# FLOOD ACTION PLAN



## INSTITUTIONAL DEVELOPMENT PROGRAM
## INTERIM REPORT No. 1
## (April 1994)



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## STUDY FOR FPCO BY
## PANEL OF EXPERTS ON INSTITUTIONAL ISSUES

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## FOREWORD

1. The POE team on Institutional Development started work in January 1993. At the time no decision had yet been taken about the manner in which the FAP 26 study would be carried out. It was suggested that the team prepare the TOR for FAP 26. Following discussions on the matter with FPCO, it was agreed that the team, comprised as it is of senior professionals, should undertake the study itself.

2. Upon commencement of work, the POE team found that majority of FAP studies were still to be completed. This meant that a clear picture of the FAP project portfolio and implementation needs thereof were yet to emerge. In the interim period, the team examined and gave its views on two issues: (i) institutional set-up to be tested under the Compartmentalisation Pilot Project and (ii) arrangements for continuation of FPCO work.
In the latter case, the team, after considering various options available, recommended extension of the term of FPCO till December 1995 by which time the final FAP report and all on-going studies were expected to be completed.

3. The present volume, Interim Report No. 1, examines five major areas as the table of contents will show. Definitive recommendations have been made where possible; otherwise key issues have been identified and lines of further investigation indicated. Subject to agreement of FPCO, the team proposes the following topics for Interim Report No. 2:

   (i) review of performance of BWDB-organisational strengths and weaknesses--role in FAP implementation
   (ii) review of allocation of functions between BWDB, RRI and WARPO
   (iii) enhancement of private sector capability for planning, designing, supervision and implementation of water sector projects
   (iv) appropriate base for GIS.
   (v) categorization of projects

4. The POE team has been working under short-duration contracts renewed from time to time. There was no contract for some months. This on-again-off-again situation does not provide a sound basis for sustained effort. The team has also no fund for secretarial support. It is suggested that a contract defining the whole work and tied to a time-schedule for performance, be issued.

The team thanks FPCO management, Mr. Ross Wallace of the World Bank, and the Consultants of various FAP projects for their cooperation and assistance.

**Members of the POE team for Institutional Development**

# CHAPTER 1

## PROJECT PORTFOLIO GENERATED BY FAP AND INSTITUTIONAL FRAMEWORK FOR ITS IMPLEMENTATION

1.1 This section provides an analytical review of FAP in terms of the project-portfolio that will be generated. It also examines the institutional framework to execute these projects keeping in view the potential of:

- Government agencies;
- Local government bodies;
- NGOs and
- Local consultants/contractors.

1.2 Since December, 1989 when FAP was born, it has focused its attention on "the identification, planning and possible construction of technically, economically, environmentally and socially feasible high priority projects".[1]

1.3 To oversee eleven main studies and fifteen supporting studies, Flood Plan Coordination Organization was created in 1990 to manage the Government's commitment to FAP. As an arm of the Ministry of Irrigation, Water Development and Flood Control (MIWDFC), FPCO has been given the responsibility for coordinating the implementation of the studies and monitoring the performance of all FAP activities. In addition, the World Bank, Dhaka Office has a Resident Coordinator who works closely with FPCO and other development partners for monitoring and coordination of the studies under FAP.

### The Studies

1.4 The summary of the implementation status of FAP is shown at annex I. It will be seen from annex I that the total investment for the studies is US$ 147.8 million of which 134.85 (91.24%) is provided by the development partners and the remaining fund by the Government of Bangladesh. It is further seen from the annex that, eleven main studies are in fact thirteen in number with addition of FAP 8B and 9B. Out of twenty eight studies (main studies 13 and supporting 15), eighteen final reports upto December 1993, have been submitted leaving a balance of ten.[2]

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[1] Proceedings of the Second Conference on the Flood Action Plan, p. ix, March 1992.

[2] Bangladesh Flood Action Plan, Progress Report, December, 1993, P.4.

1.5 It is perhaps relevant to point out that till March, 1992, the total estimated cost of the FAP studies stood at US$ 131.1 million which was less by about US$ 16.70 million, the estimate shown in the December'93 progress report of FPCO. This upward swing in cost is accounted for in part by lack of estimated figure for FAP 11 and costs for some other studies, in particular, FAP 26.

1.6 It is also important to bear in mind that some of the FAP studies are continuation of previous ones. These include, but not necessarily limited to, the following:

a. Cyclone Protection Project (FAP 7);
b. Greater Dhaka Protection Project (FAP 8A);
c. Dhaka Integrated Flood Protection Project (FAP 8B);
d. Secondary Towns Integrated Flood Protection Project (FAP 9A);
e. Brhamaputra Right Embankment Strengthening (FAP 1);
f. Meghna River Bank Protection Project (FAP 9B);
g. Flood Forecasting and Warning Project (FAP 10);
h. Disaster Preparedness Programme (FAP 11).

**Institutional Issues : A Review of Preliminary Debate:**

1.7 An outline paper on Institutional Development Programme was prepared in 1991. Thereafter UNDP supported a consultant for Needs Assessment Survey in late March, 1992. The report of the consultant was examined but was not eventually accepted by the Government. The Second FAP conference focussed on the following, among other issues:

- Prioritizing future FAP **Project investments** within the national development budget and projects that would compete with other sector investments for a slot in the three year investment programme. There did not seem to be any support for a special FAP funding programme.

- Strengthening of FPCO and Panel of Experts (POE) was essential.

- A strong linkage should be developed between FAP and the National Water Plan (NWP). The institutional merging of FPCO and Water Resource Planning Organization (WARPO) should be thoroughly investigated.[3]

1.8 Of the three issues listed above, steps for strengthening of FPCO and the POE have been taken. With regard to the question of merger of FPCO with WARPO (after 1995), there seems to be consensus between FPCO and MIWDFC. This, however, is still in a formative stage and no formal decision has yet been taken. As for prioritizing FAP

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[3] Second FAP Conference, OP.Cit, p.56.

project investment, nothing much appears to have been done. On the other hand, the Second FAP Conference had further asserted that "the FPCO, the Bangladesh Water Development Board (BWDB) possibly through specially established units and the Local Government Engineering Department (LGED) would have important roles to play. At the same time, other agencies would be involved and their specific contribution has to be determined".[4]

1.9 In late 1993, the POE took up the task of investigation relating to the institutional development programme. FAP study reports (1-25) were reviewed. General and specific suggestions on the recommendations made in the studies were provided to FPCO in the form of a matrix on institutional elements, issues and considerations.[5]

**Approach to Institutional Framework For FAP Projects**

1.10 It is felt that the approach to the institutional issues should be based solidly on the project portfolio that will be generated by FAP and the potential of key institutions both Government, Local Government, NGOs and private sector (local consultants/contractors). In the paragraphs that follow, an attempt is made to provide an analytical and evaluative account of the project portfolio of FAP. The key institutions identified by FPCO or FAP studies as implementing agencies and the extent of the need for an institutional framework for FAP projects, the size of investment and the time-frame for implementation are kept fully in view to make the account closer to reality than would otherwise be the case.

1.11 It is argued that two of the most important parameters are (a) the size of investment against each implementing agency and (b) the time required for implementation of the identified projects. The size of investment acquires greater relevance if seen in conjunction with the issue or issues listed in paragraph 1.7 relating to (i) prioritization of FAP projects and (ii) making these projects compete with projects of other sectors within the framework of the national budget and the three-year rolling investment plan. Additionally, there is also the question of the existing institutional capacity of the key institutions and the extent to which such institutions can effectively bear the work load to be generated by FAP projects.

1.12 The second aspect, that of timeframe for implementation, is also important. The longer the time-frame, the more complex and difficult perhaps is the task for assessment and design of an institutional framework. Again, if the policy decision is not to have any special funding for FAP projects, as articulated during the Second FAP Conference, and

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4 Ibid., P.25

5 Matrix of Institutional Elements: Issues and Considerations on Flood Action Plan Studies

to have these fit into the existing budgetary and planning framework, in competition with other sectoral projects, there is perhaps less need for additional units within the same organization. The approach in such a policy context is to upgrade and enhance their implementation capability. This can perhaps be achieved by (a) more intensive monitoring and supervision, (b) setting pre-determined standards of performance (c) ensuring accountability and (d) greater delegation of financial and administrative authority down the line within a given organization.

**The Future of FPCO**

1.13 The future of FPCO and the question of its merger with WARPO or some other institution in the water resource sector has been the subject of considerable debate since the issue was raised in course of the Second FAP Conference in 1992. Investigations carried out in 1993 by POE revealed that its original life span upto December 1993 was not adequate to complete the FAP studies which were expected to generate investment projects.[6] At that time it was pointed out that out of twenty five studies (excluding FAP 26), final reports of only nine studies representing thirty six percent were submitted.[7] This necessitated further extension of the life of FPCO upto 1995.

1.14 The present status of completion of the studies looks much better than it was in 1992 or 1993. This is shown in Table 1.1 below :

**Table 1.1 : Current Status of FPCO Studies**

| Sl. No. | Final Report Submitted | Final Report yet to be Submitted |
|---|---|---|
| 1. FAP Study Number | 1,2,3,4,5,7,8A,8B, 9A,9B,12,13,14,15, 16,21,22 and 23 | 6,10,11,17,18,19,20,24, 25,26 |
| 2. Total Number | 16 | 10 |
| 3. % of Progress | 61.54 | 38.46 |

**Source : FPCO, Progress Report, December, 1993.**

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6 A M M Shawkat Ali, "On and About FPCO" April, 1993, a note submitted to FPCO.

7 FPCO, Progress Report, December, 1992.

1.15 Interim reports, the stage preceding the final report, have been submitted for FAP-6,10,11,17,18,19,20,24 and 25 by December 1993. This means that more than ninety six percent of the FAP studies are expected to be complete by December, 1994.

**Project Portfolio Generated by FAP**

1.16 The data relating to the project portfolio generated by main FAP studies (FAP 1-11) obtained from FPCO show that in all there are about 139 projects with an investment size of US$ 7139.65 million. The implementation period for these projects varies from less than three years to about 20 years. The list of projects generated by different FAP studies with stipulated time-frame for implementation is shown respectively at annex III, IV and V.

1.17 The results of the above three annex are summarised at Table 1.2 below:

**Table 1.2 : Summary of Projects and Investment Size**

| | Project Nos. | Investment in US$/Million |
|---|---|---|
| 1. Less than 3 years | 18 | 167.20 |
| 2. 3-7 years | 60 | 1451.68 |
| 3. Above 7 years | 35 | 5509.97 |
| Total | 113 | 7128.85 |

**Source: FPCO, February, 1994**

Note: 1) Includes Projects of FAP 1-11

2) Excludes flood proofing subproject under FAP-2, flood response measures, fisheries and institutional development sub-projects of Fap-3, Meghna Road & Highway Bridge, Maniknagar under FAP-9b. Estimates for periods of implementation needed for these projects or in some cases investment size are not available.

**Initial investment and the current size of estimated investment**

1.18 It is relevant to compare the initial investment estimate as shown in the Flood Policy Study (1989) and the estimate given at Table 1.2. The Flood Policy Study provided two scenarios. Scenario I covering 20 year implementation period shows an estimate of US$ 1.77 billion without O&M cost as against 7.12 billion of Table 1.2. This is also without O&M cost. Scenario II covering an implementation period of 15 years shows an expenditure requirement of US$ 2.5 billion. The current estimates, therefore, is about threefold higher than the initial estimate under scenario II and about fivefold higher than the initial estimate under scenario I. All these raise substantiative questions of not only the capability of BWDB as implementing agency but also the availability of financial resources for investment. Further probe into all these aspects are necessary.[8]

1.19 It is seen from Table 1.2 that over the next twenty year period under current rate of exchange about US$ 7.12 billion would be the required investment. The investment size per annum would be about US$ 356 million. However, if exchange rate and inflationary cost is taken into account, there would be further addition of about US$ 700 million over a period of twenty years. Then the likely cost would be about US$ 8 billion . The per annum investment size for FAP projects alone would be about 400 million. In other words, the per annum investment for FAP projects alone will be more than double the amount that is currently allocated to BWDB. Table 1.3 shows the ADP allocations since 1989-90 and allocations for the BWDB.

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[8] Flood Policy Study, 1989, Table 6.4, p.6.20

**Table 1.3 : ADP Allocation (Original and Revised) in BWDB during 1989-90 to 1993-94.**

**(In Million Taka)**

| Year | Original BWDB ADB | Revised BWDB ADP | Total Revised ADP | Revised BWDB ADP as % of Total Revised ADP | No. of Project in the BWDB | Total No. of Projects in whole ADP | No. of BWDB Projects as % of Total No. of projects Included in Revised ADP |
|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 1989-90 | 5722 (171.67) | 6054 (181.63) | 51028 (1531.99) | 12 | 61 | 925 | 7 |
| 1990-91 | 5184 (145.21) | 6124 (171.54) | 65210 (1826.61) | 9 | 50 | 776 | 6 |
| 1991-92 | 6804 (178.39) | 6490 (170.16) | 71500 (1874.67) | 9 | 46 | 899 | 5 |
| 1992-93 | 6720 (171.51) | 7013 (178.99) | 81210 (2072.74) | 9 | 41 | 928 | 4 |
| 1993-94 | 6426 (162.68) | 6426 (162.68) | 97500 (2468.35) | 7 | 35 | 907 | 4 |

**Source:** MIWDFC.

**Note:**

1. 90% Of the ADP is for projects, 10% for other specific programmes and block allocations.
2. ADP for 1993-94 is yet to be revised (March'94).
3. Rate of Exchange Based on "Flow of External Resources into Bangladesh", February 24, 1993, Economic Relations Division (ERD).
4. Figures in the parentheses indicate US$ in Million.
5. 1992-93 and 1993-94 allocations include some FAP projects but excludes FFW allocations estimated at about US$ 24 million per annum.

1.20 The respective agencies, projects allocated to them and the investment size, as tentatively indicated by FPCO are shown in Table 1.4 below:

**Table 1.4 : FAP Projects and Implementation Agency**

| Sl. No. | Agency | No. of Projects | Investment Size (US$/Million) |
|---|---|---|---|
| 1 | BWDB | 86<br>(76) | 4771.28<br>(67) |
| 2 | Others | 27<br>(34) | 2357.57<br>(33) |
| | Total | 113 | 7128.85 |

**Source : FPCO, February 1994.**

Note: **1. Others Include Agriculture, BIWTA, LGED, Municipalities, NGO, DWASA, DOE,DOF etc.**

**2. Figures in the parentheses indicate % of the total.**

1.21 It is seen from Table 1.4 above that BWDB as implementing agency will account for 76% of the total number of FAP generated projects and 67% of the projected investment. This will make BWDB the single largest agency which will be responsible for implementing the projects under FAP in the coming years. The question of institutional capacity of BWDB to take on the increased workload thus accquires added relevance.

1.22 This question needs to be examined with reference first to past trends of the ADP utilization capacity of BWDB. This is shown in Table 1.5 below:

**Table 1.5: Utilization of ADP by BWDB.**

(In Million/Tk)

| Year | Revised BWDB ADP | Expenditure | Expenditure as % of Allocation |
|---|---|---|---|
| 1989-90 | 6054 (181.63) | 5541 (166.24) | 92 |
| 1990-91 | 6124 (171.54) | 4214 (118.00) | 69 |
| 1991-92 | 6490 (170.16) | 4987 (130.75) | 77 |
| 1992-93 | 7013 (178.99) | 5936 (151.50) | 85 |
| 1993-94 | 6426 (162.68) | 1720 (43.54) | 27 |

**Source : MIWDFC.**

**Note: 1. 1993-94 is not complete.**

**2. Rate of Exchange based on "Flow of External Resources into Bangladesh", February 24,1993 Economic Relations Division (ERD).**

**3. Figures in the parentheses indicate US$ in Million.**

**4. Excludes FFW allocations and includes for 1992-93, 1993-94 some FAP projects.**

1.23 Table 1.5 shows a not too unhappy scenario in regard to the ADP utilization capacity of BWDB except for 1993-94. However, the historical trend is that it is only in the third (January-March) and fourth (April-June) quarters that over 60% of the utilization of ADP is achieved. This conclusion draws its validity from the figures presented at Table 1.6 below:

**Table 1.6: ADP Expenditure by Quarter (In Percent)**

| | Q1 | Q2 | Q3 | Q4 | Total |
|---|---|---|---|---|---|
| 1991-92 | | | | | |
| Total | 7.4 | 21.5 | 19.1 | 52.0 | 100.0 |
| Taka | 7.5 | 19.8 | 19.1 | 53.6 | 100.0 |
| P.A | 7.4 | 22.8 | 19.0 | 50.8 | 100.0 |
| 1992-93 | | | | | |
| Total | 11.2 | 24.3 | 21.9 | 42.6 | 100.0 |
| Taka | 11.6 | 21.4 | 20.7 | 46.3 | 100.0 |
| P.A | 10.9 | 27.1 | 23.0 | 39.0 | 100.0 |

**Source : IMED. Quoted in World Bank Economic Mission To Bangladesh-1993-94 (Table 4)**

1.24 According to Table 1.5 the highest amount utilized was in 1989-90 at US$ 166.24 million. The utilization capacity of BWDB ranges between US$ 118 to 166 million. If the investment requirement of FAP projects are added, the figures for BWDB in ADP will shoot at US$ 500 million per annum. BWDB will thus need considerable strengthening if it were to successfully implement the projects allotted to it.

## O&M Budget and Expenditure of BWDB

1.25 It is important to distinguish between Operation and Maintenance (O&M) budget and the ADP allocations. The situation with regard to O&M budget and expenditure is shown in Table 1.7 below:

**Table 1.7: O & M allocation and expenditure of BWDB**

**(Taka in Million)**

| Year | Fund Requested | Fund Allocated | Fund Utilised | O&M Expenditure as % of ADP Expenditure |
|---|---|---|---|---|
| 1989-90 | 1091.80 (32.75) | 691.20 (20.37) | 743.70 (22.31) | 13.42 |
| 1990-91 | 1010.60 (28.30) | 790.10 (22.13) | 838.80 (23.49) | 19.90 |
| 1991-92 | 1379.60 (36.17) | 871.60 (22.85) | 871.60 (22.85) | 17.47 |
| 1992-93 | 1695.60 (43.27) | 968.10 (24.70) | 994.90 (25.39) | 16.75 |
| 1993-94 | 1771.20 (44.84) | 1090.20 (27.60) | 0.00 | -- |

Source : **MIWDFC.**

Note: 1) **Utilization figure for 1993-94 is not available.**
2) **Rate of Exchange based on "Flow of External Resources into Bangladesh", February 24, 11993, Economic Relations Division (ERD).**
3) **Figures in the parentheses indicate US$ in Million.**

1.26 It is seen from Table 1.7 that the O&M requirement of BWDB ranges from US$ 28 to 45 million. However, funds allocated are almost invariably less than the demand for it. The O&M expenditure as percentage of ADP expenditure (Table 1.5) ranges between 13% to 20%. If the demand for fund is taken into account and not the actual ADP expenditure, the requirement would be around 25%.

