% Change	+107%	+113%	+116%	+50%	+46%	+35%

Price Per decimal (Source : FAP 12, Kolabashukhali Project PIE Survey p-10.9)
Note H = Highland
M = Medium Land
L = Lowland
Pre-Project = about 1980
Post-Project = Mid 1991

- Impacted (project) area households had more assets in comparison to control areas.

- A slightly higher level of credit is used in FCD project areas.

- There was an increase of workload for women both in project and control areas. The percentage is 81% in project area and 67% in the control area. In the polder 17/2, also it was found that women had more work (30%) in post harvest period.

- 25% of the maintenance workers of CARE and FFW are women. A number of women (200) are engaged in shrimp processing.

- In the Polder 17/2 project embankments and link roads improved the road network particularly in the south east corner which was almost inaccessible. There was a change in mode of transport from waterways to roads, shortened journey times for government and other agencies (NGOs).

- New settlement developed in the low lying area due to Gangrail closure (Polder 17/2).

- The projects (17/2 and sluices) made a psychological impact on all beneficiaries. The stress levels seem to have been reduced as the losses from flooding and salinity are eliminated to a large extent. Housing conditions improved and people

were enthusiastic and confident. The beneficiaries were optimistic towards project activities compared to Pre-Project condition though thought they were not enjoying full benefits yet due to many constraints compared to their Pre-project situation.

In the Sonamukhi and Sukunia Projects also there was increase in agricultural activities and production. In post harvest period there were more work for women. Rice husking mills were installed where women could work as wage earners. There was an increase in migration of labour during harvesting season. Women were engaged in LGED programme of PEP/BRDB (Productivity Employment Project). In Sukunia major NGOs are working with the landless labour and women. Pond fish culture developed gradually.

Negative/Adverse Impacts

The negative or adverse effects are highlighted below:

- There is a significant reduction of capture fishing in the Post-Project situation and this has not been offset by increased culture fishery production.
- There was a substantial decline in boat transport and navigation in the project area resulting in unemployment to the boatmen.
- Problems have arisen from water logging and declining in soil fertility due to inadequate internal drainage in the KBK project that highlights the need for good initial design and sensible O&M procedures.
- Work load on womenfolk were increased.
- There is typically a problem regarding the payment of compensation money for acquisition of land from projects. Table 2.23 shows the trend of the problem in this regard.

TABLE 2.23

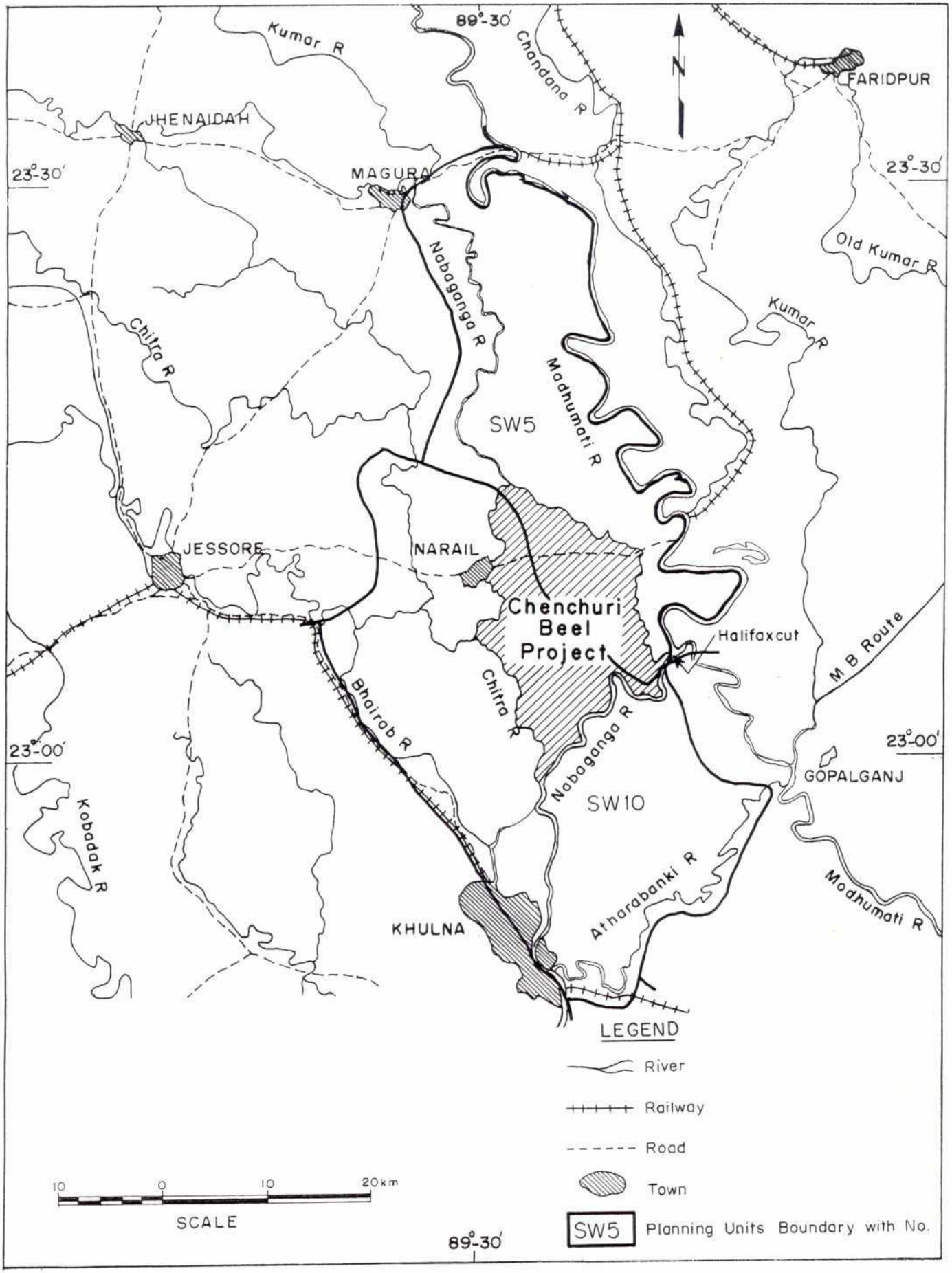
Payment of Compensation for Acquired Land, Kolabashukhali

Category	No
Not Compensated	9
Compensated with no bribe	17
Compensated after bribe	17
All Cases	43

(Source: KBK Project)

The problem is so acute that compensation money cannot be received with normal procedure. Of the 43 cases 9 did not get any compensation at all, 17 got after payment of bribe to the officials. Only 17 got money without any trouble. It was reported that it takes a long time to get compensation money. This is one of the major issues to be taken notice of when implementing a project.

Figure 3.1



Chenchuri Beel Project: Location Map

3 CHENCHURI BEEL IMPROVEMENT PROJECT

3.1 Introduction

The Chenchuri Beel Improvement Project is one of the eight different water resources management schemes identified by FAP-4 for the Southwest Area and studied to pre-feasibility level. The location of the scheme is in the Narail district covering 3 thanas namely - Narail, Kalia and Lohagora or the planning units SW 5 and SW 10 (Figure 3.1). The area is almost surrounded by the embankments of the Narail FCD/I project on the river Chitra in the Southwest and the Nabaganga in the Northwest and South. The scheme comprises of many beels such as Chenchuri, Takimara, Sarulia, Patakua and of which Chenchuri is the major one after which the project is named. The scheme is adjacent to the projects - Chenchuri Irrigation Sub-project to the north, Singia - Nabagati Beel Drainage Scheme and the Barnal - Salimpur - Kolabasukhali Project to the Southwest and Southeast respectively and the Madhumati - Nabaganga Project to the Northeast. The Net Cultivable Area of the project is about 17,900 ha comprising 8,900 ha in the SW 5 and 9,000 ha in the SW 10 planning units. The population of the project area is about 703,400 with a density of approximately 750 per sq km.

This section presents an outline of the prevailing socio-economic situation in the project area based on a field survey and observations made during field visits and group discussions with people living within it.

For the purpose of this study, the households have been stratified into 6 socio-economic groups. Farm families have been stratified according to the amount of land they operate. The households categories and their holding sizes are given below:

Household Category	Operated land (ha)	No of Households
Landless	0.00-0.20	8
Marginal Farmer	0.21-0.50	8
Small Farmer	0.51-1.00	8
Medium Farmer	1.01-2.00	8
Large Farmer	2.00+	8
Female Headed Household	---	8
Fishermen	---	8

3.2 Demographic Characteristics

The population sampled households was 335 in 56 households. this is equivalent to almost 6 persons each household. Table 3.1 sets out selected basic data for the survey sample.

The average age of household heads is almost 45 years and with the exception of fishing families over 41 years for each of the seven household categories. Heads of fishing households were found to be younger at 36 years.

There are about 102 males to 100 females. The male population constitutes the main active working group. The female population except from the landless, women headed and fishermen households of the project area do not normally work in the fields. They are mainly engaged domestically in winnowing, drying and storing of agricultural crops, parboiling and pounding of paddy, poultry, keeping, caring of children, etc. Socio-religious tradition demands that they should not be seen in public places and this has virtually prohibited their easy access to, and participation in, many economic activities outside the home.

The age group between 11-50 years which constitute the main working force in the project area, altogether account for about 71 percent of the total population, leaving the remaining 29 percent outside the productive age group (below 11 and above 55 years of age).

The average family size in the sample area is just under 6 persons, the large and medium farm households category shows a much higher size of 8.8 and 7.4 persons respectively. Female headed and fishing households were the smallest with 3.1 and 4.4 persons respectively.

The dependency ratio in the project area is 3.37, higher than the SWR average of 2.54. There seems to be a direct relation between the dependency ratio and the farm size indicating concentration of family members in the high category of farm holdings.

TABLE 3.1

Selected Basic Data for the Chenchuri Beel Sample Survey Population

Age of household head	Landless		Marginal Farmer		Small Farmer		Medium Farmer		Large Farmer		Farmer Total		Women		Fisherman		Total	
	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%
Upto 30							1	12.50	1	12.50	2	5.00	2	25.00	3	37.50	7	12.50
31 - 40	3	37.50	4	50.00	3	37.50			1	12.50	11	27.50	1	12.50	3	37.50	15	26.79
41 - 50	5	62.50	2	25.00	3	37.50	2	25.00	2	25.00	14	35.00	3	37.50	1	12.50	18	32.14
51 - 60			2	25.00	3	37.50	4	50.00	2	25.00	10	25.00	2	25.00	1	12.50	13	23.21
61 +							1	12.50	2	25.00	3	7.50					3	5.36
Total	8	100.00	8	100.00	9	100.00	8	100.00	8	100.00	40	100.00	8	100.00	8	100.00	56	100.00
Av. age		41.50		45.88		45.88		51.50		49.25		46.80		43.38		36.38		44.82
Male	21	48.84	27	55.10	31	58.49	24	40.68	38	53.52	141	51.27	12	48.00	18	51.43	171	51.04
Female	22	51.16	22	44.90	22	41.51	35	59.32	33	46.48	134	48.73	13	52.00	17	48.57	164	48.96
Total	43	100.00	49	100.00	53	100.00	59	100.00	71	100.00	275	100.00	25	100.00	35	100.00	335	100.00
Av.household size persons	5.4		6.1		6.6		7.4		8.9		6.9		3.1		4.4		6.0	

Source: Chenchuri Beel Sample Survey 1992/93.

TABLE 3.2

Chenchuri Beel - Literacy by Household Class

Level of Education	Landless		Marginal Farmer		Small Farmer		Medium Farmer		Large Farmer		Farmer Total		Women		Fisherman		Total	
	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%
Illiterate	6	75.00	3	37.50	3	37.50	3	37.50	3	37.50	18	45.00	8	100.00	6	75.00	32	57.14
Education Upto Class-IV	1	12.50	4	50.00	3	37.50	2	25.00	2	25.00	12	30.00			2	25.00	14	25.00
Upto Class-X									2	25.00	8	20.00					8	14.29
S.S.C.	1	12.50	1	15.50	1	12.50	3	37.50	1	12.50	1	2.50					1	1.79
H.S.C.											1	2.50					1	1.76
Graduate +					1	12.50												
Total	8	100.00	8	100.00	8	100.00	8	100.00	8	100.00	40	100.00	8	100.00	8	100.00	56	100.00

Source: Chenchuri Beel Sample Survey 1992/93.

3.3 Literacy and Education

The overall literacy rate of the population in the project area is 43% which is much higher than the SWA figure of 25%. The literacy rate increases with the size of landholding. Among all household categories, 100 percent of the female headed households and 75 percent of the fishermen communities are illiterate (Table 3.2). The number of literate persons increases as the economic condition of the family improves. The highest literacy rate is found in the farmers household category.

These data should be treated with considerable caution since the high literacy rates reported are unlikely. They may arise from respondents exaggeration of their literacy and also by equating all levels of education (see Table 3.2) with actual literacy.

The survey also indicates that basic literacy among females is much lower than among males. The majority of the literate persons, about 58% have had only primary education, while 33% have had secondary education and 4% higher secondary. The low education level emphasises the importance of direct contact between the field staff and project beneficiaries, the limited application of printed literature, and the potential for radio programmes and audio-visual aids for extension purposes.

3.4 Labour Force, Occupation and Employment

Tables 3.3 and 3.4 set out the primary and secondary occupations of households in the survey sample respectively.

The labour force of the project area is estimated at 36 percent of the total population. In this estimate, the labour force is defined to include all males (females are excluded from the labour force as they do not generally work in the field) in the age groups of 11-55 years excluding the physically handicapped and school children.

The overall participation rate, defined as the ratio of employed to total labour force, is 84 percent. It varies between the different household categories. The overall unemployment rate is therefore 16 percent. Table 3.3 indicates that the participation rate is higher in the case of the landless; which implies the pressing need to earn a living for the lower strata of households mainly through the sale of labour. Furthermore, the participation rate among the age group 21-55 years is high compared to age group 11-20 years, reflecting present emphasis on education.

The labour force in the project area is predominantly agricultural, generally self-employed and suffers from low productivity and high underemployment due to seasonality of activities, high level of landlessness and lack of non-farm employment opportunities. Broadly speaking, some 66 percent to the employed labour force is occupied in agriculture, of which 36 percent is on own farm, 25 percent on own and others farm and 10 percent as day labour. About 16 percent is engaged in full time fishing (Table 3.3).

Non-agricultural or fishing occupations account for some 16 percent of the total employment. Important among these are: services and professions.

The occupation distribution of the employed labour force by landowning categories shows that about 47 percent of the landless work as agricultural day labour. Agricultural labour is drawn primarily from the landless and marginal farmers. About 46 percent of the small farm households farm their own and share cropped land and also work on others land; some 28 percent are occupied in non-agricultural activities like service, business, and transportation.

TABLE 3.3

Chenchuri Beel - Primary Household Occupations

Main Occupation	Landless		Marginal Farmer		Small Farmer		Medium Farmer		Large Farmer		Farmer Total		Women		Fisherman		Total	
	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%
Agriculture	5	62.50	8	100.00	8	100.00	8	100.00	8	100.00	37	92.50					37	66.07
Fishery Capture	1	12.50									1	2.50			8	100.00	9	16.07
Agri Labour	1	12.50									1	2.50					1	1.79
Non-Agri Labour	1	12.50									1	2.50	6	75.00			7	12.50
Others													2	25.00			2	3.57
Total	8	100.00	8	100.00	8	100.00	8	100.00	8	100.00	40	100.00	8	100.00	8	100.00	56	100.00

Source: Chenchuri Beel Sample Survey 1992/93.

TABLE 3.4

Chenchuri Beel - Secondary Household Occupations

Secondary Occupation	Landless		Marginal Farmer		Small Farmer		Medium Farmer		Large Farmer		Farmer Total		Women		Fisherman		Total	
	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%
Agriculture																		
Fishery Capture	1	20.00									1	4.35					1	4.00
Agri Labour	3	60.00	5	71.43	4	57.14					12	52.17			1	100.00	13	52.00
Non-Agri Labour																		
Business	1	20.00	2	28.57	2	28.57	2	100.00	2	100.00	9	39.13					9	36.00
Others					1	14.29					1	4.35	1	100.00			2	8.00
Total	5	100.00	7	100.00	7	100.00	2	100.00	2	100.00	23	100.00	1	100.00	1	100.00	25	100.00

Source: Chenchuri Beel Sample Survey 1992/93.

In all, about 45 percent of the total employed labour force has secondary occupations (Table 3.4). The highest proportion, 87 percent falls in the small farmers category. Wage labour and business appear to be the most important second occupations. The seasonal nature of agricultural activities affects the employment pattern. During the slack season more than half of the labour suffers from under-employment. On the other hand, during peak seasons, over two-third of the employed force work more than normal working hours.

With regard to seasonal variation in agricultural sector, three peak demand periods exist. These coincide with: (i) land preparation, sowing, or transplanting; (ii) weeding and other inter-culture operations, and (iii) harvesting. Under the existing crop pattern the peak seasons, occur in (i) April-May, (ii) July-August, and (iii) November-December.

The wage rates are closely related to supply and demand. The average wage rate per day is Tk 32 for males and Tk 24 for the females. They vary from Tk 45 per day in the peak season to Tk 24 per day in the off season. The system of exchange labour is practiced to a limited extent, especially among neighbors and near relatives.

3.5 The Social Division of Labour in the Household Production System

Existing knowledge about utilization of family members in the project area is scanty. However, the survey indicates difference in the use between male and female labour. The precarious household economy of the larger majority of rural people in the project area is based on the contribution of all its members. Within this powerful and pervasive religious and social practices women are confined to specific tasks and roles. The seclusion (purdah) system imposes severe restrictions on women's movements outside the homestead. Thus traditionally, women's economic activities have been undertaken within the confine of their homesteads and its immediate surroundings. Mainly for this reason their contribution to their household economy has often been greatly underestimated.

Broadly, women tend to specialize in activities which keep them close to their homesteads while men undertake activities outside the homestead. Children follow the gender role of their parents. Work activities of men may be divided into three categories: (i) agricultural work; (ii) work generating supplementary income ; and (iii) work around the household. Some of the men's work may overlap with that of his wife and children. The male head of the household is primarily responsible for ensuring that the field agricultural activities are completed. He generally assumes primary responsibility for the preparation of the field, for ploughing, planting, harvesting, weeding, irrigating, and harvesting the crop. Men also take care of most commercial transaction, both agricultural and non agricultural. Those activities provide a formalized mechanism in which men interact socially. Women have productive control in all activities related to crop processing and storage. Women have also complete responsibility for the production of crop such as vegetables, spices and fruit grown in their homestead plots,as well as for the processing of this produce. Animal husbandry is also widely practiced by women.

Children beginning at 9-10 years, also make a contribution to the economy of the household. For the most part girls use these methods as role methods and boys learn their economic responsibilities from their fathers.

Although the traditional division of labour generally is still valid, under the pressure of increasing poverty, the restriction on female activities is being relaxed, and in many poor households female participation in activities outside the homestead is reported to be expanding quite rapidly. When family consumption needs cannot be met through field activities and earnings of male members, the only survival strategies left for the farm families is increased participation in wage labour activities or non traditional off-farm activities by the women household members.

3.6 Land Holdings

3.6.1 Structure of Landholding

About 90 per cent of the total land owned by farmers in the project area is under cultivation. The average land/man ratio is 0.22 ha. The average size of landholding in the project area is 1.1 ha. It varies from 0.45 ha among small farmers to 3.33 ha in large households according to the sample respondents.

The most important factor in rural income inequalities is undoubtedly the pattern of land distribution. Land ownership is significant for both the expansion of existing resources as well as for the acquisition of new ones. In fact, land is not only a material resource it is also the basis for negotiating access to additional resources. Land and other resources, in turn, increase the status of selected rural families. Control of land also locates families in complex social and political network where influence and power, access to education and many of the government services are negotiated. The process by which the household mobility is achieved or lost is dependent on a variety of factors of which the acquisition, maintenance or loss of land remains important, if not of sole significance. Land ownership in the project area like other parts of Bangladesh is unequally distributed. About 75 per cent of the land is owned by 35 per cent of the households (medium and large), comprising 43 per cent of the population. The remaining 69 per cent of the households belong to the small farms and landless categories with only 24 per cent of land. The field survey also reveals that the farmers in small holdings are net sellers of land than farmers of medium and large holdings.

3.6.2 Land Tenure

The land tenure system in the project area is broadly similar to that prevailing in other parts of Bangladesh. There are three distinct types of tenurial arrangements (Table 3.5). Owner operators are the most predominant, accounting for about 80% of households, with some 75% of the total area controlled by them. Owner cum share croppers account for 14% of households and 24% of the land in use. The incidence if pure share cropping, however, is low, being 5% of the households with only 1% of the total farmed land. Net share cropping "in" is practiced by the landless, marginal and small farmers. The terms of share cropping are the same for all crops in the project area; i.e, full cost of cultivation is borne by the tenant who receives one half of the total output in return.

Leasing arrangements are insignificant in the area. However, mortgaging (both in and out) is widely reported. The mortgage system often leads to the net loss of ownership of land by the small farmers through failure to redeem mortgage.

TABLE 3.5

Chenchuri Beel - Land Tenure

Land Ownership	Self Cultivated		Share in		Share out		Others		Total	
	No	%	No	%	No	%	No	%	No	%
0 - 0.20 Ha	6	10.71	3	5.36					23	41.07
0.21 - 0.50	8	14.29	3	5.36					8	14.29
0.51 - 1.00	7	12.50	1	1.79					9	16.07
1.01 - 2.00	8	14.29	1	1.79					8	14.29
2.01 - Above	8	14.29			2	3.57	1	1.79	8	14.29
Total	37	66.07	8	14.29	2	3.57	1	1.79	56	100.0 0

Source: Chenchuri Beel Sample Survey 1992/93

3.7 Landless Situation

Causes of landlessness are a complex set of socio-economic, demographic and institutional factors. A fundamental reason is the rapid growth in population, placing extreme pressure on already limited resources . Also the fragmentation of land holdings, low agricultural productivity, the deteriorating employment situation, the declining real income and the resultant economic hardship have led among other things to increasing landlessness.

Almost all the landless labour force are engaged in the agricultural sector as cultivators and also as daily paid or permanent basis (10 to 11 months contract per year) labourers. Permanent agricultural labour is generally employed by large farmers.

As no one can afford to remain unemployed, people are obliged to take any work available-however intermittent or ill paid. Thus most employment is part time, unlike other household categories, and they often work long hours, generally in low productive activities.

Daily paid workers experience a seasonal flux in demand for labour, and receive wage rates ranging from Tk 45 per day in peak demand and Tk. 24 in off periods. Agricultural employment drops sharply in the month of September, October, November, and they remain unemployed for more than half of the time in these months. Many of them subsists on part time fishing.

