United Nations Development Programme
World Bank
Bangladesh Water Development Board
Ministry of Irrigation, Water Development and Flood Control
Government of the People's Republic of Bangladesh

South East Region
Water Resources Development Programme
BGD/86/037

(FAP 5)

FAP 5

BNC 127
171

Regional Plan Report
Executive Summary

October, 1993

Sir M MacDonald and Partners Limited, UK
in association with
Nippon Koei Company Limited
Resources Development Consultants Limited
House of Consultants Limited
Desh Upodesh Limited

United Nations Development Programme
World Bank
Bangladesh Water Development Board
Ministry of Irrigation, Water Development and Flood Control
Government of the People's Republic of Bangladesh

South East Region
Water Resources Development Programme
BGD/86/037

(FAP 5)

Regional Plan Report
Executive Summary

October, 1993

Sir M MacDonald and Partners Limited, UK
in association with
Nippon Koei Company Limited
Resources Development Consultants Limited
House of Consultants Limited
Desh Upodesh Limited

CONTENTS

TABLES

FIGURES

PREFACE

The South East Region Water Resources Development Programme Report describes proposals for the Regional Water Plan and includes summaries of the two feasibility studies recently completed for two substantial areas within the region.

The draft Regional Plan Report was presented in April 1992. After comments were received, replies drafted and a full review completed in July 1992 it was agreed that the draft reports would be amended and upgraded to include the results of the feasibility studies of the Gumti Phase II and Noakhali North Drainage and Irrigation Project. It was also agreed to include upgraded treatment of proposals for the Dakatia/Little Feni transfer scheme including drainage of adjacent areas.

The final Report consists of five Volumes as follows:

Volume 1	Regional Water Resources Plan Part 1 - Existing Situation	
Volume 2	Regional Water Resources Plan Part 2 - The Regional Water Plan	
Volume 3	Annex I	Soils
	Annex II	Agriculture
	Annex III	Sociology
	Annex IV	Environment
Volume 4	Annex V	Hydrogeology
	Annex VI	Hydrology and Water Modelling
Volume 5	Annex VII	Fisheries
	Annex VIII	Financial and Economic Analyses
	Annex IX	Estimate of Costs of Minor Irrigation
	Annex X	Engineering Costs
	Annex XI	Comments, Replies and Actions on Draft Regional Plan Report
	Annex XII	Terms of Reference and Amendments
	Annex XIII	Dakatia/Little Feni Transfer Draft TOR

In addition the consultants have prepared the Executive Summary (this volume) to provide a brief overview of the plan and its principal proposals and recommendations.

SUMMARY

S.1 South East Regional Study (SERS)

This study forms component five of the Flood Action Plan (FAP 5) and covers an area of about 9,000 sq. km. as shown in Figure 1. However as the full name implies the South East Region Water Resources Development Programme covers all aspects of water resources development rather than only flooding and drainage issues.

The final regional plan report presents a water resources development plan to provide as far as possible, sustainable development of all parts of the regional economy taking into account social and environmental factors. The SERS focuses on areas where flooding and impeded drainage hamper economic activity and identifies a series of measures to alleviate these adverse effects. It also evaluates the available water resources and proposes studies and projects for their most cost effective development throughout the region. There are two main volumes of the report describing the existing situation (Volume 1) and the Regional Water Plan (Volume 2). These volumes are augmented by a further three volumes containing thirteen Annexes which provide supporting documents, data and analyses.

S.2 Regional Overview

The region may be sub-divided, for water planning purposes, into three sub-regions by considering topographical and water resources issues and it has been further sub-divided into 13 Planning Units taking into account river and catchment divides, boundaries created by existing embankments (roads and railways) and existing water development project boundaries. Figure 2 illustrates the P.U. boundaries and the three sub-regions may be referred to as:

Northern Sub-region	P.U. 10, 11, 12 and 13
Mid Sub-region	P.U. 3, 4, 5, 6, 7, 8 and 9
Southern Sub-region	P.U. 1 and 2

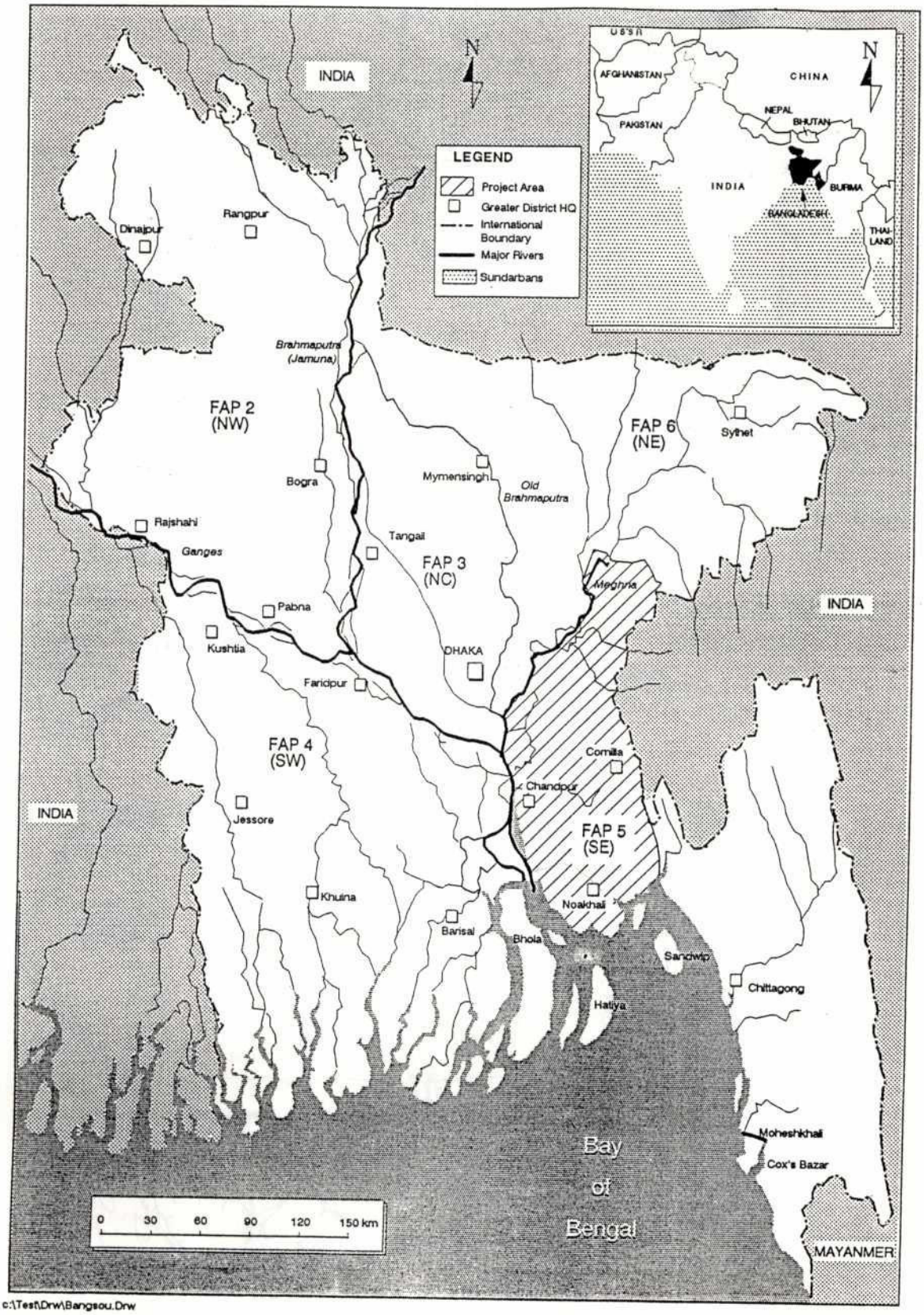
A substantial proportion of the SER is flooded annually and in years or extreme flood such as 1987 and 1988 the majority of the region is under floodwaters to varying depths.