**Concerns about BWDB and need for Reform**

1.27 Indeed, even without FAP, concerns have been expressed by the development partners about BWDB's low implementation capacity (though not corroborated by the evidence already presented in Table 1.5). It is said that "no reforms have occurred at the Bangladesh Water Development Board (BWDB). BWDB's low implementation performance, lagging operations and maintenance efforts, serious problems of quality of service, and widespread allegations of rent-seeking indicate urgent need for reform. Two immediate actions could be taken : the Ministry of Irrigation must fill with permanent, high quality and full-time officials all of the vacant Board positions and agreement should be reached on an action plan with concrete measures for restructuring and institutional change".[9]

1.28 The organizational weaknesses and other shortcomings of BWDB have more elaborately been dealt with in another Bank Report.[10] It had identified some key areas such as (a) weak management, (b)unsatisfactory financial controls and (c) neglect of operations and management. Based on identification of the above, the report had suggested a set of interventions and directions for reform. These are:

- Management improvement by selecting a suitable chairman from a national list of potential candidates (preferably with an engineering background), not confined to the seniority list of BWDB only. The tenure for the selected incumbent should be 3-5 years in order to have a salutary impact on management and institutional performance;

- Modernization of Accounts and Financial Management System more or less based on the principles of CIDA-funded Master Plan (1990-91);

- Establishment of separate O&M divisions whose sole function would be operation and maintenance of projects completed by separate construction divisions;

- Improving quality control in project implementation;

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9 The World Bank, Dhaka, "Bangladesh: Recent Progress in Implementing Structural Reforms", p.2, paragraph 6.

10 The World Bank, The Country Economic Memorandum, March, 1993.

- Upgrading contract management practices to international standards;
- Monitoring and evaluation of BWDB's various development programmes;
- Accepting private sector and NGO roles in the construction and management of small schemes;
- Shifting priority from construction to O&M and sustainability considerations and from supply driven to beneficiary participation in the planning, implementation, rehabilitation and O&M of all its development projects.

1.29 At the same time, the Bank report recognizes some of the successes achieved by BWDB and concludes that: "These developments give reasons for optimism that BWDB, which has a large cadre of highly qualified technical staff, could perform as an efficient water development organization, provided it be given effective leadership and properly planned donor assistance."

1.30 The analyses presented in the foregoing paragraphs justify an in-depth review of BWDB in the light of what has been achieved so far, what more needs to be achieved keeping in view the FAP projects that would come on-stream in the next ten years or beyond. The starting point of the review would be that BWDB does have a potential provided some well-planned reform efforts on the lines already indicated above and some more are implemented within a time-bound action plan which can form part of the main report on institutional study of FAP.

**Other Agencies and Institutions**

1.31 In Table 1.4, it has been shown that of the total investment 67% is indicated to be of BWDB and the remaining 33% of other agencies and institutions. This raises the question of individual work load of government agencies, parastatal bodies, local government institutions and NGO's and their potential as executing agencies for projects generated by FAP studies.

1.32 From the evidence available with FPCO, it is seen that four government departments, three parastatal bodies, two city corporations, five (district) municipalities will be involved either independently or in association with BWDB to execute projects or components of individual projects. This is presented at Table 1.8 below:

**Table 1.8: The Number and Cost of Projects/Components with Implementing Agencies Other Than BWDB.**

| Agency | No. of Projects and/or Components | Investment Size (US$/Million | Remarks |
|---|---|---|---|
| PHE | 5 (FAP-6) | 947.50 | Three exclusive two with NGO and DOE |
| DOE | 8 (FAP-6&7) | 409.20 | Seven exclusive and one with PHE |
| NGOs | 8 (FAP-3.1,6,7) | 229.77 | Three exclusive others with LGED,DOE,PHE |
| DOF | 2 (FAP-6) | 22.00 | |
| BIWTA | 4 (FAP-6) | 53.70 | Two exclusive, two with BWDB |
| Private | 10 (FAP-5&6) | 24.95 | Nine with BWDB and one exclusive |
| DCC | 2 (FAP-8B) | 7.03 | One exclusive and one with BWDB |
| DWASA | 2 (FAP-8B) | 44.51 | One exclusive and one with BWDB |
| KCC | 1 (FAP-9A) | 35.90 | Exclusive |
| Five Municipalities | 5 (FAP-9A) | 27.02 | Exclusive |
| LGED | 2 (FAP-6) | 66.25 | With BWDB and NGO |
| RAJUK/DWASA / DCC/ FAP-8A | 1 | 489.74 | With BWDB (40%) |
| Total | 50 | 2357.57 | |

**Source: FPCO, February, 1994.**

Note: 1. **About 40% of the number of projects are in fact components of main projects as recorded by FPCO.**

2. **The exact share of RAJUK,DWASA and DCC in FAP-8A has not yet been determined by FPCO. It is estimated that of total amount shown in 8A, about 40% of the cost will belong to these organizations and remaining 60% to BWDB. Some of the components may be independent projects in course of time.**

1.33 It is seen from Table 1.7 that except for PHE, DOE, RAJUK, DWASA and DCC, other institutions will not have significant workload in terms of the size of investment. NGOs belong to a different category and will be discussed separately.

1.34 The size of investment again will have to be seen in context of the time frame for implementation. The available evidence presented in annex III, IV and V indicates that FAP-6 projects allocated to DOE will have implementation period ranging between 2-20 years. Similarly DOF in FAP-6 will have an implementation period of 10 years from 1994. FAP-8B will have 6 years. In the event per annum size of investment will be proportionately scaled down. These and other related issues can be investigated and result of the investigation may form part of the main report on institutional framework of FAP-26.

**NGOs**

1.35 The total number of NGOs was said to be 669 in 1992.[11] These NGOs, in that year, were responsible for executing 615 projects approved by the NGO Affairs Bureau. The total outlay involved was Tk 6.39 billion which was about 9% of the total ADP for the relevant year. The details are shown in annex-VI.

1.36 It is seen from annex VI that in 1991-92 (July through June), the largest share is claimed by Rural and Urban Development Sector (42%) followed by Health (18%).

1.37 Under FAP generated projects, NGOs are expected to utilize US$ 229.77 million (See Table 1.8). The specific FAP studies which have suggested NGO involvement are : FAP 3.1,6 and 7.

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[11] NGO Affairs Bureau, NGO's in Bangladesh (Brief Activities of NGO's), December, 1992. NGO Affairs Bureau is yet to have updated figures for 1992-93 and 1993-94.

1.38 The details of the activities of NGOs suggested in FAP 3.1, FAP-6 and FAP-7 are shown in Table 1.9 below:

**Table 1.9 : NGO Activities in FAP**

| FAP STUDY NO. | ACTIVITIES | INVESTMENT IN US$/MILLION |
|---|---|---|
| FAP-3.1 | NGO Programme | 1.39 (8) |
| FAP-6 | a) Urban Sanitation | 100.00 (N.A) |
| | b) Jamuna Flood Plan | 2.00 (5) |
| | c) Pond Agriculture | 0.50 (6) |
| | d) Fisheries Management | 20.00 (10) |
| | e) Improved Household Platform | 100.00 (10) |
| | f) Village Afforestation | 4.00 (4) |
| | g) Environment Research and Education | 0.70 (1) |
| FAP-7 | Afforestation | 1.18 (3) |
| | Total | 229.77 |

**Source : FPCO, February, 1994.**

Note: **Figures in the parentheses indicate number of years for implementation.**

1.39 It is seen from Table 1.9 that 87% of the projected investment are claimed by urban sanitation and improved household platform and next in line is fisheries management about 9%. Although the implementation period for urban sanitation is not available, assuming a 10 year time-frame, 96% of the investment would need a per annum investment of only US$ 22 million.

1.40 It is concluded that the size of investment @ US$ 22 million per annum is not likely to add significantly to the existing work load of the NGOs. This conclusion is based on the following, amongst other, grounds:

a) In 1991-92, the project investment of 669 NGOs amounted to about US$ 160 million;

b) NGOs have strong inclination to rural and urban development and have experience in agriculture, fisheries, environment and forest.

1.41 Two factors need to be kept in view while talking of NGO involvement in FAP generated projects. **First,** the question of designing criteria for selection of NGOs for specific programmes. **Second,** the cost of enlisting the support from the NGOs. The first question is not a difficult one to resolve as in many foreign aided projects, NGOs are also partners with government agencies involved in the implementation process.

1.42 The second question is more substantive in that available evidence indicate that the cost is higher in case of NGOs than in case of government agencies. There is also the question of sustainability of programmes and permanent dependency syndrome that are likely to be created by NGO involvement. FAP 15 has drawn attention to these issues. It has categorically stated (Chapter V of the Report) that the effectiveness of the NGOs "is seldom based on any rigorous analysis and/or detailed empirical evidence." This is not to argue against the involvement of the NGOs but to point out some of the perceived inadequacies that need attention.

**Local Government Bodies**

1.43 The projects generated by FAP studies shown in this analysis have not been allotted to, except for five municipalities and two city corporations, any other local government bodies such as the Zila and Union Parishads. This appears to be a gap that needs attention. For instance, there is adequate scope for the Union Parishads to implement, in addition to the NGOs, projects or components like afforestation. About 4500 in number, the Union Parishads have a long experience in undertaking rural development works which need not be ignored to ensure people's participation. In appropriate cases, the Zila Parishads, with similar background and experience, can become partners in implementation along with other agencies. This issue can be investigated in greater depth and incorporated in the main report on institutional framework for FAP generated projects.

**Local Consultants**

1.44 The information on local consulting industry is scanty. An added difficulty is that the information lie scattered in different agencies where they are enlisted or have on-going work. The Technical Assistance Coordination Cell (TACC) located in ERD is supposed to maintain a roster of consulting firms and individual consultants. It is said that TACC made an effort last year to update their old roster but is yet to complete the work. Yet another difficulty is the absence of information in this area on sector by sector basis.

1.45 Enquiries made with ERD reveal that they have on their roster a total of 169 firms. Since 1990, when FAP studies began, foreign and local consulting firms have been working in this field. Invariably, foreign firms are taking the lead. Placing team leadership with

foreign firms provide little incentive for local firms to give their best. This situation is additionally aggravated by lower remuneration and other benefits to locally recruited personnel.

1.46 There are 93 consulting firms enrolled in the panel of local consultants Many of these firms are manned by competent professionals some of whom are ex-BWDB personnel.

1.47 In order to assess the potential of existing local consulting firms, it will be necessary to have in-depth discussion with:

- a cross-section of local firms;
- selected foreign firms;
- TACC of ERD;
- relevant ministries and executing agencies;
- relevant development partners.

1.48 The results of the review can then be incorporated in the main report of the institutional development programme.

**Local Contractors**

1.49 The information on local contractors are agency-based. They are generally categorized into 'A', 'B' and 'C' categories in accordance with their length of experience, the volume of work done and logistic support maintained. An assessment of their existing capability will have to follow the same route as has been suggested in case of local consulting firms.

1.50 Available information indicate that only 'A' category contractors are centrally enlisted by BWDB. As on March'94, BWDB had a total of 175 'A' class contractors.

**Concluding Remarks**

1.51 The foregoing analysis has shown that, based on the available information, BWDB is going to be a major agency for implementing projects generated by FAP studies. However, institutional reforms, some of which have already been identified, will have to be carried out. In respect of other institutions, more information will be needed although in some cases, as already indicated, further action may not be needed.

1.52 It is important that priortization of the projects already identified be made prior to drawing up the institutional development programme. This exercise should be followed by specific decisions by the government and the development partners on the question of the modalities of financing FAP generated projects. The key issue is whether the projects go through the normal drill of ADP or are given a separate treatment.

1.53 Immediate resolution of these issues are imperative to determine the level of fund and the consequent choice of the implementing agency or agencies, the work load to be placed on these agencies and determination of the need for institutional strengthening.

Annex I

## SUMMARY OF FAP IMPLEMENTATION STATUS

DECEMBER, 1993

| FAP NO. | COMPONENTS | COST MILLION US$ | | REPORTS | | |
|---|---|---|---|---|---|---|
| | | TA | GOB | INCEPTION | INTERIM | FINAL |
| 01 | Brahmaputra Rt. Embankment Strengthening (River Training Study of Brahmaputra River) | 3.298 | .116 | ■ | ■ | 1 ■ |
| 02 | North West Regional Study | 4.472 | .242 | ■ | ■ | ■ |
| 03 | North Central Regional Study | 2.248 | .204 | ■ | ■ | ■ |
| 03.1 | Jamalpur Priority Project Study | 1.845 | .025 | ■ | ■ | ■ |
| 04 | South West Area Water Resources Management Study | 3.838 | .153 | ■ | ■ | 2 ■ |
| 05 | South East Regional Study | 2.200 | .130 | ■ | ■ | ■ |
| 06 | North East Regional Study | 13.251 | .029 | ■ | ■ | □ |
| 07 | Cyclone Protection Project-II | 1.521 | - | ■ | ■ | ■ |
| 8A | Greater Dhaka Protection Project | 2.969 | .206 | ■ | ■ | ■ |
| 8B | Dhaka Integrated Flood Protection Project | .572 | .064 | ■ | ■ | ■ |
| 9A | Secondary Towns Integrated Flood Protection Project | .550 | .059 | ■ | ■ | ■ |
| 9B | Meghna River Bank Protection Short term Study | .808 | - | ■ | ■ | ■ |
| 10 | Flood Forecasting and Warning Project | 5.899 | 1.821 | □ | □ | □ |
| 11 | Disaster Preparedness Programme | 1.071 | 3 - | □ | □ | □ |
| 12 | FCD/I Agricultural Study | 1.598 | .027 | ■ | ■ | ■ |
| 13 | Operation & Maintenance Study | .491 | .028 | ■ | □ | ■ |
| 14 | Flood Response Study | .922 | .121 | ■ | ■ | ■ |
| 15 | Land Acquisition and Resettlement Study | .403 | .028 | ■ | ■ | ■ |
| 16 | Environmental Study | 4.248(R) | .212 | ■ | ■ | ■ |
| 17 | Fisheries Study & Pilot Project (Phase-I) | 3.004 | .289 | ■ | ■ | □ |
| 18 | Topographic Mapping | 5.329(R) | 3.204 | □ | □ | □ |
| 19 | Geographic Information System | 4.627(R) | .278 | ■ | ■ | □ |
| 20 | Compartmentalisation Pilot Project | 9.438 | 2.004 | ■ | ■ | □ |
| 21/22 | Bank Protection and River Training/AFPM Pilot Project | 41.176 | .860 | ■ | ■ | 4 ■ |
| 23 | Flood Proofing Pilot Project | .260 | .010 | ■ | ■ | ■ |
| 24 | River Survey Programme | 10.417 | 1.326 | ■ | ■ | □ |
| 25 | Flood Modelling and Management | 2.575 | .161 | ■ | ■ | □ |
| 26 | Institutional Development Programme | 5.823(R) | 5 1.474 | □ | □ | □ |
| Total | | 134.85 | 13.07 | | | |

1 *Final Master Plan*
2 *Draft Final Reports*
3 *This cost shows for the project of the Ministry of Relief*
4 *Draft Final Report for Phase I Submitted*
5 *Only FPCO TAPP portion which has been revised*

**Source : FPCO Progress Report, December, 1993.**

Annex-II

## A COMPARATIVE VIEW OF FUNCTIONS OF RRI, WARPO AND BWDB

| SL. No. | RRI SECTION 7 OF THE ACT, 1990 | WARPO SECTION 6 OF THE ACT, 1992 | BWDB SECTION 8 OF THE ACT, 1972 |
|---|---|---|---|
| 1 | Surface water modelling studies relating to river training | Formulation of National Water Plan for water resource development which is environmentally friendly. | Construction of dams, reservoirs, irrigation embankment, drainage, bulk water supply to communities and recreational use water resources |
| 2 | Mathematical modelling studies relating to environment related issues connected with surface/ground water | Determining national strategies /policies fro scientific use of water resources and water preservation | Flood control including water-shed management |
| 3 | Investigation and evaluation of materials used, the quality of work etc. of river training. | Assisting/Advising other organizations for water resources development, use and preservation. | Prevention of salinity, water congestion and reclamation of land. |
| 4 | conduction training in above matters and publication of reports etc | Conducting/assisting in the conduct of studies relating to water resource development use and preservation. | Maintenance, improvement and extension of channels for inland water transport, including dredging. |
| 5 | Advising the Government, local authorities or organizations on all of the above matters. | a. Advising other organizations through evaluation/studies on matters connected with water resource development, use and preservation.<br>b. Improving the quality of education, training and professional standard of water resource development. | Excluding all such operations as may be assigned to any other agency by the Government. |
| 6 | Cooperating with national/foreign institutions undertaking similar work and engaging in joint exercise. | a. Collecting of data relating to water resources, analysis and publicity thereof.<br>b. Organising national, international seminar, workshop etc, on water resource. | Regulation of channels of river flow for more efficient movement of water, silt and sand excluding all such operations as in the opinion of the Government may be carried out by another agency. |
| 7 | Taking any step necessary to undertake work referred to above. | Deal with any other matters referred to by the Government. | |

**Source : The Acts for the relevant organizations.**

Annex-III

## PORTFOLIO OF PROJECTS WITH IMPLEMENTATION PERIOD OF LESS THAN 3 YEARS

| FAP NO. | PROJECT TITLE AND TYPE | YEAR OF IMPLEMENTATION | INVESTMENT IN US$/M | IMPLEMENTING AGENCY |
|---|---|---|---|---|
| FAP-2 | NORTH WEST REGIONAL STUDY, FCD | | | |
| | 1) Sub-Regional Plan | (2) | 2.5 | BWDB |
| FAP-5 | South-East Regional Study: | | | |
| | 1) Chandpur Irrigation Project (Retire+Rehab), FCD I | (2) | 1.6 | BWDB |
| | 2) Sonaichari-Kilpana Extension | 1996 (2) | 1.0 | BWDB |
| | 3) Settlement and Rural Development | 1995 (2) | 1.6 | BWDB |
| FAP-6 | North-East Regional Study: | | | |
| | 1) Duckweed Based Domestic Water Treatment | 1994 (2) | 1.0 | PHE |
| | 2) Bhairab Bazar Erosion Protection | 1994 (2) | 15.8 | BWDB |
| | 3) Mrigi River Drainage Improvement | 1996 (2) | 1.3 | BWDB |
| | 4) Pulp and Paper Mills Effluent Treatment | 1994 (2) | 2.0 | Private |
| | 5) Pilot Project to Institutionalise Public Consultation | 1994 (2) | 0.5 | BWDB |
| | 6) Improved Flood Warning | 1994 (2) | 6.25 (1.25) | BWDB/LGED |
| | 7) North-East Region Environment Research and Education Centre | 1995 (1) | 0.7 | NGO |
| | 8) Surface Water Quality Management Strategic Planning Exercise for Environment Pollution Directorate | 1995 (1) | 0.4 | DOE |
| | 9) Biodiversity Strategic Planning Exercise for MOEF | 1995 (1) | 0.4 | DOE |
| FAP-9B | Meghna River Bank Protection: | | | |
| | 1) Chandpur Town: | | | |
| | a) Short-term | 1993 (2.25) | 71.2 | BWDB |
| | b) Emergency | 1993 (1.1) | 37.9 | BWDB |
| | 2) Bhairab Bazar and Railway Bridge | 1993 (1.25) | 15.3 | BWDB |
| | 3) Munshiganj Town | 1993 (1.25) | 7.7 | BWDB |
| | Total 17 | | 167.2 | |

Source : FPCO, February 1994.