In general, most of the landless are absolutely poor; their annual per capita income is low and they are characterized by low health and poor nutritional status, which also affects their capacity to work. They have problems of access to institutional sources of credit and depend almost entirely on non-institutional sources. They have no interest in being members of any organized group. To the landless, making and eking out a living is a way of life. The self-perpetuating plight of the absolute poor has tended to cut them off from whatever economic progresses have taken place elsewhere in their own society. They have remained largely outside the development effort; able neither to contribute much to it, nor to benefit fairly from it.

3.8 Nutrition and Health

Malnutrition is a widespread, persistent, and apparently an increasing problem in the project area. Less than 5 percent of the population consume an adequate quantity and quality of food. Malnutrition most severely affects children under five years of age, and also pregnant and lactating women. Evidences show that the daily per capita calorie consumption has deteriorated significantly in the last two decades - compared with an estimated minimum daily requirement of 2,200 calories per capita per day - which shows that average consumption is well below 20 percent of the requirements specially for the landless, marginal, small, female headed households and the fishermen communities, even ignoring unequal distributions of food between and within families.

In-take of protein is also very low. This is attributed primarily to a decline in the consumption of pulses which has again resulted from the dominance of rice in the cropping patterns. The survey indicates that an estimated 77% of household are likely to be deficit in protein consumption.

TABLE 3.6

Caloric Intake (per person/day) By Groups

	LL	MF	SF	MDF	LF	F.Total	Women	Fishermen
Cereals	1420 (81)	2061 (79)	2419 (77)	2169 (72)	3560 (76)	2311 (76)	1210 (79)	2172 (79)
Fish/Meat/ Pulses	119 (7)	195 (8)	297 (9)	334 (11)	617 (13)	327 (11)	83 (5)	294 (11)
Vegetables	224 (12)	344 (13)	430 (14)	516 (17)	533 (11)	413 (13)	241 (16)	275 (10)
Total	1763 (100)	2600 (100)	3146 (100)	3019 (100)	4710 (100)	3051 (100)	1534 (100)	2741 (100)

Note: 1) LL - Landless; MF - Marginal Farmers; SF - Small Farmers; MDF - Medium Farmers; LF -Large Farmers.

2) Numbers in parentheses are the percentages of the total.

The major determinants of food consumption in the project area are household income and wealth, which primarily depend on the ownership and the size of the landholding, employment and the price of rice. The survey reveals that the relationship between landholding and food intake is directly related (Table 3.6). But cereal intake showed an inverse relation- it goes down with the size of land holding. Among food groups fish, meat, fruits and vegetables consumption were found to be increasingly higher with high income groups. Most of the nutrients showed a rising trend with the increase in the land holding size and a positive correlation was found between them. Malnutrition is, therefore, essentially a poverty and rural employment generation problem. The situation for the rural landless and the female headed families and those in the informal labour market is particularly difficult -- reflecting the over-supply of labour, and the declining average daily real wage rates of agricultural labour. Improving employment opportunities and increasing real income through income generating activities are of overriding importance in significantly improving the nutritional status of the poor in the project area.

With regard to safe drinking water, one of the most important socio-economic indicators, most of the inhabitants have got access to the available relatively safe drinking water facility - hand tubewells. It is found in the survey that about 36% of the respondents have got tubewells in their own houses and 54% replied that wells are within 100 yards from their houses and the rest 10% are located within 200 yards.

Although the area seems to have been enjoying better drinking water facilities gastric, fever, diarrhoea etc are the most common diseases found in the descending order of frequency with 77%, 65% and 52% respectively (Table 3.7).

TABLE 3.7

Health Status

Diseases	Landless Farmer		Marginal Farmer		Small Farmer		Medium Farmer		Large Farmer		Farmer Total		Women		Fisherman		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Chicken Pox			3	37.5	4	50.0	2	25.0	4	50.0	13	32.5			1	12.5	14	25.0
Dysentry	2	25.0	7	87.5	4	50.0	2	25.0	5	62.5	20	50.0	2	25.0	4	50.0	26	46.4
Diarrhoea	5	62.5	3	37.5	1	12.5	5	62.5	4	50.0	18	45.0	5	62.5	6	75.0	29	51.8
Gastric	7	87.5	3	37.5	8	100	7	87.5	6	75.0	31	77.5	5	62.5	7	87.5	43	76.8
Fever	4	50.0	3	37.5	3	37.5	5	62.5	6	75.0	21	52.5	7	87.5	7	87.5	35	62.5
Others	2	25.0	3	37.5	6	75.0	3	37.5	5	62.5	19	47.5			1	12.5	20	35.7
Total Respondents	8	100	8	100	8	100	8	100	8	100	40	100	8	100	8	100	56	100

3.9 Income

The Chenchuri Beel sample survey attempted to provide an indication of household income for the respondent households. Table 3.8 summarises the results by household category. The results, as to be expected shows that landless and women headed households are significantly less well off than other, including marginal farmers. This is illustrated below:

	Tk/year	% of average
Average All respondents	19940	
Landless Hh	9565	48
Women headed Hh	6815	34

(Figures rounded)

Fishing households with an average income of Tk 13325/av. were slightly above marginal farmers but distinctly less than farmers with more than 0.5 ha.

Table 3.8 clearly shows the declining dependance of households on income from secondary sources as landholding sizes increase : from almost 40% for the landless and marginal farmers to 15% for medium scale farmers (1 - 2 ha) and 8% for farmers who operate more than 2 ha. The restrictions on women operating outside their households may account for the rather low proportion of income from secondary occupations, 20% compared to other disadvantaged groups such as the landless (30%), marginal (39%) and even small farmer (29%).

TABLE 3.8

Chenchuri Beel - Reported Annual Income (Taka)

Sources of Income		Landless Farmer	Marginal Farmer	Small Farmer	Medium Farmer	Large Farmer	Women	Fisherman	Total
Main	Mean -	5900	6975	13125	22313	38125	5313	13138	14984
	Median -	6000	7000	12000	19500	29000	6000	10900	10400
	% -	61.70	58.68	51.72	79.76	85.43	77.98	98.59	75.15
Secondary	Mean -	3663	4663	7375	4250	3750	1375	188	3609
	Median -	3500	4000	4000					1750
	% -	38.30	39.22	29.05	15.19	8.40	20.18	1.41	18.10
Others	Mean -		250	4875	1413	2750	125		1346
	Median -			1000	500	1000			
	% -		2.10	19.21	5.05	6.16	1.83		6.74
Total	Mean -	9563	11888	25375	27975	44625	6813	13325	19938
	Median -	8550	11500	19500	22500	40000	7000	11500	14000
	% -	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Source: Chenchuri Beel Sample Survey 1992/93.

Table 3.9 summarises the survey's tentative findings on household expenditure in the project area. Almost 60% of expenditure for the whole sample was on food, varying from 54% in households with over 2 ha of land to 68% and 70% in landless and fishing households and 75% in households headed by women. Other major expenditures were clothing, 13% and education 11%. However the latter only exceeded 10% in the cases of small, medium and large scale farmers and was less than 2% in fishing and female headed

households illustrating these groups' lack of future prospects. The ability to save among households with even the greatest resources seems to be very small as also appears to be the ability or, perhaps, willingness to take credit from any source.

The results from such income - expenditure surveys often show, that under reporting of income and expenditure particularly in the landless, large farmers, female headed households and fishermen. The replies in all cases show only very small surpluses, Tk 325 / overall, or deficits during 1992.

TABLE 3.9

Chenchuri Beel - Reported Household Expenditures

Heads of Expenditure		Landless Farmer	Marginal Farmer	Small Farmer	Medium Farmer	Large Farmer	Women	Fisherman	Total
Food	Mean -	7625	7313	11600	16000	24625	5338	9288	11627
	Median -	7000	7600	11000	13000	23000	5750	9000	9000
	% -	67.78	64.93	60.66	56.21	53.97	74.78	69.70	58.45
Cloth	Mean -	2363	1338	3125	3813	6875	725	1288	2646
	Median	700	1250	2000	2500	5000	600	1100	2000
	% -	21.00	11.88	13.74	14.29	12.88	10.16	9.66	13.42
Education	Mean -	313	563	4125	2813	6750	125	163	2121
	Median -	200	500	1000	2000	5000			500
	% -	2.78	4.99	18.13	10.54	14.79	1.76	1.22	10.76
Shelter	Mean -	600	875	1600	1813	1375	363	913	1063
	Median	500	750	1000			400	750	600
	% -	5.33	7.77	6.59	6.79	3.01	5.08	6.85	5.39
Others	Mean -	350	975	1375	1375	5500	588	450	1516
	Median -	350	1000	2000	1000	4000	150	400	1000
	% -	3.11	8.66	6.04	5.15	12.05	8.23	3.38	7.69
Cr Repay	Mean -		125	375	875	1250		613	463
	Median				500	1000			
	% -		1.11	1.65	3.28	2.74		4.60	2.36
Savings	Mean -			750	625			463	263
	Median -								
	% -			3.30	2.34			3.47	1.33
Cap. Exp	Mean -		75		375	250		150	121
	Median								
	% -		0.67		1.41	0.55		1.13	0.62
Total	Mean -	11250	11263	22750	26688	45625	7138	13325	19720
	Median	8550	10750	20500	20500	4000	7000	11500	15000
	% -	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Source: Chenchuri Beel Sample Survey 1992/93.

3.10 Vulnerable Groups

As illustrated in the last section female headed households, fishermen, landless and marginal farmers are the most vulnerable social groups in the project area. According to official estimates, in Bangladesh about 16% of the households are headed by females, this percentage may be even higher in the project area. Under the present social conditions, while men have power and authority over women, they are also obliged to provide women with food, clothing and shelter. The reality of this arrangement diverges from the ideal. Certain women have always been vulnerable to being left exposed and without protection. Increasing poverty is placing strain even on the bonds of obligations and sometimes males from very poor households, who cannot fulfill their obligations towards their family, abandon them and their offspring and migrate elsewhere where despite initial expectations they are unable to remit sufficient income to support those they leave behind.

Widowhood, separation or abandonment are reported to be generating an increasing number of women who must fend for themselves - and their children - in an environment which presents very few opportunities for doing so. Most of these women and their household members live in sub-human conditions. Although the total number of these "distressed" women is not known, they are estimated to be significant. It is anticipated that with the project intervention, the plight of these women group may be improved through the increased farm and off-farm activities.

3.11 Survival Strategies of the Rural Poor

Given the small size of their holdings, marginal and small farmers are obliged to adopt a combination of survival strategies: one such strategy is sharecropping of land. The extent of sharecropping in the project area has been discussed earlier. Although all farm holding categories share some land in, the bulk of it (71% of all shared in land) is share cropped by small and marginal farmers. Conversely, the largest amount of land shared out, originates from larger scale farmers. It may seem unusual that marginal and small farmers also share out land. It is however most likely that the marginal farmers are obliged to share out their land and to engage themselves as day labourers because they cannot afford to buy the necessary inputs for agricultural operations.

It could be argued that the tenancy market might have some moderating effect on the inegalitarian structure of land ownership. However, under the prevailing terms and conditions of share tenancy, the tenant often typically receives little from the shared-in land than he would have received by selling labour. Inspite of the new legislation, under most of the sharecropping arrangements, the tenant provides all the inputs but has to surrender 50% of the gross produce to the landowner as rent. A recent study indicates that for most of the crop varieties the return to sharecropper's labour is lower than the market wage rate (Cost and Returns Studies, 1982). Still, the tenancy arrangement is preferred to labour hiring because of the security of employment it provides.

Another survival strategy often adopted by the marginal and small farmers is livestock rearing (or sharecaring stocks for richer households). Trading of livestock products - milk, ghee, eggs, hides and live animals - is an important source of income for the marginal and small farmers. Although the size of the livestock owned increases with the size of holdings, livestock may make a sizeable contribution to the meager cash flow of the landless, marginal and small farm households. Moreover, animal waste is a principal means of replenishing soil nutrients for the marginal and small farmers as well as a major source of energy for fuel in the project area.

The majority of marginal and small farmers, however, cannot subsist on the produce - and income - derived from their land and from their livestock. They must revert, along with some of their family members, to both wage labour and to non-farm activities in order to barely survive.

Landless, marginal and small farmers are main sellers of labour; on the other hand, medium and large farmers, in general, become net purchasers of labour. Behind this overall pattern is hidden the fact that even the marginal and small farmers may hire in some labour. Thus in the project area, for example, the marginal and small farmers were found to hire in 5% of the labour used on their holdings. This finding may seem implausible at first. It should be realized, however, that some farm families only have one family labourer, and that there are seasonal peaks of labour requirements in excess of what is available within the family. Thus, the condition that the aggregate mandays of labour supply during the year is in excess of what holding at the disposal of the household can absorb is not a guarantee against hiring labour. Indeed, employment in the project area dominated by agricultural activities, is characterized by a great deal of seasonality. The pattern of seasonality differs significantly between rural communities depending on the cropping pattern prevailing in the micro-region. Broadly speaking, in the project area there are three peak seasons: the highest one occurs at harvest time of aman rice in November - December; another peak, nearly as high as the first, takes place in August- September when the dominant activities

are harvesting of aus rice and jute and the translating of aman rice; a third peak occurs in April at the time of the harvesting of boro rice and the broadcasting of aus and aman rice. The slack seasons precede the peaks. Thus, a sharp decline in employment takes place just before the aman harvest, in the months of October and, partly, November. A second trough occurs in June- July and a third trough occurs in February-March. These slack seasons also coincide with a sharp drop of wage employment and with the cost of labour. This phenomenon is aggravated by the fact that during this period, marginal and small farmers are net buyers of foodgrains and that food prices are highest during this period. The nutritional consequences of these overlapping factors are poor heath condition and malnutrition.

Since wage labour opportunities are quite limited in the project area, especially in the dry winter season, wage sellers are often obliged to migrate to other areas in the hope to find even a few weeks of gainful employment. Although the total incidence of seasonal migration is believed to be high, its dimensions are not known.

Wages for both farm and non-farm employment are usually quite low. Reflecting the oversupply of labour; daily real wage rates of unskilled agricultural workers have declined in the project area in the last decade. The same holds true for employment in non-farm activities; they are generally of rudimentary nature with very low wages. Also, self-employment in the project area is rare and, moreover, has very low returns to labour. Therefore, marginal and small farmers in the project area have to work long hours most days of the year to earn very little income. The situation at the bottom end of land holdings is therefore one of very high intensity of low income employment.

For all the reasons outlined above, income levels of the poor segment of the population in the project area are low. Income estimates need to be taken with the usual caution.

3.12 Sources of Credit

To take advantage of FCD/I developments such as proposed in the Chenchuri Beel project, credit will be required and it is anticipated will be provided, particularly for pumpsets, irrigation system development, crop inputs and to enable certain households such as fishermen to relocate or take up alternative occupations. At present individuals obtain loans from institutional (formal) sources such as KSS, Grameen Bank etc and more commonly from non-institutional (informal) sources including traders, family and neighbours. Table 3.10 summarises the results of the Chenchuri Beel survey relating to credit.

TABLE 3.10

Chenchuri Beel : Sources of Credit

	Land less	Farmers				Women H/h	Fishing H/h
		Marginal	Small	Medium	Large		
Formal (1)							
Commercial Bank	-	-	-	-	63	-	-
Krishi Bank	-	-	-	62	34	-	-
Sub-Total	-	-	-	62	97	-	-
Informal							
Money lender	-	83	33	15	3	-	100
Relatives	-	8	33	17	-	-	-
Neighbour	100	9	34	6	-	100	-
Sub-Total	100	100	100	38	3	100	100
Total	100	100	100	100	100	100	100

Source: Chenchuri Beel Sample Survey.

The table reflects the difficulty of obtaining loans from the formal sector which require physical collateral and often involve lengthy procedures and it is reported unofficial commissions to staff or agents of the credit institutions. The work position of women headed households, fishermen and the landless are highlighted. The exception to the general rule in the formal sector is the Grameen Bank which provides small loans to members, usually women, of small, 5 person, groups which act as their own joint guarantors. Only those classed as landless qualify for such loans however and none were found in the survey sample.

3.13 Participation

Survey respondents were asked about their attitudes to participating in development schemes, sponsored by government. Eighty four percent stated that they were willing to contribute through participation to project design and operation. No respondent said they were unwilling to participate but 16% did not respond to the question (Table 3.11).

Unexpectedly 66% of those with land said they would be willing to put this land, or some of it forward for acquisition if needed for project development. This reply was not followed up but presumably generous compensation would be expected in such instances (Table 3.12).

Over half, 52%, of those questioned said that O&M of any FCD/I scheme in their locality should be undertaken voluntarily by beneficiaries; 46% suggested that this should be under the guidance of some form of O&M committee and 36% suggested other organising - coordinating institutions including the Union Council should be responsible. However, in contrast 46% stated that BWDB should be responsible for O&M, indicating at least some inwillingness to participate. Many made clear that any beneficiary participation committee should be broad based within the community in order to minimise, or eliminate, the influence of individuals in the area.

3.14 NGOs

May be the poor socio-economic feature of the area attracted a number of NGO's to work on. The major NGO's working in this area are Proshikha Manobik Unayan Kendra (Dhaka), Esho Samaj Gori, Banchta Shekha etc (Table 3.13) who are actually working with most vulnerable groups - the landless, marginal farmers and women groups. Their areas of activities includes income generating projects (46%), loan disbursement (14%), women programmes, child and adult education, health care services etc (Table 3.14).

3.15 Expected Impact of the Proposed Project Intervention

Data presented in Table 3.15 delineate the beneficiaries's expectations out of the proposed project (intervention). They expected more of benefits than disadvantages with a degree of variations from group to group and community to community. All the farmer groups, irrespective of land holding size, expected increased production in agriculture. On the other hand majority respondents of fishermen community (88%) expected that there would be a reduction of fish production as an adverse impact of the project.

TABLE 3.11

Chenchuri Beel - Peoples Participation in Project Activities

Participation	Landless Farmer		Marginal Farmer		Small Farmer		Medium Farmer		Large Farmer		Farmer Total		Women		Fisherman		Total	
	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%
Willing	8	100.00	8	100.00	7	87.50	8	100.00	8	100.00	39	97.50	4	50.00	4	50.00	47	83.93
Not willing																		
No Response					1	12.50					1	2.50	4	50.00	4	50.00	9	16.07
Total	8	100.00	8	100.00	8	100.00	8	100.00	8	100.00	40	100.00	8	100.00	8	100.00	56	100.00

Source: Chenchuri Beel Sample Survey 1992/93.

TABLE 3.12

Chenchuri Beel - Willingness to Donate Land for Development

Allow BWDB to Acquire Land	Landless Farmer		Marginal Farmer		Small Farmer		Medium Farmer		Large Farmer		Farmer Total		Women		Fisherman		Total	
	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%
Willing	4	50.00	7	87.50	7	87.50	8	100.00	8	100.00	34	85.00	2	25.00	1	12.50	37	66.07
Not willing	1	12.50									1	2.50					1	1.79
No Response	3	37.50	1	12.50	1	12.50					5	12.50	6	75.00	7	87.50	18	32.14
Total	8	100.00	8	100.00	8	100.00	8	100.00	8	100.00	40	100.00	8	100.00	8	100.00	56	100.00

Source: Chenchuri Beel Sample Survey 1992/93.

TABLE 3.13

Chenchuri Beel - Major NGOs in the Area

Names of Cooperatives and NGOs	Landless Farmer		Marginal Farmer		Small Farmer		Medium Farmer		Large Farmer		Farmer Total		Women		Fisherman		Total	
	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%
BRAC																		
Grameen Bank	2	25.00	1	12.50	2	25.00	4	50.00	6	75.00	15	37.50					15	26.79
Proshikha	1	12.50	1	12.50			1	12.50	2	25.00	5	12.50					5	8.93
BRDB/PEP																		
Women Development							1	12.50			1	2.50					1	1.79
SPPI																		
Asho Shamaj Gari	1	12.50	1	12.50	1	12.50	1	12.50	2	25.00	6	15.00					6	10.71
Banchte Shakho	2	25.00	4	50.00	1	12.50	3	37.50	1	12.50	11	27.50	1	12.50	3	37.50	15	26.79
Others																		
Total Respondent	8	100.00	8	100.00	8	100.00	8	100.00	8	100.00	40	100.00	8	100.00	8	100.00	56	100.00

Source: Chenchuri Beel Sample Survey 1992/93.

TABLE 3.14

Chenchuri Beel - Main Activities of NGOs

Names of Cooperatives and NGOs	Landless Farmer		Marginal Farmer		Small Farmer		Medium Farmer		Large Farmer		Farmer Total		Women		Fisherman		Total	
	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%
Loan Disbursement	2	25.00					2	25.00			4	10.00	1	12.50	3	37.50	8	14.29
Income Gen. Project	4	50.00	6	75.00	4	50.00	5	62.50	7	87.50	26	65.00					26	46.43
Women Programs					1	12.50					1	2.50					1	1.79
Social Forestation					1	12.50					1	2.50					1	1.79
Seri-Culture																		
Others									1	12.50	1	2.50					1	1.79
Total Respondent	8	100.00	8	100.00	8	100.00	8	100.00	8	100.00	40	100.00	8	100.00	8	100.00	56	100.00

Source: Chenchuri Beel Sample Survey 1992/93.

TABLE 3.15

Chenchuri Beel Expected Benefits and Adverse Effects of the Proposed Project

Benefits/ Adverse Effects	Large Farmer		Medium Farmer		Small Farmer		Margin. Farmer		Landless		Farmer Total		Women		Fisherman		Total	
	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%
Benefits																		
1 Overall Benefit			1	13	3	38	1	13	5	63	10	25	2	25			12	21
2 Increased Income	4	50	4	50	7	88	3	38	2	25	20	50	2	25			22	39
3 Increased Production	8	100	8	100	8	100	8	100	3	38	35	88	2	25			37	66
4 Increased Intensity	3	38	1	13	2	25	1	13	1	13	8	20					8	14
5 Adequate Water Supply	1	13	1	13	3	38	1	13	3	38	9	23	1	13			10	18
6 Communication	3	38	2	25	2	25	2	25	1	13	10	25					10	18
7 Flood Control	1	13	3	38	5	63	3	38	4	50	16	40	2	25	3	38	21	38
8 More employment							1	13	1	13	2	5					2	4
9 Less water Logging	1	13	1	13	1	13	2	25	1	13	6	15	1	13			7	13
10 Salinity control	1	13									1	3					1	2
11 Developed fish culture	3	38							1	13	4	10					4	7
Adverse Effects																		
1 Land Acquisition	1	13	2	25	1	13	1	13			5	13					5	9
2 Fish reduction	3	38	3	38	8	100	2	25	3	38	19	48			7	88	26	46
3 Navigation problem	2	25	3	38	8	100	2	25	1	13	16	40			3	38	19	34
4 Increased Water Logging	1	13			1	13					2	5			1	13	3	5
5 River Erosion					1	13					1	3					1	2
6 Unemployment															2	25	2	4
7 Salinity															1	13	1	2
8 Decreased Income															1	13	1	2
Total Respondents	8	100	8	100	8	100	8	100	8	100	40	100	8	100	8	100	56	100

Source: Chenchuri Beel Sample Survey 1992/93.