Flooding in the South East Region can originate from three principal sources; direct rainfall, main river (Meghna) overbank spillage and overbank spillage from internal regional rivers, the last mentioned often occurring as flash floods earlier in the year than the other two main causes of floods.

In the northern sub-region all three causes of flooding exist and the high Meghna river levels can cause prolonged deep flooding.

Figure 1

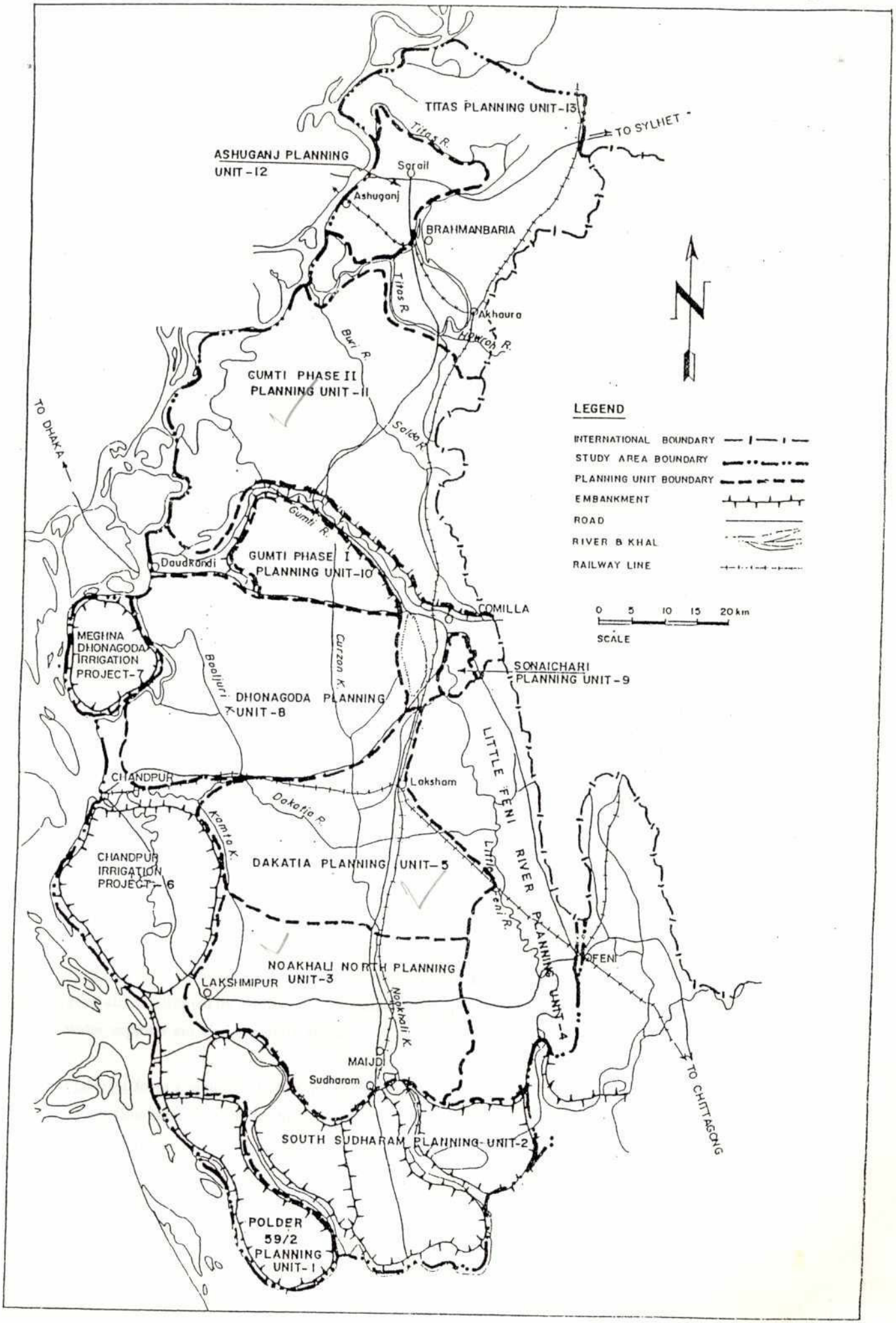
South-East Region, Bangladesh



c:\Test\Drw\Bangsou.Drw

Figure 2

Planning Units



As the Meghna proceeds south through the mid sub-region its level relative to flood plain levels decreases and overbank spillage is much reduced. Also this sub-region is better protected by existing embankments. However this region suffers heavier rainfall and extensive flash flooding in its eastern parts from the Tripura Hills. Also in this sub-region the Meghna river is tidal which has increasing effects on drainage of local rainfall particularly in the lower areas.

The mid sub-region can also suffer from prolonged flooding but this is mostly caused by local rainfall and run-off from the Tripura hills rather than over-bank spillage from the Meghna. The land was once coastal but now drains westward to the Meghna.

The southern sub-region comprises recently accreted lands at the mouth of the Lower Meghna and is not affected by river flooding. However this sub-region is subject to tidal, cyclone and salinity effects and natural drainage is to the south but is increasingly restricted by polder embankments and congested drainage due to the sedimentation of estuaries as accretion continues.

The soils of the region are chiefly of the floodplain type comprising four Agro-Ecological Zones (Middle Meghna, Lower Meghna, Young Meghna and Old Meghna - AEZ 16-19). Along the northern and eastern fringes of the region are small areas of four other AEZs (Sylhet Basin, N and E Piedmont Plain, N and E Hills and Akhaura Terrace AEZ 21, 22, 29 and 30). Most soils are good to moderate for rice production but some areas in the coastal areas suffer from salinity.

The climate of the area is tropical monsoon with average annual rainfall ranging from 2000 mm in the middle of the northern sub-region to over 3500 mm in the coastal areas. The south west monsoon winds begin in May and last through to October bringing heavy and persistent rains. The remainder of the year is generally dry. At the beginning and end of the monsoon period the coastal areas are periodically subject to severe cyclonic storms which produce extremely high winds and associated tidal surges (April/May and September/October).

Agriculture is the main productive activity in the region. Cropping patterns are determined by seasonal flooding and weather regimes with rice as the predominant crop. Paddy production is estimated at about 3 million tons/year and in general the region is a net exporter of foodgrains (to Dhaka etc.) However there are the parts of the region where foodgrains are still in deficit - chiefly in the coastal areas where soils are poorer and the salinity and cyclone constraints restrict both boro and HYV aman cropping. In addition continuing population growth will require growth of production to maintain per capita production levels.

Irrigation has increased significantly in recent years to about 38% of the region's net cultivable area and is generally not limited by groundwater potential except (presently) in the southern sub-region where fresh surface water supplies are also generally absent.

Fisheries form a significant resource of the region particularly capture fisheries in the northern and mid sub-region floodplains and in the Meghna river. Pond culture fisheries are also well established in the region and there is evidence that this is now the dominant fishery in production terms in the southern part of the mid-region.

Socio-Economic aspects of the SERS are summarised in the Study and problems relating to the water sector and to agriculture include unemployment, women's activities, water quality (drinking) and health and nutrition (poverty). These problems are also linked to the very high population densities which occur in some parts of the region and to land settlement and migration issues in the more recently accreted areas. These issues can combine, in some areas, to form severe constraints for sub-regional development and are taken into account in the development of the regional plan.