Note:
1. Figures in the parentheses indicate number of years for implementation.
2. Out of US$ 167.2 million, BWDB's share is US$ 161.45 (96.56%), remaining US$ 5.75 million is for LGED (1.25), PHE (1), Private (2), NGO(0.7), DOE(0.4), DOE (0.4).
3. The year in which implementation will commerce has not been shown for two projects of FAP-2 and FAP-5.

Annex-IV/1

## PORTFOLIO OF PROJECTS WITH IMPLEMENTATION PERIOD OF 3 TO 7 YEARS

| FAP | PROJECT TITLE AND TYPE | YEAR OF IMPLEMENTATION | INVESTMENT IN US$/MILLION | IMPLEMENTING AGENCY |
|---|---|---|---|---|
| FAP-1 STAGE 1A HP.1,2,3,4 | BMRE STRENGTHENING, RIVER TRAINING | 1995 (3) | 78.50 | BWDB |
| FAP-1 STAGE 1B HP.5,6,8,9, 10 | AS ABOVE | 1998 (3) | 68.25 | BWDB |
| FAP-2 | NORTHWEST REGIONAL STUDY CHALAN BEEL POLDER C&D, FCD | 1993-94 (7) | 10.12 | BWDB |
| FAP-2 | AS ABOVE LITTLE JAMUNA RIGHT BANK,FCD | 1993-94 (4) | 0.84 | BWDB |
| FAP-2 | AS ABOVE CHALAN BEEL POLDER-3,FCD | 1996-97 (5) | 2.46 | BWDB |
| FAP-2 | AS ABOVE SIRDAP, FCD | 1997-98 (7) | 4.23 | BWDB |
| FAP-2 | AS ABOVE CHALAN BEEL POLDER A & B, FCD | 1998-99 (7) | 8.08 | BWDB |
| FAP-2 | AS ABOVE TEESTA LEFT BANK, FCD | 1998-99 (7) | 14.94 | BWDB |
| FAP-2 | AS ABOVE FLOOD PROOFING | 1993-94 (5) | 2.50 | BWDB |
| FAP-2 | AS ABOVE ENVIRONMENTAL MANAGEMENT PLAN | 1993-94 (3) | 0.75 | BWDB |
| FAP-2 | HURASGARS, GR. RIVERS | 2006 (5) | 1.58 | |
| FAP-3 | RS-2 JAMALPUR TO BHUAPUR DEVELOPMENT, FCD/I | 1994-95 (5) | 32.40 | BWDB |
| FAP-3.1 | DRAINAGE | 1994-95 (4) | 1.03 | BWDB |
| FAP-3.1 | FLOOD PROOFING EMBANKMENT | 1994-95 (4) | 1.81 | BWDB |
| FAP-3.1 | EMBANKMENT | 1994-95 (6) | 11.82 | BWDB |
| FAP-3.1 | STRUCTURES | 1994-95 (7.5) | 8.18 | BWDB |
| FAP-3.1 | FISHERIES | 1993-94 (7) | 1.68 | BWDB/ PRIVATE |
| FAP-3.1 | LAND ACQUISITION | 1993-94 (7) | 2.87 | BWDB |

NOTE: FAP 3.1 IS THE JAMALPUR PRIORITY PROJECT. COLUMN 2 ABOVE INDICATES COMPONENTS OF THE PROJECT.

| FAP NO. | PROJECT TITLE AND TYPE | YEAR OF IMPLEMENTATION | INVESTMENT IN US$/MILLION | IMPLEMENTING AGENCY |
|---|---|---|---|---|
| FAP-4 | GORAI AUGMENTATION | 1993 (5) | 4.49 | BWDB |
| FAP-4 | CHENCHURI BEEL FCD/I | 1993 (7) | 8.35 | BWDB |
| FAP-4 | BISHKHALI | 2006 (5) | 11.73 | BWDB |
| FAP-5 SOUTHWEST REGIONAL STUDY | MEGHNA-DHONAGODA FCD/I | - (4) | 5.50 | BWDB |
| FAP-5 | ASHUGANJ | 1997 (4) | 4.55 | BWDB/ PRIVATE |
| FAP-5 | GUMATI PHASE II | 1997-2006 (5-8) | 26.23 | BWDB/ PRIVATE |
| FAP-5 | NOAKHALI NORTH | 1997 (7) | 33.48 | BWDB/ PRIVATE |
| FAP-5 | DHONAGODA KHAL DEEPENING | 1997 (4) | 0.73 | BWDB |
| FAP-5 | LITTLE FENI MUSAPUR REGULATOR | 2004 (4) | 9.00 | BWDB |
| FAP-5 | DHONAGODA FLOOD CONTROL | 2001 (6) | 5.92 | BWDB |
| FAP-5 | DHONAGODA KHAL DEEPENING | 1997 (4) | 0.73 | BWDB/ PRIVATE |
| FAP-6 | INDUSTRIAL POLLUTION | 1994 (3) | 300.00 | DOE |
| FAP-6 | HABIGANJ-KHOWAI AREA DEVELOPMENT | 1994 (5) | 14.5 | BWDB |
| FAP-6 | MANU RIVER PROJECT IMPROVEMENT | 1994 (5) | 21.2 | BWDB |
| FAP-6 | NARAYANGANJ-NARSINGDI PROJECT | 1994 (6) | 55.00 | BWDB |
| FAP-6 | GROUND WATER INVESTIGATION | 1994 (3) | 0.9 | BWDB |
| FAP-6 | JAMUNA FLOOD PLAN FLOOD PROOFING | 1995 (5) | 5.00 | BWDB/ NGO |
| FAP-6 | UPPER KANGSA RIVER BASIN DEVELOPMENT | 1994 (4) | 7.5 | BWDB |
| FAP-6 | UPPER SURMA KUSHIARA PROJECT | 1998 (5) | 21.5 | BWDB |
| FAP-6 | POND AQUA CULTURE | 1994 (4) | 2.5 | BWDB |
| FAP-6 | SURMA RIGHT BANK PROJECT | 1996 (3) | 1.6 | BWDB |
| FAP-6 | NARSINGDI DISTRICT DEVELOPMENT PROJECT | 1998 (3) | 2.7 | BWDB |
| FAP-6 NORTH EAST REGIONAL STUDY | APPLIED RESEARCH FOR IMPROVED FARMING SYSTEM | 1994 (3) | 0.8 | OTHERS (AGRICULTURE) |
| FAP-6 | SURMA-KUSHIARA BAULAI BASIN PROJECT | 1999 (4) | 35.8 | BWDB |
| FAP-6 | KUSHIARA-BIJNA INTERBASIN PROJECT | 1996 (5) | 11.9 | BWDB |

ANNEX IV/3

| FAP NO. | PROJECT TITLE AND TYPE | YEAR OF IMPLEMENTATION | INVESTMENT IN US$/MILLION | IMPLEMENTING AGENCY |
|---|---|---|---|---|
| FAP-6 | DHARMAPASHA RUBI BEEL PROJECT | 1999 (3) | 4.3 | BWDB |
| FAP-6 | UPDAKHALI RIVER PROJECT | 1999 (3) | 2.0 | BWDB |
| FAP-6 | SINGARBEEL PROJECT | 1999 (3) | 1.8 | BWDB |
| FAP-6 | BAULAI DREDGING | 1994 (3) | 12.0 | BWDB/ BIWTA |
| FAP-6 | KUSHIARA DREDGING | 1994 (7) | 35.0 | BWDB/ BIWTA |
| FAP-6 | JADUKATHI-RAKTI RIVER IMPROVEMENT PROJECT | 1996 (3) | 7.0 | BWDB |
| FAP-6 | SARIGOYAN-PIYAIN BASIN DEVELOPMENT | 1996 (4) | 6.7 | BWDB |
| FAP-6 | UPLAND BIODIVERSITY CONSERVATION STUDIES | 1994 (3) | 0.5 | DOE |
| FAP-6 | LOCALLY BASED MANAGEMENT OF INTERNATIONALLY SIGNIFICANT, N WETLAND | 1994 (4) | 3.0 | DOE |
| FAP-6 | THREATENED ECOLOGICAL COMMUNITY RECOVERY PROGRAMME | 1994 (3) | 2.00 | DOE |
| FAP-6 | RECOVERY PLANS FOR THREATENED AND COMMERCIALLY THREATENED LOWLAND PLANT AND SPECIES | 1994 (3) | 0.4 | DOE |
| FAP-6 | VILLAGE WATER SUPPLY AND SANITATION | 1994 (7) | 64.5 | PHE |
| FAP-6 | VILLAGE AFFORESTATION | 1995 (4) | 4.0 | NGO |
| FAP-6 | DREDGING FOR NAVIGATION | 1995 (5) | 14.9 | BIWTA |
| FAP-6 | SUPPORT TO COUNTRY BOATS | 1995 (6) | 10.00 | BITWA |
| FAP-6 | BWDB STRENGTHENING | 1994 (3) | 0.24 | BWDB |
| FAP-7 CYCLONE PROTECTION PROJECT | i) EMERGENCY PROJECT<br>ii) MID-TERM PROGRAMME<br>iii)AFFORESTATION | 1992 (2)<br>1993 (3)<br>1994 (3) | 50.95<br>41.40<br>3.68 | BWDB<br>DOE<br>NGO |
| FAP-8A GREATER DHAKA PROJECTION PROJECT | NARAYANGANJ DND | 2005 (5) | 90.75 | BWDB/ DWASA/RAJUK/ DCC |
| FAP-8A | SAVAR | 2005 (5) | 68.16 | AS ABOVE |

## PORTFOLIO OF PROJECT WITH IMPLEMENTATION PERIOD OF 3 TO 7 YEARS

| FAP NO | PROJECT TITLE AND TYPE | YEAR OF IMPLEMENTATION | INVESTMENT IN US$/M | IMPLEMENTING AGENCY |
|---|---|---|---|---|
| FAP-8B | Dhaka Integrated Flood Protection Project | 1991-92 (6) | 109.9 | BWDB/Others |
| | a) Flood Protection | | 52.0 | BWDB |
| | b) Drainage | | 39.7 | DWASA |
| | c) Environment: | | | |
| | 1) Slum | | 2.25 | DCC |
| | 2) Solid Waste | | 4.78 | DCC |
| | 3) Sanitary/Water Supply | | 4.77 | DWASA |
| | d) Implementation Assistance | | 6.37 | BWDA |
| FAP-9A | Secondary Towns Integrated Flood Protection Project | 1992-93 (6) | 66.20 | |
| | a) Khulna | | 35.90 | KCC |
| | b) Dinajpur | | 9.37 | Pourashaba |
| | c) Kurigram | | 5.64 | Pourashaba |
| | d) Panchagarh | | 3.23 | Pourashaba |
| | e) Habiganj | | 4.31 | Pourashaba |
| | f) Moulvi Bazar | | 4.47 | Pourashaba |
| | g) Implementation | | 3.28 | Pourashaba |
| FAP-10 | Flood Forecasting and Warning | | 6.107 | BWDB |
| | a) Coordination, Monitoring and Supporting Studies | 1994 (3) | 2.061 | BWDB |
| | b) Expansion of Model Application | 1994 (3) | 0.396 | BWDB |
| | c) Development of Forecasts and Public Awareness | 1994 (3) | 0.391 | BWDB |
| | d) Telemetory System | 1992 (3) | 3.259 | BWDB |
| FAP-11 | Disaster Preparedness | | 4.425 | Others |
| | a) Disaster Management Bureau | 1993 (3) | 0.412 | Others |
| | b) Technical Assistance and Related Inputs UNDP and Others | 1993 (3) | 2.513 | Others |
| | c) UNICEF Funding for Research, Training, Advocacy and Promotion | 1993 (3) | 1.50 | Others |
| | Total : 79 | | 1451.68 | |

**Source : FPCO, February 1994.**

Note: **Figures in the parentheses indicate number of years for implementation.**

## PORTFILIO OF PROJECTS WITH IMPLEMENTATION PERIOD OF ABOVE 7 YEARS

| FAP NO | PROJECT TITLE AND TYPE | YEAR OF IMPLEMENTATION | INVESTMENT IN US$/M | IMPLEMENTING AGENCY |
|---|---|---|---|---|
| FAP-1 | Brahmaputra Right Embankment Strengthening Stage-2, R.T | 2000 (20) | 285.65 | BWDB |
| FAP-2 | North-West Regional Study (Gaibandha),FCD | 1993 (11) | 41.75 | BWDB |
| FAP-2 | Mohananda Right Bank | 2006 (20) | 3.99 | BWDB |
| FAP-2 | Upper Karatoya (Bangshai F. Way) | 2006 (20) | 54.55 | BWDB |
| FAP-3 | North Central Regional Study: | | | |
| | 1) RS3-Dhaleswari To Kaliganga Development Phase-I | 1995 (10) | 27.43 | BWDB |
| | 2) RS3-Dhaleswari To Kaliganga Development | 1999-2000 (10) | 38.95 | BWDB |
| | 3) RS4-Bangshai River Improvement | 1995-96 (10) | 49.25 | BWDB |
| FAP-3.1 | Jamalpur Priority Project: | | | |
| | 1) Engineering | 1993-94 (8) | 5.75 | BWDB |
| | 2) NGO Programme | 1993-94 (8) | 1.39 | NGO |
| | 3) Charland and Set Back Main Phase | 1993-94 (8) | 36.37 | BWDB |
| FAP-4 | South-West Area Water Management Study: | | | |
| | 1) Ganges Barrage | 1996 (10) | 1200.0 | BWDB |
| | 2) South West Development | 1993 (27) | 747.05 | BWDB |
| | 3) South Central Development | 1993 (27) | 196.71 | BWDB |
| | 4) Arial Khan FCD/I | 1993 (17) | 39.68 | BWDB |
| | 5) Padma | 1993 (10) | 23.88 | BWDB |
| | 6) Barisal | 1995 (15) | 7.78 | BWDB |
| | 7) Swarupkati | 2002 (8) | 10.18 | BWDB |
| | 8) Narail | 1995 (10) | 16.23 | BWDB |
| FAP-5 | South East Regional Study: | | | |
| | 1) Ramgati Poler 59/2 | 1994 (10) | 10.43 (0.85) | BWDB/Private |
| | 2) Dakatia Little Feni Transfer | 1998 (10) | 34.43 (1.33) | BWDB/Private |
| | 3) South Sudharam Drainage | 2004 (8) | 12.32 | BWDB |
| | 4) STW/DSSTW, I | 1995 (15) | 4.50 | Private |
| | 5) FDTW, I | 1995 (20) | 11.50 | Private |
| | 6) Environment Protection | 1995 (20) | 7.50 | BWDB |
| FAP-6 | North East Regional Study: | | | |
| | 1) Urban Potable Water | 1995 (20) | 232.0 | PHE |

| FAP NO | PROJECT TITLE AND TYPE | YEAR OF IMPLEMENTATION | INVESTMENT IN US$/M | IMPLEMENTING AGENCY |
|---|---|---|---|---|
| | 2) Urban Sanitation | 1995 (20) | 150.0 (PHE-50) NGO-100 | PHE/NGO |
| | 3) Water Quality Characteristics | 1995 (20) | 700.0 (DOE-100 PHE-600) | DOE/PHE |
| | 4) Fisheries Engineering Measures | 1994 (10) | 5.0 | BWDB |
| | 5) Fisheries Management Programme | 1994 (10) | 40.0 (DOF-20 NGO-20) | DOF/NGO |
| | 6) Improvement of Homestead Plantforms | 1995 (10) | 165.0 (100 NGO 65 LGED) | NGO/LGED |
| FAP-8A | Greater Dhaka Protection Project: | | | |
| | 1) Greater Dhaka East | 1995 (15) | 557.4 | BWDB/ DWASA/DCC |
| | 2) Narayanganj DND | 1995 (10) | 188.2 | " |
| | 3) Narayanganj West | 2005 (10) | 303.3 | " |
| | 4) Tongi | 2000 (10) | 62.9 | " |
| | 5) Keraniganj | 2000 (10) | 181.1 | " |
| FAP-9B | Meghna River Bank Protection: | | | |
| | 1) Eklaspur | 1993 (13) | 26.5 | BWDB |
| | 2) Haimchar | 1993 (15) | 29.3 | BWDB |
| | Total : 37 | | 5509.97 | |

**Source : FPCO, February 1994.**

Note : **Figures in the parentheses indicate number of years for implementation.**

## NUMBER OF SECTOR-WISE PROJECTS APPROVED BY NGO AFFAIRS BUREAU WITH ESTIMATED COST IN (1991-92)

| SL. NO. | NAME OF THE SECTORS | NUMBER OF PROJECTS | ESTIMATED COST |
|---|---|---|---|
| 01. | Family Planning | 47 | 23,67,98,686.00 |
| 02. | Health | 38 | 1,18,46,26,111.00 |
| 03. | Public Health | 05 | 18,06,72,105.00 |
| 04. | Women Development | 34 | 19,36,32,068.00 |
| 05. | Legal Aid | 10 | 1,90,45,230.00 |
| 06. | Child Development | 11 | 8,07,27,817.00 |
| 07. | Child Home & Orphanage | 11 | 9,07,27,814.00 |
| 08. | Education | 47 | 32,25,40,863.00 |
| 09. | Rehabilitation Programme For Physically Vulnerable & Mentally Retardated | 14 | 30,23,21,661.00 |
| 10. | Rural & Urban Development | 82 | 2,70,50,55,615.00 |
| 11. | Adult Education | 07 | 5,69,74,802.00 |
| 12. | Income Generation | 32 | 50,28,58,056.00 |
| 13. | Relief & Rehabilitation | 24 | 31,90,77,252.00 |
| 14. | Agriculture | 10 | 9,52,01,354.00 |
| 15. | Fisheries | 05 | 6,56,10,525.00 |
| 16. | Motivation | 15 | 1,92,56,623.00 |
| 17. | Environment & Forest | 07 | 49,74,025.00 |
| | Total | 465 | 6,39,20,55,179.00 |

**Source: NGO Affairs Bureau**

# CHAPTER 2

## INSTITUTIONAL ARRANGEMENTS FOR PEOPLE'S PARTICIPATION IN PLANNING, IMPLEMENTATION AND MANAGEMENT

2.1 In the previous section the project portfolio that will be generated by FAP and institutional framework to execute these by various institutions within and outside the government have been examined. In this section the institutional arrangements for involvement of local people in project planning, implementation and management will be examined in the light of past experience and present concerns.