Major benefits can be summarized in Table 3.16 by group/community.

TABLE 3.16

Summary of Expected Project Benefits

Benefits	Farmers %	Women %	Fishermen %
Increased production	88	25	-
Increased Income	50	25	-
Flood control	40	25	38
Communication	25	-	-
Adequate Water Supply	23	13	-
Increased Production Intensity	20	-	-

Source: Chenchuri Beel 1992/93

Though there have been identified as many as 11 benefits but only 6 are found common to all the groups of respondents. The figures (in percent) show the trend. As mentioned earlier land holding group is more benefitted than other groups. The least benefitted group is fishermen followed by the women headed households. The possible reason behind is that the project is agricultural biased and it has no provision to incorporate the disadvantageous groups like fishermen or women community.

Adverse Effects

Beneficiaries identified as many as 8 adverse effects out of the project (Table 3.15). Major ones may be summarised in Table 3.17 by group/community.

TABLE 3.17

Summary of Expected Adverse Effects from Project

Adverse effects	Agricultural %	Women %	Fishermen %
Reduction of fish	48	-	88
Navigation Problem	33	-	38
Unemployment	-	-	25
Decreased Income	-	-	13

Source: Chenchuri Beel Sample Survey 1992/93.

Of the eight negative effects, four relate to reduction of fish, resources, navigation, employment and decreased income (Table 3.16). As the table shows the fishermen apprehended more of adverse effects than benefits in comparison to other community/group.

As a beel area Chenchuri is a natural ground for fish production. A large number of fishing community (capture fishing) is found in the area. Due to the interventions beels will be used as agricultural land so they may loose natural fishing ground. The fishermen in large number (88%) apprehended a drastic reduction of capture fish and loss of fishing areas. This leading them to unemployment and decreased income. In these circumstances they expect to have to leave their profession and join the already over-abundant agriculture wage labour group.

Women

The Chenchuri beel area is traditional one and women are not generally found working in agriculture. There is no women wage labour in the sample. Women are generally engaged in homestead as housewives. They are not exposed to outside world. This may be the possible reason for their lack of expressed opinions on the impact of the project.

The foregoing presentation and analysis reveal positive and negative impacts of the proposed plan depicting the following trend.

Positive Impact

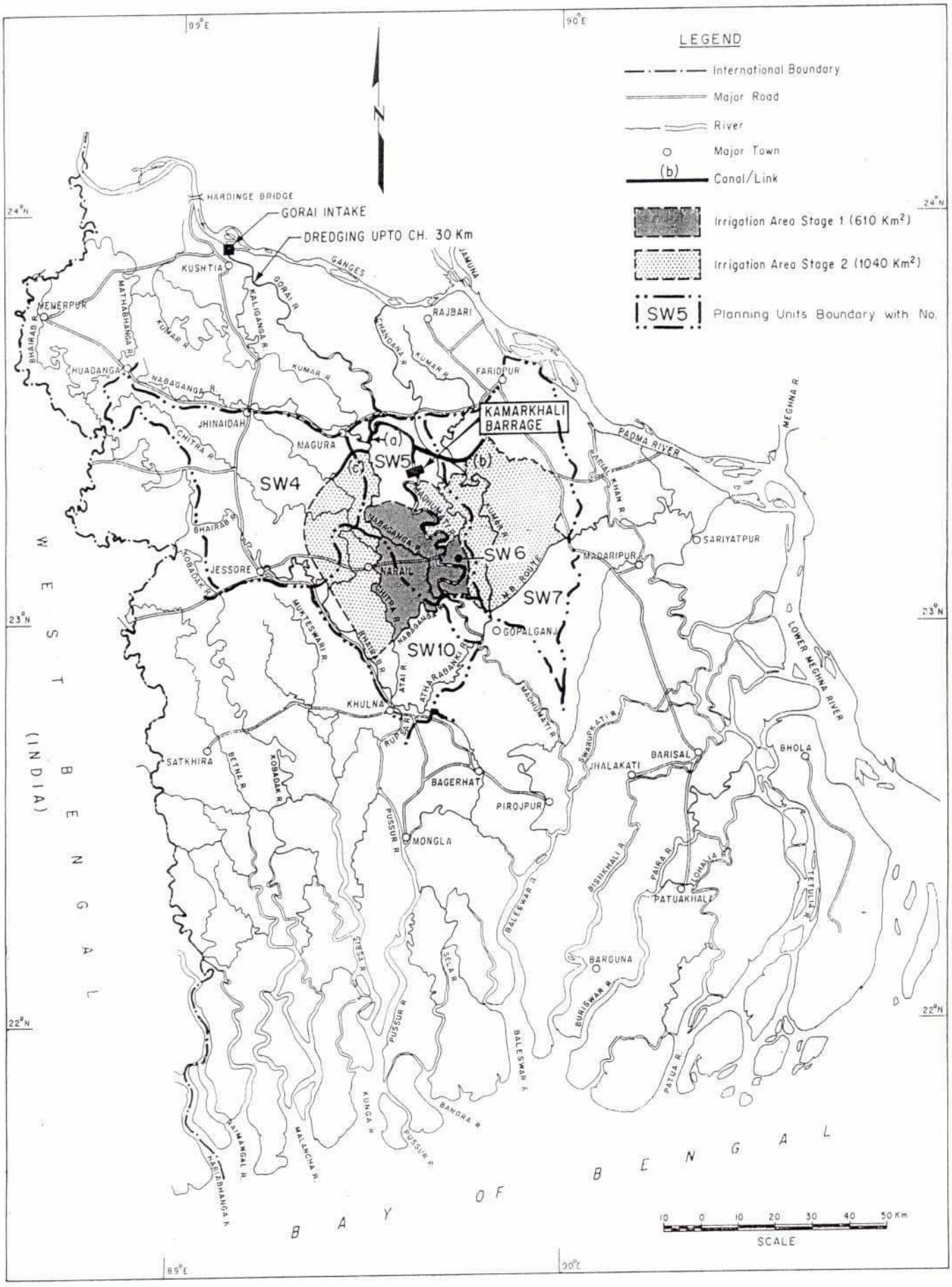
- Land owning group expect more benefits than other groups/community such as fishermen, women headed households, landless etc.
- Flood, water logging and salinity problems will be minimised.
- It will increase agricultural production and generate more income.
- It will develop road communication and develop culture fishing.

Negative Impact

- Capture fish and fishing area would be decreased to a large extent leading to severe employment problem for the traditional fishing community.
- There would be problem of navigation disrupting prevailing communication system.
- The marginal, disadvantaged and women groups are expecting no major benefits out of the project.
- There is a distinct identification of the advantaged and disadvantaged groups/community. The already disadvantaged ones are more disadvantageous such as fishermen and women.

These findings more or less reflect the findings of other studies in this region and elsewhere. Similar findings are recorded in Flood Action Plan (FAP) 12/13 studies of the improvement of Sukunia Beel (Faridpur) Polder 17/2 (Khulna), Sonamukhi Bonmander Beel Drainage Project (Jessore), Kolabashukhali (KBK) Project (Khulna) and Meghna Dhonagoda Irrigation Project (Chandpur).

Figure 4.1



Gorai Augmentation Project : Location Map

4 GORAI AUGMENTATION PROJECT

4.1 Introduction

The Gorai Augmentation Project is one of the priority projects identified under the Study and was studied to pre-feasibility level. The project comprises a structure at the Gorai mouth, dredging of the mouth and further downstream, a structure at Mohammadpur to lift water for irrigation. The project benefits an area of about 160,000 ha in Planning Units SW4, SW5, SW6, SW7 and SW10 (Figure 4.1). The project is to be implemented in phases cover a period of 10 years.

As part of the Social Studies an RRA type survey was conducted in the project area. In addition information was gathered during the numerous field visits, surveys, observations and group discussions. 47 villages were selected at random in the districts of Faridpur, Gopalganj and Magura in 6, 3 and 2 thanas respectively. The names of the villages surveyed and thanas are given below:

District	Thanas	Villages
Faridpur	Bhanga	Madhayapara, Shilardharchar, Chowdhuridanga, Bharoitanga, Pukuria, Nurpur
	Sadarpur	Horinna, Nurullahganj, Natundangi
	Boalmari	Golaynagar, Sarokanda, Dhulpukuria, Mohishala
	Kotwali	Purbagangabardi, Bokail, Talugram, Jair, Kajudha, Habilidyarampur
	Alfadanga	Kamargram, Char Kamargram, Alfadanga, Jhatikgram
	Nagarkanda	Bashnaqari, Lashkadia, Majikanda, Kashikanda, Bilgobindapur, Singapratap
	Modhukhali	Mechardia, Utali
	Moksudpur	Batikamari, Moharajpur, Padmakanda, Kohaldia, Nonikheer
Gopalganj	Kasiani	Barashpur, Chapta, Bishwanathpur
	Rajoir	Purbanagardi, Tatikandi
Magura	Mohammedpur	Dhoail, Joshpur, Mohammedpur, Binodpur, Tollabaria, Mousha, Jangalia

This section presents the prevailing socio- economic situation in the Project Area and is based on field survey and observations, made during field visit and group discussion with the people living within the project area.

For the purpose of this study, the households have been stratified into 6 socio-economic groups. The farm families have been stratified according to the amount of land they operate. The categories of household and their holding size are given below.

Household Category	Operated land (ha)	No of Households
Landless	0.00 - 0.20	15
Marginal Farmer	0.21 - 0.50	15
Small Farmer	0.51 - 1.00	15
Medium Farmer	1.01 - 2.00	15
Large Farmer	2.00 +	15
Female Headed Household	------	15
Fishermen	------	15

4.2 Demographic Characteristics

The total population of the sampled household was estimated at about 703 comprising some 105 households. This roughly works out to about 6.7 persons per household.

The proportion of male and female is almost same. The male population constitutes the main active working group. The female population except from the landless, women headed and fishermen households of the project area do not normally work in the fields. They are mainly engaged domestically in winnowing, drying and storing of agricultural crops, parboiling and pounding of paddy, poultry keeping, caring of children, etc. Socio- religious tradition demands that they should not be seen in public places and this has virtually prohibited their easy access to, and participation in, many economic activities outside the home.

The age group between 11-50 years which constitute the main working force in the project area, altogether account for about 73 percent of the total population, leaving the remaining 27 per cent outside the productive age group (below 11 and above 55 years of age). The average age of the respondents is about 43 years (Table 4.1).

The average family size in the project area of the sampled population was 6.7 persons which is higher than the SWA average of 5.6 persons. However, the large and medium farm households category shows a much higher size of 10.5 and 8.5 persons respectively. This probably reflects the influence of the joint family system in the upper category of farm family.

Dependency ratio in the project area is found to be 1.36 which is lower than both the SWA and national average. There is a direct relation between the dependency ratio and the farm size indicating concentration of family members in the high category of farm holding.

The overall literacy rate of the population in the project area is 49% which is much higher than the SWA average of 25%. The literacy rate increases with the size of landholding. Among all household categories, 93 percent of the female headed households and 67% of the fishermen communities are illiterate (Table 4.2). The number of literate persons increases as the economic condition of the family improves. The highest literacy rate is found in the large farmers household category (about 94%). However the figures found in the sample may be exaggerated as a result of judging literacy from attendance at school and also over-reporting by respondents.

The survey also indicates that literacy among females is much lower than among males. The majority of the literate persons, about 48% have had only primary education and may not be functionally literate, while 38% have had secondary education and 10% higher secondary. The low education level emphasizes the importance of direct contact between the field staff and project beneficiaries, the limited application of printed literature, and the potential for radio programmes and audio-visual aids for extension purposes.

TABLE 4.1

Gorai Augmentation Project - Selected Basic Data for the Sample Survey Population

Age	Landless Farmer		Marginal Farmer		Small Farmer		Medium Farmer		Large Farmer		Farmer Total		Women		Fishermen		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Upto 30	6	40.00			2	13.33	3	20.00	2	13.33	13	17.33	3	20.00	5	33.33	21	20.00
31 - 40	3	20.00	10	66.67	4	26.67	3	20.00	3	20.00	23	30.67	6	40.00	3	20.00	32	30.48
41 - 50	4	26.67	2	13.33	6	40.00	3	20.00	2	13.33	17	22.67	5	33.33	2	13.33	24	22.86
51 - 60	2	12.33	3	20.00	1	6.67	5	33.33	6	40.00	17	22.67	1	6.67	2	13.33	20	19.05
60 +					2	13.33	1	6.67	2	13.33	5	6.67			3	20.00	8	7.62
Total	15	100.00	15	100.00	15	100.00	15	100.00	15	99.99	75	100.00	15	100.00	15	100.00	105	100.00
Average age		37.73		41.13		44.27		44.93		50.07		43.63		39.60		41.93		42.81
Male	41	50.62	43	55.13	51	47.66	61	47.66	84	54.55	280	51.09	20	36.36	51	51.00	351	49.93
Female	40	49.38	35	44.87	56	52.34	67	52.34	70	45.45	268	48.91	35	63.64	49	49.00	352	50.07
Total	81	100.00	78	100.00	107	100.00	128	100.00	154	100.00	548	100.00	55	100.00	100	100.00	703	100.00

TABLE 4.2

Gorai Augmentation Project - Literacy by Household Class

Level of	Landless Farmer		Marginal Farmer		Small Farmer		Medium Farmer		Large Farmer		Farmer Total		Women		Fishermen		Total	
Education	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Illiterate	11	73.33	8	53.33	4	26.67	5	33.33	1	6.67	29	38.67	14	93.33	10	66.67	53	50.48
Upto Class - IV	4	26.67	4	26.67	4	26.67	7	46.67	4	26.67	23	30.67	1	6.67	1	6.67	25	23.81
Upto Class - X			3	20.00	5	33.33	1	6.67	2	13.33	11	14.67			2	13.33	13	12.38
S.S.C					2	13.33	1	6.67	2	13.33	5	6.67			2	13.33	7	6.67
H.S.C							1	6.67	4	26.67	5	6.67					5	4.76
Graduate +									2	13.33	2	2.67					2	1.9
Total	15	100.00	15	100.00	15	100.00	15	100.00	15	100.00	75	100.00	15	100.00	15	100.00	105	100.00

Source : Consultants' Survey, 1992.

vp\gorai\tab4-1

4.3 Occupations and Employment

The labour force of the project area is estimated at 36% of the total population. In this estimate, the labour force is defined to include all males (females are excluded from the labour force as they do not generally work in the field) in the age groups of 11-55 years excluding the physically handicapped and school children.

The labour force in the project area is predominantly agricultural, generally self- employed and suffers from high under-employment due to seasonality of activities, a high level of landlessness and lack of non-farm employment opportunities. Broadly speaking, some 68% of the employed labour force is occupied in agriculture, of which 42% are on their own farm, 25% on their own lands with additional land share cropped and 14% work as day labourers. About 14% are engaged in full time fishing (Table 4.3).

Non-agricultural occupations account for only 5% of the total employment. Important amongst these are : business, services and professions.

The distribution of occupation of the employed labour force by landowning categories shows that about 47% of the landless work as agricultural day labour. About 46% of the small farm households farm their own and share cropped land and also work on others land; some 28% are occupied in non-agricultural activities like services, business, and transportation.

In all, about 41% of the total employed labour force has secondary occupations. The highest proportion, 60% falls in the marginal farmers category. About 7% of the marginal farmers also takes up fishing as their secondary occupation. Wage labour and business appear to be the most important second occupation (Table 4.4). The seasonal nature of agricultural activity affects the employment pattern. During the slack season more than half of the labour suffers from under-employment. On the other hand, during peak seasons, over two-third of the employed force work more than normal working hours.

Table 4.5 shows the average area of land cultivated by various categories of farmers. As can be seen from the table there is a wide difference between the area cultivated by large farmers and others.

With regard to seasonal variation in agricultural sector, three peak demand periods exist. These coincide with: (i) land preparation, sowing, or transplanting; (ii)weeding and other inter-culture operations, and (iii) harvesting. Under the existing crop pattern the peak seasons, occur in (i) April-May, (ii) July-August, and (iii) November-December.

The wage rates are closely related to supply and demand. The average wage rate per day is Tk 32 for male and Tk 24 for the female. They vary from Tk 45 per day in the peak season to TK 24 per day in the off season. The system of exchange labour is practiced to a limited extent, especially among neighbours and near relatives.

Existing knowledge about utilization of family members in the project area is scanty. However, in SWA the survey indicated differences in work carried out between males and females. Nevertheless the precarious household economy of the majority of the rural people in the project area as elsewhere in SWA is based on the contribution of all its members.

Powerful and pervasive religious and social practices constrain women to specific task and roles. the seclusion (purdah) system imposes reactions on womens' movements outside the homestead. This traditionally, womens' economic activities are usually undertaken within the confine of their homesteads and its immediate surroundings. Mainly for this reason their contribution to their household economy has often been disregarded, though it is substantial.

TABLE 4.3

Gorai Augmentation Project - Primary Household Occupations

Main	Landless Farmer		Marginal Farmer		Small Farmer		Medium Farmer		Large Farmer		Farmer Total		Women		Fishermen		Total	
Occupation	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Agriculture	8	53.33	15	100.00	15	100.00	15	100.00	15	100.00	68	90.67	3	20.00			71	67.62
Fishery Capture															15	100.00	15	14.29
Fishery Culture																		
Agri Labour	7	46.67									7	9.33	7	46.67			14	13.33
Non-Agri Labour																		
Business													2	13.33			2	1.9
Others													3	20.00			3	2.86
Total	15	100.00	15	100.00	15	100.00	15	100.00	15	100.00	75	100.00	15	100.00	15	100.00	105	100.00

TABLE 4.4

Gorai Augmentation Project - Secondary Household Occupations

Main	Landless Farmer		Marginal Farmer		Small Farmer		Medium Farmer		Large Farmer		Farmer Total		Women		Fishermen		Total	
Occupation	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Agriculture													1	20.00			1	2.33
Fishery Capture			3	33.33							3	8.57					3	6.98
Fishery Culture																		
Agri Labour	1	14.29			1	12.50					2	5.71	1	20.00			3	6.98
Non-Agri Labour	2	28.57	1	11.11	1	12.50					4	11.43	1	20.00			5	11.63
Business	4	57.14	3	33.33	6	75.00	2	33.33	3	60.00	18	51.43	1	20.00	2	66.67	21	48.84
Others			2	22.22			4	66.67	2	40.00	8	22.86	1	20.00	1	33.33	10	23.26
Total	7	100.00	9	100.00	8	100.00	6	100.00	5	100.00	35	100.00	5	100.00	3	100.00	43	100.00

Source : Consultants' Survey, 1992.

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Broadly speaking women tend to specialize in activities which keep them close to their homesteads while male undertake activities further afield. Children typically follow the gender role set their parents. Work activities of men may be divided into three categories:(i) agricultural work; (ii) work generating supplementary income ; and (iii) work around the household. Some of the men's work may overlap with that of his wife and children. The male head of the household is primarily responsible for ensuring that the field agricultural activities completed. He generally assumes primary responsibility for the preparation of the field, for ploughing, planting, weeding, irrigating, and harvesting the crop. Men also take care of most commercial transaction, both agricultural and non agricultural. Those activities provide a formalized mechanism in which men interact socially. Women have productive control in all activities related to crop processing and storage. Women have also complete responsibility for the production of crop such as vegetables, spices and fruit grown in their homestead plots,as well as for the processing of this produce. Animal husbandry are also widely practiced by women.

Children beginning at 9-10 years of age, also make a contribution to the economy of the household.

Although the traditional division of labour is generally still valid under the pressure of increasing poverty the restriction on females working is being relaxed, and in many landpoor households female participation in activities outside the homestead is expanding quite rapidly. When family consumption needs can not be met through field activities and earning from male members, the only survival strategies left for the farm families can be increased participation in wage labour activities or non traditional off-farm activities by the women members of the household.

4.4 Structure of Landholding

About 90 of the total land owned by farmers in the project areas is under cultivation. The average land/man ratio is 0.22 ha. The average size of landholding in the project area is 1.7 ha, varying from 0.34 ha among small farmers to 5.21 ha in the large farmer household category (Table 4.5).

TABLE 4.5

Gorai Augmentation Project : Average NCA per Household

Farmer Group	Irrigated	Rainfed	Total
	Ha	Ha	Ha
Landless	0.22	0.12	0.34
Marginal	0.21	0.42	0.63
Small	0.40	0.55	0.95
Medium	0.52	0.99	1.51
Large	1.71	3.50	5.21
Average	0.61	1.12	1.73

The most important factor in rural income inequality is undoubtedly the pattern of land distribution. Land ownership is significant for both the expansion of existing resources as well as for the acquisition of new ones. In fact, land is not only a technical resource it is also the basis for negotiating access to additional resources. Land and other resources, in turn, increase the status of rural families. Control of land also places families complex social and political network where influence and power, in this government access to education and many of the services are negotiated. The process by which the household mobility is achieved or lost is dependent on a variety of factors of which the acquisition, maintenance or loss of land remains a key factor. Land ownership in the project area like other parts of Bangladesh is unequally distributed. About 75% of the land is owned by 35% of the households (medium and large), comprising 43% of the population. The remaining 65% of the house-holds are in the marginal and small farm and landless categories with only 24% of land. The field survey also revealed that farmers in the small farm group are net sellers of land usually to farmers in the medium and large categories.

The land tenure system in the project area is broadly similar to that prevailing in other parts of Bangladesh. There are three distinct type of tenurial arrangements. In the project area owner operators are the most predominant, accounting for about 93% of households, with some 75% of the total area controlled by them (Table 4.6). Owner cum share croppers account for 29% of households and 24% of the land in use. The incidence of pure share cropping, however, is low, being 5% of the households with only 1% of the total farmed land. Net share cropping "in" is practiced by the landless, marginal and small farmers. The terms of share cropping are the same for all crops in the project area; i.e, full cost of cultivation is borne by the tenant who receives one half of the total output in return.