The knowledge, aspirations and perceptions of the local communities have been assessed through various elements of a public participation programme undertaken at various levels during the studies. This aspect is crucial for the development of a successful water resources plan. Meetings have been held at Thana level, and at village level in many parts of the region and a public meeting was held in Comilla to discuss the draft plan which heard the views of some Members of Parliament and other representatives of the Region. This programme of meetings has resulted in additional studies being undertaken and some revisions to the final form of the regional plan.

S.3 Water Development Strategy

The development of the region's water resources must be arranged to serve the principal needs of the local population. The present and likely future development of the Southeast region will be dominated by the agricultural sector. There is virtually no water consuming industry in the region and therefore the primary requirements for water use are for domestic supply and for irrigated agriculture. It is considered unlikely that large water consuming industries are likely to be developed in the region during the plan period.

The present situation in the region is similar to that of all regions of Bangladesh with an over abundance of water during the monsoon season and severe shortages in the dry season. There are no opportunities for seasonal storage in any significant quantities except for groundwater. Thus all potential future development must involve improved water management through flood control, drainage and irrigation. Also all future water utilisation will require pumping of surface or groundwater resources since gravity supplies during the dry season are generally impossible due to the low river levels. Adequate domestic water supplies are the first priority requirement and all calculations for water availability for agriculture must allow for such supplies.

Development of the region's agricultural sector faces a number of specific constraints. Critical constraints at present include:

- the extreme scarcity of undeveloped cultivable land
- flooding
- limited irrigation water availability, and
- scarcity of public and private sector financial resources either for investment or for operation and maintenance of flood control facilities.

Deficiencies in the physical infrastructure and weaknesses in the systems of agricultural credit provision and other support services are further, but less intractable, problems affecting the sector.

Productivity improvements in agriculture will depend essentially on:

- land enhancement through appropriate flood control and drainage schemes, and increases in irrigated areas; the latter generally yielding the best returns to investment.
- increases in crop yields as a result of improved crop varieties and cultivation practices, and higher levels of inputs.

Together, appropriate land enhancement schemes and increases in irrigated areas should lead to further increases in cropping intensities, and greater use of high yielding crop varieties. This will increase aggregate agricultural output and output per unit input of land, water and capital. Aggregate farm incomes and employment will therefore increase, with multiplier effects in agro-processing, marketing and other related activities.

At present, nearly 38% of the region's cultivated area is irrigated. In the absence of planned additions to the utilisable surface water resources, the irrigated area could increase by about one fifth in the period 1992 to 2012 to over 44% of the cultivated area. The remaining scope for increased groundwater development is limited owing to possible difficulties in achieving the full potential of force mode wells.

The first component of the proposed strategy for development of the region's water resources comprises improvements to land productivity, through the implementation of cost-effective flood control and drainage schemes. This will improve the productivity and profitability of both irrigated and rained agriculture. The second, related component, is the optimal development of irrigated areas through the provision of surface water- where economically viable - to supplement available non-saline groundwater resources.

Any public sector investment programme for flood control and irrigation must take into account the realities of Bangladesh's financial and organisational situation. The resources available for public sector investment are limited in relation to the scale of the country's overall requirements. It is therefore essential that investments be limited to those programmes which merit the highest priority in terms of economic returns per unit of capital invested.

The success of the strategy will, of course, depend crucially on the maintenance of a national agricultural policy framework which is conducive to productive investment in agriculture.

The strategy must also take into account the impacts of water resources development for the agricultural sector on other economic sectors, and the social and environmental implications of potential development options. In the case of FCD/FCDI schemes, the most critical impact outside agriculture is likely to be on the fisheries sector. Capture fisheries will be, usually negatively, affected by the implementation of any new flood control measures, whereas the development of aquaculture could yield substantial benefits.

The Regional Water Plan aims to provide the Government of Bangladesh and potential donors with a range of developments spread throughout the region to promote improved living conditions through flood control, drainage and irrigation, increased agricultural output and enhanced incomes in a balanced programme over an extended period of time. Most of the identified components of the plan will require studies at feasibility level followed by detailed design before construction can begin. However other activities have been identified which could proceed direct to design and implementation or are ongoing programmes under existing projects.

Feasibility studies may revise the scope and priority of projects identified here and therefore the plan must be flexible to allow for changing priorities.

The plan is more than just a collection of projects and it must include a number of related programmes which will allow the regional strategy described to develop.

The strategy may be summarised as follows:

a) Improved and secure potable water supplies for the population to have the highest priority in allocation of resources

b) Systems of drainage and flood control to be appropriate to each part of the region taking into account causes of flooding and existing users (e.g. farmers, fishermen, boat operators etc.).

c) Water Resources Strategy:

i) Groundwater development to be encouraged in areas where fresh surface water is absent or where it will be difficult or expensive to develop. This could also involve policies to control the use of groundwater in coastal aquifers.

ii) Surface water systems to be developed first in those areas where it can be most cost effectively utilised. This suggests that this will initially be in those areas where good quality and cheaply available groundwater is absent or in short supply.

d) Fisheries will be developed and exploited, both capture and culture, both with or without the plan. However research into the capture fisheries is still at an early stage (FAP 17) and new initiatives will need to be tested before definite development proposals can be included in national or regional plans.

Culture fisheries programmes are currently receiving much attention nationally and they are potentially highly profitable. Parts of the SER are already well developed in this respect through a combination of public and private initiatives. This is expected to continue but in consumptive water use terms it is not significantly different from irrigation requirements per unit area.

The fisheries component of the plan is therefore primarily a programme of practices and policies with measures to mitigate adverse impacts and to promote increased production.

e) Irrigation development at the tertiary level is now in the private sector for all types of development. Therefore, the approach of this regional plan has been to identify schemes which allow supplies to be delivered into existing distribution systems on a least cost basis. This will need to be combined with an intensive effort to registers all water users who abstract water from these systems so that they can be equitably treated in terms of guaranteed supplies (with established water rights) and in terms of accepting a need for payment to maintain those rights.

f) Other Water Users

The preceding paragraph (e) raises the issue of water rights use and abuse. There is a need to develop and implement comprehensive national systems to identify, register, charge and control the use and abuse of water resources not only for irrigation but also for and by industrial users. hardly any → 5.3

The introduction of drainage charges for beneficiaries of flood control projects is already in the early stages of development under the SRP. However it will also be necessary to develop systems for monitoring and control of industries and large communities which discharge waste to water bodies (directly or indirectly) which are subsequently used by others or which contain fish which may be consumed by the population.

These are national not regional issues but are a vital component for successful implementation of any plan.

g) Navigation is generally tested as an impact for proposed interventions under the plan so that other sectors benefitting impose the minimum interference to important navigation routes. Where flood control or drainage makes land flood free then alternative transport systems (roads) will be consequently improved. dykes as roads

h) Flood proofing is again a national rather than a regional consideration but it has been specifically considered where proposed interventions could cause other areas to be adversely impacted in terms of flooding.

Ranking of identified development options takes into account such factors as regional balance, environment, economics, finance, social equity and sustainability.

The regional water resources consequences of the various proposals have been examined and a tentative prioritisation and programming of project interventions and other complementary and supplementary policies and programmes is presented.

S.4 Development Options

A number of development options have been formulated and these include:

- full controlled flooding and drainage based on embanked areas with gated structures and major drainage improvements
- semi-controlled flooding and drainage where flooding depends partly on embankments with gated structures and partly on natural openings
- water management systems tidal and non-tidal

- development of unprotected or partially protected areas in terms of flood proofing, flood preparedness and early warning systems

- surface water irrigation systems using low lift pumps with gravity supply or with main left pumping. Both these options are considered either alone or in combination with flood control systems

- groundwater development for domestic water supply and for irrigation utilising both shallow and deep aquifers.