### The Purposes of People's Participation

2.2 The purposes of people's participation are to:

a) have better projects;

b) ensure the cooperation of local people at all stages and facilitate land acquisition;

c) give the people a sense of ownership of the project;

d) prepare them for undertaking operation and maintenance work, and

e) induce them to bear part of the cost.

2.3 The need for finding out an institutional approach to participatory project planning, implementation and management arises out of concerns expressed both within and outside the country that FAP projects are being imposed from the top without taking into account the needs, aspirations and perceptions of the people for whom the projects are supposed to be beneficial.

2.4 That this line of reasoning is not entirely unfounded is attested by the fact that the Second FAP Conference had taken full cognizance of this.[12] It notes: "If projects are to succeed, local communities must be involved fully in project planning, implementation and management and feel a sense of ownership."[13]

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[12] Proceedings of the Second FAP Conference, 1992, P.45, (paragraphs 95-97)

[13] Ibid., p.45

2.5 At the same time, the conference notes that "the participatory approach will not be easy to implement in Bangladeshi communities where there is such a diversity of interest groups and where the more influential groups sometimes try to manipulate government programmes in their own interest".

**FPCO Initiatives**

2.6 Based on the experience gained in various innovative programmes, FPCO had developed "Guidelines on Participatory Planning". Furthermore, in the Compartmentalization Pilot Project (FAP-20) various alternatives are being tested. Additionally, FPCO in cooperation with BWDB have initiated steps to have organized public debate on specific projects and FAP as a whole.

**Project Scale Factor**

2.7 The Guidelines for People's Participation (GPP) has rightly drawn attention to the need for a variable approach to people's participation.[14] Some FAP projects will have a distinctly local focus such as compartmentalization, flood response, flood proofing, small FCDIs etc. For such projects it should be possible to organize people's involvement at all stages of the project cycle through local level groups or institutions.

2.8 For large scale projects, which perhaps are the majority in FAP, participatory approach will have to be different. The GPP proposes to have multi-disciplinary Planning Teams which will ensure people's participation during feasibility stage.

2.9 The Planning Team is expected to ensure people's participation in the following stages:

a) Prefeasibility

b) Feasibility

c) Detailed Design

d) Implementation/Construction

e) Operation and Maintenance (O&M).

f) Monitoring & Evaluation (M&E).

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[14] Guidelines For People's Participation, FPCO, March, 1993 (Draft).

2.10 However, at (c) above, a Project Coordination Committee (PCC) is to be established to ensure people's participation from detailed design to M&E. The composition of the PCC is spelt out in the GPP. It also refers to the formation of Water Users'Association (WUA) in projects with substantial irrigation component. The WUAs may be formed either independently or as sub-committees of PCC. The WUAs may eventually take over ownership of small irrigated projects. The stages of project cycle, the activities and the institutions/agencies involved in the participatory process are shown in **Figure 1.**

**People's Participation : Jamalpur Priority Project Studies**

2.11 For Jamalpur Priority Project Studies, a separate proposal for Criteria, Concrete Objectives and Working Modalities has been prepared.[15] The mechanism is shown in **Figure 2.**

2.12 It is important to bear in mind that Jamalpur Priority project is part of CPP (FAP 20). The question of the mechanism for people's participation in this project was earlier discussed with FPCO and the consultants by POE. FAP-20 covers three locations:Tangail, Sirajganj and Jamalpur. The consensus reached in course of the discussions held was that three approaches could be adopted. **First,** traditional institutions supported by the project administration more or less on the pattern of KIP. **Second,** contracting out the task of implementation as envisaged in the scope of work of the project in which NGOs and competent private sector firms can participate. **Third,** ask the people themselves living in the project area to take up the responsibility of implementation with support from BWDB and other relevant government agencies.

2.13 As to the choice of locations where the above options are to be tried, it was suggested that the **First option** be tried in Tangail, the **Second** in Sirajganj and the **Third** in Jamalpur.

2.14 With regard to the need for forming Water Users Groups (WUG), it was suggested that at these locations, groups are there already around DTW and LLP command areas. These groups are both formal and informal. In this context, it was agreed that new groups would be constituted only in the absence of KSS/other groups.

2.15 The mechanism is based more or less on the GPP. It recommends setting up of a Project Council (PC) with 5 MPs, 40 UP Chairmen of the project area and an advisory body with ex-officio membership including interest groups and NGOs. The DC is suggested to be the Chairman of PC. The BWDB engineer, the head of SMU will act as Secretary to the PC. It is understood that FPCO is currently examining the proposal for people's participation for Jamalpur Priority Project.

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15 Jean Rabes, People's Participation During The Jamalpur Priority Project Studies, Final Report, February 19, 1994.

**Guidelines For People's Participation in Water Development Projects**

2.16 It is understood that the MIWDFC has also prepared a draft guidelines for people's participation in water development project. It is learnt from MIWDFC that the draft is an improved version of the GPP prepared by FPCO. It is yet to be approved by MIWDFC.[16]

2.17 An examination of the draft guidelines show that it is basically modelled on GPP prepared earlier by FPCO. It has, however, some additionalities which include issue of notice by BWDB/other agencies to DC/TNO/Chairmen of UPs during pre-project consultation stage, holding of pre-project meetings.[17] It also suggests formation of Project Council consisting of representatives of water users, beneficiaries of the project, executing agencies, NGOs and local administration.

2.18 DC is to be Chairman if the project area cuts across the boundaries of more than one thana, TNO in case it is limited to a single thana. There is provision of Vice Chairman also. The question of Member-Secretary is not discussed in GPP. This is a gap that needs to be addressed.

2.19 During prefeasibility stage, there is provision for consultations with socio-economic and other interest groups. The techniques of consultations spelt out are not very different from that of GPP. The only difference is that it is the PC not Planning Team which takes on this responsibility.

2.20 During this stage the interaction by different study groups with local community or communities is suggested. It also includes review by sectoral specialists and submission of a summary for approval by PC. This is followed by detailed design stage when PC is expected to interact further with local people.

2.21 During implementation stage, the activities of PC include, among others, promoting active participation, review implementation process, develop and adjust recommendations of O&M and M&E. At O&M stage, the draft guidelines suggest an elaborate chain of WUGs, setting up WUG Board and WUG committees. It also suggests WUGs to be federated in cases of project areas involving many hydrologic units. Finally, the draft guidelines provide for O&M funding based on classification of projects.[18]

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16 Guidelines for People's Participation In Water Development Project,MIWDFC, (Draft), March, 1994.

17 Ibid, P. 5-6.

18 Ibid, P.18.

2.22 An important feature of the draft guidelines is the provision for training beneficiaries to be drawn by the PC. There are provisions for penalty if the guidelines are violated and appeal against penalty imposed.[19]

2.23 The institutional framework for people's participation which the draft guidelines provide is shown at Figure 3.

2.24 It has been said already that the latest draft guidelines of MIWDFC is not basically different from GPP prepared by FPCO. Some essential differences in elements not of approach are:

a) GPP divides responsibility between Planning Team and PCC, the draft guidelines integrates the two into PC;

b) GPP does not provide time-frame of consultations at each stage such as Pre-feasibility and Feasibility, the draft guideline does;

c) GPP is less elaborate with regard to formation of WUGs., the draft guidelines are more elaborate with a greater leaning on participation by WUGs during operations and maintenance stage;

d) GPP does not spell out the need for training, the draft guideline does;

e) Finally, the GPP does not provide for penalty and appellate authority for violations, draft guidelines provide for the same.

2.25 It is important to bear in mind that inherent in the concept of the guidelines is the element that they are illustrative in nature and not mandatory to invoke penalty for violations. Again, such an approach will also be violative of the principle of participation by a disparate group/agencies in particular, local people.

2.26 The other important aspect that needs attention is that the guidelines when finally adopted by the government cannot be a "fit-all" apparel for every water resource development project. Indeed if it were so, the very objective of participation would be defeated. It should be distinctly understood that people's participation is not an easy process. It is time consuming although "sustainable benefits of involving the people in the development process far outweigh the time, effort and money invested".[20]

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19 Ibid, p.19

20 Dirk Frans, People's Participation, Draft dated March 1, 1992, p.2.

2.27 It is important to be conceptually clear about people's participation. The starting point for clarity surrounding the somewhat intractable issue must be that it is primarily, though not wholly, a political task of sound and good government. The approach to participation should not be stretched too far to exclude what essentially is the legitimate responsibility of the political institutions that draw their strength from the constitution of the country. The other important premise, in the context of water development projects, is that the type and modalities of participation will vary depending on the size and nature of the project. Even within the same project emphasis on the participatory elements will vary in the different stages of the project cycle.

2.28 The basic approach to public participation in water development projects will be to combine institutional with non-institutional participation. This is shown in **Figure 4.** It seeks to combine the two streams of participation.

2.29 Based on the many ideas that have surfaced during the last two years or so on the question of people's participation, a more elaborate and specific approach is shown in **Figure 5.**

**Recommend Framework For People's Participation**

2.30 Figures 1 to 3 show micro-level framework which is elaborated and synthesized in Figures 4 and 5. As already explained, the micro-level framework has to be flexible to accommodate special features/requirements of projects and the local institutions both formal and informal. There cannot therefore be any fixity or unalterable rigidity in the framework to be adopted.

2.31 Some of the micro-level approaches are being tested on the ground in project specific areas. Once the results of the tests are available and evaluated, project specific framework can be designed and implemented. However, if the objective is to ensure people's participation, there is need for uniformity in the approaches during planning stage such as prefeasibility and feasibility. In Figures 1 to 3 this uniform approach is available.

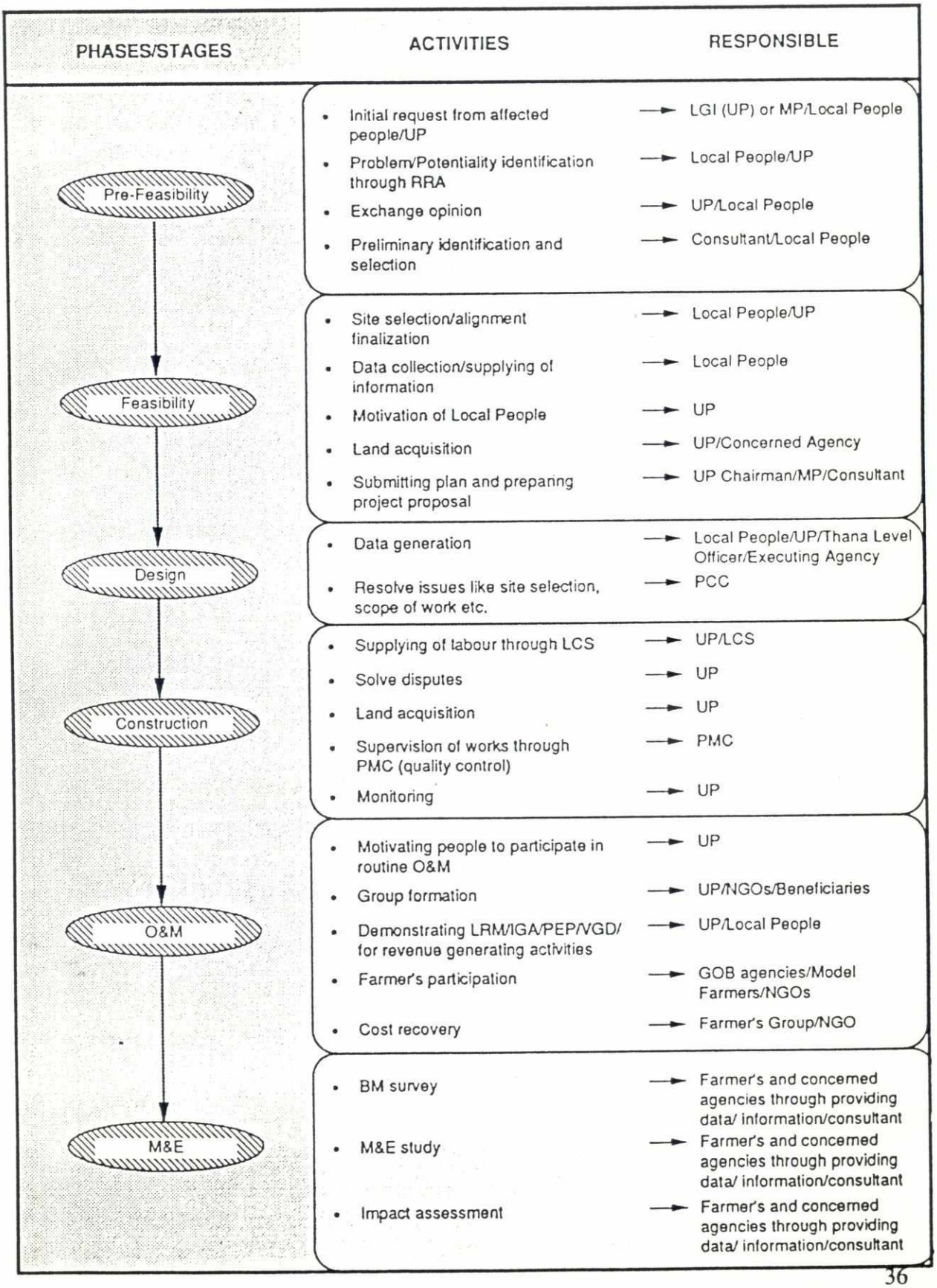
**The Impediments**

2.32 The impediments to people's participation are mainly five. **First,** there is lack of people within government departments that have experience in participation. **Second,** if people really get involved in determining their own development, every organisation and individual in the existing aid system will have to adjust and even give up some power. On top of it all, the development partners will have to accept the fact that in projects with a major people's participation component, disbursement rates may not be a valid criteria. New criteria for measuring project progress will have to be developed.

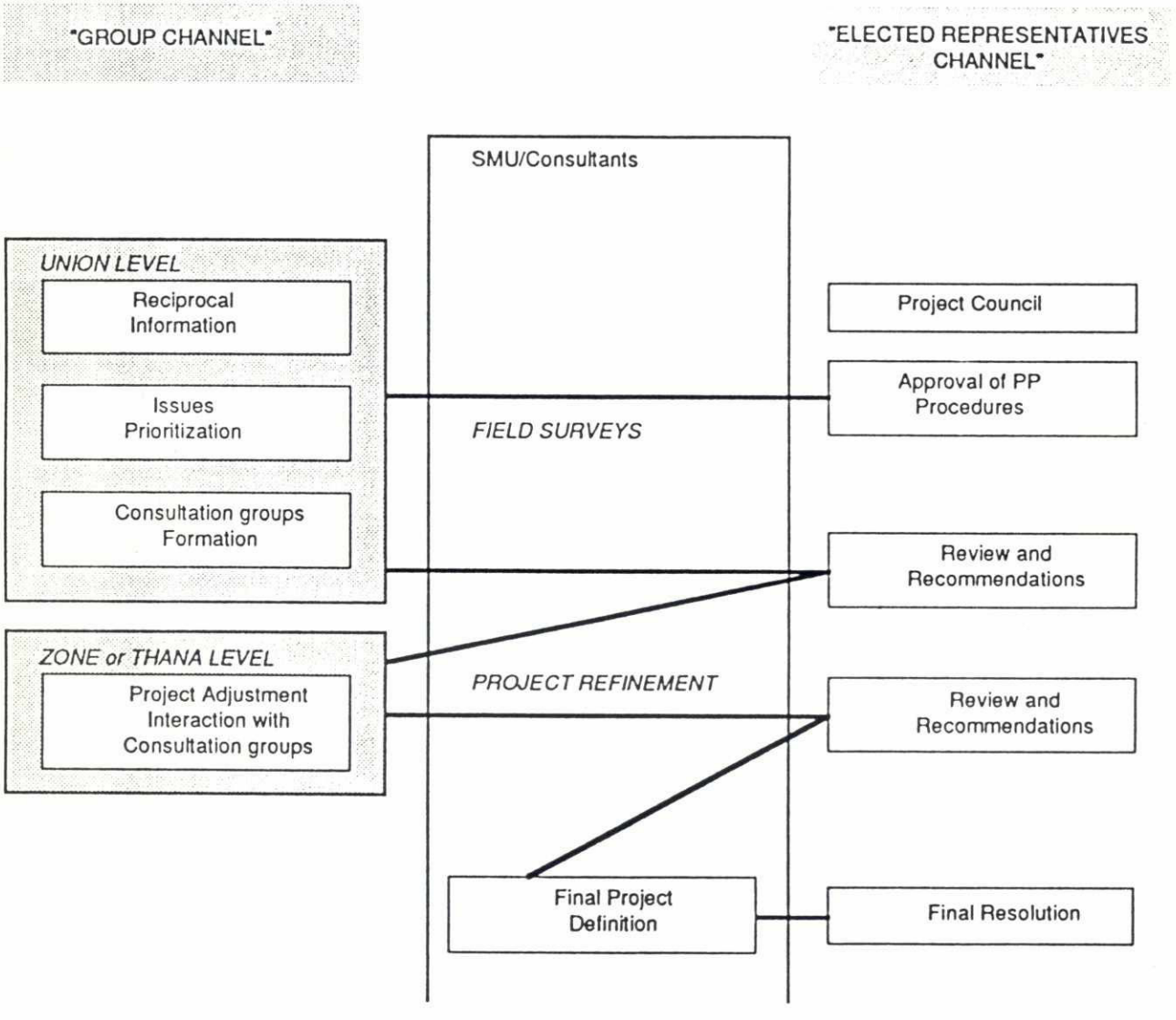
2.33 **Third,** if the projects fail to deliver the anticipated benefits to the people, there will not be any participation in post-completion stage thus creating the problem of sustainability. **Fourth,** the agencies identified with clear responsibility for different components during feasibility stage, will have to continue to provide the needed support to the beneficiaries on a regular basis. This may call for adjustment in the personnel deployment programme currently being followed in government system.

Fifth, consensus will be difficult where conflicting interests of different groups/individuals are involved. This may delay implementation and in extreme cases even lead to dropping of a project or an essential component because local people, as a whole group, will not be able to reach a consensus.