TABLE 4.6

Gorai Augmentation Project : Land Tenure

Land Ownership	Self Cultivated		Share in		Share out		Others		Total	
	No	%	No	%	No	%	No	%	No	%
0 - 0.20 Ha	7	6.67	7	6.67					38	36.19
0.21 - 0.50	18	17.14	7	6.67					20	19.05
0.51 - 1.00	15	14.29	6	5.71					17	16.19
1.01 - 2.00	14	13.33	7	6.67					15	14.29
2.01 - Above	14	13.33	3	2.86	4	3.81	1	0.95	15	14.29
Total	68	64.76	30	28.57	4	3.81	1	0.95	105	100.00

Leasing arrangements are insignificant in the area. However, mortgaging (both in and out) is widely reported. The mortgage system often leads to the net loss of ownership of land by the small farmers through failure to redeem mortgage.

4.5 The Landless

Causes of landlessness are complex, socio-economic, demographic and institutional factors all play a part. A fundamental reason is the rapid growth in population placing extreme pressure on already limited resources. The fragmentation of land holdings, low resources to raise agricultural productivity, the deteriorating overall employment situation, declining real income and the resultant economic hardships for most families have led among other things to increasing landlessness.

Almost all the landless labour force are engaged in the agricultural sector as cultivators on both daily paid and on a permanent basis (10 to 11 months contract a year). Permanent agricultural labour is generally employed by large farmers and is relatively rare compared to daily paid work.

No one can afford to remain unemployed, so people are obliged to take any work available, however intermittent or ill paid. Thus most employment is part time and long hours are usual, generally in low productive activities.

Daily paid workers experience a seasonal flux in demand for labour, and receive wage rates ranging from TK 45 per day in peak demand and Tk 24 in slack periods. Agricultural employment drops sharply in the months of September, October and November.

In general, most of the landless are absolutely poor; their annual per capita income is very low and they are characterised by low health and poor nutritional status, which also affects their capacity to work. They often have problems of access to institutional sources of credit and depend almost entirely on non-institutional sources. They have no interest in being members of any organized group. To the landless, making and eking out a living is a way of life.The self-perpetuating plight of the absolute poor has tended to cut them off from whatever economic progresses had taken place elsewhere in their own communities. The landless have remained largely outside the development effort; able neither to contribute much to it, nor to benefit fairly from it.

4.6 Nutrition and Health

Malnutrition is a widespread, persistent, and apparently increasing problem in the project area. Less than 5 percent of the population consume an adequate quantity and quality of food. Malnutrition most severely affects children under five years of age, and also pregnant and lactating women. Evidences show that the daily per capita calorie consumption has deteriorated significantly in the last two decades, compared with an estimated minimum daily requirement of 2,200 calories per capita per day, which reveals that average consumption is well below 20 percent of the requirements specially for the landless, marginal, small, female headed households and the fishermen communities, even ignoring unequal distributions of food between and within families (Table 4.7).

TABLE 4.7

Caloric Intake (per person/day)

	Landless	Marginal	Small	Medium	Large	Farmers	Women	Fishermen
Cereals	1631 (81)	1552 (70)	2202 (74)	2556 (69)	2950 (72)	2178 (73)	2131 (72)	2417 (68)
Fish/Meat/Pulses	165 (8)	283 (13)	344 (12)	499 (14)	567 (14)	372 (12)	295 (10)	528 (15)
Vegetables	223 (11)	373 (17)	415 (14)	635 (17)	585 (14)	446 (15)	550 (10)	596 (17)
Total	2019 (100)	2208 (100)	2961 (100)	3690 (100)	4102 (100)	2996 (100)	2976 (100)	3541 (100)

Note : Values in brackets are percentages relating to total caloric intake of each group

Source: Consultants Survey, 1992.

Although the field survey data shows a reasonable level of per capita caloric intake, the proportion or the percentage of main nutrients, the major sources of energy, is fairly low compared to the recommended level. Only 12% protein and 15% vegetables are consumed on an average by the farmers' group.

The low protein intake is attributed primarily to a decline in the consumption of pulses which has again resulted from the dominance of rice in the cropping patterns. The survey indicates an estimated 77 percent of the household were deficit in protein consumption. Furthermore, due to the calorie deficiencies, part of the protein consumed is converted for energy purposes, thus exacerbating the protein deficiencies. Average daily consumption of dietary fat was also severely deficient at about 5 gram per capita, representing only about 35 percent of the recommended level.

Deficiencies in essential micronutrient also characterize the typical diet in the project area. The high proportion of cereals (about 71 percent) in the diet, the low amount of protein, and the absence of fish, meat,milk, fruits and vegetables, all exacerbate the chronic situation of caloric insufficiency. Indeed, the survey results show that an increasing proportion of households specially from the landless, small and marginal farmers consume significantly less than the minimum requirements of all the major micronutrient.

The major determinants of food consumption in the project area are household income and wealth, which primarily depend on the ownership and the size of the landholding, employment and the price of rice. The survey reveals that the relationship between landholding and food intake is directly related. But cereal intake showed an inverse relation - it goes down with the size of land holding. Among food groups fish, meat, fruits and vegetables consumption was found to be directly related to income. Most of the nutrients showed a rising trend with the increase in the land holding size and a positive correlation was found between them. Malnutrition is, therefore, essentially a poverty and rural employment generation problem. The situation for the rural landless and the female headed families and those in the informal labour market is particularly difficult, reflecting the over-supply of labour and the declining average daily real wage rates of agricultural labour. Improving employment opportunities and increasing real income through income generating activities are of overriding importance in significantly improving the nutritional status of the poor in the project area.

The high incidence of diarrhoeal disease and intestinal parasites (Table 4.8) further compromises nutritional status in the project area, particularly among children under five, by limiting both the availability and absorption of food for metabolic use. Measles is also a major factor in precipitating severe or life threatening malnutrition.

TABLE 4.8

Diseases by Respondents

Diseases	Landless Farmer		Marginal Farmer		Small Farmer		Medium Farmer		Large Farmer		Farmer Total		Women		Fisherman		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Chicken Pox	11	73.3	9	60.0	11	73.3	8	53.3	6	40.0	45	60.0	11	73.3	5	33.3	61	58.1
Dysentry	1	6.7			4	26.7	2	13.3	4	26.7	11	14.7					11	10.5
Diarrhoea	14	93.3	13	86.7	12	80.0	12	86.7	11	73.3	63	84.0	12	80.0	11	73.3	85	81.9
Gastric			4	26.7	5	33.3	4	26.7	5	33.3	18	24.0					18	17.1
Fever	10	66.7	6	40.0	6	40.0	10	66.7	7	46.7	39	52.0	5	33.3	5	33.3	49	46.6
Others	1	6.7	2	13.3	1	6.7	2	13.3	5	33.3	11	14.7	2	13.3	2	13.3	15	14.2
Total Respondents	15	100	15	100	15	100	15	100	15	100	15	100	15	100	15	100	15	100

4.7 Vulnerable Groups

Female headed households, fishermen, landless, marginal and small farmer categories are the most vulnerable social groups in the project area. According to official estimates, in Bangladesh about 16% of the households are headed by females, this percentage may be even higher in the project area. Under the present socio-religious condition, while men have power and authority over women, they are also normally obliged to provide women with food, clothing and shelter. The reality of this arrangement diverges from the ideal. Certain women have always been vulnerable to being left exposed and without protection. Increasing poverty is placing strains even on the bonds of obligations and sometimes males from very poor households, who cannot fulfill their obligations towards their family, abandon them and their offsprings and migrate elsewhere.

Widowhood, separation or abandonment are generating an increasing number of women who must fend for themselves - and their children in an environment which presents very few opportunities for doing so. Most of these women and their household members live in extremely poor conditions. Although the total number of these "distressed" women is not known, they are estimated to be significant. It is anticipated that with the project intervention, the plight of these women group may be improved through the increased farm and off-farm activities but only if the project approach is designed to reach this group.

Marginal and small farmers living in the project area are two other vulnerable groups.

Given the small size of their holdings, marginal and small farmers are obliged to adopt a combination of survival strategies: one such strategy is sharecropping of land. The extent of sharecropping in the project area has been discussed earlier. Although all farmholding categories share some land in, the bulk of it (66% of all shared in land) is "shared-in" by the landless, small and marginal farmers. Conversely the largest amount of land "shared out" (almost 100%), originates from rich farmers. It seems marginal and small farmers also "share out" land. It is marginal farmers who sometimes obliged to share out their land and to engage themselves as day labourers because they cannot afford to buy the necessary inputs for agricultural operations, or they fall into debt to larger landowners or traders and may in the end lose all access to of their own land.

It could be argued that the tenancy market might have some moderating effect on the inegalitarian structure of land ownership. However, under the prevailing terms and conditions of share cropping tenancy, the tenant hardly receives more from the shared-in land than he would have received by selling his labour. In spite of new legislation , under most of the sharecropping arrangements, the tenant provides all the inputs but has to surrender 50% of the gross produce to the landowner as rent. A recent study indicates that for most of the crop varieties the return to sharecropper's labour is lower than the market wage rate (Cost and Returns Studies, 1982). Still, the tenancy arrangement is preferred to hiring out labour because of the security of employment it provides.

Another survival strategy adopted by marginal and small farmers is livestock rearing, or sharecaring stocks for richer households. Trading of livestock products - milk, ghee, eggs, hides and live animals - is an important source of income for the two categories of farmers. Although the size of the livestock owned increases with the size of holdings, livestock make a sizeable contribution to the meager cash flow of the landless, marginal and small farm households. Moreover, animal waste is a principal means of replenishing soil nutrients for the marginal and small farmers as well as a source of energy for fuel in the project area.

The majority of marginal and small farmers, however, cannot subsist on the produce - and income - derived from their land and from their livestock. They revert, along with some of their family members, to both wage labour and to non-farm activities in order to subsist.

Landless, marginal and small farmers are the main source of labour; primarily to medium and large scale farmers. Behind this overall pattern is hidden the fact that even the marginal and small farmers may hire in some labour. Thus in the project area, for example, the marginal and small farmers were found to hire in 5% of the labour used on their holdings. It should be realized, that some farm families only have one family labourer, and that there are seasonal peaks of labour requirements in excess of what is available within the family. Thus, the condition that the aggregate mandays of labour supply during the year is in excess of what holding at the disposal of the household can absorb is not a guarantee against hiring labour. Indeed, employment in the project area dominated by agricultural activities, is characterized by a great deal of seasonality. The pattern of seasonality differs significantly between rural communities depending on the cropping pattern prevailing in the micro-region. Broadly speaking, in the project area there are three peak seasons: the highest one occurs at harvest time of aman rice in November - December; another peak, nearly as high as the first, takes place in August- September when the dominant activities are harvesting of aus rice and jute and the translating of aman rice; a third peak occurs in April at the time of the harvesting of boro rice and the broadcasting of aus and aman rice. The slack seasons precede the peaks. Thus, a sharp decline in employment takes place just before the aman harvest, in the months of October and, partly, November. A second trough occurs in june- july and a third trough occurs in February-March. These slack seasons also coincide with a sharp drop of wage employment and with the cost of labour. This phenomenon is aggravated by the fact that during this period, marginal and small farmers are net buyers of foodgrains and that food prices are highest during this period. The nutritional consequences of these overlapping factors are poor health and malnutrition.

4.8 Income and Credit

Since wage labour opportunities are limited in the project area, especially in the dry winter season, wage sellers are often obliged to migrate to other areas in the hope to find even a few weeks of gainful employment. Although the total incidence of seasonal migration is believed to be high, its extent is not known.

Wages for both farm and non-farm employment are usually quite low. Reflecting the oversupply of labour; daily real wage rates of unskilled agricultural workers have declined in the project area in the last decade. The same holds true for employment in non-farm activities; they are generally of rudimentary nature with very low wages. Also, self-employment in the project area is rare and, moreover, has very low returns to labour. Therefore, marginal and small farmers in the project area have to work long hours most days of the year to earn very little income. The situation at the bottom end of land holdings is therefore one of very high intensity of low income employment.

For all the reasons outlined above, income levels of the poor segment of the population in the project area are low. Income estimates need to be taken with the usual precaution. According to the survey, annual average income of the marginal and small farmer groups was Tk. 34,656 comparable to the national average (Table 4.9). The Table 4.10 below shows that the average per capita income of the people of this area is approximately Tk 5729 whereas the farmers' average is Tk 6083. Mainly the very high per capita income differential is responsible for the discrepancy here. The per capita income of the large farmers is significantly high, Tk 12013, among the respondents while the landless group stands at the bottom of all groups with only Tk 3581.

TABLE 4.9

Income and Expenditure

	Landless	Marginal	Small	Medium	Large	Farmers	Women	Fishermen	Ave for all
Per capita income	3581	4095	5139	5587	12013	6083	4176	6929	5729
Per capita Expenditure	3749	4193	5179	5779	12719	6324	4632	6829	5928

Source: Consultants Survey, 1992.

Per capita expenditure is Tk 5928 for all groups while that for the farmers' group is a bit higher - Tk 6324.

In order to be able to anticipate how expected increase in levels of income in the target group population may affect future household consumption expenditure, it may be of interest to analyze present patterns of household consumption expenditure. These appear in Table 4.11. About 58% of the total consumption expenditure in low-income households is devoted to purchase of foodgrains compared to 46% in the high income groups. High income households allocate more than 41% of their total consumption expenditure to "other non food" which consists of services such as education, health, transportation and domestic services. For low income households the corresponding percentage share is about 13% of total expenditure. Expenditure elasticities of various groups of foods are considerably higher in low income than in high income households, whereas for total non-food expenditures elasticity is higher for high income households. The difference is even greater for the "other non food category": here high income groups have an expenditure elasticity almost twice as high as low income groups. The implication of these findings would appear to be that if the same expenditure pattern were to apply to the project area the demand for food items would increase. The viability of some off-farm activities such as crop processing and livestock products and by-products would tend to increase accordingly.

Sources of Credit

To take advantage of the developments proposed, credit will be required and it is anticipated this will be provided for LLPs, crop impute and to enable certain households such as the fisherman to relocate or take up alternate occupations. At present individuals obtain loans from both institutional (formal) sources such as commercial banks, KSS, Grameen Bank etc. and from non-institutional (informal) sources including money lenders; neighbours, relatives. Table 4.12 summarises the results of the Gorai Augmentation Project survey relating to credit.

The table reflects the difficulty of obtaining loans from the formal sectors particularly for the small farmers and landless. It is interesting to note that all women interviewed borrowed money from the Banks and not from non-institutional sectors. On the others hand fishermen almost entirely dependent on the informal sector for their credit needs.

4.9 Position of Women

As stated in the previous sections women are one of the most vulnerable social groups in the Area. Women have very low social status in the rural Bangladesh and is not different in the SWA. Increased poverty is placing strains on the bonds of obligations of marriage and sometimes husbands abandon their wives and children and migrate elsewhere in search of employment.

TABLE 4.10

Gorai Augmentation Project - Sources of Income

Sources of Income		Landless Farmer	Marginal Farmer	Small Farmer	Medium Farmer	Large Farmer	Women	Fisherman	Total
Main	Mean -	15973	16886	26187	31047	94155	8717	39260	33175
	Median -	10000	12900	24000	25000	70000	8000	25500	22400
	% -	64.56	58.03	65.12	65.14	76.32	56.87	84.94	71.10
Secondary	Mean -	5902	9907	8060	11320	13587	5363	4533	8382
	Median -	3100	5400	4000	2800		4000		2800
	% -	23.85	34.04	20.04	23.75	11.01	34.99	9.81	17.96
Others	Mean -	2867	2307	5967	5293	15633	1247	2427	5106
	Median -	2000		3000					
	% -	11.59	7.93	14.84	11.11	12.67	8.13	5.25	10.94
Total	Mean -	24741	29099	40213	47660	123375	15327	46220	46662
	Median -	20000	27500	30000	49500	82000	13000	30000	30000
	% -	100	100	100	100	100	100	100	100

TABLE 4.11

Gorai Augmentation Project - Expenditure by Heads & Groups

Heads of Expenditure		Landless Farmer	Marginal Farmer	Small Farmer	Medium Farmer	Large Farmer	Women	Fisherman	Total
Food	Mean -	16567	16045	22457	27350	48985	10705	24633	23820
	Median -	12600	13000	20000	28000	46800	10000	16000	18000
	% -	64.59	56.17	53.66	55.48	37.5	62.97	54.08	49.25
Cloth	Mean -	2173	2013	3060	3867	5967	1277	3667	3146
	Median -	1500	1500	2500	3000	6000	1000	2000	2000
	% -	8.47	7.05	7.31	7.84	4.57	7.51	8.05	6.51
Education	Mean -	180	1660	1010	2107	10300	373	1387	2431
	Median -			500	2000	5000			500
	% -	0.70	5.81	2.41	4.27	7.89	2.2	3.04	5.03
Shelter	Mean -	953	1220	1803	820	7633	1080	1507	2145
	Median -	500	500	1000	500	5000	100	500	750
	% -	3.72	4.27	4.31	1.66	5.84	6.35	3.31	4.44
Others	Mean -	3407	3083	7783	7740	36080	2150	3900	9163
	Median -	1500	2000	5000	4500	24000	500	2500	3000
	% -	13.28	10.79	18.6	15.7	27.62	12.65	8.56	18.95
Cr Repay	Mean -	1948	1171	3187	2938	1320	709	3133	2058
	Median -								
	% -	7.6	4.10	7.62	5.96	1.01	4.17	6.88	4.26
Savings	Mean -	220	327	1580	2900	13107	533	3027	3099
	Median -								
	% -	0.86	1.14	3.78	5.88	10.03	3.14	6.64	6.41
Cap. Exp	Mean -	200	3047	967	1573	7233	173	4300	2499
	Median -								
	% -	0.78	10.67	2.31	3.19	5.54	1.02	9.44	5.17
Total	Mean -	25648	28566	41847	49295	130625	17001	45553	48362
	Median -	20000	27500	36700	51600	94000	13000	30000	30400
	% -	100	100	100	100	100	100	100	100

Source : Consultants' Survey, 1992.

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TABLE 4.12

Gorai Augmentation Project : Sources of Credit

Sources of Loan		Landless Farmer	Marginal Farmer	Small Farmer	Medium Farmer	Large Farmer	Women	Fisherman	Total
I Formal									
	Mean -		267	500	1000		733	200	386
Comm Bank	Median -								
	% -		17.02	14.29	16.3		64.71	4.29	11.79
	Mean -	333	667	1000	1800	1633			776
Krishi Bank	Median -								
	% -	17.86	42.55	28.57	29.35	40.5			23.73
	Mean -	200	133		200		167		100
Grameen Bank	Median -								
	% -	10.71	8.51		3.26		14.71		3.06
	Mean -			333			233		81
Co-operative	Median -								
	% -			9.52			20.59		2.47
	Mean -								
BRDB	Median -								
	% -								
II Informal									
	Mean -	333	467	800	267			3400	752
Money Lender	Median -								
	% -	17.86	29.79	22.86	4.35			72.86	23.00
	Mean -	733	33	133	2000	2400		467	824
Relatives	Median -								
	% -	39.29	2.13	3.81	32.61	59.5		10.00	25.18
	Mean -			333				133	67
Neighbour	Median -								
	% -			9.52				2.86	2.04
	Mean -	267		400	867			467	286
Others	Median -								
	% -	14.29		11.43	14.13			10.00	8.73
	Mean -	1867	1567	3500	6133	4033	1133	4667	3271
Total	Median -			2000	3000			1500	
	% -	100	100	100	100	100	100	100	100

Source : Consultants' Survey, 1992.

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Survey information from women headed households (WHH) confirmed that their major activities, as with women in other households, predominantly centre around the household. A wide range of categories and activities were defined and the results are shown in Table 4.13. This shows that still household activities dominate all other activities. There was very little change in the activities carried out by WHH over the last five years and it is not expected to change in the future either. Significant activities outside the household work includes waged labour (40%), off-arm activities (26%), cooperatives (26%) and agriculture (13%). Although waged labouring has doubled over the past five years it is not expected in increase in the future.

TABLE 4.13

Gorai Augmentation Project : Activities of Women

Activities	Now		5 years Before		Expected	
	No	%	No	%	No	%
Household	15	100.00	15	100.00	15	100.00
Agriculture	2	13.33	1	6.67	2	13.33
Off Farm	4	26.67	3	20.00	2	13.33
Waged Labour	6	40.00	3	20.00	5	33.33
Cooperatives	4	26.67	2	13.33	1	6.67
Others	2	13.33	1	6.67	1	6.67
Total Respondents = 15						

For more than 90% of the women, firewood is the main source of fuel (Table 4.14) and a large proportion (80%) also used Bio-mass and crop residue. Not unexpectedly kerosine and electricity are the most least used (less than 10%) fuel.

TABLE 4.14

Gorai Augmentation Project : Sources of Fuel

Type of Fuel	Now		5 years Before	
	No	%	No	%
Firewood	14	93.33	13	86.67
Kerosine	2	13.33	2	13.33
Electricity	1	6.67	1	6.67
Crops Residue	12	80.00	13	86.67
Bio-mass	12	80.00	13	86.67
Total Respondents = 15				

4.10 Major Problems

Table 4.15 shows the response to the major devastating forces in the last six years. In 1992 draught was the overwhelming devastating force (72%) whereas four years before (in 1988) flood was the main cause of concern (98%). It is interesting to note that since 1989 flood is not a major threat in the project area and only about 4% thought that flood is major problem.

TABLE 4.15

Gorai Augmentation Project : Major Devastating Forces (all Respondents)

Devastating Forces	Year 1987		Year 1988		Year 1989		Year 1990		Year 1991		Year 1992	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Flood	85	81	103	98	9	9	4	4	4	4	4	4
Drought	3	3	4	4	6	6	7	7	8	8	75	72
Heavy Rainfall	10	10	12	11	4	4	34	32	4	4	23	22
Waterlogging	1	1	3	3			1	1	1	1	2	2
Total Respondents											104	100

4.11 People's Participation

The Gorai project area survey findings confirm that people in the project area in large numbers are willing to participate in the project interventions. However participation was qualified by enquiries about their willingness to provide land for the system implementation by the executing agency. About 55% of the respondents expressed their willingness to provide land (Table 4.16). Whether or not this would be followed up in practice is open to question, however, since ownership of land is one of the major sources of permanent income in the area.

4.12 Operation and Maintenance of the Project Structures

The operation and maintenance status of the prevailing structures in the project area are reported to be in a precarious condition. It is in the grip of interested groups. The survey shows that overwhelming majority (92%) are willing to participate in O&M activities (Table 4.17). Only about 6% of the respondents said they are not willing to participate and the majority are from the non-farmer groups. Asked for suggestions for implementing O&M, over 86% suggested to form an O&M committee and another 10% said that BWDB should be responsible for O&M (Table 4.18). Another suggestion was that O&M committee should be more broad based to include beneficiaries from the whole beneficiary areas so that people who are interested can voice their views regarding impacts of the project in the adjoining areas. Nearly half the respondents (46%) were willing to give their services voluntarily if it is to benefit the Project.