S.5 Preliminary Screening of Development Options

Appropriate flood alleviation and water resource development options have been considered for each planing unit within the region. In some cases this has required consideration of a number of planning units together when considering either sub-regional flooding or drainage problems or surface irrigation supplies.

In addition it has been necessary to take into account the practical possibilities for developing inter-basin transfer proposals to include areas beyond the region boundaries as defined in the terms of reference.

S.6 The Planning Process

A substantial number of development components were identified during the study and these have been taken through various levels of study according to information available and additional funding available for detailed studies. The planning process was multidisciplinary and involved the use of a hydrodynamic model (SERM) for a large part of the region together with engineering and economic analyses supplemented with agricultural, fisheries, institutional, socio-economic and environmental studies.

Over 30% of the region has been studied at feasibility level covering most of planning units 3, 5 and 11. The remainder of the region has been studied at pre-feasibility or reconnaissance level depending on the data available. The results of all these studies have been incorporated into a multi-criteria analysis of the identified schemes.

The Regional Water Plan (RWP) is presented below but the success of the complete plan is subject to implementation of a number of policies and programme's including institutional changes, and to using to good effect the experience gained from several of the completed and ongoing FAP supporting studies.

At this regional level of planning and analyses the qualitative criteria cannot be examined in detail but the consultants have tried to be as objective and consistent as possible in their treatment of options considered. No doubt there will be many other presentations which could be identified for some areas but the consultants believe that they have been able to identify the principal viable options.

Apart from the two areas already studied at feasibility level it has not been possible to optimise costs or benefits of the schemes proposed for development. Both the feasibility studies have identified how in depth study and effective use of modelling techniques can produce improved rates of return compared with prefeasibility level studies.

For this reason the schemes have been divided into two economic categories as follows:

i) Schemes having a base case EIRR in excess of 12%

ii) Schemes having a base case EIRR of less than 12% but greater than 9%.

Schemes having returns of less than 9% have not been considered for ranking (being unlikely to attract funding).

All schemes have been compared in the light of their qualitative ranking to see if environmental aspects were significantly different for proposals in the same priority classification. It should be noted here that proposals which had severe environmental problems have been amended, if possible, during evaluation to minimise such effects. However, many options have regressive tendencies in terms of social equity or fisheries impact and this has been pointed out in the analyses.

There are 15 proposed projects or components with a base rate of return which exceeds 12% on present assumptions.

S.7 The Regional Water Plan (RWP)

The main components of the Regional Water Plan include both structural and non-structural elements. Many of the structural components will require further studies before implementation and this is taken into account in the proposed implementation schedule. The plan also includes a number of projects which are already under implementation or could be described as ongoing programmes.

The components of the RWP are shown in Figure 3. They comprise the following:

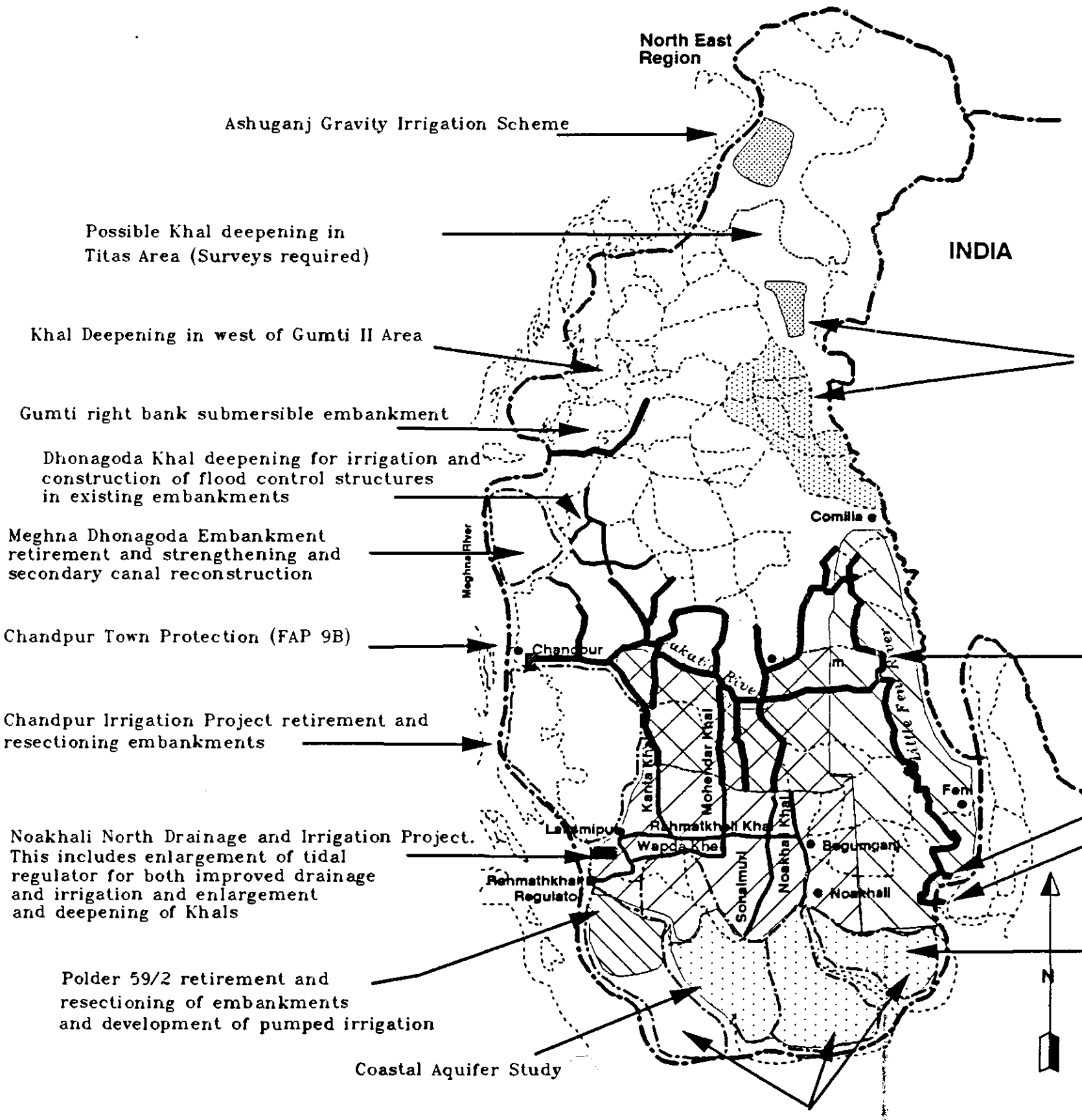
Structural Measures

- Retirement of embankments at Hanarchar and other rehabilitation measures for the existing Chandpur Irrigation Project (PU 6). This work is to be carried out under the Systems Rehabilitation Project.

- Retirement and strengthening of embankments, provision of locks and rehabilitation of secondary canals within MDIP (PU 7).

- Chandpur Town Protection works as proposed by FAP 9B are considered to have a high priority since not only is the town at risk but so also is the Chandpur Irrigation Project (PU 6).

Figure 3
Regional Water Plan



The map shows the measures proposed for incorporation in the Regional Water Plan
In addition to structural measures shown many units will benefit from groundwater development (see text)
Associated Development Components include:
- flood proofing (especially in the northern parts of the region)
- fisheries mitigation and enhancement
- improved O & M of all schemes through funding and people's participation
- environmental management plans

c:\ies\iesmaps.drw

- Further Groundwater Development in planning units 3, 4, 5, 8, 9, 10, 11 and 13 incorporating both STW and FMTW technologies are anticipated for up to 50,000 ha. This development is to be supported by the NMIDP. However a major new study is recommended for planning units 1 and 2 to investigate the potential of the deep aquifer in the coastal area.