## Figure 1 : The Mechanism for People's Participation

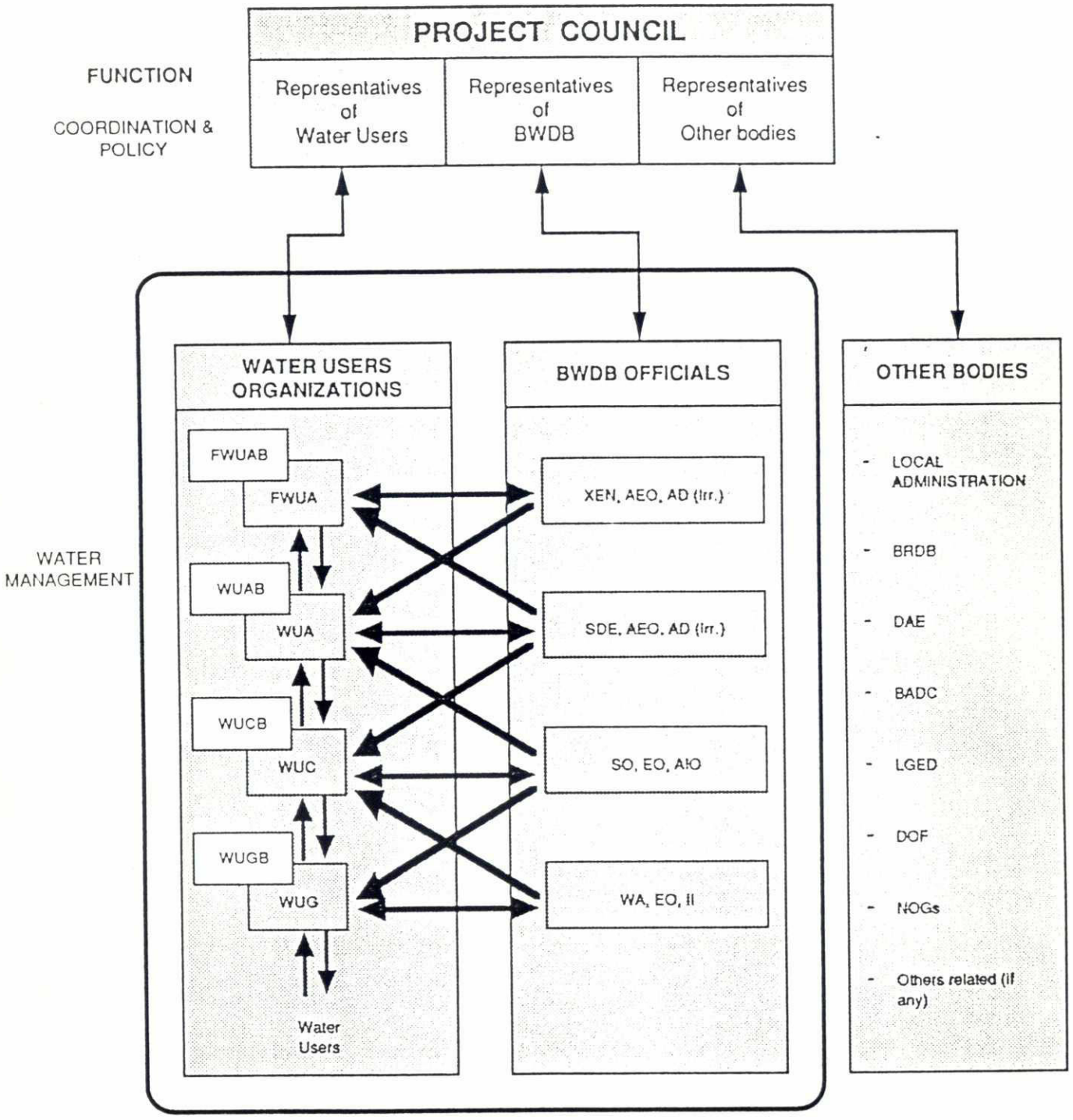


## Figure 2 : The Mechanism for People's Participation




**Source :** Jean Rabes, People's Participation Implementation during the Jamalpur Priority Studies, P. 19

Fig. 3 : Institutional Framework for People's Participation in Water Development Project




| | |
|---|---|
| AD (Irr.) | Asstt. Director (Irrigation) |
| AEO | Asstt. Extenstion Officer |
| AIO | Asstt. Irrigation Officer |
| BRDB | Bangladesh Rural Development Board |
| BADC | Bangladesh Agricultural Development Corporation |
| DAE | Department of Agricultural Extension |
| DOF | Department of Fisheries |
| EO | Extension Officer |
| FWUA | Federation of Water Users Association |
| FWUAB | Federation of Water Users Association Board |
| II | Irrigation Inspector |
| LGED | Local Government Engineer Department |
| NGOs | Non-Government Organizations |
| SDE | Sub-Divisional Engineer |
| SO | Sectional Officer |
| WA | Work Assistant |
| WUA | Water Users Association |
| WUC | Water Users Committee |
| WUG | Water Users Group |
| WUAB | Water Users Association Board |
| WUCB | Water Users Committee Board |
| WUGB | Water Users Group Board |
| XEN | Executive Engineer |

Source : Guidelines for People's Participation, MIWDFC, Annex - 'A'

**Figure 4 : Typologies of Participation**

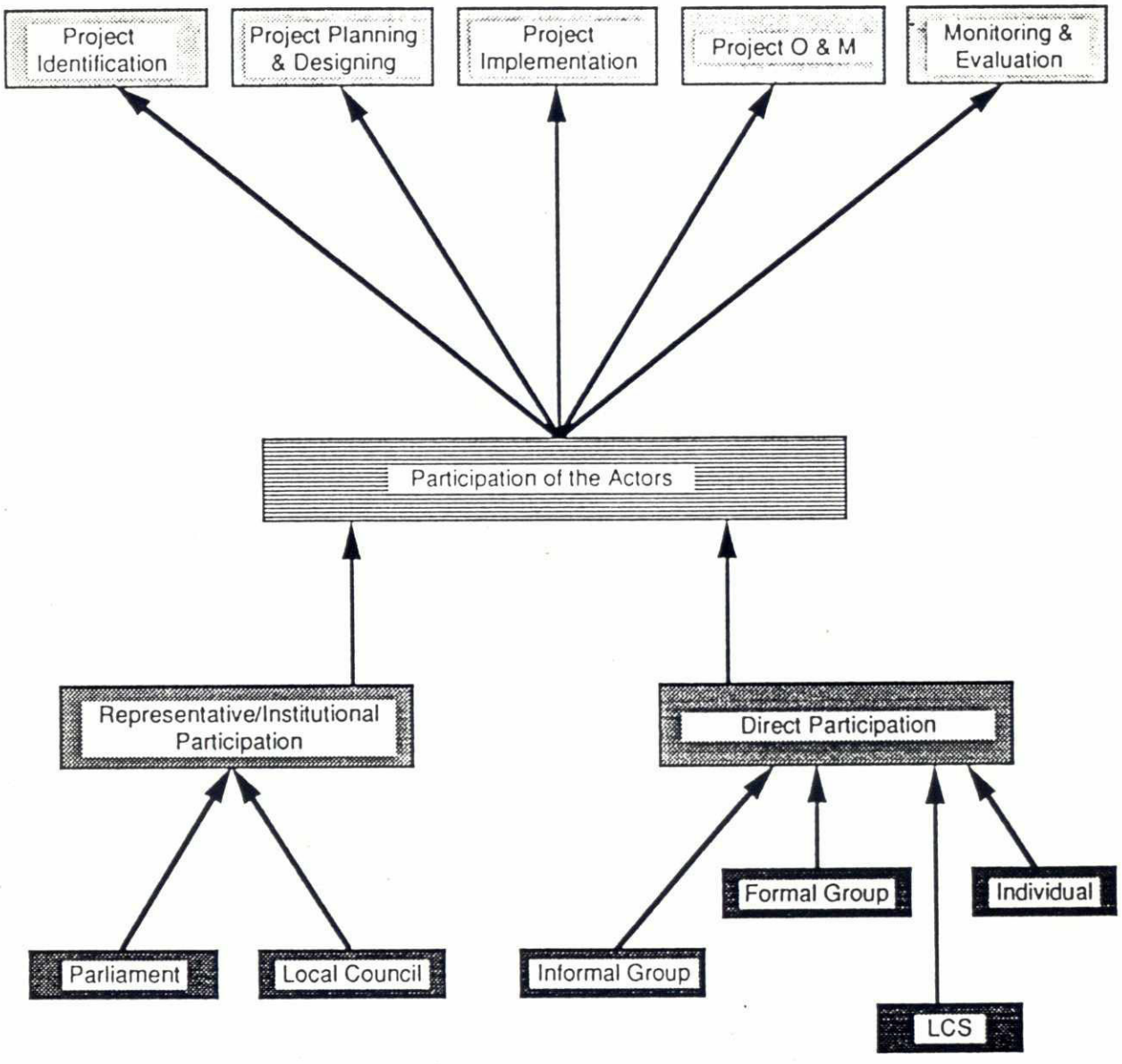
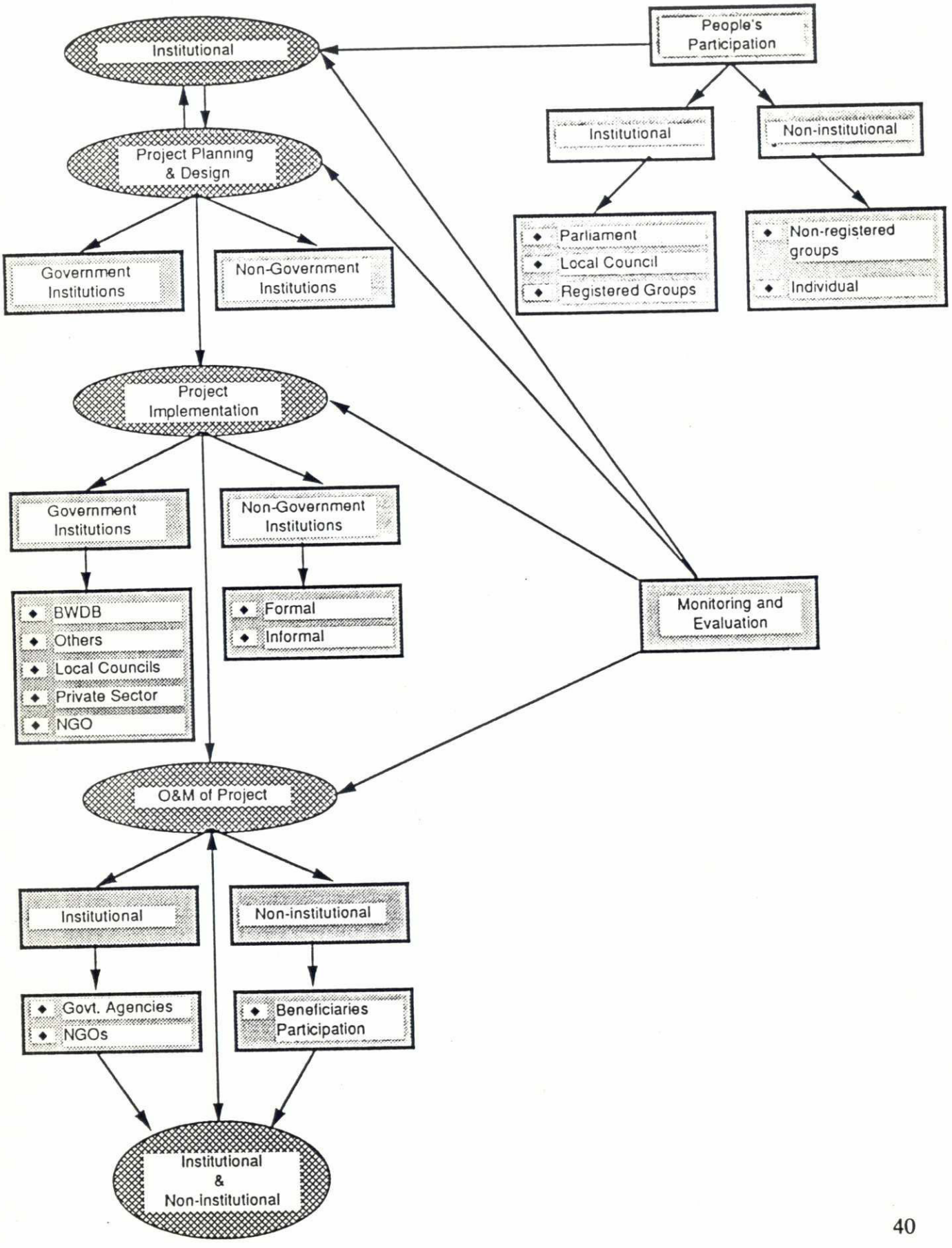


Figure 5 : Flow Diagram for Participatory Approach in Water Resource Project



# CHAPTER 3

## INSTITUTIONAL ARRANGEMENT FOR DISASTER MANAGEMENT, FLOOD PROOFING AND OTHER NON-STRUCTURAL SOLUTIONS

### A. Disaster Management:

3.1 Bangladesh with its peculiar funnel-shaped Bay of Bengal is visited by natural disasters but these disasters (floods, cyclones, tidal surge etc.) do not follow a time-schedule. Obviously, the first thing to remember would be that when an effective machinery for combating disaster management problems has been identified and set up, the effectiveness of this machinery should be tested even during non-disaster period through drills in a mock crisis. These drills could be quite expensive; however the particular aspects of the machinery which might demand monitoring are the rapidity of activation of the information systems and the provision of logistic support to the affected people. Apart from the question of accountability the key words for an effective machinery for disaster management should be capability, adequacy and efficiency. The institutional arrangements for disaster management should naturally include the following:

(A) Expansion of Flood Forecasting and Warning Services:

Flood forecasting and warning is a key component of the Flood Action Plan. An early forecasting and warning can, besides enabling the relevant sector to cope with the floods, prevent considerable damage to life and property.

The present Flood Forecasting and Warning Centre is a division of the Directorate of Surface Water Hydrology-2 under the control of the Chief Engineer (Hydrology) of BWDB. Field operations are supported by the construction and instrumentation division. Flood forecasting operations depend on a working arrangement with Bangladesh Meteorological Department (BMD) for receipt of different types of meteorological information e.g. radar pictures, synoptic charts etc. During the monsoon period FF & WC also receives daily satellite imagery from the Western Pacific Geostationary Satellite (GMS-Japan), which is monitored by SPARRSO (Space Research and Remote Sensing Organisation) in Dhaka. Once the river situation and forecast are prepared, it is disseminated to the following:

1. New Agencies
2. Radio and TV
3. Public Information Department
4. Ministry of Relief and Rehabilitation
5. Concerned Government Officials
6. Concerned Water Development Board Officials
7. Field Wireless Stations

3.2 A Disaster Co-ordination and Monitoring Unit (DCMU) has recently been established and is to be developed under FAP 11. FF & WC will continue to perform its present responsibility for dissemination of information and will further assist DCMU in interpretation of information. FAP 11 and DCMU will identify and develop pathways for distribution of forecast and warning information which will be an input from FAP-10.

The work has been envisaged as a series of interconnected modules based on specific activities. The modules that have been proposed are:

Module 1. Co-ordination and monitoring to maintain the progress made in setting up the FF & WC within BWDB to ensure that other activities and their outputs are integrated satisfactorily into the Flood Forecasting and Warning System including access to external hydrometric information and continuing the established links with other FAP components.

Module 2. Expansion of Flood Forecasting System through updated and improved modelling activities including the development of flooded area/depth forecast in conjunction with FAP-19 and FAP-25.

Module 3. Development and improvement of forecast outputs, public and user awareness and dissemination with special emphasis on development of appropriate warning systems at grass root levels.

Module 4. Installation and development of Telemetry system to upgrade data collection and improve forecast accuracy and lead time.

3.3 The objective of the module-based project is to upgrade the capacity of the Flood Forecasting and Warning Centre of the Bangladesh Water Development Board (BWDB). In the long-term the project aims to extend the short-wave radio network, overhaul and calibrate the weather radar, design and install weather satellite receivers, upgrade computer systems, develop data exchange with the Bangladesh Meteorological Department (transfer models from SWMC and FAP-25) and develop flood forecasting models. The initial phase of the project was completed in November 1992 with the successful installation of the weather satellite receivers and the computer local area network. Funding is available for the supply of balance of the hardware and the Government is presently exploring further development partner support for several key technical assistance posts. Although it is difficult to develop an effective flood forecasting and early warning system in Bangladesh with higher lead time without real time data on river levels and rainfall from relevant watersheds in the neighboring countries, FAP-10 would demonstrate the level of accuracy it can offer in inundation forecasting under such situation.

3.4 From what has been discussed above, the following observations about future institutional development in the area of disaster management programme would be of some relevance.

(a) Collaboration in exchange of real time data on river levels and rainfall from relevant watersheds in the neighboring countries could encounter some political problems. However, serious effort must be made at the government level to seek solutions to these problems in the spirit of SAARC collaboration.

(b) The work on disaster management is spread between a number of agencies/organisations. Greater co-ordination amongst these agencies is critical for successful disaster management.

(c) Under FAP-10, a satellite receiving station has been established. The necessity for this becomes questionable when BWDB already has been receiving weather satellite imagery from SPARRSO. This imagery could be transmitted by fax hourly. Thus the duplication of efforts should be avoided.

3.5 (B) Disaster Management Programmes of the Government and NGOs:

Most government and NGO programmes tend to have some common elements like

(a) distribution of food, clothes, medicine, plastic covering etc.
(b) deployment of medical teams
(c) dewatering of contaminated ponds, sinking new tubewells and supplying potable water by other means.
(d) preparation, supply and distribution of oral rehydration solution (ORS), water purification tablets etc.
(e) running relief camps to give food and shelter to the hungry and destitute- if not also to provide clothing and other basic needs.

Obviously the efforts of NGOs and government agencies need to be co-ordinated. For example, NGOs could be efficient in collecting relief materials and sending these down as near as possible to the disaster affected area. On the other hand, these materials could then be transported to such outlying areas, including off-shore islands by navy ships and airforce aircrafts and helicopters. Such forms of co-operation between agencies could be achieved through the Ministry of Relief and Rehabilitation.

3.6 <u>New Institutional Arrangement for Disaster Management:</u>

Recently in an UNDP document entitled "Support to Comprehensive Disaster Management BGD/92/002/A/01/99, some new institutional arrangements for disaster management in Bangladesh have been proposed. Figures 6 and 7 of that document which

are self-explanatory are reproduced here. The purpose of this arrangement is to support the recently created Disaster Management Bureau (DMB) of the Ministry of Relief which would become the focal point for GOB disaster management activities in both normal times and at times of emergency prior to and following a disaster. The new arrangements are supposed to encourage and facilitate co-ordination and co-operation between the various Ministries, agencies and organisations involved in disaster management activities.