4.13 Types of Social Conflicts and Their Resolution

There are various types of social conflicts in the area. Some of them are traditional and some are new; as for example quarrel over the distribution of irrigation water is a new phenomenon. It is to be mentioned in comparison to other areas the disputes over irrigation water was mentioned by relatively few respondents, 21%. Nearly 9% of respondents said there is no major conflict but 83% said that powerful sections often create problem as a

TABLE 4.16

Gorai Augmentation Project - Willing to Provide Land

Allow BWDB to	Landless Farmer		Marginal Farmer		Small Farmer		Medium Farmer		Large Farmer		Farmer Total		Women		Fishermen		Total	
Acquire Land	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Willing	4	26.67	9	60.00	13	86.67	14	93.33	15	100.00	55	73.33	2	13.33	1	6.67	58	55.24
Not Willing	2	13.33	4	26.67	2	13.33	1	6.67			9	12.00	9	60.00	4	26.67	22	20.95
No Response	9	60.00	2	13.33							11	14.67	4	26.67	10	66.67	25	23.81
Total	15	100.00	15	100.00	15	100.00	15	100.00	15	100.00	75	100.00	15	100.00	15	100.00	105	100.00

TABLE 4.17

Gorai Augmentation Project - Participation in O&M

Participation	Landless Farmer		Marginal Farmer		Small Farmer		Medium Farmer		Large Farmer		Farmer Total		Women		Fishermen		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
WIlling	13	86.67	15	100	14	93.33	15	100.00	15	100	72	96.00	13	86.67	12	80	97	92.38
Not willing	1	6.67			1	6.67					2	2.67	2	13.33	3	20.00	7	6.67
No Response	1	6.67									1	1.33					1	0.95
Total	15	100.00	15	100.00	15	100.00	15	100.00	15	100.00	75	100.00	15	100.00	15	100.00	105	100.00

TABLE 4.18

Gorai Augmentation Project - Suggestion for O&M

Suggestions	Landless Farmer		Marginal Farmer		Small Farmer		Medium Farmer		Large Farmer		Farmer Total		Women		Fishermen		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Voluntary Services	5	33.33	8	53.33	9	60.00	7	46.67	10	66.67	39	52.00	5	33.33	4	26.67	48	45.71
O&M Committee	15	100.00	11	73.33	13	86.67	12	80.00	15	100.00	66	88.00	12	80.00	13	86.67	91	86.67
BWDB					3	20.00	2	13.33	4	26.67	9	12.00			2	13.33	11	10.48
Existing System							2	13.33			2	2.67			1	6.67	3	2.86
Any Other					1	6.67					1	1.33					1	0.95
Total Respondents	15	100.00	15	100.00	15	100.00	15	100.00	15	100.00	75	100.00	15	100.00	15	100.00	105	100.00

Source : Consultants' Survey, 1992.

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TABLE 4.19

Gorai Augmentation Project - Social Conflicts

Social Conflicts	Landless Farmer		Marginal Farmer		Small Farmer		Medium Farmer		Large Farmer		Farmer Total		Women		Fishermen		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Water Problem	1	6.67	4	26.67	2	13.33	6	40.00	1	6.67	14	18.67					14	13.33
Quarrel:Water Distribution	4	26.67	5	33.33	3	20.00	6	40.00	3	20	21	28.00	1	6.67			22	20.95
No Major Conflict					3	20.00	1	6.67	5	33.33	9	12.00					9	8.57
Village Cooperatives											3	4.00					3	2.86
Powerful Section					3	20.00					5	6.67	2	13.33			7	6.67
Other Conflicts					2	13.33	2	13.33										
Total Respondent *	15	100.00	15	100.00	15	100.00	15	100.00	15	100.00	75	100.00	15	100.00	15	100.00	105	100.00

TABLE 4.20

Gorai Augmentation Project - Resolution of Conflicts

Resolution of Project	Landless Farmer		Marginal Farmer		Small Farmer		Medium Farmer		Large Farmer		Farmer Total		Women		Fishermen		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Through Discussions	4	26.67	4	26.67	3	20.00	7	46.67	5	33.33	23	30.67	1	6.67			24	22.86
Lessening Water Supply									1	6.67	1	1.33	1	6.67			2	1.9
Through Vill Panchayet	1	6.67			3	20.00	1	6.67	2	13.33	7	9.33					7	6.67
Union Council	1	6.67			1	6.67					2	2.67					2	1.9
Other Means	1	6.67	2	13.33	3	20.00	1	6.67	1	6.67	8	10.67					8	7.62
Total Respondent *	15	100.00	15	100.00	15	100.00	15	100.00	15	100.00	75	100.00	15	100.00	15	100.00	105	100.00

Note : * These are not column totals, rather total number of respondents

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result of the Patron-Client relation in the area (Table 4.19). It would be summarised that the powerful sections of the community are controlling events in the area though the majority replied that there was no major conflicts and this could be misleading and may not reflect the real situation. The poorer section of the group may not be willing to express their attitude against dominance of the more powerful section.

Through field observation concerning group conflicts would be identified.

There is a serious conflict in O&M of the Pateswari regulator. The construction work of BWDB and embankment is disturbed by particular groups of people. The general public is not willing to express their views against this group. This is hampering the development activities in the area. It is also observed that these groups are politically motivated.

These socio-political factors need to be confirmed objectively at the feasibility stage that may follow this study.

The major resolutions are made through natural discussion (22%). Others are through Village Panchayet (7%) and Union Council (2%) (Table 4.20). The incidence of litigation is less. But there is no resolution for the unhidden issues as mentioned above.

4.14 Co-operatives and NGOs

There are different types of organisations both governmental and non-governmental (NGO) working in the rural area in SWA with the specific concepts of rural development poverty alleviation through motivation and human resource development (Table 4.21). The Bangladesh Rural Development Board (BRDB) under the Ministry of Local Government and Rural Development (LGRD) is the pioneering body representing the government responsible for rural development. The government has a co-operative division also working for the rural community through co-operative ventures. These are mostly professional as Farmers' Co-operative Societies, Landless co-operative, Fishermen co-operative etc. After independence there developed the non-governmental organisations and agencies (NGO) mostly engaged in relief and rehabilitation activities as CARE, WFP and some local as BRAC (Bangladesh Rural Advancement Committee). In course of time these NGOs increased in a massive way with the programme of rural development through poverty alleviation and other programming like education in different types of Income Generating Activities (IGA). There are as many as 400 NGOs in Bangladesh presently. They are playing a vital role in the rural community throughout Bangladesh.

The study briefly looked at the NGOs working in the area and their types of involvement in rural community. This may help motivating and participation of the beneficiaries to the proposed plan.

Bangladesh Rural Development Board (BRDB) Proshika both Dhaka and Comilla Land source local NGOs like Asho Samaj Gori, Gono Shahajya Sangstha, Banchte Shekho, Kajer Dak, and some local Youth Clubs are operating their programmes of rural development (Table 4.22). Except Proshika other groups are at limited stages.

TABLE 4.21

Gorai Augmentation Project - Cooperatives and NGOs Active in the Project Area

Names of Cooperatives and NGOs	Landless Farmer		Marginal Farmer		Small Farmer		Medium Farmer		Large Farmer		Farmer Total		Women		Fishermen		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
BRAC	3	20.00	7	46.67	6	40.00	7	46.67	8	53.33	31	41.33	6	40.00	3	20	40	38.1
Grameen Bank	2	13.33	1	6.67			4	26.67			7	9.33	4	26.67			11	10.48
Proshikha	2	13.33							1	6.67	3	4.00	2	13.33			5	4.76
BRDB / PEP	1	6.67	2	13.33	3	20.00	2	13.33	2	13.33	10	13.33	1	6.67			11	10.48
Women Development			1	6.67	1	6.67			1	6.67	3	4.00			1	6.67	4	3.81
SPPI									1	6.67	1	1.33					1	0.95
Asho Shamaj Gori															1	6.67	1	0.85
Banchte Shakho																		
Others	8	53.33	10	66.67	5	33.33	6	40.00	8	53.33	37	49.33	6	40	12	80	55	52.38
Total Respondent *	15	100.00	15	100.00	15	100.00	15	100.00	15	100.00	75	100.00	15	100.00	15	100.00	105	100.00

TABLE 4.22

Gorai Augmentation Project - Activities of NGOs and Cooperatives

Activities of Cooperatives and NGOs	Landless Farmer		Marginal Farmer		Small Farmer		Medium Farmer		Large Farmer		Farmer Total		Women		Fishermen		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Loan Disbursement	6	40.00	14	93.33	9	60.00	13	86.67	11	73.33	53	70.67	15	100.00	3	20.00	71	67.62
Income Gen. Project	10	66.67	5	33.33	3	20.00	2	13.33	3	20.00	23	30.67			1	6.67	24	22.86
Women Programs			1	6.67	1	6.67	1	6.67			3	4.00			2	13.33	5	4.76
Social Forestation			1	6.67	1	6.67	1	6.67			3	4.00	1	6.67			4	3.81
Seri - Culture																		
Other	4	26.67	6	40.00	6	40.00	3	20.00	6	40.00	25	33.33	4	26.67	6	40.00	35	33.33
Total Respondent *	15	100.00	15	100.00	15	100.00	15	100.00	15	100.00	75	100.00	15	100.00	15	100.00	105	100.00

Note : * These are not column totals, rather total number of respondents

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4.15 Expected Impact of the Proposed Project Intervention

The Project area is presently characterised by low levels of agricultural production causing acute level of poverty. Economic and social benefits are expected to accrue from the proposed Project. The envisaged physical improvements from the interventions proposed under the project and other associated developments within the project area can be summarised as follows :

During the monsoon period :

(a) Controlled monsoon flows through the Gorai to a maximum of its present dominant discharge which would remove drainage congestion in substantial areas in the Southwest Region north of Khulna;

(b) Controlled drainage and internal water management through compartmentalisation;

(c) Controlled flooding through construction of FC embankments and outfall regulators, and associated developments;

(d) Controlled flood flows directed to beels to improve fisheries potential;

During the dry season :

(e) Improved flow down the Gorai / Madhumati in support of irrigated agriculture;

(f) Allocation of potable water use in the industrial town of Khulna;

(g) Improved navigability particularly for the country boats;

(h) Allocation of water to beels to maintain minimum storage for fisheries needs.

The group that will mainly benefit from the project is the farmers who would not only have opportunity to increase HYV cultivation during all seasons and thereby increase the cropping intensity but also better category of lands when inundation depths are reduced. There will also be opportunities to improve fisheries in most beels.

Improvement in the agricultural production and fish productivity will accelerate the mobility of the economic activities. As a consequence, increase in employment opportunities for the agricultural and non-agricultural population, improvement in the wage situation, improvement in the standard of living etc will take place implying a step forward towards poverty alleviation - the major concern of most of the projects. Undoubtedly, the most vulnerable social groups, the landless and the marginal farmers, will be positively benefitted, to a great extent, through the process of being taken up from below the absolute poverty line and will develop entrepreneurial ability of some people also.

Improved standard of living will enable the rural people to afford better health and sanitation facilities in addition to achieving better nutritional levels. They are expected to enjoy improved quality of life if they are guided in the correct direction as far as the health and hygiene are concerned.

Construction of some new embankments and proper maintenance of the old ones as required by the implementation of the project will provide an improved rural transport and land communication facilities to the inhabitants which will, probably, also create some new jobs in this area. The project would also reduce inundation (local runoff) of the low lying areas, thus giving further security to life and agricultural production.

As far as the operation and maintenance of the project is concerned the beneficiaries of the project will participate spontaneously with the view to protect themselves from any further devastation and their agricultural benefits.

About two percent of land will have to be acquired for the construction of the canal and drain network and short lengths of new embankments, which will still be considered as a disbenifit by the beneficiaries. But this is an inevitable situation which goes with implementing any structural project. Compensatory measures will have to be provided for the affected people.

Another major disbenefit identified is with the fisheries. It is estimated that the area of floodplains for fisheries will be reduced by approximately 37% due to the implementation of the project which needs to be assessed with greater emphasis in any future feasibility studies. Embankments will create hindrance to the natural movement of the open water fisheries and therefore will affect the traditional capture fishing community which, eventually, will likely to lead them to change their profession. However, there would be potential for fisheries programmes in the secured beels and in the canal/drain network.

The results presented in Table 4.23 shows the beneficiaries perceptions of the benefits of the proposed project. The results show that the people expected more benefits than disbenefits out of the project with some degree of variation from group to group. Overwhelming majority of the respondents (86%) irrespective of groups indicated that increased income will be a major benefit. Almost all farmers expected increased production (88%) as the primary benefit.

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TABLE 4.23

Gorai Project : Expected Benefits and Adverse Effects of the Proposed Project

Benefits/Adverse Effects	Large Farmer		Medium Farmer		Small Farmer		Margin. Farmer		Landless		Farmer Total		Women		Fisherman		Total	
	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%
Benefits																		
1 Overall Benefit	4	27	2	13	6	40	8	53	7	47	27	36	4	27	6	40	37	35
2 Increased Income	10	67	14	93	12	80	15	100	14	93	65	87	14	93	11	73	90	86
3 Increased Production	13	87	15	100	15	100	15	100	8	53	66	88	6	40	1	7	73	70
4 Increased Intensity	6	40	4	27	8	53	9	60	2	13	29	39	1	7			30	29
5 Adequate Water Supply	4	27	4	27	3	20	5	33	1	7	17	23	1	7	2	13	20	19
6 Communication	2	13	2	13	2	13	1	7	1	7	8	11			3	20	11	10
7 Flood Control	1	7	2	13	2	13	1	7	1	7	7	9	1	7	2	13	10	10
8 More Business	1	7							1	7	2	3	2	13			4	4
9 More Employment	1	7	5	33	4	27	6	40	5	33	21	28	8	53	8	53	37	35
10 Developed fish culture			2	13							2	3			14	93	16	15
Adverse Effects																		
1 Land Acquisition	5	33			2	13			2	13	9	12					9	9
2 Fish reduction	1	7									1	1			2	13	3	3
3 Navigation problem	1	7									1	1					1	1
4 Increased water logging			1	7	1	7					2	3					2	2
Total Respondents	15	100	15	100	15	100	15	100	15	100	75	100	15	100	15	100	105	100

Major Benefits can be summarised in Table 4.23 by group/community.

TABLE 4.24

Summary of Expected Benefits

Benefits	Farmers %	Fishermen %	Women %
Increased Production	88	7	40
Increased Income	87	73	93
Flood Control	9	13	7
More Employment	28	53	53
Adequate Water Supply	23	13	7
Communication	11	20	-
Development of Fish Culture	3	93	-

Though there have been identified as many as 10 benefits only 5 are found common to all group of respondents. These figures should be treated with caution but they show a trend and are in consistent with studies elsewhere. Farmers appear to be the most benefitted group, followed by fishermen and women.

Land acquisition was identified as the most disbenefit of the project, however the number of respondents who replied in the affirmative mere for less than expected (9%). Of the groups the large farmer group are the most people who said land acquisition is the most adverse effect (33%) compared to 12% to all farmers.

The results of the disbenefits are summarised in Table 4.25 below:

TABLE 4.25

Summary of Expected Adverse Effects

Adverse Effects	Farmers	Women	Fishermen
Land Acquisition	12	-	-
Fish Reduction	1	-	13
Navigation Problem	1	-	-
Increased Water Logging	3	-	-

5 INSTITUTION

5.1 General

Institutions in SWA are covered under five headings: public administration; institutions involved in the control, conservation and exploitation of water resources and organisations whose activity clearly support and enhance water sector projects but are not dependent upon them; coordination of development agencies; people's participation; water users associations and finally a series of recommendations. The position of the institutions covered is viewed primarily in the light of the need to develop practical and effective inter-organisational links and real public participation in the proposed water resource development projects in SWA.

It is realised that in Bangladesh there are a multitude of agencies, mainly Non-Government Organisations (NGOs), involved in rural development, often at the field level and targeted to specific social groups. These bodies play an important and at times a very effective part in enabling sections of the community to take advantage of water resource developments, but the individual NGO's impact on a regional scale may not be great. Collectively NGOs are important, however, especially in bringing benefits to the poorer sections of the community and their existence cannot be ignored. The larger of these institutions are referred to later in this section. It is increasingly realised that to achieve full benefits of development schemes and to ensure as far as possible the equitable division of benefits throughout the community requires the inclusion of NGOs as representatives of the more vulnerable social groups at all stages of project preparation, design and implementation.

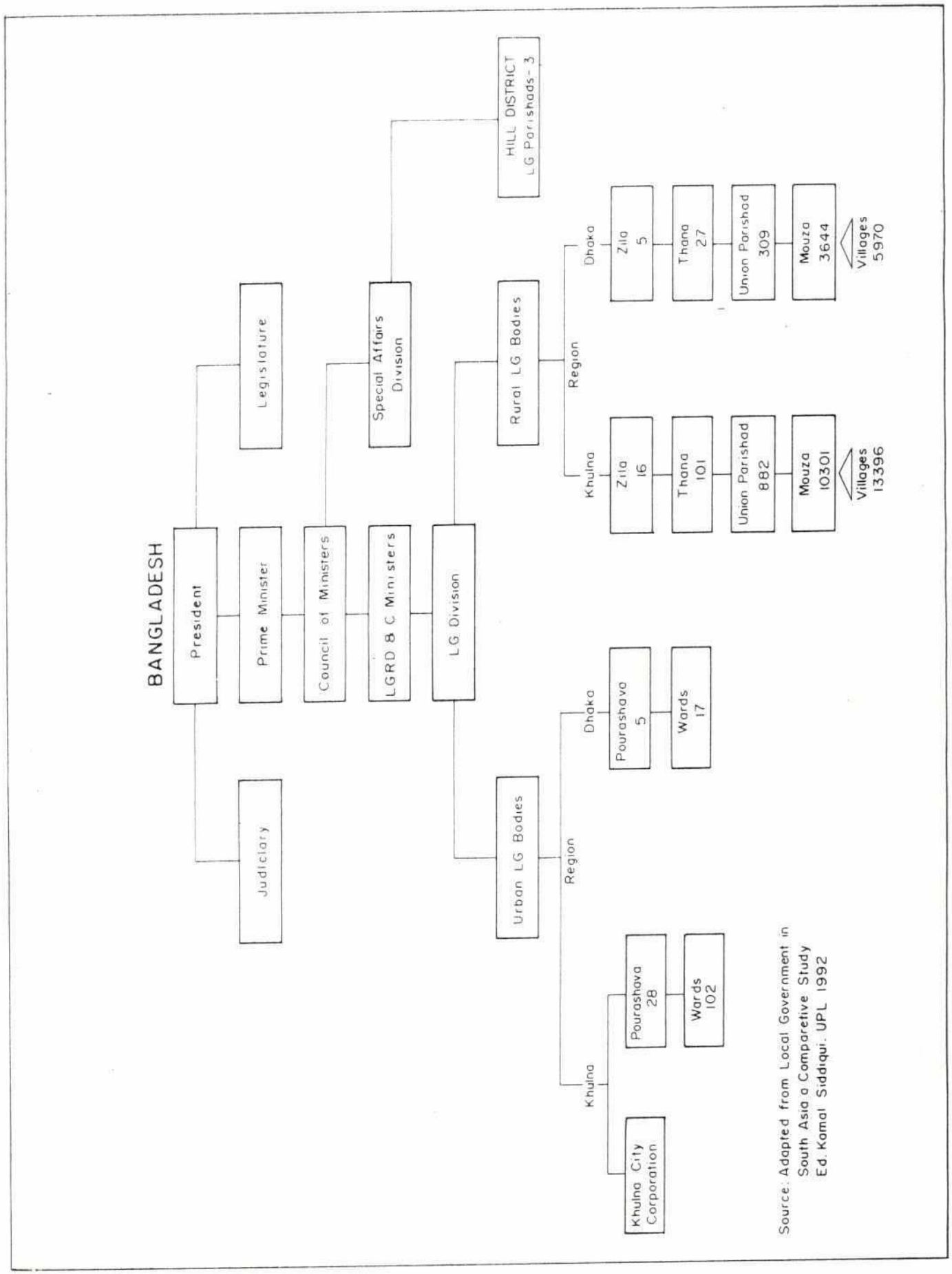
5.2 Public Administration

The Ministry of Local Government, Rural Development and Cooperatives (MLGRDC) is responsible for local government administration. The structure for public administration in the urban and rural areas of SWA is illustrated in Figure 5.1.

The SWA falls within three administrative divisions; Khulna, part of Dhaka and the newly formed Barisal Division. Public affairs are regulated in the area by one metropolitan city corporation (Khulna), 28 municipalities and 29 districts known as Zillas. There are 128 Thanas (formerly upazillas), which are the principal blocks for the administration and implementation of many development schemes in rural areas. Each thana serves a population of about 185,000 grouped usually into nine Union Parishads which vary considerably in physical area but average about 260 km^2. The village, the basic social unit, has no legal standing in the country's administrative system. However each Union Parishad is composed of a number of mauzas or villages, typically 8 to 16. The mauza has no physical location but is the smallest legally recognised unit for revenue collection and administration. The Union Parishad is the lowest tier within the local government system and is responsible for many of government's development and administrative functions in the rural areas. Union Parishads are composed of a democratically elected body, headed by a chairman.

The Thana administration is run by a civil servant, the Thana Nirbahi Officer (TNO). It is the prime unit for planning and implementing government development initiatives at the micro level. The TNO assists and coordinates officers of various line agencies in a wide range of development activities including education, health, social welfare, cooperatives, agriculture, livestock, fisheries etc.