- The ongoing CERP works in planning units 1 and 2 should be completed within the first few years of the plan and these will be complemented by cyclone shelter provisions and early warning systems also under other ongoing projects.

- Khal deepening programmes are proposed for planning units 8, 11 and also possibly for units 10, 12 and 13 depending on further investigations. These programmes could be funded through FFW or extension of the Model Rural Development Plan. These programmes are primarily for improved irrigation supplies in areas close to the Meghna river.

- Ashuganj irrigation project (PU 12) is to be developed using available gravity supplies from the power station.

- A submersible embankment on the right bank of the Gumti river extending down to the existing Homna road embankment giving protection against flash floods (PU 11).

- The Noakhali North Drainage and Irrigation Project comprises an additional Rahmatkhali drainage regulator, enlarged and deepened khals and provisions for entry of irrigation water. Both drainage and irrigation rely on the tidal water regime. This project offers substantial scope for improved drainage (PU 3 and 5) and 18,500 ha of additional irrigation development in PU 3. There will be a need for additional studies to finalise a mitigation programme for affected capture fishermen.

- Two polder schemes recommended by the Gumti Phase II feasibility study (1993) (intersections 1A and B) together with a dredging programme are included in the plan and again there is a need to develop fisheries mitigation programme (PU 11).

- A major study is proposed to investigate the sub-regional development strategy envisaged for the Dakatia/Little Feni transfer scheme together with associated drainage improvements for both river catchments. The strategy includes improved drainage for the Sonaichari area (PU 9) and for the Little Feni (PU 4) and for a major transfer of Meghna water through pump stations on the Dakatia river and on the Mellar khal to serve areas in PUs 4, 5 and 8 and also to provide additional supplies to Muhuri.

- Retirement of existing polder embankments, resectioning and 8,500 ha pumped irrigation development for the northern part of PU 1 is proposed. These works will complete the protection works proposed under CERP for Polder 59/2.

- Improved drainage is proposed for planning unit 2, although the choice of drainage option will be dependent upon the proposals and recommendations of the forthcoming FAP 5B study.

- Planned improvements to flood control and drainage to the Dhonagoda area (PU 8) are proposed utilising the alignment of existing road embankments and those currently programmed, supplemented by regulator structures to exclude high floods whilst permitting natural drainage when levels permit (low tide).

- Other possible schemes which could be introduced later in the plan include an additional irrigated polder scheme in PU 11 but this should be deferred to see whether local people can develop the area using groundwater potential.

Non-structural

Parallel programmes are recommended for implementation with the plan and these include:

- Carefully targeted programmes to provide mitigation of adverse effects on capture fishermen on a projects by project basis.

- A programme of flood proofing in areas still inadequately protected in this respect. This may be particularly appropriate in areas of planning units 11, 12 and 13 and also areas outside protected parts of PU 8.

- An environmental protection and monitoring programme.

- All developments should include continuing efforts to consult with and involve the local communities at every stage of development to ensure their understanding and acceptance of the project concepts and their benefits and obligations.

S.8 Programming Criteria

Having selected a number of schemes for definite or possible inclusion in the plan it is necessary to consider how these projects might be scheduled to provide the Government of Bangladesh with a balanced programme and also one which allows the maximum flexibility for the later part of the programme. This flexibility is especially necessary when the environmental sensitivity of many of the possible development projects is taken into account and the outcome of future feasibility studies is uncertain. It is therefore important to identify the major factors which may have a bearing on the scheduling of projects.

i) Financing

One of the objectives of the FAP is to enable choices to be made between competing water resources development projects and programmes for different parts of Bangladesh, in accordance with their relative technical and economic viability. Until such time as the project pre-feasibility studies for all regions are complete, it is impossible to judge the priority which should be attached to projects in the south-east region, relative to competing projects elsewhere. However, for the purposes of this study it necessary to estimate the

likely scale of public sector finance which might be available for projects in the south-east region, for comparison with the possible requirements for particular projects, or groups of projects. This has been investigated and indicates a level of expenditure of about Tk 550 to 600 million per year (1991 prices) from about 1994 onwards.

ii) Regional Water Resources

The primary physical constraint to irrigation development in the region is the availability of water in the critical month of March which has the highest water demands and lowest quantities available in the rivers and khals of the region.

The consultants have attempted to maximise the utilisation of available resources by recommending the development of substantial areas by the groundwater modes of STWs and FMTWs whilst acknowledging that there are practical problems which may limit this development below its theoretical potential. This constraint has been applied to a number of planning units.

The consultants have taken note of, but not been restricted by the National Water Plan allocation of 204 m^3/s for the SER in March because at this stage of planning and when all regions of the country are being reassessed for their potential it is considered prudent merely to indicate the amounts which would be required if certain levels of development occur whether or not any particular allocation is exceeded. When the results of all the regional plans are available then a review of the allocations can be undertaken.

a) Groundwater

The plan assumes a total increment in groundwater irrigation of approximately 50,000 ha. This total is spread throughout most of the region except in the coastal area, where a potential resource has been identified and it is recommended that this resource should be investigated to assess its potential and spatial extent. Primarily this will be for the planning units 1 and 2.

If the most efficient use of water resources is to be achieved then FMTW technology will need to be encouraged and this may require some limited subsidy for FMTW to make them competitive with STWs. If this does not happen the groundwater resources may be under utilised and this would result in increased demand for surface water systems which are totally subsidised. This would place a greater burden on the Government's financial resources.

The studies have identified the need to introduce some degree of control over deep groundwater development in the southern part of the region so that the available resources can be reserved for those purposes and areas which are considered to have the highest priority. The highest priority must be given to domestic water supply and it is expected that most of this will come from groundwater. Indeed all the groundwater calculations have been based on the assumption that all such requirements are met from the groundwater resource in the future and the resources stated to be available for irrigation are estimated net of water supply requirements.

b) **Surface Water**

The study has identified a possible total additional 74,575 ha of surface water irrigation

The existing utilisation of surface water resources is shown in columns 21 and 22 of Table S.1. The difference between the two columns is the total presently utilised from tributaries such as the Gumti river and/or taken from locally stored rainfall. All surface water requirements are based on a peak crop water requirement of 1.3 l/s/ha. The planned future utilisation of surface water is shown in columns 23 and 24 of the table and the difference is again the locally available water. However it should be noted that in this case the locally available resources are diminished. This is because the more efficient drainage schemes in unit 3 and 5 (Noakhali North and Dakatia) will have removed some of the water which is currently stored on flooded land and used for local irrigation. Thus in the "with plan" situation all the water required for the area of irrigation of Noakhali North served by the newly excavated khals and some of that for Dakatia/Little Feni transfer will have to be provided from the Lower Meghna.

The total surface water requirement from the Lower Meghna if the full development is realised could be 291 m^3/s compared with a present requirement of 174 m^3/s.

The prioritisation of projects between regions cannot be done by this report but some considerations could be given for prioritisation within the region. It is considered that first priority should be given to schemes which require no primary pumping. In this plan the projects identified would be the khal deepening programmes in Dhonagoda, Gumti II and possibly also in PUs 12 and 13, the scheme in Noakhali North and the Ashuganj project Even these schemes would raise the Meghna water requirement to about 230 m^3/See.

However this would leave planning units 1 and 4 (Little Feni) without much prospect of further agricultural development given the groundwater constraints. The study has also identified that an efficient transfer system could provide water for up to 9 500 ha of additional irrigation to the Muhuri catchment if the Dakatia-Little Feni transfer scheme were to be developed and a feasibility study for this scheme combined with study of the drainage problems of the Sonaichari, Dakatia and Little Feni catchments is proposed.