According to the above mentioned UNDP document, the DMB will seek to:

i) strengthen the capacities of households and village communities in the highly disaster-prone areas to cope, individually and collectively, with both the risks and the effects of cyclones, floods, and river bank erosion before, during, and after the occurrence of such events.

ii) enhance the capacity of the Government and local-level authorities to:

- warn people of imminent threats of cyclones or floods;
- organise evacuations and other precautionary measures when necessary and possible;
- assess damage and needs in the immediate aftermath of a sudden disaster and during an extensive flood;
- organise rescue, relief and short-term rehabilitation activities effectively and efficiently, when needed, and to co-ordinate the activities of all involved;
- plan integrated post-disaster reconstruction programmes.

iii) ensure that natural hazards and other risks are properly considered during the formulation and implementation of development programmes and projects. The objective is to ensure that measures to reduce risks are implemented, whenever possible, and that development projects in all sectors are neither unduly vulnerable to known hazards nor increase the vulnerability of people in the areas concerned.

A proposed DMB staffing plan has also been shown in the document.

3.7 The proposed new institutional arrangements and the staffing pattern of the DMB appear to be reasonable. It must be stressed however that community mobilisation activities in co-operation with other relevant organisations is of paramount importance in disaster management. External help can be of substantial use only when our own national homework for consciousness generation and community mobilisation has been in place. In a disaster-prone country, the disaster-preparedness programme of the country should find a place in the school curriculum as part of the overall environmental study programmes. The role of the Open University of Bangladesh is enhancing community mobilisation efforts can be quite appreciable.

Figure 6

# Proposed Institutional Arrangement for Disaster Management in Bangladesh

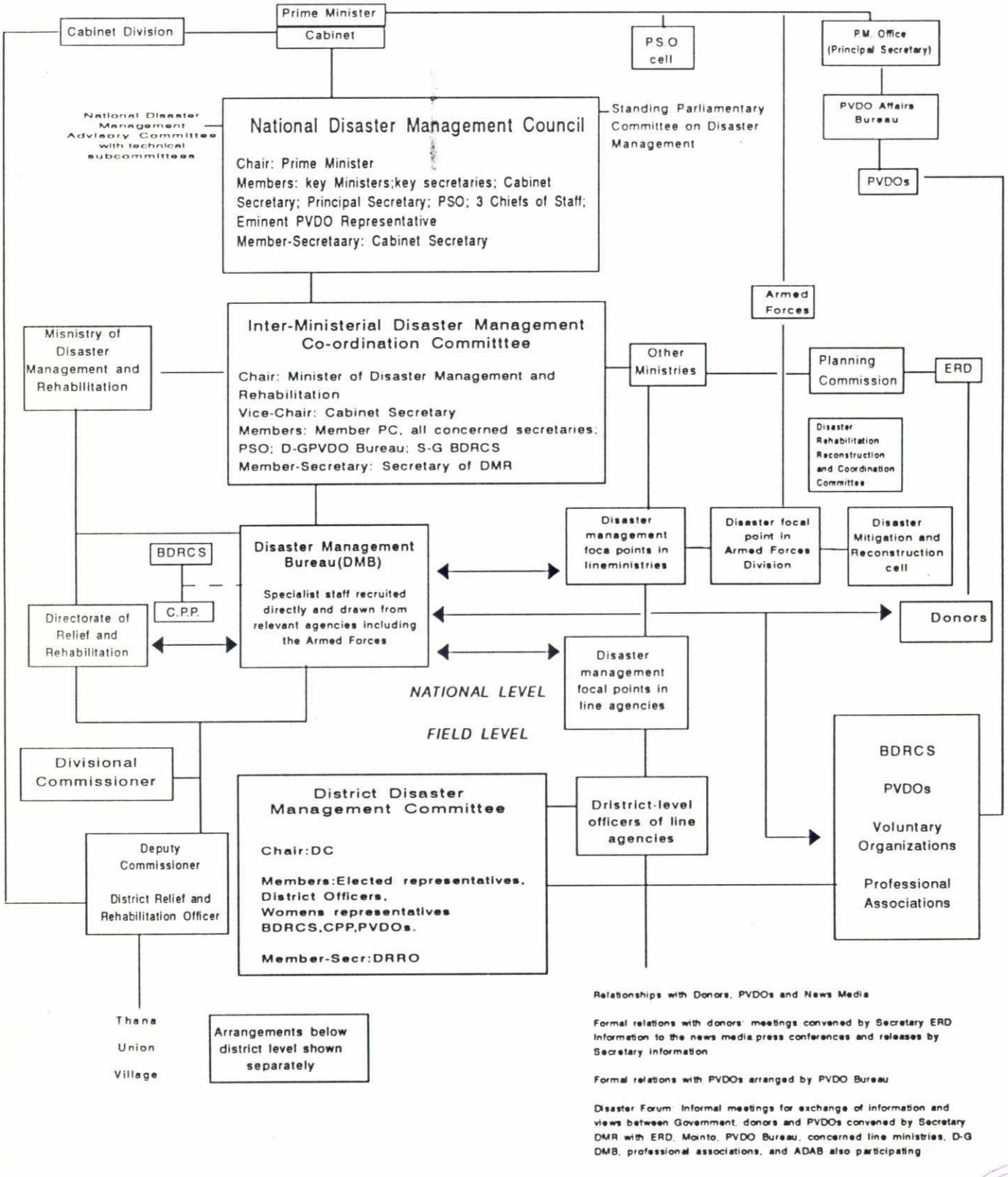
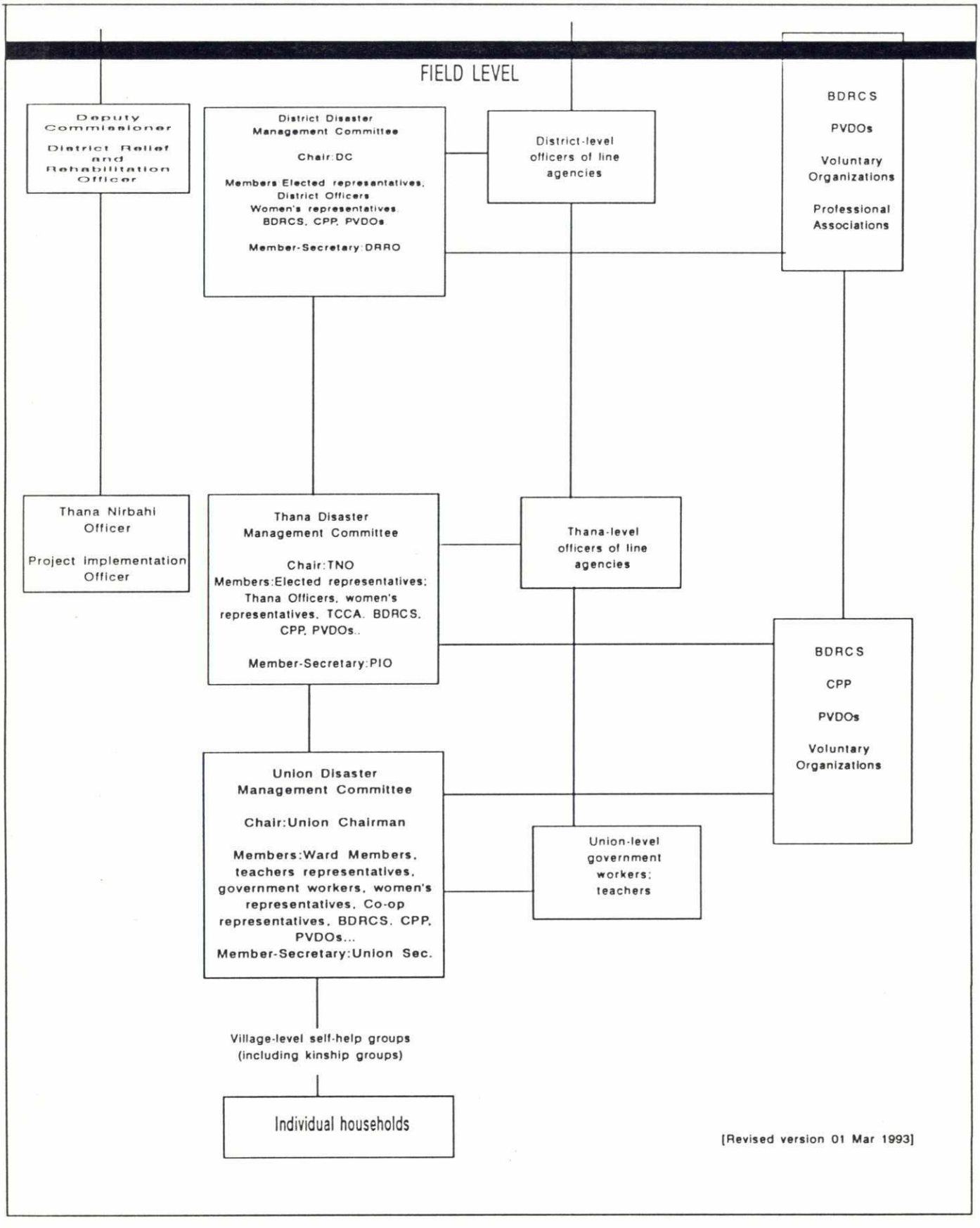


FIGURE 7

## Institutional Arrangements for Disaster Management at Field Level

(at district level and below)



## B. Flood proofing and other non-structural solutions:

3.8 Flood proofing has been construed to include any measure, non-structural or minor-structural, that will avoid or reduce flood damage and disruption without increasing damages to others.

The project study team identified more than 40 potential flood-proofing measures that have sufficient merit to justify further investigation. These measures have been identified in actual practice in Bangladesh as well as from international experience. The different measures could be highly varied.

For example, for a rural household or urban resident, the measures would be:

(a) raise the plinth or floor level or install a macha
(b) provide improved seed-storage vessels or grain drying facility
(c) work with neighbours to raise ground and improve a shelter area and to raise hand pump outlet above flood level.

For a shop or factory, the task would be to:

(a) raise material or goods stores and electrical equipment above flood level
(b) arrange water transport for employees, raw materials or products if roads are closed

For city administrations or central government, the idea would be to:

(a) set hydraulic standards for transport and other infrastructure
(b) regulate land use to avoid exposure to unplanned risk for new investments.

3.9 From the institutional point of view, the important findings of the flood proofing study are listed below:

- ☐ Considerable institutional and technical resources are available for rapid implementation. However, enhanced dedication and commitment will be needed to achieve the (a) untried levels of cooperation necessary among government agencies, and with the private sector, for effective implementation, and (b) delegation of authority and responsibility by central government units to allow local representatives to apply initiative and take actions, on-the-spot, to avoid or mitigate damage and disruption.

- ☐ Institutionalisation of flood-proofing concepts on a national scale will require supporting efforts for education of stakeholders (investors and beneficiaries), trust-building between government officials and stakeholders, and monitoring of

results and refinement of methods to build on experience. Foremost, it will need strong and flexible policy and management leadership, preparation of manuals covering applications for flood proofing measures and training of government officials.

3.10 Some pilot projects have been suggested to develop flood proofing techniques for application nationwide. The pilot projects should be located in areas with different flood characteristics to illustrate the range of measures required to mitigate the effects of different types of flood.

3.11 At present, no new institutional arrangement may be necessary for flood response and flood proofing. The services of the thana staff of the local LGED who have been involved in making development plans of roads, irrigation facilities, flood control embankment and water and land use can still be utilised. LGED should, however, prepare improved maps for upazilla and union planning.

In fact, the effectiveness of the present institutions could easily be tested for each of the needs outlined in the checklist prepared under FAP-14 (Flood Response Study). For effective flood proofing measures, an evaluation of the NGO activities as well as the community measures should be made.

3.12 Earlier ISPAN (Project Consultants) made the following recommendations:

☐ Implement a ***Risk Information Centre*** to provide, nationally, for rapid release and application of existing data on flood hazards and a prompt start on educational efforts and local-area technical support, including:

- ♦ Indicator Posts
- ♦ Flood Maps
- ♦ Hazard Maps
- ♦ Flood Education
- ♦ Floodway Protection

☐ Initiate a Pilot Project for ***Refugee (Shelter) Facilities*** to improve local protection and resources for rural residents, including:

- ♦ Individual Actions
- ♦ Leadership
- ♦ Raised Refuge
- ♦ Flood Education
- ♦ Water Supply

☐ Initiate a Pilot Project for ***Flood-Proofed Infrastructure*** Project that will include expanded support like standards and training for flood proofing key infrastructure:

- ♦ Hydraulic Standards
- ♦ Roads & Bridges
- ♦ Posts & Telecomm
- ♦ Water & Sanitation
- ♦ Model Community
- ♦ Review Board

☐ Consider initiation of ***Flood-Emergency Centres*** to provide Upazila command and communications centres to lead education and preparedness, as well as to provide flood-fighting and relief operations, including:

- ♦ Water and Sanitation
- ♦ Stockpiles
- ♦ Communications
- ♦ Indicator Posts
- ♦ Flood Education
- ♦ Technical Support

The implementation of these recommendations would involve funds and donors have to be requested. However, flood proofing is one area in which existing institutions can be utilised profitably and the project need be donor-driven. It must be remembered that communities who have been living with floods for years are the best institutions to be used. If any new flood proofing measure is suggested, it is they who can judge the adequacy of the measure. Any measure that is found useful is readily acceptable to them. For example, during some of the past floods, no flood control authority asked the affected people to use shallow tubewell engines for driving country boats - people made the innovative use themselves. Again, some people have shown their agricultural ingenuity during floods when they have used floating platforms for seed bed.

3.13 Another aspect of flood proofing which should be kept in mind is the psychology of the affected people. An example could make this point clear. It has been proposed that when floods actually visit the people, they could rush to some raised structure. The psychological factor that is often neglected during making such a suggestion is that no person cares for his own safety alone- everyone cares for the poultry and livestock also. They cannot think of any rehabilitation after the floods without their livestock and poultry. Thus whatever raised structure is suggested for use by the people during flood, it must be capable of accommodating the domestic animals also.

In summary, unless some new institutional arrangement emerges as a dire necessity out of the pilot project envisaged under flood proofing study, communities and existing government and non-governmental agencies/organisations should be activated to try out the different flood-proofing measures and provide a critical evaluation of the same.

# CHAPTER 4

## CO-ORDINATION OF FAP PROJECTS WITH RHD, LGED, BIWTA AND OTHER SIMILAR ORGANISATIONS

4.1 Co-ordination with Roads and Highways Department (RHD), Local Government Engineering Department (LGED) and Bangladesh Inland Water Transport Authority (BIWTA) is important for two reasons. Firstly, activities of these organisations, such as construction of highways and rural roads, digging of canals, and dredging of channels for navigation have a direct impact on the hydrological regime. For example, narrowing of channels while constructing bridges/culverts reduces the carrying capacity of rivers and streams, an important factor causing floods. Road alignments cutting across the terrain gradient (north to south in case of Bangladesh) also contribute to and aggravate the impact of floods. Unplanned digging of canals and construction of embankments, while alleviating localised problems, can disturb the overall hydrologic balance in a region and eventually cause serious problems for large areas. Any intervention in the hydrological regime should keep the overall situation in view. Secondly, large investments are currently being made in flood control and irrigation (BWDB), highways (RHD), rural roads, embankments and canal-digging (LGED) and channel maintenance and improvement (BIWTA). Co-ordination of activities of these organizations, from planning through implementation stage, will result in (i) better designed projects, and (ii) large economies in investment where structural components can be combined.

### (a) Roads and Highways Department:

4.2 RHD is the major agency responsible for construction and maintenance of all primary and major portion of the secondary road network in the country. Roads under RHD are classified into three categories ——— national highways, regional highways and feeder roads type A[1]. At present, RHD has nearly 15,000 km of roads, of which 8200 km are paved. Details are given below:

---

[1] Feeder roads type A connect thana headquarters with the national/regional network. Feeder roads type B are constructed and maintained by local government bodies.

## ROAD NETWORK UNDER RHD

(Length in Km)

| Category of roads | Paved road | Partly paved or brick paved road | Earthen road | Total |
|---|---|---|---|---|
| 1. National Highways | 2,820.69 | 36.67 | 61.98 | 2,919.34 |
| 2. Regional Highways | 1,427.60 | 123.54 | 78.50 | 1,629.64 |
| Sub-total: | 4,248.29 | 160.21 | 140.48 | 4,548.98 |
| Percentage: | 51.61 | 6.87 | 3.57 | 31.37 |
| 3. Feeder Roads type A | | | | |
| (a) Thana connecting roads | 2,293.09 | 1,596.67 | 2,881.85 | 6,771.61 |
| (b) Road connecting other growth centres | 1,689.38 | 575.85 | 915.64 | 3,180.87 |
| Sub-Total | 3,982.47 | 2,172.52 | 3,797.49 | 9,952.48 |
| Percentage | 48.39 | 93.13 | 96.43 | 68.63 |
| Total | 8,230.76 | 2,332.73 | 3,937.97 | 14,501.46 |
| Percentage | 100.00 | 100.00 | 100.00 | 100.00 |

4.3 Though small compared with size of the country, the highway network has made substantial impact on the hydrological regime. Criss-crossed with rivers and canals, inland waterways served as the main transportation artery for centuries. Habitation followed the river course and the river system suffered very little intervention until recent decades. At the time of the partition of India in 1947, there was only about 600km of paved roads in the area now constituting Bangladesh. Construction of the highway network since then has compartmentalised the country

to some extent. Road embankments[2] act as huge barriers and have drastically altered the traditional pattern of drainage of water during heavy rain and floods.

4.4 In RHD, hydrological investigation is carried out by 2 Bridge Design Circles, (East and West) each under a Superintending Engineer. Both technical and economic feasibility is listed as a requirement. Technical feasibility normally includes, amongst other, the following: river

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2 **GEOMETRIC STANDARDS OF ROADS UNDER RHD**

| Sl. No. | Category of roads | Crest width (metre) | Pavement width (metre) | Shoulder width on each side of road (metre) | Definition |
|---|---|---|---|---|---|
| 1. | National Highways<br>(a) Category A<br>(b) Category B | <br>12.20<br>12.20 | <br>7.32<br>5.50 | <br>2.44<br>3.36 | Highways connecting the national capital with divisional headquarters, old district headquarters, port cities and international highways. |
| 2. | Regional Highways<br>(a) Category A<br>(b) Category B | <br>11.00<br>11.00 | <br>5.50<br>3.66 | <br>2.75<br>3.67 | Highways connecting different regions with each other, which are not connected by national highway system. |
| 3. | Feeder Roads<br>(Type A) | 7.32 | 3.66 | 1.83 | Roads connecting important growth centres and places of socio-economic importance (other than Thana Headquarters) with the paved road network. |
| 4. | Thana Connecting Roads<br>(Feeder Roads Type A) | 7.32 | 3.66 | 1.83 | Roads connecting Thana Headquarters with the nearest paved road network. |

morphology study, river hydrology study, soil investigation, topography study and selection of suitable sites. RHD usually consults with BIWTA for hydrological data. Highway design is done at the offices of the Additional Chief Engineers of the 5 zones into which the country is divided. For foreign-aided projects, which constitute bulk of the RHD portfolio, separate studies are carried out by project consultants.