Figure 5.1



Local Government Structure

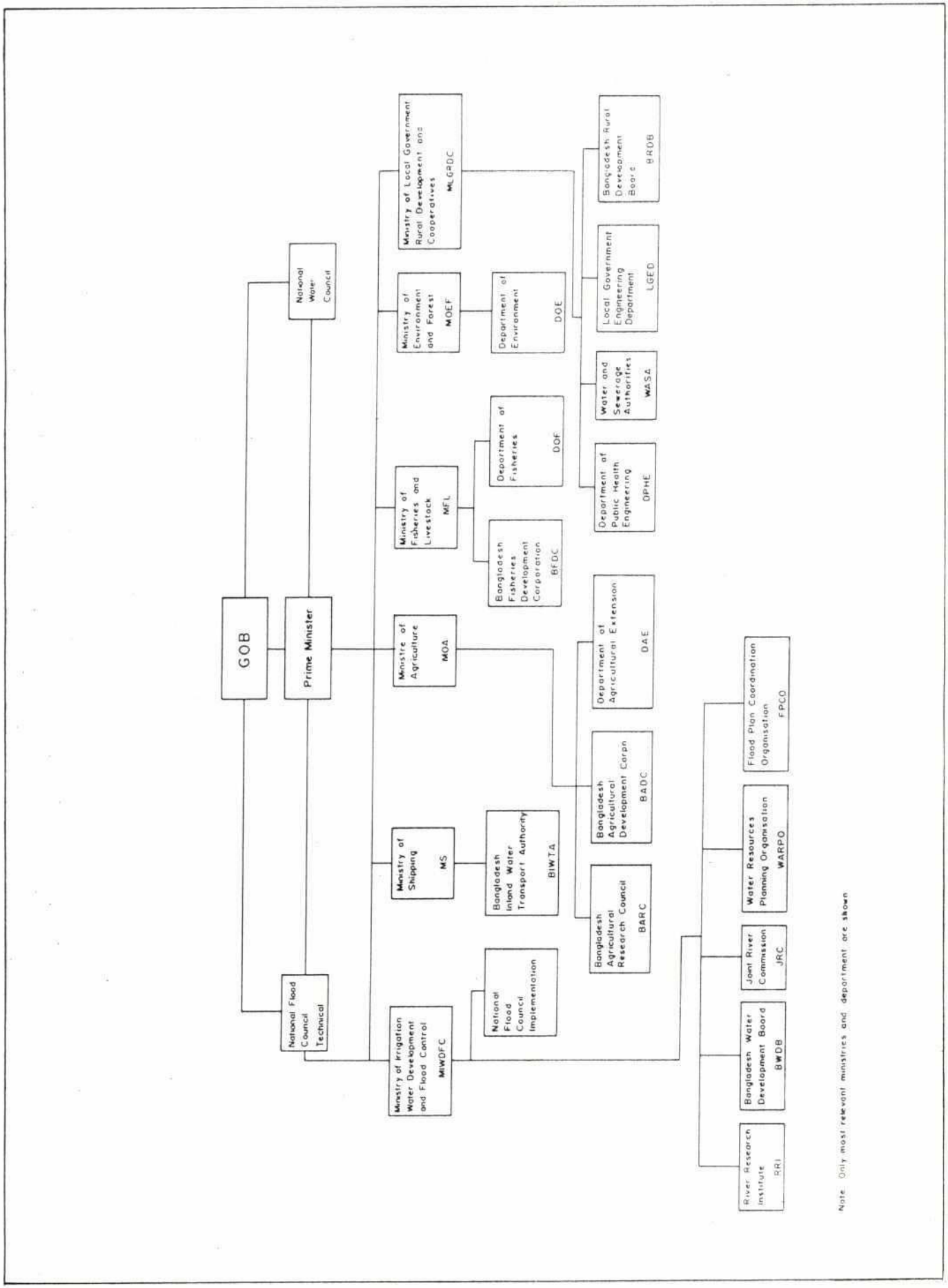
5.3 Institutions Involved in Water Resources Development

Figure 5.2 shows the position of the major government ministries and their related executive agencies. Those with a direct bearing on water resource management include the National Water Council (NWC) and the National Flood Council (NFC), both headed by the Prime Minister. The NWC is responsible for national policy and strategic guidance for water resource development. The NFC's brief is more directly concerned with technical aspects and implementation at the highest level.

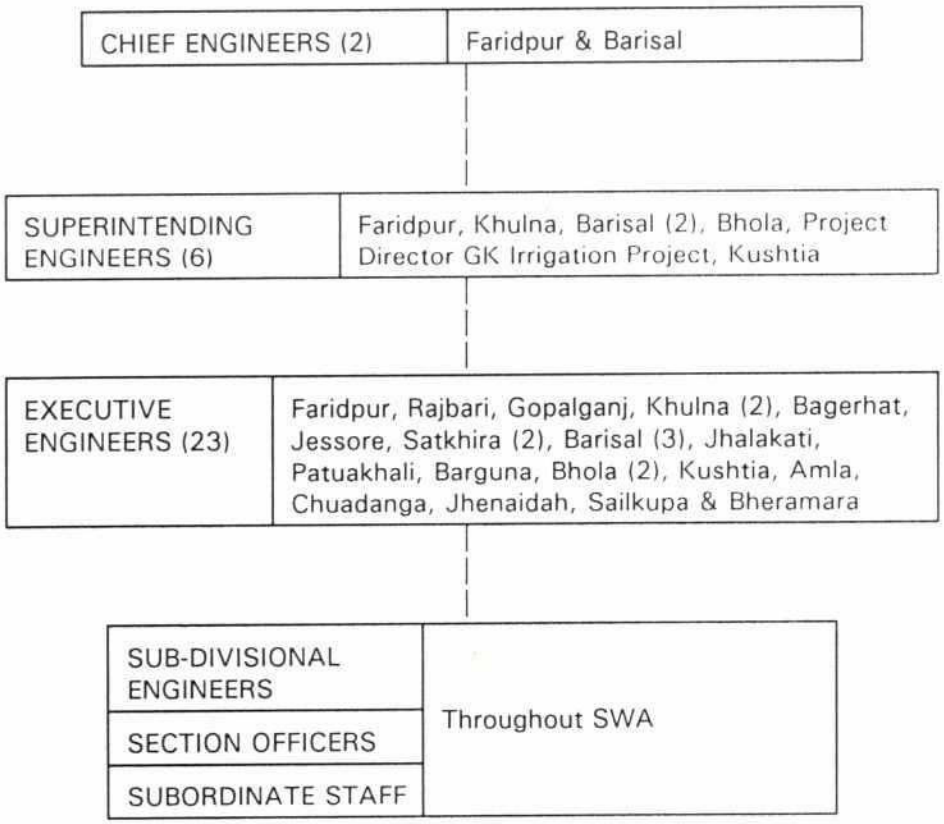
The Ministry of Irrigation, Water Development and Flood Control (MIWDFC) is the agency with greatest responsibility and is expected to continue to be involved in both the development and management of water resources. It includes a number of agencies with specific responsibilities in the field of water resource management. The Water Resources Planning Organisation (WARPO) has succeeded the Master Plan Organisation (MPO) and is government's permanent planning institution in the sector. The Flood Plan Coordination Organisation (FPCO) is an independent agency specially established within MIWFDC to manage and coordinate FAP studies. The Bangladesh Water Development Board (BWDB) is a semi-autonomous Public agency under the direct administrative control of MIWDFC. It is responsible for planning, implementation and O&M of large, medium and small-scale FCD/I Projects. BWDB has established an O&M organisational structure and the management system for O&M on FCD/I Projects has a hierarchy of BWDB officers and engineers whose responsibility is to supervise the work of employees, who are assigned to each physical structure and to specified lengths of embankment. BWDB is the leading agency in the water resources development sector and flood control has undertaken both large and small scale water resources projects.

The BWDB Southwest Zone covers SWA from Chief Engineers' Offices in Faridpur and Barisal. The Area's BWDB structure is as follows:

Figure 5.2



Ministries with Water Resources Interest



A number of other institutions are responsible for various aspects of the development of agricultural sector and, therefore, are indirectly concerned with the country's water resources.These include the Bangladesh Agriculture Development Corporation (BADC), Bangladesh Rural Development Board (BRDB), Bangladesh Krishi Bank (BKB), Rajshahi Krishi Unnayan Bank (RAKUB), Department of Environment (DOE), the Department of Forestry (DOF), Department of Agricultural Extension (DAE), Department of Fisheries and Livestock. On the research side, under the National Agriculture Research System (NARS), the Bangladesh Agriculture Research Council (BARC) is the key organisation. Institutions that are affiliated with BARC are the Bangladesh Agriculture Research Institute (BARI), Bangladesh Rice Research Institute (BRRI), Bangladesh Jute Research Institute (BJRI), Bangladesh Institute of Nuclear Agriculture (BINA), Bangladesh Agricultural University (BAU) and the Sugarcane Research Institute (SRI). All of these agencies operate more or less autonomously and coordination of policies and related activities is generally absent. Figure 5.2 presents the position of these major government ministries and their related-agencies.

The Bangladesh Agricultural Development Corporation (BADC), Bangladesh Rural Development Board (BRDB) and Bangladesh Krishi Bank (BKB) also play a significant role in the operation and maintenance (O&M) of FCD/I projects.

The concept of small scale irrigation programmes in rural development originated from the Thana Irrigation Programme (TIP) designed by the Bangladesh Rural Development Academy (BARD) in 1962. As a component of integrated rural development, small-scale projects for flood control, drainage and irrigation have been implemented to support agricultural development. Under several rural development projects the distribution of minor irrigation equipment was promoted, and, under irrigation management programmes in the rural development sector, training of irrigation operators and group managers has been undertaken. In 1984 Government adopted a strategy for Rural Development Projects

(SRDP) that envisaged over a 10 year period (FY 1984 - FY 1995) an additional 930,000 ha of irrigation programmes including quick-yielding projects that include small-scale flood control, drainage and irrigation.

Since 1986 the Local Government Engineering Department (LGED), formerly LGEB, has developed its own small-scale water resources development schemes with some degree of beneficiary participation in Faridpur, Madaripur, Gopalgonj, Rajbari (within SCR) and Kurigram (in NWA) districts under the Infrastructure Development Project (IDP) of the Rural Employment Sector Programme (RESP) financed by the Swedish International Development Agency and the Norwegian Agency for Development Corporation. These small-scale FCD schemes (200 to 600 ha sub-projects) have been successfully implemented by local government staff under the supervision of LGED which has completed 35 small-scale water resources development schemes with a further 26 on-going schemes, covering an area of 25,000 ha. Since the FFYP envisages expansion of irrigated agriculture through the provision of small-scale flood control and drainage facilities and also with the change of the organisational status of LGED, the role of LGED is expected to increase. Recently the Asian Development Bank has approved a TA to undertake a feasibility study for small-scale water resources projects in the western part of the county.

Bangladesh Rural Development Board (BRDB) was established to assist in the rural development and poverty alleviation efforts of government through the establishment of a strong rural institutional infrastructure across different segments of the population. BRDB is also responsible for supervising farmers Co-operatives, for coordinating all concerned government agencies in mobilizing supplies, services and support for KSSs and the TCCA system. The BRDB also promotes intensive agriculture, mainly through the use of mechanized irrigation facilities using surface and groundwater. However, the emergence of private management of irrigation has changed the dimension of irrigation practices. Firstly, in some cases, the internal dynamics of KSS groups has led to Cooperative management being discredited or ousted from control, enabling private management to move in. Secondly, since non-KSS groups or individuals are now permitted to buy irrigation equipment on the open market, it has become possible for such private agents to offer their services to those farmers who have no irrigation schemes of their own, including KSS groups. This may be seen as a process of the takeover of the irrigation management of KSS groups by private enterprises from outside. Finally, there are more complex cases where private operators in mixed management systems have broken free of their dependence on KSS allotment of irrigation equipment, and have developed into full-fledged private enterprises. This change to private sector development will be strongly supported by the World Bank funded National Minor Irrigation Development Project (NMIDP) and ADB supported Northeast Minor Irrigation Development Project. Thus government's privatisation policy has substantially undermined the cooperative sector by reducing its attractiveness to farmers as a source of access to production inputs. This has been clearly inconsistent with the government's original intention of making the KSS-TCCA system the principal vehicle for disseminating improved farming technology.

5.4 Coordination among Development Agencies

Water resources management and agriculture requires coordination of the work of all agencies involved in providing technical and institutional support and services to the farmer. There are two critical dimensions to this coordination. First, coordination between government agencies involved with the common purpose of creating agricultural facilities, and second, the linkages between the owners of these facilities and their users, usually farmers and farmer groups. Regarding the first, coordinated approach towards development and implementation of all schemes in the water resource sector that reflects the need policies in the national plan is critical. This means an integrated system of planning, that incorporates the activities of all concerned organisations and sets out their

short and long term roles. This form of planning management shifts the emphasis from project-oriented planning to goal-oriented planning. Under BWDB, planning has been mainly project-oriented, responsive to the requirements of other agencies. BWDB clearly has overall responsibility for planning in the water resources sector, but a serious gap exists at the lower level (Thana) between the planners of large flood control and drainage projects and those institutions that look after the installation of small pumps and water management within the command areas of these pumps. An overall consistency in the planning approach is lacking, between BWDB and other agencies concerned with minor irrigation, on such issues as policy on water charges, pump ownership and the sharing of responsibilities between the institutions and the beneficiaries.

Only in a few large scale BWDB Irrigation projects like Chandpur and Barisal Irrigation projects has some inter-agency coordination been obtained through a Project Implementation Committee (PIC), with members drawn from other involved agencies, BADC, BRDB, DAE etc. There is one interesting matrix management concept where the committee members remain responsible to their respective organisations but are also responsible for the project.

Looking at the second aspect of coordination between the executing agency and user group, it should be clear that there must be some point in the water resources development and management system where government institutions should mesh with people's organisations such as Co-operatives, farmers' associations or water user groups. For effective operations of a developed system, there has to be some form of joint management between the project executing agency and beneficiaries. Planning new systems should also be the joint effort of both the development agency and project beneficiaries. Experience in other countries shows that where irrigation facilities need to be managed communally, substantial efforts are required to enable the irrigators to organise themselves effectively before decisions are taken on planning and installation and the best results occur where beneficiaries are actively involved in the decisions about the physical development of the project.

5.5 People's Participation

The success of any development plan depends on the active support of the people it is designed to benefit. Unfortunately, in the case of BWDB, except in very small scale projects conceived at the field level, there is very little input from the beneficiaries in project planning, implementation and O&M. Projects developed by BWDB have a major impact on the lives of the people in a project area. But for many projects beneficiaries have been hardly involved in the project preparation and implementation. This lack of participation causes misunderstanding and delays in project implementation, resulting in under performance and delays in reaching full development as well as difficulties in cost recovery. Operation and maintenance is another neglected component of BWDB executed FCD/I projects. Lack of proper operation and maintenance has resulted in many FCD/I projects not yielding their full potential, expected benefits of improved crop production and increased economic activity in rural areas have not been realised. The Government is fully aware of these problems and has formulated a strategy for the development of water resources that includes: (1) motivating and training potential beneficiaries of completed and on-going projects ; (2) creating and stimulating interest of the people in a promising project area; (3) selecting projects for implementation where the people have expressed a clear interest; (4) the formation of polder committees and through these involving the people in future development initiatives right from the project identification stage to project implementation and the operation of the facilities. Unfortunately, there have been no serious efforts to implement this strategy. Local involvement in Project Planning has been grossly neglected and links with local bodies are not maintained for project identification and planning, even in the small-scale Food for Works Programme schemes. This does not

necessarily mean that omitting local participation from the planning process is entirely BWDB's fault. Experience has shown that people's participation in local water sector planning is full of pitfalls. These include : (1) bureaucratic domination by the agency which bears the prime responsibility for the project, making the role of public representation nominal; (2) local project polder committees tend to be infiltrated by small groups of rural elite representing only their vested interests, which takes objectiveness away from project selection ; (3) as many water development projects impact very large areas and local problems arise from non-local causes, peoples cooperation is difficult to obtain. These externalities require a greater degree of centralized planning. Thus, there has to be a trade-off between the extent of satisfying local demand and the preservation of equity for the entire population affected by the plan. Only a national planning organisation with adequate local participation can achieve this.

The result of good planning and implementation is reflected in the projects benefit. The actual 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. Most FCD/I projects executed by the BWDB are under performing. For example, only 49 percent of the total command area under System Rehabilitation Project (SRP) was irrigated and there has been severe under-utilisation of other ground and surface water irrigation projects. In the BIP phase 1, only 18 percent of the designed command area was utilised. Reasons for this massive under performance have been identified as : (1) defective physical design ; (2) lack of credit facilities for farmers ; (3) absence of effective extension services ; (4) poor operation and maintenance and (5) absence of able leadership within farmers groups in the project area. All of these imply that certain essential linkages in the project between the responsible agency and groups of individual beneficiaries were missing.

A significant characteristic of FCD and surface irrigation schemes is that they involve whole communities. They are not and cannot be directed specifically towards particular groups such as the more vulnerable small scale and marginal farmers, fishermen or the landless.

As a result of the past experiences illustrated earlier the importance of people's participation (PP) in planning, implementation and operation of development projects has been recognised. FPCO has issued guidelines (GPP) for FAP projects and a parliamentary bill to provide public participation in flood control, drainage and irrigation introduced in 1992 is reported to be under consideration.

How effective the proposed GPPs will be when applied to FCD/I schemes will be largely determined by the political will and commitment of project implementing agencies towards incorporating people in project activities. Participation is a political and a local issue. Apart from the lack of political willingness at the government and the project level, effective people's participation may be restricted or made ineffective by localised village politics and/or individuals with specific interests of their own.

Although the concept of people's participation defined by FPCO (1992) is very comprehensive, evidence suggests that PP in FCD/I projects has so far been used within a very narrow context. Two different conceptions of people's participation in development programmes can be identified : participation as a functional element to achieve overall project or centrally planned objectives; and participation as an end in itself where the stress is on enabling people to take control over development processes and opportunities in order to more closely tailor them to their particular circumstances and needs.

In FAP and FCD/I projects so far PP has been used as a functional element. Dialogue with local communities to identify projects, listening to people about their opinions on the proposed schemes and joint consideration of project options so as to incorporate community views in project formulation and design process has not occurred.

Evidence from FCD/I schemes suggests that project implementation, operation and overall socio-economic benefits are better when people are involved at all stages of project development, and small-scale projects produce better results than large-scale projects. Regional water management programmes are likely to provide only limited scope for PP but the individual component projects often may be small enough to permit active participation. While studies at the feasibility stage will address details of PP and recommend appropriate, practical institutional arrangements the following paragraphs highlight some key requirements for successful long term peoples' participation.

There needs to be free access for individuals and groups to information about the project its objectives, method of implementation and a degree of openness on the part of the executive agency(ies) about the expected effects on all groups in the affected community. Only through this can those to be affected judge the consequences, good or bad, for themselves and put forward practical ideas in response. Such a process, though it will increase the time required for planning and design will result in modifications at an early stage to avoid physical, social and institutional mistakes in design and it will also engender in the majority of the community a sense of "ownership", direct interest and responsibility for the schemes future operation and maintenance. Communities are less likely to feel alienated if such an approach is followed.

In order to involve all groups within a FCD/I, or other community-wide scheme there is a need for accountability and a focus for project activities. As with routine monitoring and regular evaluation of development projects people's participation can only be positive if the implementing and operating agencies are willing to take account of the views and suggestions expressed and act upon them. Strong linkages between the people and the project implementation agencies through the establishment of a Project Coordination Committee (PCC) consisting of representatives from BWDB, other relevant government departments at the Thana level, Union Parishad elected representatives and representatives from different local socio-economic groups nominated by the members of each group. Due to the lack of sufficient knowledge about the existing organisational facilities in the project area, it is too early to specify exactly how this ought to be organised. A sensible approach in these circumstances is to have the identification of the most appropriate form of participation as a main objective in initial meetings and discussions in the project area. In this way, the organisation of participation itself can become a participatory process.

Where some form of village organisation exists these can often be utilised to form an institutional base at the village level to act on behalf of the people. However, how effectively the existing organisations can be used to voice the needs of the people would depend on which socio-economic groups they cater for. For example, farmers' cooperatives would not represent the interests of other socio-economic groups. It is important to create an institutional base which would voice the needs of people from all social strata, especially the disadvantaged groups, i.e. marginal farmers, landless labourers, the fishing community, boat men and female headed households. Appropriate social organisation have to be created where they do not exist.

NGOs are considered as important agents is organising these different interest groups in the project areas of the FCD/I schemes. Indeed, NGOs operating at the village or thana level may be the best option for helping to organise local level institutions and linking them to thana level representatives of the central government (Ministry of Local Government and Cooperatives).

In FAP-4, people's participation included formal and informal exchange of views, meetings and interviews. Appendix 2 gives a summary of the formal meeting held with the elected representatives in Jessore.

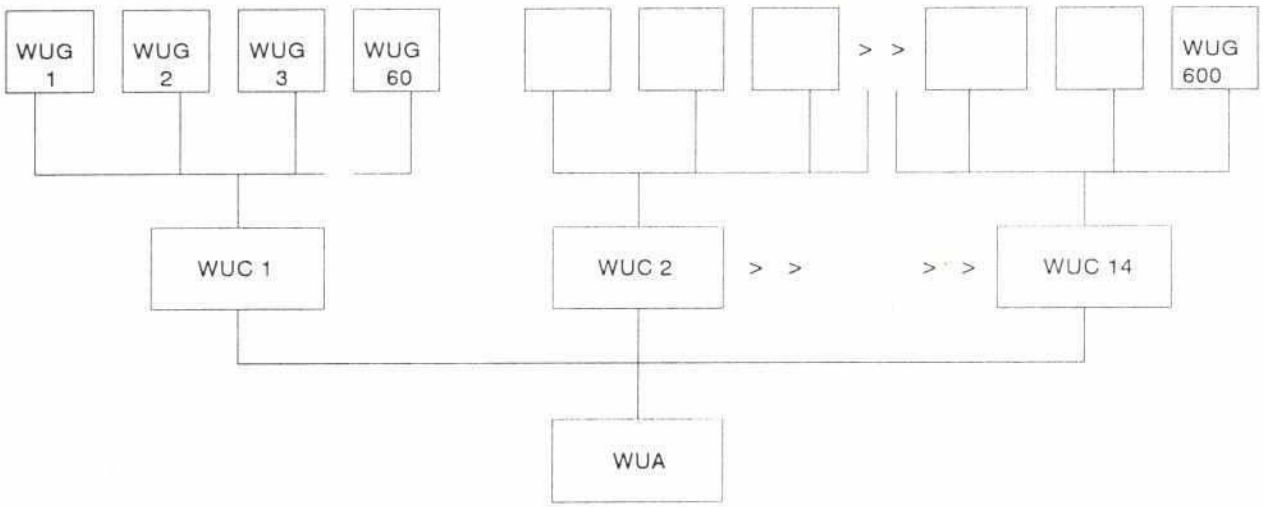
5.6 Water User Groups

The SWA proposals include a large surface irrigation component using low lift pumps (LLP). Each pump of 54 l/s capacity can serve a net cultivable area of 20 ha. The small size of land holdings makes it apparent that individual farmers will need to cooperate closely in order to afford a LLP and to consolidate sufficient land for each pump set's distribution system and cropping. Studies at the Regional level indicate that some form of water user group (WUG) will be needed but that the precise form, type of linkage with other groups and with Project Coordinating Committees may need to vary from project to project as appropriate to local circumstances. The functions of a WUG and its links with other WUGs are outlined in Table 5.1. The table sets out the preliminary, pre-feasibility proposals made for the Chenchuri Beel Rehabilitation Project dealt with in detail in Volume 13. Each WUG would cover a 20 ha LLP area.