It is clear that unless the water allocation for the South East Region can be increased from that provided in the National Water Plan that difficult decisions will be required and that some areas within the region would suffer retarded development as a result.

S.9 Plan Formulation

The plan does not seek to place the various proposals in a definite order of priority. It does include a number of proposals which are not included in this study but which nevertheless are concerned with the South East Region and therefore have an impact on the regional development of water resources. As already described the plan includes eight proposals or projects which are concerned with Flood control, erosion and / or drainage, seven proposals concerning surface irrigation, and regional proposals for development of groundwater.

TABLE S.1

Planned Projects – Summary of Water Resources Demands

Ref No	Planning Unit	Net Cultivated Area (NCA)	Potential Irrigated Area Total 75% of NCA (i)	Potential Area Irrigable by Ground water	STW	FMTW	Balance needing Surface Water Irrigation (ii)	Net Surface Water Req.	Present Irrigated Area			Future Irrigated Area without project (FWO)			Planned Irrigated Area				Proposed Irrigation Percent of Potential		Existing Gross Surface Water Req.	Existing Meghna Surface Water Req.	Future Gross Surface Water Req.	Future Meghna Surface Water Req.
									Total	Ground water	Surface	Total	Ground water	Surface	Total	Ground water	Surface New	Surface FWO	Total	Ground water				
	(1)	(ha) (2)	(ha) (3)	(ha) (4)	(ha) (5)	(ha) (6)	(ha) (7)	m3/s (8)	(ha) (9)	(ha) (10)	(ha) (11)	(ha) (12)	(ha) (13)	(ha) (14)	(ha) (15)	(ha) (16)	(ha) (17)	(ha) (18)	(%) (19)	(%) (20)	m3/s (21)	m3/s (22)	m3/s (23)	m3/s (24)
1	Polder 59/2 (iii)	26 500	19 875	0			19 875	27							8 500		8 500		43	0			11	11
2	South Sudharam (iii)	89 600	67 200	36			67 164	91	1 594	36	1 558	1 594	36	1 558	1 594	36		1 558	2	100	2		2	
3	Noakhali North	74 500	55 875	2 727	877	1 850	53 148	72	25 833	1 727	24 106	26 833	2 727	24 106	45 342	2 727	18 509	24 106	81	100	31	7	55	37
4	Little Feni (iv)	80 200	60 150	25 883	2 586	23 297	34 267	46	18 839	9 410	9 429	29 858	20 429	9 429	57 135	17 429	8 501	9 429	95	67	12		23	23
5	Dakatia	68 500	51 375	13 750	5 100	8 650	37 625	51	22 946	7 903	15 043	28 793	13 750	15 043	36 835	13 750	8 042	15 043	72	100	20	10	30	25
6	Chandpur	39 750	29 813	219			29 594	40	23 132	219	22 913	23 132	219	22 913	23 132	219		22 913	78	100	30	30	30	30
7	Meghna Dhonagoda	13 450	13 440	0			13 440	18	13 440		13 440	13 440		13 440	13 440			13 440	100	0	17	17	17	17
8	Dhonagoda (iv)	88 050	66 038	25 873	9 572	16 301	40 165	54	31 026	14 635	16 391	39 244	22 853	16 391	42 264	21 853	4 020	16 391	64	84	21	10	27	16
9	Sonaichari	15 950	11 165	11 165	2 346	8 819			9 757	8 022	1 735	10 425	8 690	1 735	11 960	8 690	1 535	1 735	100	78	2		4	
10	Gumti Phase I	26 150	18 305	8 483	5 105	3 378	9 822	13	8 500	4 666	3 834	12 316	8 482	3 834	13 316	8 482	1 000	3 834	73	100	5	4	6	5
11	Gumti Phase II	122 150	91 613	91 615	37 200	54 415			60 980	26 317	34 663	83 085	48 422	34 663	83 085	38 422	10 000	34 663	91	42	45	34	58	47
12	Ashuganj	25 900	20 720	11 354	1 279	10 075	9 366	13	14 767	5 108	9 659	14 767	5 108	9 659	19 681	5 054	4 968	9 659	95	45	13	13	19	19
13	Titas	90 000	67 500	32 833		32 833	34 667	47	47 987	16 611	31 376	56 200	24 824	31 376	56 200	24 824		31 376	83	76	41	41	41	41
	Other areas (v)	18 200	13 650	4 073	4 073		9 577	13	7 251	1 098	6 153	10 226	4 073	6 153	10 226	4 073		6 153	75	100	8	8	8	8
	Sub – total	778 900	586 718	228 011	68 138	159 618	358 709	484	286 052	95 752	190 300	349 913	159 613	190 300	422 710	145 559	65 075	190 300	72	64	247	174	332	279
	Muhuri transfer (vi)		14 950				14 950	20									9 500		n.a.	n.a.			12	12
	Total	778 900	601 668	228 011	68 138	159 618	373 659	504	286 052	95 752	190 300	349 913	159 613	190 300	422 710	145 559	74 575	190 300	72	64	247	174	344	291

Notes

(i) Potential area estimated as 75% of NCA except for Meghna Dhonagoda and Ashuganj

(ii) Potential area irrigated by surface water calculated from total potential area less groundwater potential

(iii) Groundwater potential requires investigation

(iv) Includes area between Kazirhhat and Musapur

(v) These areas are near the Meghna and Lower Meghna rivers

(vi) Muhuri additional irrigation area assumes gross crop water reqirement of 1.30 l/s/ha

Two major studies are also proposed and both are concerned with improved water resource exploitation although one also has a major drainage component. All parts of the region are included in the plan under at least one component.

The plan gives priority to the rehabilitation and improvement of existing schemes this not only serves to protect existing investments but should lead to greater confidence of the people of the area that future projects will be maintained. Also such projects usually offer good returns to the investments made.

Development within the region will be a dynamic process. Both external and internal conditions are constantly changing and the relative merits of different modes of development will also change. The development plan must accommodate this dynamism and must be changed to take account of changing circumstances.

The plan developed here should allow this quite easily since, with one exception, there are no very large single stage proposals in the plan which generally comprises relatively small scale investments which will form the building blocks of regional water resources development and can be rearranged according to need since few of them are interdependent.

The outline scheduled for RWP is shown in Figure 4.

S.10 Financial Plan

Figure 5 indicates the plan financing requirements in 1991 prices which has been the year used throughout the study in accordance with FPCO guidelines.

The largest single element in the plan is the Chandpur town protection project under FAP 9B which FAP 5 supports since the risks involved in not attempting to stabilise the Meghna seem immense.

The fact that there are a large number of quite small projects included in the plan could make for a bunching of expenditure in the early years.

However by delaying work in the southern polders until FAP 5B has reported and the Gumti II irrigation and drainage polder, which is not recommended unless groundwater development does not take place, it is possible to delay some of this. In addition the Dakatia-Little Feni transfer proposals will require detailed study and design periods before implementation and they can also be staged as shown in the schedule.

The overall levels of expenditure excluding the Chandpur town protection works would seem to be within expected levels when compared with those discussed in Section S.8(i) above.