4.5 Drainage factor should be a major consideration while building roads in a flood-prone delta like Bangladesh. To what extent are all relevant aspects taken into consideration ? POE discussed the matter in a meeting with top officials of RHD for an assessment of the overall situation. Additionally, two project documents[3] were examined in this connection. The following recommendations are made:

(i) Hydrological investigation is mostly limited to construction of bridges. The emphasis is on providing water passage and navigation. There is a noticeable tendency to keep bridge spans to the minimum out of cost consideration. This narrow focus needs to be changed.

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3 **ACER Freeman Fox: Dhaleswari River Bridge Study (1991)**
**SAPROF Team: Route 2 Improvement Project (1993)**

Drastic reduction of water flow over the years is noticed in a large number of bridged rivers. Investigation of this observed phenomenon is necessary.

(ii) More importantly, hydrological impact assessment does not receive sufficient attention while road alignments are fixed. Flood-flow patterns and terrain gradient are seldom included as criteria for highway routing. The emphasis is on connecting administrative and business centres by the shortest route utilising existing alignments where possible. Construction of high embankments in this manner drastically changes the drainage situation (according to a recent decision, all major highway embankments are to be raised one metre above the highest flood level). While current RHD criteria are indeed very important, it is recommended that hydrological impact assessment must be adopted as an essential element while determining road alignment.

(iii) Coordination and consultation with BWDB is minimal except for protection work. RHD officials acknowledged that considerable benefits could be derived by co-ordinating projects of these two organisations, particularly the structural components and opined that the Planning Commission is the appropriate forum for this.

**(b) <u>Local Government Engineering Department (LGED):</u>**

4.6 LGED had its origin (1982) as a very small unit to assist the Ministry of Local Government, Rural Development and Cooperatives in administering the Rural Works Program. The Works Program Wing, as it was then called, was upgraded as the Local Government Engineering Bureau (LGEB) in 1984. The organisation was given wider responsibilities and made a full-fledged department in 1992. LGED is headed by a Chief Engineer and has its own network of technical personnel at district and thana levels all over the country.

Major functions of LGED are listed below:

(i) Plan, design, and implement rural infrastructure development projects of the Ministry of Local Government, Rural Development and Cooperatives,
(ii) Provide technical assistance (engineering/planning/management aspects) to local government institutions at district, thana and union levels and to municipalities,
(iii) Implement rural infrastructure projects of other ministries,
(iv) Design, prepare and circulate technical manuals relating to planning and implementation of infrastructure development projects,
(v) Impart training in engineering, management and financial aspects of project implementation,
(vi) Assist preparation of Thana/Union Plan Books to facilitate systematic and harmonious implementation of development projects in rural areas,
(vii) Implement Canal Digging Program of the Government.

LGED is now a major engineering orgnisation of the Government and received an allocation of TK 13280.20 million in the 1993/94 ADP. It will be seen from its project portfolio (Annex VII) that LGED is involved in the implementation of a wide range of infrastructure development activity.

4.7 LGED is a dynamic and forward looking organisation. This is the main reason for its rapid growth in recent years. LGED initiated the use of Labour Contracting Societies (LCS) which is now adopted by other agencies. In addition to Plan Books and engineering manuals, LGED has brought out two pioneering documents: Manual on Land and Water Use Planning, and Guidelines on Environmental Issues Related to Physical Planning. Though much work needs to be done on both documents, these are commendable efforts. LGED is also developing a Geographic Information System (GIS) of its own incorporating population, road network, waterways, educational institutions, land use characteristics, etc in its database. When fully developed, it will provide both screen displays and hard copy products (maps/lists/charts) for all thanas of the country.

4.8 LGED is intimately involved in the water sector. Thana/Union Drainage and Embankment Plan, Thana/Union Irrigation Plan, Thana/Union Land and Water Use Development Plans are integral components of the Plan Books initiated by LGED. Apart from irrigation/embankment components of Infrastructure Development Projects (IDPs) of LGED, the department is also implementing Small-scale Water Resource Schemes and the Canal-digging Program. BWDB has entrusted some components of Bhola Irrigation Project and Secondary Town Protection Project to LGED. Thana-level engineers of LGED consult with local BWDB officials in respect of water sector planning and project preparation. It appears, however, that there is very little co-ordination at regional or national levels.

4.9 POE considers close co-ordination with LGED as essential. FAP is not an isolated activity, it has to fit in with overall land and water use planning. The following recommendations are made in this connection:

(i) FAP Consultants do not appear to have taken advantage of the work underway/done by LGED. All parties stand to gain by drawing on each other's information pool and harmonizing database and analytical software. The Ministry or the Planning Commission could initiate action in the matter.

(ii) FAP 20 should work more closely with local level LGED officials. LGED could contribute significantly in future replication of compartmentalisation projects.

(iii) BWDB and LGED should periodically exchange project information to integrate structural components and ensure complementarity where possible. There is enormous scope for cost-saving and better-designed projects. Nazirganj-Nagarbari Road in Pabna district, in which LGED utilised the embankment constructed by BWDB, is an example. In this case, LGED took over an existing BWDB embankment along the Padma, compacted the earthwork, upgraded the embankment to a geometric shape and put in the road surface. The result is a durable embankment and a road, with minimal cost to the economy.

(c) **Bangladesh Inland Water Transport Authority:**

4.10 BIWTA, established in 1958, is responsible for maintenance and development of inland and costal waterways. Its Hydrography Department conducts regular hydrographic surveys of both inland and coastal waterways to facilitate conservancy and channel marking. The department has 18 survey vessels equipped with DECCA receivers and echo sounders for hydrographic survey and related data collection. The department regularly publishes river charts in various scales (ranging from 1:1000 to 1:75000). Hydrographic surveys carried out during last 10 years are listed below:

| Years | Navigational Survey | | Dredging Survey Km |
|---|---|---|---|
| | Inland waters Km | Coastal waters Sq. Km | |
| 83-84 | 1332 | 453 | 32 |
| 84-85 | 1395 | 1294 | 171 |
| 85-86 | 2137 | 790 | 201 |
| 86-87 | 2313 | 1372 | 120 |
| 87-88 | 2124 | 70 | 55 |
| 88-89 | 1480 | - | 140 |
| 89-90 | 1526 | 910 | 125 |
| 90-91 | 1325 | 450 | 155 |
| 91-92 | 1842 | 190 | 185 |
| 92-93 | 1635 | 616 | 185 |

4.11 Changes in navigation channels result from geo-morphological changes in the hydrological regime. BIWTA has continuous channel data for both inland and coastal waterways for nearly three decades. Focussed analysis of this data can yield valuable information relating to morphological changes of invidual rivers as well as of the river system as a whole. The analysis will also reveal illuminating clues as to the relationship between the state of the river system and silt deposition in the shallow coastal waters. No such study appears to have been undertaken in the past. It is recommended that the FAP project on river morphology study this whole matter.

It is further recommended, on a general basis, that FAP consultants establish and maintain regular contacts with BIWTA officials (in particular of (i) Hydrography and (ii) Conservancy and Pilotage Departments) who have a wealth of practical knowledge of the behavior of Bangladesh rivers.

# PROJECTS UNDER IMPLEMENTATION BY LGED
## ADP 1993-94

(Taka in Lakh)

| Sl. No. | Project Title | Duration | Project Cost | ADP Allocation (93-94) | Source of Aid | Project Area |
|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| | **Development projects**<br>**Sector : RD & I(LGD)** | | | | | |
| (A) | **ON GOING PROJECTS:** | | | | | |
| 1. (a) | Rural Development Project-3: Infrastructure, Old Sylhet District (Revised) (Phase-I) (02-030-001-8693) | 1986-87 1993-94 | 4,606.00 | 850.00 | USAID +IDB | Sylhet, Moulvibazar Hobigonj & Sunamgonj District |
| (b) | Rural Development Project-3: Infrastructure, Old Sylhet District (Phase-II) | 1993-94 1997-98 | 5,770.00 | 550.00 | IDB | Sylhet, Moulvibazar Hobigonj & Sunamgonj District |
| 2. | Rural Development Project-4: Infrastructure, Faridpur, Madaripur, Rajbari, Shariatpur and Gopalganj District (02-030-009-9093) | 1990-91 1994-95 | 13,042.00 | 3,000.00 | SIDA/ NORAD | Faridpur, Madaripur, Rajbari, Gopalgonj, Shariatpur and Kurigram District |
| 3. | Rural Development Project-6: Infrastructure, Old Dhaka District (Manikganj Dist.) (02-030-002-8892) | 1988-89 1993-94 | 3,943.75 | 1,230.00 | SDC | Manikgonj district |
| 4. | Rural Development Project-7: Infrastructure, Old Rajshahi, Pabna & Bogra District (02-030-003-8895) | 1988-89 1994-95 | 28,659.50 | 4,600.00 | IDA, SDC & Kfw | Rajshahi, Natore, Naogaon, Nawabgonj, Pabna, Sirajgonj, Bogra & Joypurhat District |
| 5. | Rural Development Project-8: Infrastructure, Greater Rangpur District (02-030-004-8893) | 1988-89 1993-94 | 7,820.52 | 1,730.00 | EEC/ NETH. | Rangpur, Gaibandha, Nilphamari & Lalmonirhat District |
| 6. | Rural Development Project-13: Infrastructure, Old Dinajpur & Jamalpur District (02-030-006-8895) | 1988-89 1994-95 | 34,953.12 | 7,500.00 | ADB | Dinajpur, Thakurgaon, Panchagarh, Jamalpur & Sherpur district |
| 7. | Rural Development Project-14: Infrastructure, Tangail District (02-030-010-9093) | 1990-91 1994-95 | 2,790.00 | 1,288.00 | GTZ | Tangail district |

ANNEX VII/2

| Sl. No. | Project Title | Duration | Project Cost | ADP Allocation (93-94) | Source of Aid | Project Area |
|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 8. | Rural Development Project-16: Infrastructure, Old Barisal & Patuakhali District (02-030-011-9097) | 1990-91 1996-97 | 7,314.00 | 11.00 | DANIDA | Barisal, Jhalokati, Pirojpur, Bhola, Patuakhali & Barguna District |
| 9. | Rural Development Project-18: Infrastructure, Greater Khulna, Jessor & Kushtia district | 1992-93 1998-99 | 40,930.00 | 7,600.00 | ADB | Greater Khulna, Jessore & Kushtia District |
| 10. | Model Rural Dev Project (Phase-I) | 1990-91 1993-94 | 6,100.00 | 1,750.00 | JICA | Daudkandi & Homna Thana |
| 11. | Cyclone Rehabilitation Project: Feni, Noakhali & Laxmipur District (02-030-013-9194) | 1991-92 1993-94 | 1,088.00 | 988.00 | SAUDI | Feni, Noakhali & Laxmipur District |
| 12. | Construction of Cyclone Shelters with Japanese assistance(02-030-9194) | 1991-92 1993-94 | 5,821.00 | 175.00 | JICA | Chittagong, Cox's Bazar, Feni, Noakhali, Laxmipur, Patuakhali, Borguna & Bhola District |
| 13. | IDA Assisted 3rd Flood Rehabilitation Project (02-030-008-8892) | 1989-90 1992-93 | 10,086.00 | 375.00 | IDA | Rajshahi & Khulna Division and Greater Faridpur District |
| 14. | ADB Assisted Flood Rehabilitation Project (02-030-007-8891) | 1989-90 1993-94 | 22,521.00 | 44.00 | ADB | Dhaka (Except Greater Faridpur District) & Chittagong Division |
| 15. | Construction of large Bridges under PL-480, Title-III | 1993-94 1997-98 | 11,854.00 | 2,178.00 | USAID | All Over Bangladesh |
| 16. | Rural Infrastructure Development Project (Special Public Interest) | 1993-94 1995-96 | 19,200.00 | 3,600.00 | GOB | All Over Bangladesh |
| | **SUB-TOTAL (1-16):** | | **226,498.89** | **37,469.00** | | |

| Sl. No. | Project Title | Duration | Project Cost | ADP Allocation (93-94) | Source of Aid | Project Area |
|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| | Sector: PPWS & H(LGD) | | | | | |
| (B) | On Going Project | | | | | |
| 17. | Slum Improvement Project Phase-II | 1988-89 1994-95 | 2,434.00 | 760.00 | UNICEF | 4 City Corporation & 21 Pourashavas |
| 18. | Secondary Towns Infrastructure Development Project (10 Towns) | 1990-91 1996-97 | 19,002.00 | 3,900.00 | ADB | 10 Pourashavas |
| | SUB TOTAL (17-18): | | 21,436.00 | 4,660.00 | | |
| | TOTAL (1-18): | | 247,934.89 | 42,129.00 | | |
| | TA Projects Sector RD & I(LGD) | | | | | |
| (C) | On Going TA Projects | | | | | |
| 19. | Technical Assistance for Improvement of Planning/Implementation Capability of the Thana Infrastructure Programme | 1990-91 1993-94 | 870.00 | 350.00 | UNDP/ ILO | Technical Assistance for all Thanas of the Old 11 Districts about Planning, Mapping & Training |
| 20. | Technical Assistance for Coordination of Projects under RESP-II and Institutional Support to Local Government Engineering Department | 1990-91 1994-95 | 4,911.00 | 1,100.00 | SIDA/ NORAD | Technical Assistance for Institutional Capability of all stages of LGED's Districts, Thanas & HQ |
| 21. | Technical Assistance for Small Scale Water Development at Thana & Union level | 1992-93 1993-94 | 190.00 | 140.00 | ADB | All over Bangladesh |
| | SUB TOTAL (19-21): | | 5,971.00 | 1,590.00 | | |

| Sl. No. | Project Title | Duration | Project Cost | ADP Allocation (93-94) | Source of Aid | Project Area |
|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| | Sector: PPWS & H(LGD) | | | | | |
| (D) | On Going Projects | | | | | |
| 22. | TA for Secondary Towns Infrastructure and Development Project (20 Towns) | 1991-92 1993-94 | 210.00 | 110.00 | ADB | 20 Towns (TA) |
| | SUB TOTAL (22): | | 210.00 | 110.00 | | |
| (E) | New Projects: | | | | | |
| 23 | TA for Municipal Services Project | 1993-94 1994-95 | 608.00 | 510.00 | IDA | TA for investment project of Rajshahi & Khulna City Corporation and selected 8 secondary towns |
| | SUB TOTAL (23): | | 608.00 | 510.00 | | |
| | SUB TOTAL (19-23): | | 6,789.00 | 2,210.00 | | |
| | TOTAL (1-23) : | | 254,727.89 | 53,738.00 | | |
| | Works of Other Ministries Implemented by LGED | | | | | |
| A. | Ministry of Irrigation, Flood Control & Water Resources | | | | | |
| 24. | Bhola Irrigation Project (Phase-II) | 1992-93 1996-97 | 2,288.78 | 625.00 | ADB | 6 Thana in Bhola District |
| 25. | Secondary Towns Integrated Flood Protection Project (Municipal Services Component) | 1992-93 1996-97 | 13,029.21 | 2,750.00 | ADB | Khulna, Dinajpur Panchagarh, Kurigram, Hobigonj & Moulvibazar |
| 26. | Char Development and Settlement Project. | 1992-93 1994-95 | 1,240.00 | 230.00 | Dutch | Shudharam Thana of Noakhali District |
| | SUB TOTAL (24-26): | | 16,557.99 | 3,605.00 | | |

| Sl. No. | Project Title | Duration | Project Cost | ADP Allocation (93-94) | Source of Aid | Project Area |
|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| B. | Ministry of Agriculture | | | | | |
| 27. | North-East Minor Irrigation Project (Construction of Bridge/Culvert on Rural Roads) | 1992-93 1994-95 | 6,174.00 | 2,400.00 | ADB | Sylhet, Moulivibazar, Sunamgonj, Hobigonj, Netrakona and Kishoregonj District. |
| | SUB TOTAL (27): | | 6,174.00 | 2,400.00 | | |
| C. | Ministry of Education | | | | | |
| 28. | General Education Project (IDA Assisted) | 1990-91 1994-95 | 27,450.00 | 10,400.00 | IDA | Rural Primary School of Dhaka, Rajshahi & Khulna Division |
| 29. | General Education Project (ADB Assisted) | 1990-91 1994-95 | 7,978.00 | 2,550.00 | ADB | Chittagong Division |
| 30. | IDA Assisted 3rd Floor Rehabilitation Project (Pry. School) | 1990-91 1993-94 | 7,567.00 | 210.00 | IDA | Dhaka & Chittagong Divisions |
| 31. | IDB Assisted Primary Schools | 1993-94 1997-98 | 3,500.00 | 30.00 | IDB | Selected 26 Districts of 5 Divisions |
| 32. | ADB Assisted Cyclone Rehabilitation Project (1st phase) | 1991-92 1993-94 | 4,690.80 | 1,484.00 | ADB | Costal area of Khulna and Chittagong Division |
| 33. | ADB Assisted Cyclone Rehab. Project (2nd phase) | 1992-93 1993-94 | 5,201.00 | 3,481.00 | ADB | Coastal ares of Khulna and Chittagong Division |
| 34. | Registered Non-Govt. Primary School Development Project | 1992-93 1993-94 | 42,737.00 | 18,000.00 | GOB | All over Bangladesh |
| 35. | Revenue Maintenance of Govt. Primary Schools | 1993-94 | 2,500.00 | 2,500.00 | GOB (Revenue) | All over Bangladesh |
| | SUB TOTAL (28-35): | | 101,623.80 | 38,655.00 | | |
| D. | Cabinet Division | | | | | |
| 36. | IFAD Assisted Special Assistance Project for Cyclone Affected Rural Households | | | | | |

| Sl. No. | Project Title | Duration | Project Cost | ADP Allocation (93-94) | Source of Aid | Project Area |
|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| (a) | Development of Small Scale Water Resources | 1991-92 1993-94 | 681.00 | 341.00 | IFAD | Chokoria, Banskhali, Anowara, Kutubdia Thana |
| (b) | Construction of Cyclone Shelter | 1991-92 1993-94 | 821.00 | 533.00 | IFAD | |
| | **SUB TOTAL (36):** | | 1,502.00 | 874.00 | | |

E. Special Affairs Division

| | | | | | | |
|---|---|---|---|---|---|---|
| 37. | Construction of physical Infrastructure for socio-economic development of the inhabitants of cluster villages under Hill Tracts Region. (Special Affairs Division) | 1992-93 1994-95 | 3,208.00 | 250.00 | GOB | Bandarbon, Rangamati & Khagrachari district |
| | **SUB TOTAL (37):** | | 3,208.00 | 250.00 | | |