A number of WUG's would combine under a Water Users Committee (WUC) and as shown in Table 5.1, these would inturn be represented on a Project Water Users Association (WUC). The WUC provides the primary link with the Project Coordination Committee (PCC) which as noted earlier is recommend to be the main agency to coordinate the development of FCD/I projects in the FPCO Guidelines for People's Participation (March 1993).

Table 5.1 summarises the composition and responsibilities and agencies likely to be involved at each of the three proposed levels of water user representative bodies. Again it has to be stressed that the idea put forward is preliminary. It is likely to be modified in detail for each FCD/I project in the light of project specific findings when feasibility studies are carried out. At this stage the participation of all groups in the affected local communities is required and the final form and structure of such groups as well as of the PCC will be decided.

TABLE 5.1
Recommended Institutional Arrangement for Implementation, Operation & Maintenance And Cost Recovery



Name of Water User Units	Composition of Water User Units	Responsibilities of Water User Units	Participating Agencies
Water User Group (WUG)	20-50 ha Canal Unit. 10-20 farmers associated with a LLP or outlet to form Water User Group.	Responsible for provision of watercourses / field channels / pumps and their O & M.	Supported by field extension staff involved in Agriculture, Fisheries etc. and NGOs.
Water User Committee (WUC)	500-1500 ha sub-compartment. One representative from each WUG within a sub-compartment.	Participate in main, secondary and tertiary canals/drains network planning;	BWDB staff supported by Union Parishad staff & NGOs.
		Organise WUGs to participate in tertiary canals/drains construction on the basis of payment for work done.	-- Do --
		Responsible for cost recovery to finance O & M of the main, secondary and tertiary network.	Union Parishad staff supported by BWDB staff and NGOs.
		Organise WUGs to participate in all O & M activities on the basis of payment for work done.	-- Do --
Water User Association (WUA)	Covers the entire project (17,900 ha)	Participate in formulating O & M criteria and work programme for each of the sub compartments.	
	WUA comprises a representative from each WUC, SDE of BWDB and a representative from relevant government agencies (DAE, BRDB, LGED, BADC etc.). WUA shall be chaired by the XEN of BWDB O & M Division.	Coordinate and supervise the activities of all WUCs and WUGs.	----
		Liaise with relevant Government and other agencies.	

[vp\tab2-35]

5.7 Recommendations

Project Management

The beneficiaries of a water development project are the farmers, fishermen, boatmen, and also the landless poor in terms of incremental employment opportunities. Water development projects are usually designed within a "command area" which is the area covered effectively by the project. It is the responsibility of the development agency to develop main systems whereas the beneficiaries are supposed to link their lands with these established facilities though secondary and tertiary systems. Management and institutional deficiencies at this point have contributed to under-utilisation and mismanagement of water resources development projects and caused financial bottlenecks and political backlash in many cases. It is, therefore, important that the project management organisation should undertake the following essential activities:

- develop the institutional mechanism for delivering the projects output to the end-users
- organize user-groups that would take initiatives to collectivize the needs of individual farmers and make necessary arrangements for procuring these from the project sources
- create a system for producing extension services to user-groups and individual farmers and educate them in the efficient utilization of the facilities
- establish a system for extending financial facilities to the farmers enabling them to repay for the services they receive
- create a system for collecting payment for the services from the users to offset project O & M costs.

The SWA studies envisages the need for full participation by potential beneficiaries at all stages of development planning, implementation and also O&M. The most significant characteristic of FCD/I projects is that they involve the entire community living within the project area and development cannot be targeted to specific segment of the population.

Therefore it is essential that beneficiaries should be involved from initial specific project identification to the implementation and O&M stages of FCD/I projects. Top level management is to remain with BWDB, but it would listen more to beneficiary representatives than in the past and would direct work towards the landless. The formation of strong groups based on their requirement of services and a mechanism whereby BWDB has to take these interests into account in managing systems is vital.

Every efforts should be made to organise and use labour contracting societies composed of landless males and females in the implementation and maintenance of FCD/I facilities. Direct beneficiary participation will essentially involve the following :

- people who share a common interest in water resources management would participate in organising user groups which will enable them to deal with their own water management problems at their own level;
- as a group they should acquire, operate and maintain their own equipment;
- the development agencies (DAE, BRDB, LGED, DOF, BWDB, Banks and NGOs should extend their support to these groups or associations;

- each groups or association should appoint a representative to speak on its behalf;

- organized landless people should be given the opportunity to negotiate employment in routine maintenance of earthworks of the main project systems and in periodic maintenance of other engineering works.

Another way of involving the beneficiary is through the formation of a local project coordination committee (as in CEP and BWDB small scheme project). The PCC is formed during the planning stage of each sub-project and is made up of representatives of local government agencies (Union Parishad), farmer groups, fishermen and the landless. The major functions and responsibilities of PCCs include :

- dissemination of information on planning, implementation, operation and maintenance of the sub-project and to seek beneficiaries reactions and consent on system design and, most importantly to act on reactions and suggestions that they receive;

- assist in the process of land acquisition necessary for physical facilities;

- 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 support services, including strengthening agricultural extension, supply of seeds, fertilizers, pesticides and provision of credit;

Involvement of local government institutions will also ensure beneficiary participation. The inherent advantage with these institutions (Thana Parishad, Union Parishad) is that they are already set-up at the most appropriate level for the task. Their autonomous nature gives them administrative and political advantage for undertaking the programme. The problems, however, lie in possibility of over bureaucratization of procedures in the organisation. However, public representatives drawn from the rural elite are more likely to compromise the interest of poorer sections of the community in matters like allocation of water rights, collection of dues, etc. Moreover, the task of collecting water rates is an unpleasant work for local political bodies and the probability of having to pay for the project's O&M expenses from their budget not be easily accepted.

BRDB has the capacity to perform the project management task through beneficiary participation under specific conditions. BRDB was established to organize farmers co-operatives for utilizing irrigation benefits provided by the government. It will be fairly simple to extend its mandate to become a project management agency for all irrigation and flood control projects. Its experience with farmers cooperatives could be used to reorganise these into water users associations. But the BRDB's drawback lies in the same set of limitations that characterise public organisations noted above. Moreover, the main objectives of BRDB has been to create farmers access to credit, which is clearly different from the objectives of a water users associations.

A number of Non-government organisations (NGOs) like Proshika, BRAC, CARITAS, ICDDB, CARE etc. are already involved in the water sector in Bangladesh. They are working with government agencies to improve the management of existing facilities through traditional organisations like farmers cooperatives etc. Proshika and Grameen Bank are trying to implement new types of management modules with groups of landless farmers. The Land Reclamation project (LRP) in Khulna has involved the women based NGO - Nijera Kori, which operates under Dutch funding assistance. However, all these efforts have been marginal and isolated, without horizontal and vertical linkages with similar government

programmes, specially in the large scale water resources development projects. But with proper design and control, they may be able to meet such responsibilities.

The recently formulated Forestry Master Plan has proposed an extensive programme for plantation development on marginal lands including flood control embankments. For this purpose local landless people will be involved in plantation development, maintenance and final harvest through an appropriate benefit sharing mechanism which has active support from NGOs.

Despite of all the drawbacks and weaknesses, BWDB should be given the responsibility of project identification, design, implementation and O&M of water development projects in SWA. With their long standing experience and technical know how, BWDB should seek assistance from other agencies directly or indirectly related with the sector to mobilize people's participation in the planning, implementation and operation of the water sector development initiatives.

Appendices

Appendix 1

Sample of Questionnaire

Southwest Area Water Resources Management Project

Socio-Economic Survey
(June / July 1992)

FCD and Non-FCD Areas

SOUTHWEST AREA WATER RESOURCES MANAGEMENT PROJECT (FAP-4)

SOCIO-ECONOMIC AND ENVIRONMENTAL STUDY

(PRIMARY DATA COLLECTION QUESTIONNAIRE)

Project : .....
Village : .....
Thana : .....
District: .....

1. Age ..... 1.1 Sex ..... 1.2 Occupation: Main : .....
Secondary .....

1.3 Marital Status .... 1.4 Level of literacy .....

1.5 Family size: M ..... F ..... Total .....

2. Land ownership :		Cultivable land (decimal)	Homestead
	0 - 49	.....	.....
	50 - 125	.....	.....
	126 - 250	.....	.....
	251 - 500	.....	.....
	501 - above	.....	.....

3. Mode of agricultural operation

Self cultivation ..... Share cropping ..... Others .....

4. Main Crops and Cropping Patterns

4.1 Net cultivated land (dec) (1991-92): Irrigated: ..... (dec) Rainfed: ..... (dec)

4.2 Cropped Land and Production now (1991-92) and expected, due to the project:

Seasons	Crops	Present Area (acre)		Total Yield (kg)		Expected			
		Irrigated	Rainfed	Irrigated	Rainfed	Irrigated	Rainfed	Irrigated	Rainfed
Kharif I	Aus (L)								
	Aus (M)								
	Jute								
	B. Aman								
Kharif II	T. Aman (L)								
	T. Aman (M)								
	D.W.Aman(L)								
Rabi	Boro (L)								
	Boro (M)								
	Wheat								
	Potato								
	Sugarcane								
	Pulses								
	Oilseeds								
	Spices								
	Vegetables								
	Orchard Crops								

4.3 Major Cropping Pattern:

Plot		Now				Rabi		Expected			
		Kh-I		Kh-II				Kh-I		Kh-II	
No	Area (dc)	Crop	Area (dc)	Crop	Area (dc)	Crop	Area (dc)	Crop	Area (dc)	Crop	Area (dc)
1											
2											
3											
4											
5											
6											
7											

5. What are the source(s) and amount(s) of your Annual Income?

Sources	Now Amount Taka/Yr	Expected Amount Taka/Yr
Main Occupation		
Secondary Occupation		
Any other source(s)		
Total		

6. What are the heads of your expenditure (Annual)

Heads	Now Amount Taka/Yr	Expected Amount Taka/Yr
Food		
Clothing		
Education		
Shelter		
Others (Misc)		
Credit Repayment		
Savings		
Capital Expenditure		
Total		

7. What are your best/worst months financially?

Sources	Now		Expected	
	Best	Worst	Best	Worst
January (Agra-Poush)				
February (Magh-Falgoon)				
March (Falgoon-Chaitra)				
April (Chaitra-Baisakh)				
May (Baisakh-Jaishta)				
June (Jaishta-Ashar)				
July (Ashar-Shraban)				
August (Shraban-Bhadra)				
September (Bhadra-Aswin)				
October (Aswin-Kartick)				
November (Kartick-Agrahayan)				
December (Agrahayan-Poush)				

8.1 What is your total amount of debt outstanding ? Tk .....

8.2 What is your source(s) of credit/loan ?

Sources	Now/Year	Expected Amount/Yr
Commercial Bank		
Krishi Bank		
Grameen Bank		
Co-operative		
BRDB		
Money lenders		
Relatives		
Neighbours		
Any other		
Total		

9. Are any governmental regulations/enforcements affecting your economic well-being ? (e.g. Taxes, fees, levies, subsidies, etc.)

.....

.....

.....

.....

.....

10. Identify the major devastating forces that have made you suffer most over the last 5 years (in order of severity):

Forces	Years					
	87	88	89	90	91	92
Flood						
Drought						
Heavy Rainfall						
Waterlogging						
Total						

Most devastating = 1
Devastating = 2
Tolerable = 3

Please mention months:

11.1 There is a proposal to control these devastating forces. Would you participate ?

Yes .....
No .....

11.2 If yes, would you allow BWDB to acquire some part of your land for the purpose ?

Yes .....
No .....

12. Suggest ways and means to maintain the embankment, irrigation and drainage channels.

Voluntary services of beneficiaries	
Forming an O & M committee	
BWDB	
Existing system	
Any other	

13.1 What are the benefits/disbenefits you expect from such a proposed plan ?

Benefits	Disbenefits

13.2 How is this proposed project going to benefit/affect you economically ?

.....

.....

.....

.....

.....

.....

13.3 If more land is brought under cultivation due to the controlling of flood and other measures how would you manage it ?

Share cropping/Leasing out the whole land .....

Share cropping/Leasing out part of land .....

Hiring labour .....

Family labour .....

Mobilising resources from other sources for cultivation .....

Loans .....

13.4 In case of increased production from land how will you invest (in order of preference) ?

- Installing Tubewell for irrigation .....
- Purchasing land .....
- Fertiliser and land development .....
- Children's education .....
- Other consumptions .....

14.1 Identify the sources of water for irrigation:

Sources		Mode/Type	
Pond			
Canal		LLP	
Beel		STW	
Haor		DTW	
River		Local, Traditional	

14.2 Identify major problems that you face for irrigation water:

15.1 Identify types of social conflicts prevalent:

15.2 Process of Resolution of the conflicts:

.....

.....

.....

.....

.....

.....

16 Name of cooperative societies and NGOs working in your area:

Societies	Members	Activities

17.1 Labour wage rate in your area:

Labour force	Wage rate (Tk/day)	
	Now	Before (Project)
Men		
Women		

17.2 Any labour migration (to and from) Yes..... No.....

If yes, where and when ?

	Place		
	To	From	Season
Now			
5 years back			

18.1 Quality of life

Food (Quantity/person/week)

Food	Now		5 Years back	
	Quantity	Calorie	Quantity	Calorie
Rice				
Wheat				
Pulse				
Fish				
Meat				
Vegetables				
Others				

18.2 Sources of drinking water:

Sources		Distance
Pond		
Canal		
River		
Tubewell		
Well		

(a) If Tubewell, type .....

(b) Is there continuity of water ..... Yes/No. If No why ? .....

18.3 Types of disease(s) suffered over the last 5 years:

Name of diseases	Now	5 years back

19 Changes in environment

	Now	5 years back
Negative effects due to fertiliser/pesticides		
Sources of fuelwood		
Difficulties in river transport		
Have you seen any Crocodiles or Ghorials ?		
If yes, do you kill them ?		
Salinity		

20.1 Types of activities:

Types	Now	5 years back	Expected
Household			
Agriculture			
Off farm			
Waged labour			
Cooperative societies			
Others			

20.2 Types of social discrimination:

	Now	5 years back
Social status		
Wage		
Food		
Others		

20.3 Do you expect any change due to the project ?

Yes..... No.....

If yes .....
.....
.....
.....

20.4 (i) What fuel do you use for cooking and where do you get it from ?

Types of fuel	Now	5 years back
Firewood		
Kerosine		
Electricity		
Crop Residues		
Biomass		

20.4 (ii) What types of trees do you have in your village ?

Trees	Now	5 years back
Mango		
Jackfruit		
Coconut		
Betelnut		
Palm		
Date Palm		
Mahogany		
Teak		
Rain tree		

20.4 (iii) Do you use the timber from the trees for yourself ?

Yes..... No.....

20.4 (iv) Do you cut and sell them ?

Yes..... No.....

If yes, to whom ? .....

21.1 Places of catch and quantity of Fish:

Places	Quantity		5 years back
	Now	Future	
Pond			
Canal			
Beel			
Haor			
River			
Others			

21.2 Problems faced (in order of severity):

Now	5 years back	Expected

21.3 Do you expect any change(s) due to the Project ? Yes..... No.....

If yes, specify .....
.....
.....
.....

FIELD OBSERVATIONS (IF ANY):

Southwest Area Water Resources Management Project

Socio-Economic Survey
(February / March 1993)

Chenchuri Beel and Gorai Augmentation Projects

Group : Farmer

Professional Speciality

	Within the Household (Agriculture)		Outside the Household (non-agriculture)
0.	Lets out self-owned land to share-croppers	0.	Fish Farming
1.	Share cropper : cultivates in exchange of Crop/Fertilizer	1.	Hires pond(s) for fish farm
2.	Cultivates his own land	2.	Catches & sells fish
3.	Agricultural/Non-agricultural labour	3.	Rears cattle and poultry
4.	Hires others land for cultivation	4.	Van/Riksaw owner
5.	Other	5.	Businessman
		6.	Small shop owner
		7.	Connected with cottage Industry
		8.	Connected with other rural industries (Black smith, potter, weaver etc.)
		9.	Other occupation : e.g. boatman

• Descriptions of your farm's agricultural Production			
Size of farm	Aman/Kharif 2	Aman/Kharif 1	Boro/Rabi
Total self owned land			
Uncultivated land			
Net cultivable land (self owned)			
Total Leased out land			
Amount of land shared-out			
Hired private land			
Hired Khas land			
Amount of land taken as share cropping			
Total cultivated land			

• Type of plough used for cultivation		
Animal drawn	0.	Not used
Mechanised	1.	Self-owned
	2.	Hired
	3.	Loaned
	4.	Both hired and loaned

3. Have your cultivation ever suffered due to the lack of plough ?

0. No

1. Yes

4. Do you employ labour for your farm work ?

0. No

1. Yes, only during harvests

2. Yes - Only for other work

3. Yes - for harvesting and other work

5. Have your Harvesting ever been delayed due to lack of labour ?

0. No

1. Yes

6. What effect does normal floodings have on your land/crops

	0.	Adequate
	1.	More than adequate
	2.	Less than adequate
	3.	Cannot tell/not known

If flood water is considered to be excessive

Depth of inundation :	0.	Adequate
	1.	Inundation is very deep
The time when flooding begins :	0.	The timing is alright - usually not too early
	1.	Flooding begins too early
The time when flood water recedes :	0.	Floodwater usually recedes on time
	1.	Floodwater recedes later than it should

- During the last 10 years, what changes in your land have come about, due to flood ?

0. No Change

1. The condition has worsed

2. The condition has improved

3. Do not know

- Do you irrigates Land ?

0. No

1. Yes

- What is the quality of the water you use for irrigation ?

  0. Good - Free of Salinity
  1. Slightly saline - but is not detrimental to crop production
  2. Saline and detrimental to crop production

- Have you ever suffered from the shortage of irrigation water?

  0. No
  1. Yes - In some years, water was insufficient
  2. Yes - Water is insufficient every year

Cause of shortage (if yes) ?

  0. Lack of water in the canals
  1. Lowing of ground water table
  2. The water distribution system from pumps is not good
  3. The pump repair work is not good
  4. Dispute with neighour pump owner
  5. Others (specify)

- Do you have any source of income other than that from the farm ?

  0. No
  1. Yes

- Source of Income (If yes)

Main Source	1.	Self-owned
	2.	Land owner
Secondary source	3.	Fishing
	4.	Fish pond owner
Tertiary source	5.	Cultivating other's land
	6.	Other kinds of labour
	7.	Business/Shop
	8.	Transport
	9.	Govt. Service
	10.	Others (Specify)

- If the right of possession is from share-cropping

Share cropping	- A share of the crop given to the land owner
	- The land owner pays for the fertilizer
Hiring on cash	- Pay rent per year per bigha/decimal
Khas land	- Pay rent per year per bigha/decimal

- How long have you been associated with cultivation ?

  _____ Year(s)

- If you have been a cultivator for more than 5 years, how has the status of your land-ownership changed ?

  0. There have been no change
  1. Amount of land has increased
  2. Amount of land has decreased

  Total self-owned land_____

  Area of hired out land_____

  Area of shared out land_____
  (for share cropping)

  Area of hired in land_____

  Area of khas land taken_____

  Total area of land cultivated for crops_____

- What are the reasons for any changes that may have occurred_____

- During normal monsoon flooding

  Date when the flooding begins_____

  Date when flood water recedes_____

- If monsoon flooding has brought about any changes on your land during last 10 years, what have been the changes ?

  What are the causes of these changes ?_____

  How have these changes affected your on-farm activities ?

  _____

- What have been the changes on cultivated land, in the last 10 years (Note. Specify HYV/Local)

Name of Crop :	Increased or Decreased	Cause of change

- What have been the changes in crop cultivation during the last 10 years (Note. Specify name of crop)

Name of Crop :	Increased or Decreased	Cause of change

- The main canal that provides drainage for the land.

  Name of Channel_____

  When it was excavated first_____

  When it was last re-excavated_____

- When was the last time that your land suffered devastating flooding ?

  _____ (Year and season)

  What was the causes of flooding ?

  Did your crops, cattle and/or homested suffered damage ?

  0. Yes 0. No

- Irrigation (If the land is irrigated)
  (Note. Specify name of crop)

  Water supply

  Is the water supply limited (from questionnaire)
  0. No
  1. Limited in some years
  2. Limited in every year

  If limited, when
  (Name of month)_____

  Is this problem worsening by the year ?

  0. No, the situation is not changed
  1. Yes, it is worsening by the year
  2. No the water supply is increasing by the year

  What is the cause for the change ?

  How does the limitation of water supply affect your agricultural productivity ?

- Quality of water :

  Is the Irrigation water saline ?

  0. No, the quality of water is good
  1. Yes - Slightly saline
  2. Yes - Highly saline

If yes, which part of the year ?

(Name of the Month)

Do yield's decrease as a result of this ?

0. No

1. Yes

If yes, what crop ? Name :_____
- Which quantity

Quantity :_____

- If LLP is used, Price _____Tk.

- Is this expenditure borne by the land owner ?

0. No

1. Yes

2. Not applicable - land not hired

Are you a sole or partial owner of a mechanical plough (tractor) ?

0. No

1. Yes, sole ownership

2. Yes, partial ownership

- Cost of hired plough : Do you give ploughs to farmers on hire ?

0. No

1. Yes

2. Yes - seldom

Hire charge for each ploughing

Animal drawn plough_____ Animal drown plough_____

Tractor_____ Tractor_____

Power Tiller_____ Power Tiller_____

No. of Family members :

Total No._____ Engaged in Agriculture: No._____

Male_____ Male_____

Female_____ Female_____

Children_____ Children_____

- Whether female members of your family work in the field (Including post hervest works) - If yes, what type of work ?

  0. They work in the field
  1. Work in the field(s) in exchange of wage(s)
  2. They do not work

- Do you engage lebour for your field works ?

  0. No
  1. Yes, sometimes
  3. Yes, seldom

(specify Name of crop)

If yes, mention the type of work required for the each crop

The name of crop

1. Only male
2. Only female
3. Male and female

Amount of wage ? Tk/day

Male

with/without food

Female

- Use of hired and family labour

  Which kind of labour do you employ towards the implementation of the different types of work specified here under ?

	Land Preparation	Weeding	Harvesting	Threashing
Aman				
Aus				
Boro				
Jute				
Pulse				

1. Labourer - family member
2. Mainly family member, a few hired
3. Mainly hired, a few family members
4. Only hired labourer

Marketing

What are the crops you sale	Name	Full	Part	Little
Approx. % of production	Paddy			
	Wheat			
	Pulse			
	Oilseed			
	Vegitable			
	Others			

- Generally you purchase during the year :give ticks

0. Paddy
1. Oilseed
2. Oil
3. Pulse
4. Fish
5. Meat/Chicken
6. Vegetable

- Where do you sell your crop ?