Figure 4

Regional Water Plan

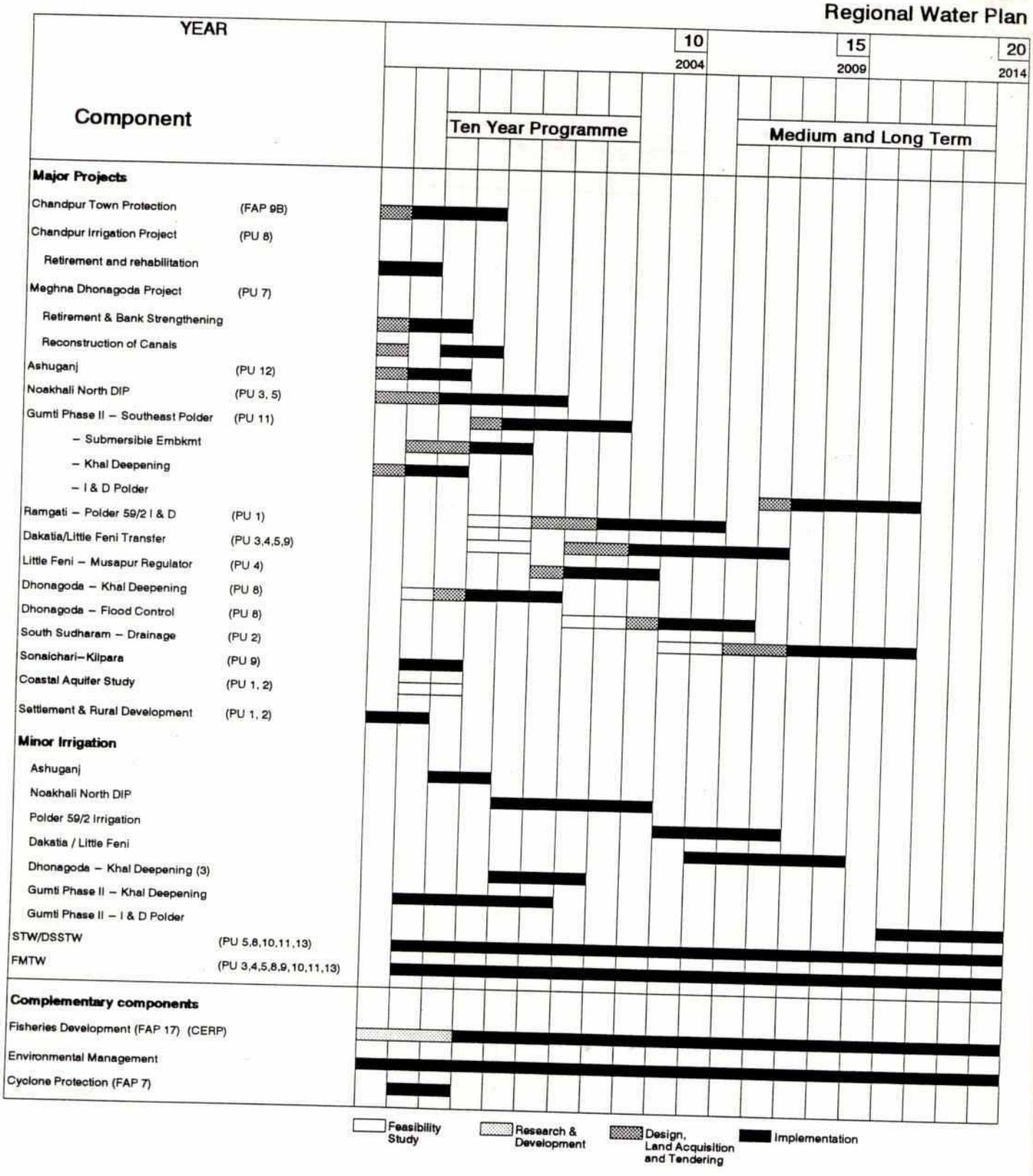


Figure 5

Financial Schedule (Tk. M)

YEAR											10			15					20		
											2004			2009					2014		
Component				Ten Year Programme										Medium and Long Term							
Major Projects																					
Chandpur Town Protection	(FAP 9B)	20	1200	1200	1200																
Chandpur Irrigation Project	(PU 6)																				
Retirement and rehabilitation		32	31																		
Meghna Dhonagoda Project	(PU 7)																				
Retirement & Bank Strengthening		10	96	96																	
Reconstruction of Canals				9	9																
Ashuganj	(PU 12)	12	75	75																	
Noakhali North DIP	(PU 3, 5)		34	161	401	442	226														
Gumti Phase II – Southeast Polder	(PU 11)				19	90	92	92	92												
– Submersible Embkmt			1	1	8	8															
– Khal Deepening		1	23	23	23																
– I & D Polder*																					
Ramgati – Polder 59/2 I & D	(PU 1)				6	6	9	10	88	88	88	88			40	114	114	114	114		
Dakatia/Little Feni Transfer	(PU 3, 4, 5, 9)				34	34		26	26	241	241	241	241	240							
Little Feni – Musapur Regulator	(PU 4)						30	110	110	110											
Dhonagoda – Khal Deepening	(PU 8)			1	4	4	4														
Dhonagoda – Flood Control	(PU 8)							6	7	56	56	56	56								
South Sudharam – Drainage	(PU 2)										8	8	12	13	113	113	113	113			
Sonaichari – Kilpara Extn	(PU 9)		20	20																	
Coastal Aquifer Study	(PU 1, 2)																				
Settlement & Rural Development	(PU 1, 2)	32	32																		
Sub–Total (Public Funds)		**107**	**1512**	**1586**	**1704**	**584**	**361**	**244**	**323**	**495**	**393**	**393**	**309**	**293**	**227**	**227**	**227**	**227**	**0**	**0**	**0**
Minor Irrigation																					
LLP																					
Ashuganj				10	10																
Noakhali North DIP						15	15	15	15	15											
Polder 59/2 Irrigation											9	9	8	8							
Dakatia / Little Feni												13	14	13	13	13					
Dhonagoda – Khal Deepening						6	5	5													
Gumti Phase II – Khal Deepening			8	8	8	8	8														
Gumti Phase II – I & D Polder*																		10	10	10	10
STW/DSSTW	(PU 5,8,10,11,13)	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12					
FMTW	(PU 3,4,5,8,9,10,11,13)	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23
Sub–Total (Private Funds)		**35**	**43**	**53**	**53**	**64**	**63**	**55**	**50**	**50**	**44**	**57**	**57**	**56**	**48**	**48**	**23**	**33**	**33**	**33**	**33**
Complementary components																					
Cyclone Protection (FAP 7) (CERP)		304	304																		
Environmental Protection		15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15
Total expenditure per year		**461**	**1874**	**1654**	**1772**	**663**	**439**	**314**	**388**	**560**	**452**	**465**	**381**	**364**	**290**	**290**	**265**	**275**	**48**	**48**	**48**

* If required

S.11 Institutional Aspects

Institutional arrangements for implementing and monitoring the FAP are under consideration in a number of quarters, notably FAP26. Issues to be addressed will include:

The relationship between FPCO and WARPO (formerly MPO). At the present stage of development of FAP, considerable reliance is being put on outside consultants, and FPCO is too short-staffed to be able to handle more than the administrative management of the programme. There is a need to put in place an organisation which can manage the planning of FAP on a continuing basis and provide continuity between major studies and implementation. This will inevitably need consultants and other organisation to become involved. An additional factor to be considered is that FAP is mainly concerned with planning for the flood season whereas it is widely recognised that there is a need to take an over-year view of water resources management as in FAP 5. It is recommended that consideration should be given to rearranging the planning and management functions within the Ministry to avoid duplication and to clearly define the responsibility for each stage of development.

Institutional issues relating to flood proofing are being addressed by FAP23. A programme of flood proofing should be instituted wherever needed. However, great care will be needed with the institutional arrangements for flood proofing so as to avoid the situation where central or local government has to take a major role. If this happens, the problem of lack of investment in the maintenance of the facilities is likely to occur, as it does with flood protection facilities. Villagers already have survival strategies to deal with floods, and the most important task required is to identify low-cost ways to support these strategies and make them more effective.