1. At the farms
2. At the market
3. At both the farms and the market

Name of the local market:	Distance Km.

Group : Fish Farmer

Professional Speciality

Within the Household

0. Only Fish Farmer (taking lease of large Govt owned khals, beels, jalmahal etc.)
1. Fish and paddy trader
2. Fish and paddy farmer
3. Share cropper and Fish Trader
4. Producer of fry in hatcheries
5. Lessor of Pond (Fish Farm)
6. Others (e.g. Aquaculture in Pond)

Outside the Household

0. Businessman/Others
1. Service Holder
2. Owner of Riksaw/Van
3. Shopkeeper
4. Politician
5. Others (Specify)

Data related to ponds

Pond No.	Area & Water Depth Cm	Whole Year	Origin	Condition of Pond	Other Years	Types of Fish		Removal of Fish before the pond is drained
						Main	Others	

Use of Fish Feed	Use of Fertilizer		Monthly Cycle	Ownership	Production (Maund)	Price Tk.
	Urea	Compost				

Water all year round_____

0. Enough Water is available for Fishcatch throughout the year.
1. Remains dry during a part of the year

Type(s) of Fish _____

0. Main Carp variety : Ruhi, Catla etc.
1. Mixed Carp : Silver Mirror gram carp etc.
2. Catfish : Magur, Shing etc.
3. Telapia
4. Shrimp
5. Mixed incoming varieties
6. Other varieties

Breeding ground :

1. Made as fish farm
2. The ground was previously a seed bed
3. Natural pond/water body/river
4. Not known

Condition of the Pond :

1. The Pond is not used - no fishes are caught
2. Fry are not cultured in the pond - incoming fishes are not caught
3. Fish culture is done with fry.

Monthly Cycle :

* Total number of months required, starting from the release of fry, to the catch of fishes

Pond Drainage/Cleaning :

0. The pond is not drained-out in the dry season.
1. The pond is drained-out in the dry season
2. The pond is drained-out and cleaned in the dry season.

Amount of fertilizer used in each pond : /yr
Urea and TSP :
Compost :

Removal of fish from the pond:

0. Existing fish are not removed
1. Existing fish are caught by nets
2. Existing fish are caught using Chemicals
3. Existing fish are caught using Chemicals and nets

Ownership:

1. Selfowned - Manager
2. Selfowned - Leased to others
3. Partnership with Others
4. Hire private ponds for cash
5. Hire Government owned ponds for cash
6. Hire the ponds in exchange for a share of its fish.
7. Others

Food for the Fishes :

Amounts of oilseeds and cereals used in each pond (Kg)_____

Amount paid to hire the ponds : Tk/Yr Tk/decimal:

Cash payment

Share of fish Owner's share Share of used articles :

List of articles :

• Supply of Fry

Crap	Price/100 Nos.	Size cm	Share of supply
Main Carp			
Mixed Carp			
Cat Fish			

Origin :

1. Capture fishing in river by pond owner
2. Fish fry trader/businessman
3. Govt. Hatchery
4. Private Hatchery
5. Others

• Labour	% of Share		
	Hired	Family/Self	Others collectively Total
Cleaning and making			100%
Guard/Chawkider			100%
Fishing			100%
Other Works			100%

- Extent of Flood Damage

Does your pond get adversly affected by flooding ?

0. No
1. Yes - In some years
2. yes - Every year

- If yes - What kind of damage by flooding ?

1. Fish goes out with water
2. Pond banks are over flooded
3. Siltation
4. Fish goes out and banks over flooded
5. Fish goes out and siltation occurs
6. Others

- Is there shortage of irrigation water ?

0. No
1. Yes - In some years
2. Yes - Every year

If yes, how do you procure the additional supply ?

0. There is no additional supply
1. From self-owned LLP
2. From hired LLP
3. From self-owned STW
4. From hired STW
5. From DTW

What percentage of your total fish production is consumed by your family ?

_____%

Do you get advice/training for fish cultivation ?

0. None available
1. From Other fish cultivators
2. From Government Offices

Please Specify_____

3. NGO
4. Others

- Capital

(A) Sources of Capital for expenditure on Pond :

Main Source :

Secondary Sources :

0. Bank
1. Co-operative Society
2. Grameen Bank
3. Relatives/Friends
4. Advance on fish sale
5. Money lender
6. Last years sale proceeds of fish
7. From other sources of income (Specify source)

(B) Sources of Capital for Reexcavation/Purchase of Pond :

Main Source : _____

Secondary Source(s) : _____

Where do you sell your fishes ?

0. Do not sell
1. Sell at the market
2. Sell at houses
3. All fishes to the fishermen

- The problems of fish cultivation, or any other problems : (applicable to the shrimp farm owners)

Main Problem :
Secondary Problem :
Tertiary Problem

0. The non-availability of capital on-time for investment
1. The lack of cooperation from the Govt.
2. The non-availability of fry on time
3. The non-availability of good quality fry
4. The non-availability of fertilizer on time
5. The problem of fish catching
6. The lack of advanced technology
7. The problem of fish feed
8. The problem of selling and marketing the fish
9. The problem of ownership of the pond
10. The problem of the theft of fish
11. Lack of water in the dry season
12. The pond banks overflooded
13. Fish Disease(s)
14. Others

Group : Small Fishermen

Professional Speciality

In which fields are you engaged at present ?

	Within the Household		Outside the Household
0.	Only fish drying	0.	Small scale fishing and selling
1.	Making fish net	1.	Wholesale fish business
2.	Rearing fish fry in the pond	2.	Sell small fries
3.	Fish cultivation in self owned pond	3.	Cultivate and export shrimps
4.	Make the appliances needed for shrimp gher (Farm)	4.	Sell shrimp fries to the gher owner
5.	Both shrimp and paddy cultivation	5.	Large hatchery owner
6.	Others (specify)	6.	Others (specify)

The following changes have occurred or may occur due to polder or embankment construction in your area. Please make your comments :

0. The small fishermen will be out of work, because the internal canals/water areas will be disconnected with the external rivers

1. You will lose your profession

2. Fish production will diminish compared to the past

3. A reduction in fish consumption will result in a proportional reduction in activities related to it

4. Due to stoppage of saline water intrusion, shrimp cultivation will be hampered

5. Shrimp cultivation has increased/will increase

6. Number of big hatcheries will increase due to reduction of water availability

7. Shrimp gher (farm) owners will be interested to cultivate more shrimps, because lack of saline water will no longer be an impediment

8. The number of small fishermen will increase

9. Labour - intensive fish cultivation will increase

10. The conflict between outside traders and gher owners will increase

11. Agricultural lands will be converted to fish farms

12. Fish farms (in ponds) will increase

13. Others (specify)

Do you think any flood control scheme in your area would be beneficial for your fish farming. If yes - How will you procure the additional labour ?

0. From within the family

1. From outside the family

2. Hired labour

What % of your total income comes from fishing ?

0. 10 - 25%

1. 25 - 50%

2. 50 - 75%

3. 75 - 90%

4. More than 90%

- How has the proportionality of income changed in the last 5 years ?

1. There have been no change

2. It has drcreased

3. It has increased

- How do you earn from fishing ?

0. Sell fishes

1. Get cash from the employer

2. Sell fishes, and get cash from the employer

- Fishing appliance

Boat	0.	Self owned
Net	1.	Partly owned
Traps	2.	Hired
	3.	Belongs to the employer

- What % of your total fish catch is consumed by your family ?

- Mainly how do you catch fish ?

  0. Collectively
  1. With family members
  2. By employing others
  3. By myself
  4. Other

- Other sources of income ?

  0. Agriculture - Principally from own land
  1. Agriculture - Principally from share cropping
  2. Owners of fish pond
  3. Agricultural labour
  4. Other day labour
  5. Riksaw puller
  6. Business/shopowner
  7. Govt Service
  8. Others (specify)

- Do this nets you use today, have the sane density in their mesh, as they had 5 years ago ?

  0. No change in the mesh
  1. Smaller mesh
  2. Bigger mesh
  3. Not known/not applicable

- How has the quantity of fish catch changed ?

- What is the principal cause of overall fish reduction ?

  Primary

  Secondary

  Tertiary

- What is the principal impediment that you face for fish catching ?

  0. Primary

  1. Secondary

  0. No fixed problem
  1. Lower catch
  2. Lack of boat and capital
  3. The selling of the fishes
  4. Cannot catch fishes in govt. owned Jalmahals, canals etc.
  5. Oppression from the non-fishermen
  6. Others (specify)

- What do you think should be done that would increase your income from fishing?

- If the drainage system is improved in your area,how do you think it would affect the fishing ? Why do you think so ?

- Where do you catch fish ?

Spring		Summer		Autumn		Winter	
Fishing On avg. how many days a week	Avg. daily amount of catch	Fishing On avg. how many days a week	Avg. daily amount of catch	Fishing On avg. how many days a week	Avg. daily amount of catch	Fishing On avg. how many days a week	Avg. daily amount of catch
Permane nt Beels							
Seasonal Beels							
Khal							
Rivers							
Fish Ponds							
Approx. Total catch in a year							
Total sale products							

- Have any changes occurred in the last 5 years ?

	Change	Main reason
Permanent Beels		
Seasonal Beels		
Khals		
Rivers		
Fish ponds		

Change

0. No change
1. Considerable reduction
2. Some reduction
3. Considerable increase
4. Some increase

Reason

0. Excessive fishing
1. Open water area has decreased
2. Obstructions in fish movement
3. Urban waste and pesticides etc.
4. Fish diseases
5. Others

- If the canals, beels etc. had more water in the dry season, how would it have affected the fishing environment ?

  Why do you think so ?

- Fishing technique(s) :

	Type of fish caught	Ownership of the water body	Type of appliances used
Permanent Beels			
Seasonal Beels			
Khals			
Rivers			
Fish ponds			

Code of appliances :

0. Large net
1. Through Net
2. Submerged net
3. Trap net
4. Other types of net
5 Trap
6. Hook
7. Others

Group : Landless

- Your occupational classification

0.	Day labourer
1.	Labourer
2.	Small fishermen fishing in Khal/Beels (selling in the markets)
3.	Riksaw/van puller
4.	Hawker of fish fry small fish and/or seedlings etc.
5.	Poultry
6.	Selling milk, eggs etc.
7.	Small cottage industry like blacksmith, Potter, Weaver, Goldsmith etc.
8.	Work in Shrimp ghers (farm)
9.	Fishing (if available), otherwise poultry rearing and selling
10.	Others (specify)

- Do you have possession of any agricultural land, ponds etc. ?

0. Yes

1. No

- If yes, state the amount

Name		Amount	Price/decimal
0.	Agricultural land		
1.	Homestead and attached land		
2.	Fallow land		
3.	Share of pond		
4.	Grazing land		
5.	Others		

•	Are you a member of any society, if yes, what are benefits you get ?
0.	Money
1.	Material
2.	Marketing facilities
3.	Training for developing own skill
4.	Advice
5.	Others (specify)

•	What was your reason for becoming landless ?
1.	Very poor economic condition inherited from past
2.	River erosion
3.	Fragmentation of property
4.	Property/land lost due to feud (consprecy by stronger village group(s))
5.	Gradual degradation of economic condition
6.	Others

•	What are the problems of your present livelihood ?
0.	Lack of adequate opportunity for earning
1.	Employer does not pay proper wages
2.	Land-leased to shrimp gher owner are not received back at proper time
3.	Cannot catch fish in govt owned Jalmahal, khal, beels
4.	Cannot use public grazing land
5.	Year round water logging
6.	River erosion
7.	Oppressed by Powerful persons/factions
8.	Excessive flood, rain & cyclone
9.	Drought
10.	Salinity
11.	Decrease demand for village products, vis a vis those made in cities (Plastic, Aluminium articles)
12.	The roads get submerged during flooding. There is a lack of good roads
13.	Others (specify)

- Under FAP 4 if your land comes within a good FCD Project area, how can you participate in its operations and maintenance ?

0. Earthwork for embankment construction
1. Operation and Maintenance
2. Operation in Sluice gates
3. Collection of water taxes
4. Social forestry proposed by BWDB
5. Terraced cultivation/afforestation taken on the slopes of embankment
6. Protection of embankment against public cuts/damages
7. Looking after drainage canals for functioning
8. Others (specify)

GROUP : WOMEN HEADED HOUSEHOLD

•	You will be classified as ?
0.	A Housewife
1.	The head of the household
2.	Other (specify)

•	Are you the only earning member in your family ?
0.	Yes
1.	No

•	If not, who are the others ?
0.	Daughter
1.	Son
2.	Mother
3.	Brother/Father

- Number of earning members 5 years back

0. Only my husband
1. Only myself
2. Father-in-law and Husband
3. Others

- Professional structure : In the Agricultural work ?
- How are you attached with the following agricultural work ?

0. Husking
1. Husking on a household pedals
2. Winnowing
3. Steaming paddy
4. Drying seeds in the sun
5. Storage seed
6. Processing seeds in the house, field or pond
7. Others

- Which of the following non-agricultural options you currently engaged in ?

0. Cottage Industry
1. Selling cosmetics, clothing, dairy and poultry etc.
2. Farming and selling poultry and cattle
3. Working in other houses
4. Maintenance of village roads (generally those on embankments)
5. Under FFW program(s)
6. Canal excavation
7. As labourer in Rice mill/tobacco factory/shrimp gher etc.
8. As an office peon
9. As book binder
10. Maintenance of embankments
11. Inoculator of cattle
12. Fish farming by leasing in pond
13. Tailor
14. Petty electrical repairing work
15. As a midwife
16. Helping with poultry or afforcetation on embankment
17. Making fishing nets etc.
18. Selling fishes
19. Money lender
20. Others (specify)

- What kinds of household work do you usually do ?

0. Looking after the family
1. Kitchen gardening
2. Milking
3. Looking after poultry, cattle etc.
4. Washing clothes
5. Collecting firewood
6. Fishing by net for family from nearby small ditches
7. Collecting vegetables from adjacent forests
8. Other agricultural work

- what kind of work can you undertake outside the household ?

0. Work as a day labourer outside the household, eg, in the field, fish pond etc.
1. As a member, undertake responsibilities of the cooperative society
2. Selling poultry/goat in the market
3. Selling egg, milk etc. in the market and in houses
4. As a hawker of various articles
5. Wholesale trading of fruit from self owned orchard
6. Selling fish
7. Money lender
8. Cottage industry - through a cooperative society
9. Work in ther preparation of shrimp ghers, or shrimp trading
10. Others

- What kinds of agricultural work do you expect to derive benefits from ?

0. Agriculture works
1. Working in the paddy field
2. Husking, cleaning paddy

3. Harvesting pulses, jute etc.

4. Drying paddy

5. Sowing seeds

6. Cleaning land

7. Earthwork in the field

8. Preparation of thrashed/popped rice

9. Drying fish

10. Preparation of other kinds of food

11. In the paddy business

12. In the vegetable/fruit business

- What are the benefits you expect out of non-agricultural work ?

0. Maintenance of road over embankment

1. The sweeping of roads, plantation of trees etc.

2. Gardening or working as a garden labour

3. Engagement in any rural industry e.g. Pottery, Weaving, Gold smith, Weaving mats and Cottage industry

4. Bee rearing (applicable only to the Sundarban area)

5. Fish farming in the pond

6. Cattle/Goat farming

7. The preparation of fuel out of livestock dung

8. Inoculator of fish/cattle

9. Apprenticeship in fish breeding

10. Looking after sluice gates in embankment and guarding against embnakment cutting/damages thereof

11. Producer and businessman of fish net dyes, and fishnets

12. Others

- Are you socially secure ? If not, why ?

0. Eviction is being sought against you

1. Therates of physical torture

2. Affected with financial problems

3. Divorced or deserted by the husband

4. Too many children in the family

5. You are cornered and neglected in the society

6. You are being pressured to marry against your will

7. Others

Are you a member of any cooperative society ?

0. Yes 1. No

If yes, Which one(s) ?

0. MSS-Women's cooperative society

1. Landless cooperative society

2. Grameen Bank

3. Poor women's cooperative society

4. Self-organised cooperative society

5. NGO organised society

6. BRDB

7. Others

What is your amount of present income and how much land do you own ?

Cash income Tk._____ Monthly

Agriculture Bigha_____

Pond Bigha_____

Others_____

APPENDIX 2

Summary of Seminar

APPENDIX 2

REGIONAL SEMINAR ON

SOUTHWEST AREA WATER RESOURCES MANAGEMENT PROJECT

(FLOOD ACTION PLAN : FAP-4)

As part of the programme for people's participation in the planning of development projects, a one day seminar was held in Jessore on 15th January 1993 where the different water resources management options for the Southwest Area were discussed. The discussion focussed on the various regional and local issues, the people's needs and the scope of the interventions suggested by the Consultants to overcome the issues and satisfy the needs.

The Chief Engineer, FPCO and some members of the Consultants' team (Team Leader, Deputy Team Leader, Irrigation and Drainage Engineer and Coastal Engineer) presented the results of the FAP-4 studies and the development options to the meeting.

Various representatives of the people, including Ministers (Minister for Agriculture, Irrigation, Water Development and Flood Control and the Minister for Foreign Affairs), Members of Parliament and Members of Local Governments who represent different areas within the Southwest Region, and the Mayor of Khulna City Corporation participated in the discussion.

The salient points of the discussion are given hereunder.

In addition to the formal seminar, numerous informal meetings, interviews and discussions were held by the Team members, with interested groups including farmers, fishermen, women groups, landless and these are described in Volume 9 - Impact Studies.

1. S.M. Mustafizur Rahman, MP, Bagerhat-2 & Hon'ble Minister, Foreign Affairs:

- Augmentation of Gorai river flow (dry season) along with increase of Ganges flow (dry season) needs, immediate action.
- Problem of Drainage Congestion in Beel Dakatia should be solved on emergency basis.
- All actions required on national basis.

2. Salahuddin Yousuf, MP, Khulna-5

- Diversion of Ganges water at Farakka created serious salinity and siltation problems in Khulna & adjoining areas - need immediate solution.
- Problem of drainage congestion in Beel Dakatia to be solved on urgent basis. Solmari river and Hamkura river should be dredged.

3. SK. Ansar Ali, MP, Satkhira-1

- Drainage congestion in Dantbhanga Beel (between Tala and Kalaroa thana in Satkhira Dist) to be removed by re-excavating existing khals of excavating new ones.
- Drainage congestion in Kadar Beel (between Tala & Dumuria thana) to be removed.
- Construction of Ganges Barrage should be taken up immediately.
- Shrimp culture and paddy cultivation together is difficult due to salinity problem.
- All policy should be taken on national basis under one cell comprising all concerned ministers.

4. Abdur Rouf Chowdhury, MP, Kushtia-2

- Serious problems created in the operation of G-K Project due to shortage of Ganges water in dry season.
- Augmentation of Gorai river flow along with Ganges flow (dry season) is essentially and immediately needed.
- Ganges Barrage should be constructed immediately.
- Other Smaller rivers of the area to be re-excavated to remove drainage congestion.

5. Dr. Mozammel Hossain, MP, Bagerhat-1

- CEP Polders 37, 36/2 & 35/2 should be implemented immediately. No Paddy cultivation in the area is possible now due to salinity.
- Heavy siltation observed at Mongla Port area.
- Augmentation of Gorai river flow (dry season) and construction of Ganges Barrage is immediately needed.

6. Mufti Mowlana A. Sattar, MP, Bagerhat-4

- Excavation of Mongla-Ghashiakhali (MG) khal created problem by increasing salinity in new area.
- CEP Polders 37 & 35/2 should be implemented immediately.
- Mara Balleswar river should be re-excavated.

7. Abdur Rouf Mia, MP, Faridpur-1

- Defects in the construction of Regulators in Chandana-Barashia Project should be rectified.

8. Dhirendra Nath Saha, MP, Narail-1

- Ganges Barrage Project should be implemented.
- Augmentation of Gorai river flow (during dry season) needed.
- Dredging of Gorai, Nabaganga & Attarabanki rivers needed.

9. Moulana Md. Sakhawat Hossain, MP, Jessore-6

- Monitoring of Project implementation is essential.
- Drainage congestion created after construction Gangrail closure (south of CEP Polder 24) should be removed.

10. SK. Tayabur Rahman, Mayor, Khulna City Corporation

- Problem of salinity and siltation near Khulna and surrounding areas should be solved.

11. Mansur Ahmed, MP, Satkhira-4

- Problem of drainage congestion (in Polder) areas should be solved.
- Ganges Barrage Project should be implemented.
- Augmentation of Gorai river flow during dry season is essentially needed.

12. Khan Tipu Sultan, MP, Jessore-5

- Drainage congestion in Bhabadaha area (north of CEP Polders 24 & 25) should be removed.
- Ganges Barrage Project should be implemented.
- Agreement between Bangladesh & India should be made for acceptable dry season flow of the Ganges in Bangladesh.

13. Shah Hadiuzzaman, MP, Jessore-4

- Problem of drainage congestion in Bhabadaha area should be removed.

14 Abdul Khaleque Talukder, MP, Bagerhat-3

- Problems of drainage congestion and salinity in Bagerhat area should be solved.
- CEP Polders No. 34/2, 35/2 and 37 should be implemented immediately.
- Excavation of Mongla-Ghashiakhali (MG) khal created problem by increasing salinity in Bagerhat area.
- Ganges Barrage Project should be implemented.
- Augmentation of Gorai river flow during dry season is essentially needed.

15. Kazi Shamsur Rahman, MP, Satkhira-2

- Public participation in implementation of projects is essentially needed.
- Serious adverse effect in Bangladesh due to withdrawal of Ganges water at Farakka.

16. Shah Md. Ruhul Quddus, MP, Khulna-6

- Adverse effect in Bangladesh due to withdrawal of Ganges water at Farakka.
- Problem of river bank erosion in some areas around Khulna, Paikgachha needs solution.
- GW should be made available for irrigation through DTW.
- Shrimp Projects should be registered under appropriate laws.

17. Moulana Habibur Rahman, MP, Chuadanga-2

- Irrigation facilities should be extended in Chuadanga area.
- Upper Mathabhanga river should be re-excavated.

18. A.M. Riasat Ali, MP, Satkhira-3

- Adverse effect in Bangladesh due to withdrawal of Ganges water at Farakka.
- Problem of serious salinity and drainage congestion in Satkhira area.
- Problem of river bank erosion is some rivers in Satkhira.

19. Maj. Gen.(Rtd) M. Majid-ul Haq, MP, Magura-1 & Hon'ble Minister, Irrigation, WD & FC and Agriculture

- Management of water resources in the area is of vital importance for development.
- Problems of the area should be solved jointly by all as a national issue.
- Government determined to solve the problems created by Farakka withdrawal with all available resources.
- Peoples participation is of vital importance in formulating and implementing projects.