A particular aspect of implementation concerns construction procedures, especially with regard to earthworks. It is important to carry out earthworks using manual labour as far as possible, in order to spread the benefits of investment to the landless, but not at the expense of standards of construction. The emphasis must be on timely commencement of work, use of good material, and satisfactory compaction and construction techniques. Use of labour contracting societies has generally resulted in better quality work, and the expansion of the LCS system is recommended.

S.12 Operation and Maintenance

There is general agreement that poor O&M has been a major factor adversely affecting the past performances of FCD projects. A great deal of interest is now being shown by Government and donors in trying to improve this situation. Within the FAP programme, two key components are FAP 13, the O&M study, and FAP20, the Compartmentalisation Pilot Project. The latter is charged with developing a Local Water Management Board with responsibility for operation and water management. Outside the FAP, both EIP and SRP are developing approaches which should lead to substantial improvements.

A significant constraint on effective O&M is shortage of funds. At present funds come through cash allocations from BWDB's revenue allocation or through FFW programmes. New legislation and the SRP programme are now making progress in the development of new changing systems to beneficiaries. This has been discussed in some detail for the NNDIP but for projects where there is no irrigation, charging for drainage raises problems which require detailed study at a national level and SRP and FAP 13 are the preferred projects to do this and current proposals strengthen the need for sensitive involvement of local communities.

S.13 Environmental Management and Mitigation Planning

The RWP would physically and ecologically transform aspects of the functioning and landscape of the river, coastal, estuarine and floodplain system. Environmental planning aims to ensure that any new environment could maintain the productive resource base in surety and intact for future generations of users. This involves mitigating the adverse impacts of the interventions. Yet, the RWP would be only one of many activities affecting the quality of life and environment in the region. To be effective environmental management also needs to be linked and coordinated, not only with FAP projects in other regions, but also with other sector activities.

The national environmental policy and the NEMAP lay out the general direction and issues for an integrated approach to environmental management. The potential scope of a regional environmental plan is wide. But it also needs to be specific and directly appreciate and support the daily decision-making world of individual environmental managers at the level of agricultural and fishing communities and industrial managers.

Much of the research and planning required involves subject areas that remain poorly developed in Bangladesh. Until local educational curriculum have been installed and sufficient local trained staff are available, international resources will have to be relied on to assist in the process and a patient attitude adopted to the speed with which progress can be made. The upgrading of training and education will require a considerable medium-term investment. Existing MOEF proposals already are looking to strengthen their capabilities. Further support from other sources will be required if a more rapid transition is to be made.

The main programmes required for the SER are to:

- Incorporate planning and management criteria and methods to sustain development potential by conserving resources through proper zoning and integrated use of resources.
- Improve policies to deal with the problems of construction.
- Improve policies to deal with the problems of land acquisition, compensation and resettlement.
- Integrate into planning the research and if necessary protection of cultural and heritage sites.
- Establish a coordinated pollution monitoring system to plan for trends in industrial, agricultural and sanitation pollution problems.
- Integrate public health programmes and monitoring into water resource projects to deal with changing disease and disease vector profiles associated with FCDI interventions.

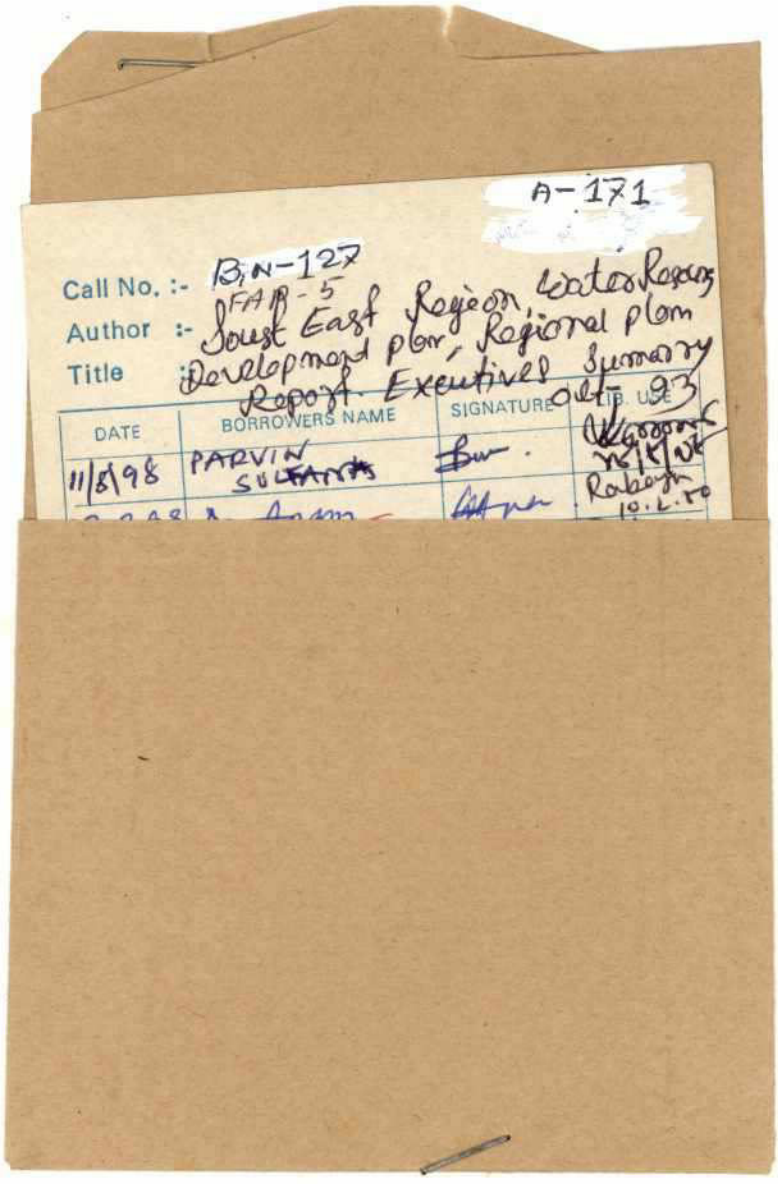
Research and Management Coordination

The considerable scope of future work in the field of environmental management and monitoring will require properly established and coordinated units of trained staff within the MOEF and the BWDB. At the present time there is a considerable reliance on consultants to carry out one-off studies. While it may be possible to rely on the inputs of international and national consultants for some initial planning surveys and studies, this approach should only be a short-term strategy. The long-term work requires daily coordination and development by personnel properly trained in the fields of environmental monitoring, planning and management. The major thrust of overall coordination should rest with the MOEF, but the BWDB should have the responsibility to bring its planning and design criteria up to the standards which reflect this more comprehensive and inter-linked approach to water resource development. The BWDB already has responsibility for monitoring various water variables important to the overall planning.

Recommendations have already come from the MOEF for environmental cells to be set up within the main government institutions. The minimum requirement would be for one senior management post within each region to allow the coordination and supervision. This post would need to be supported by field staff to carry out sampling and monitoring work. The questions of the full institutional staffing, facilities and management systems are not within the scope of the terms of reference of this study.

Consultation and Public Participation

It is important that the future planning procedure incorporates a major element of public participation and liaison at all levels. The present study has done this to a limited degree. Once some policy reaction has been indicated as a result of this study report, then the major affected parties can be drawn into the continued planning and future implementation. This would include administrative, political, media, NGO and community representatives. The basic structural and non-structural provisions and problems of land acquisition and compensation will initially need careful consideration. Later, at project feasibility stage, close liaison and coordination with other departments who would be involved in the execution would be necessary.


A-171
Call No. :- B,N-127
FAR-5
Author :- South East Rajeon Water Resources
Title :Development plan, Regional plan
Report. Executive Summary
DATE
BORROWERS NAME
SIGNATURE
LIB. USE
11/8/98
PARVIN