F. Prime Minister's Office

38. Canal Digging Programme

| | | | | | | |
|---|---|---|---|---|---|---|
| (a) | Earth Work: | 1992-93 1995-96 | 2,300.00 (3500 M.T) | 2,300.00 (3500 M.T) | GOB | All over Bangladesh |
| (b) | Structures: | 1992-93 1995-96 | 1,200.00 | 1,200.00 | GOB | All over Bangladesh |
| | **SUB TOTAL (38):** | | 3,500.00 | 3,500.00 | | |
| | **TOTAL (A+B+C+D+E+F) (24-38):** | | 132,565.79 | 49,284.00 | | |

ADP Block Allocation for LGED

| | | | | | | |
|---|---|---|---|---|---|---|
| 39. | Block Grant for Thana & Union Infrastructure | 1993-94 | 10,000.00 | 10,000.00 | GOB | All over Bangladesh |
| 40. | NICAR Infrastructure Dev.Fund | 1993-94 | 3,100.00 | 3,100.00 | GOB | All over Bangladesh |
| 41. | Flood Rehabilitation of Rural Infrastructure | 1993-94 | 1,500.00 | 1,500.00 | GOB | All over Bangladesh |
| 42. | ADP District & Thana Infrastructure | 1993-94 | 8,000.00 | 8,000.00 | GOB | All over Bangladesh |
| | **SUB TOTAL (39-42):** | | 22,600.00 | 22,600.00 | | |

| Sl. No. | Project Title | Duration | Project Cost | ADP Allocation (93-94) | Source of Aid | Project Area |
|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| | **FFW Programme** | | | | | |
| 43. | Growth Center Connecting Road Programme | | | | | |
| | a) Earth Work | 1987-88 (Running) | 1,43,752.00 (211400MT) | 3,019.00 (44400MT) | WFP | All over Bangladesh |
| | b) Structure | 1987-88 (Running) | 12,541.00 (184430MT) | 3,060.00 (45000MT) | WFP | *The Project cost is not fixed. All over Bangladesh |
| 44. | Integrated Food for Development(FFD) | 1993-94 1997-98 | 35,000.00 (5600000MT) | 7,000.00 (100000MT) | CARE | All over Bangladesh |
| | **SUB TOTAL (43-44):** | | 1,91,293.00 | 13,079.00 | | |
| | **Revenue Allocation to LGED for Maintenance** | | | | | |
| 45. | Maintenance of Rural Infrastructure | 1993-94 | 3,500.00 | 3,500.00 | | All over Bangladesh |
| | **SUB TOTAL (45):** | | 3,500.00 | 3,500.00 | | |
| | **TOTAL (1-45):** | | **604,682.68** | **132,802.00** | | |

# CHAPTER 5

## INSTITUTIONAL ARRANGEMENTS FOR CONTINUATION OF GIS, RIVER SURVEY, TOPOGRAPHIC MAPPING, FLOOD MODELLING AND OTHER STUDY/RESEARCH ACTIVITIES

5.1 FAP portfolio includes a number of important study/research projects. Though undertaken as components of FAP, these activities are in fact of a continuing nature and the output has wide use for development planning as well as for day to day operations. Some activities are new while some were being done earlier by BWDB/other agencies as part of their mandate. Relevant FAP projects are listed below:

FAP 18: Topographic Mapping
FAP 19: Geographic Information System (GIS)
FAP 21/22: Bank Protection And River Training
AFPM Pilot Project
FAP 24: River Survey Programme
FAP 25: Flood Modelling/Management Project

A brief description of study objectives and work done so far is presented at Annex VIII.

5.2 Institutional arrangements for effective continuation of these activities beyond FAP is examined in following paragraphs. Two issues are involved here: (i) institutions which will carry on these activities, and (ii) technology transfer.

### EXISTING INSTITUTIONS

5.3 We have already referred to existing agencies which are engaged in some of these activities. These are described below:

**Surface Water Hydrology:**

In the field of surface water hydrology, the routine work consists of measurement of hydrological data such as water level, river discharge (liquid and solid), rainfall, evaporation etc. These data are collected through Surface Water Hydrology-1. Surface Water Hydrology-2 is responsible for compilation, processing, storage and retrieval of surface water hydrological data. At present, these data are being processed by micro computer and a micro-computer based data bank has been established to handle and manage hydrological data. Surface Water Hydrology 1 and 2 also perform collection and processing of data of border rivers and also data of other agency as deposit work.

At the present moment, there are 314 water level stations, 104 stream flow stations (for measuring discharges), 27 sediment sampling stations, 256 rainfall stations, 39 evaporation stations, 3 climatological data stations and 65 salinity stations.

**Ground Water Hydrology:**

Ground Water Circle-1 is responsible for field investigation and timely execution of all physical works like test drilling, setting up of ground water observation wells, monitoring of observation wells, conducting aquifer tests and monitoring of water quality and collection of hydrogeological data. Ground Water Circle-2 is responsible for compilation, processing, analysis and interpretation of data, preparation of hydrological maps and reports, and storage & retrieval of data. Research and Study Section, Electronic Data Processing Cell and Processing and Publication Section of Ground Water Circle-2 perform the processing, storage and publication of data which are required for different project planning. Collection and storage of these data are to be continued for planning of projects at present and also in future.

**River Morphological Survey and Investigation:**

Knowledge of river morphology is essential for water resources development projects, in particular, for river training and bank protection work. The activities in this area are conducted by the River Morphology Directorate. This Directorate originally started functioning from October 1964 in the name of Brahmaputra Circle, subsequently renamed as Directorate of River Morphology, Research and Training for collection of hydro-morphological data of the major rivers with their tributaries and distributaries. Subsequently only the cross-section of the rivers were drawn based on the availability of fund and importance of the river with a view to studying the morphological changes in the river course.

In 1982, the Directorate of River Morphology, Research and Training with Brahmaputra Survey Division-I was abolished due to financial constraints and remaining Brahmaputra Survey Division-II was placed under the Directorate of Surface Water Hydrology-1, Dhaka. Brahmaputra Survey Division-II was entrusted with the cross-section survey work of the rivers in a very limited scale. After the devastating floods of 1987 and 1988, River Morphology and Research Circle was again created in 1989 and placed under the Chief Engineer (Hydrology). This Circle is headed by a Superintending Engineer who is responsible for field survey, data collection, processing, storage and research. The field survey is carried out by two Morphology Divisions headed by Executive Engineers.

5.4 Over the years, the Hydrology Directorate has accumulated a wealth of data. However, data verification, validation and analysis has been neglected. It would be expected that the Directorate would publish something like an annual report highlighting changes in the country's hydrological regime, but no such study appears to have been attempted. Output from the River Morphology Circle is even less satisfactory. This is not the fault of

officers working in these fields but an institutional failure. By orientation, BWDB is an engineering organisation. As a result, data collection and study/research activities receive low priority and do not feature in the career planning of its officers. Posting in these departments/circles is generally reluctantly accepted and at worst considered as a punishment. These departments become the first sufferer at times of budgetary difficulty. Poor performance is an obvious result.

**Hydraulics:**

5.5 The River Research Institute (RRI) was established in 1977 by merging the Hydraulics Research Laboratory and the Directorate of Soil Mechanics/Materials. RRI moved to its current location in Faridpur between April and June 1989. The Institute has extensive facilities to construct and run physical models to study river behaviour. It also has a well-equipped soils and materials laboratory. RRI received equipment support and technical training under Danish assistance and a UNDP-project. The institute will have world-class facilities with addition of some more equipments and some further infrastructure development.

5.6 RRI has enthusiastic professional staff. The Institute's potential is currently underutilised; the Government should give it more work and also funds for basic research. At the same time, RRI should secure work on its own, from BWDB as well as other organisations like the two Port Authorities, RHD, BIWTA and Bangladesh Railways. For example, RRI can immediately undertake study of (i) the reasons for bank erosion near the Meghna Bridge on Dhaka-Chittagong Highway, and (ii) causes of siltation in the Pussur River in front of Mongla Port jetties. RRI management could also take work from the public/private sector for soils/material analysis, compaction testing etc.

RRI was involved in a number of FAP-projects of which FAP 9B (Meghna River Study), FAP 1 (Brahmaputra River Training Project) and FAP 21/22 (Bank Protection and River Training Pilot Project) are the most important. It is regrettable that RRI was not involved with the Jamuna Bridge Project which will be the largest river training work of its kind. RRI must take up this matter with the Jamuna Bridge Authority.

5.7 The Surface Water Modelling Centre (SWMC), which is now a part of RRI, is engaged in mathematical modelling. A detailed note on SWMC is attached as Annex IX. Apart from establishing its general and regional models, SWMC has done extensive work with all main FAP projects and the Compartmentalisation Pilot Project.

**Water Resources Planning Organisation (WARPO):**

5.8 The situation with WARPO is not encouraging. Staff morale is low and the organisation appears to have difficulties in securing adequate support from the Ministry. Though WARPO has a wide charter, very little is being done beyond routine compilation work. Facilities in terms of computer hardware/software are underutilised and not maintained

properly. The top management, on deputation from BWDB, want to go back to the parent organisation.

**Transfer of Technology:**

5.9 Transfer of technology is included as a specific objective in these projects. To quote from FAP 24 TOR document :

> *"Prepare and carry out programmes for training BWDB and, where applicable, staff of other Bangladeshi Organisations, including the staff of associated local consultants and contractors in the use of modern equipment, instruments, techniques and technology so that they are able (a) to carry on with the surveys after completion of the project and (b) to upgrade the routine survey programmes being undertaken by those organisations. This would mostly take the form of on-the-job training, but would be supplemented by some training seminars and workshops."*

5.10 To what extent is transfer of technology taking place ? The situation is uneven. RRI/BWDB personnel working with SWMC and FAP 25 are taking keen interest in the new technology and they have picked-up skills quite nicely. The same cannot, unfortunately, be said of the staff of Hydrology and Design Directorates. Their participation in the work of FAP 21/22 and FAP 24 has been marginal. As a matter of fact one gets the impression that BWDB, as an organisation, has neither contributed its share to preparation and scrutiny of FAP projects nor taken expected interest in the new technology.

5.11 In contrast, the private sector has responded enthusiastically to the scope created by FAP studies. They have generally recruited and placed young, forward-looking people for the work. Expatriate Consultants have expressed full satisfaction with the ability, skills and level of effort of the personnel employed by their Bangladeshi counterparts. The same is true of Bangladeshi personnel directly recruited by the Expatriate Firms. It has been stated emphatically that these Bangladeshi personnel, given adequate support, can be expected to continue the work satisfactorily.

5.12 Lack of adequate funding and logistic support for training is hindering transfer of technology in some cases. In this connection, the problems pointed out by FAP 24 Consultants (Annex XII) deserve immediate attention. Similar problems,it is assumed, exist for other projects also.

**Private Sector Involvement:**

5.13 Performance of private consulting firms and the locally-recruited staff of expatriate firms has given rise to a demand for greater private sector involvement in water sector projects. It has been suggested that private sector capability to plan, design and supervise

projects, within the parameters of the overall national plan, should be given full scope. It has also been opined that given proper support the private sector could also undertake hydrological and hydrographic surveys, data collection and analysis. It is understood that this is already being done in many countries. While the principle is sound, following limitations must be taken note of:

(i) since private sector will work for profit, there has to be a sufficiently large market for their services;

(ii) there must be sufficient competition to ensure quality and cost-effectiveness;

(iii) private consulting firms are working (in FAP projects) as sub-contractors/associates of expatriate firms. They have to show a demonstrated ability to manage and execute projects independently in a professionally-sound and timely fashion.

POE proposes to investigate the private sector option in greater detail in the next phase of its work.

5.14 SWMC has prepared a specific proposal (Annex X) for transforming this organisation into an independent, self-financing "Centre of Excellence". It will however not be privatised, the shares are expected to be held by the Government. The proposal cites Delft Hydraulics in the Netherlands, Hydraulics Research Limited in the UK and the Lanka Hydraulics Institute Limited as examples. POE has examined the proposal and recommends its acceptance in principle. Details of staffing and gradual transformation could be worked out within the next six months or so. A dependable arrangement for continued access to data for updating the models will also need to established.

5.15 FAP 25 Consultants have prepared a proposal for transfer of personnel, equipment and software of the project to SWMC (Annex XI). The Second FAP Conference also gave the same opinion. SWMC is the natural choice for continuation of flood-modelling work. POE recommend that the Government approve this proposal immediately and inform relevant organisations accordingly. FAP 25 is scheduled to come to a close in October 1994 and an immediate decision will facilitate smooth transition.

5.16 GIS is an extremely useful tool for planning as well as for day to day operations. Ten themes are now reported to be complete for FAP 19 database, including information such as administrative boundaries, soils, hydrology, a digital elevation model and a digital satellite image mosaic. New data under development include flood regimes, a more detailed digital elevation model and linkage with 1991 census results. LGED is also developing a GIS of its own incorporating population, road network, waterways, educational institutions, land-use characteristics etc. in its database (see Chapter 4). POE is of the opinion that the effort should not be duplicated. Bangladesh is a small country and there can be one GIS incorporating the widest possible database. Development of such a GIS will not be very expensive either, considering the progress already made by

FAP 19 and LGED. Since opinion of FAP 19 Consultant on this point was awaited at the time of writing this report, further consideration of the matter is deferred.

5.17 Completion of the topographic mapping project is relevant in this connection. The GIS digital elevation model is based on topographic survey data from early sixties. New contour maps are necessary to improve the accuracy of the GIS. This work was started under the FINIDA project but only a part of the country could be covered by the time the project came to an end. It is strongly recommended that new funds be lined up for photo-contour-mosaicing of remaining areas of the country.

5.18 POE feels that current allocation of functions between BWDB, RRI and WARPO (See Annex II, Page 20) needs to be reviewed. BWDB was the all-encompassing organisation for the water sector for a long time. In the process, the organisation became too large and too diversified for efficient management. The load on BWDB has decreased with the creation of RRI and WARPO but further re-structuring is considered necessary. It is suggested that responsibilities be clearly defined on basis of broad separation of functions viz. (i) engineering work, (ii) data collection, compilation, study and analysis, (iii) research and modelling. POE proposes to address this issue in its next report.

The Water Resources Information System (WRIS) project funded by UNDESD is a case in point. By definition and content, this should have been a project of WARPO.

5.19 Strengthening of WARPO and RRI will require placement of professionals who identify their career with the organisation. Long-term commitment will motivate them to put in their best and develop the organisation. In this context, the system of deputation of officers from BWDB should be reconsidered. These organisations should be allowed to recruit their own professionals and start building up a cadre. For the present, top management can come from outside, but selection should be made on basis of option, aptitude and willingness to serve for a long period.

5.20 Finally, some words on the proposal of RRI for transforming the organisation into Bangladesh Hydraulic Institute (see Annex XIII). The idea is sound. Viability of the concept hinges on the ability of current management to secure outside work and generate own revenues. They should be encouraged to pass this test in the interim report.

# STUDY OBJECTIVES AND PROGRESS MADE[1]

## 1. FAP 18 : TOPOGRAPHIC MAPPING

Basic objective of the study is to obtain up-to-date aerial photographs and accurate maps for the purpose of undertaking various studies and facilitate planning, design and implementation of projects. To achieve this objective, aerial photography will be obtained, comprehensive geodetic and levelling network will be established, photogrammetric and spot height survey will be undertaken and finally contour mosaics will be prepared.

The planning, design and implementation of almost all the Action Plan and development activities covering related regions will be benefitted from this mapping programme. First of all the following tasks will be performed under this project:

a) Black and white and infra-red aerial photography on medium and large scale will be taken covering respectively the North-Central region and the pilot project areas of Jamalpur, Tangail and Sirajganj.

b) Establishment of adequate GPS points in the NCR and NWR.

c) Establishment of about 2300 kms of 2nd order level net for the NC Region including the Jamuna river banks.

d) Preparation of photo contour mosaics for Jamalpur, Tangail and Sirajganj areas.

e) Arrangement for printing and supply of 1:50,000 revised and/or recent edition maps to all the FAP Consultants.

f) Acquisition of Multi-spectral spot images (France) for 1989 and 1990 through 1995.

g) Establishment of a 2nd order level net (1800 kms) in the NE Region (FAP-6 area) by Survey of Bangladesh through CIDA's financial assistance.

h) Enforcement of quality control on survey and mapping works through Survey of Bangladesh.

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[1] Quoted from FPCO Quarterly Report, Dec 1993

**PRESENT PROGRESS:**

**A. Through Finida Assistance:**

1. 1: 50,000 scale aerial photography for about 22,000 sq. kms covering the North Central Region and 1:20,000 scale photography for 10,000 sq. kms. covering the pilot project areas of Jamalpur, Tangail and Sirajganj completed. Photographs, in 1:30,000 scale for the Comilla area also done.

2. A GPS net of 146 stations over North Central and North Western Regions established and the station coordinates supplied to FPCO. These are now being checked by SOB.

3. A second order level net of 2477 kms and a 3rd order level net of 312 kms in the North Central region established and preliminary adjusted heights of BMs based on the West Bank datum supplied to the study consultants.

4. For photo-contour-mosaicing 3920 kms of spot heighting for Jamalpur, 460 kms for Sirajganj and 453 kms for Tangail completed.

5. 1:20,000 scale photo-maps with 0.05 contour interval prepared by FINNMAP for Jamalpur and 1:10,000 mosaics for Tangail and Sirajganj examined by Survey of Bangladesh, received in FPCO and supplied to the Consultant.

6. While connecting right bank BM heights with those of left bank of the Jamuna river, a datum difference of about 20 cms was observed by Finnmap. SOB checked this datum change through geometrical level crossing over the rivers and river crossing over Jamuna found correct while that of the Ganges is not within permissible limits. This is to be revised by Finnmap. BM adjusted heights supplied to Consultants.

**B. Through French Assistance:**

1. Six additional sets of photomaps of A/5 above received in FPCO and supplied to Consultants.

2. Spot Image on 1:50,000 scale: multi-spectral spot mosaics of 1989 for the entire FAP area and those of 1990, 1991 and 1992 (March) covering the main rivers received and supplied to the relevant FAP study consultants. Further arrangements made with SPOT IMAGE for supply of 1:50,000 scale spot images covering the main rivers upto 1995. Images for October, 1992, March, 1993 have been received in FPCO and supplied to Consultants.

3. 44 Nos. of 1:50,000 scale topo-maps revised by SOB have been printed with a cost of Tk. 4 lakhs provided by the Government of France. Those have been supplied to the Consultants.

C. **Through CIDA Assistance in FAP-6 North-East Region:**

Arrangements made with SOB to carry out nearly 2250 kms of 2nd order levelling in the FAP-6 North West Region with 10 Nos. of precision level machines from CIDA, 5 Nos. from National Board of Survey, Finland and 4 Nos. from BWDB all on loan and 1 machine from SOB. Construction of monuments and field levelling completed with connections to 61 water lever stations except 80 km connection levelling with FINNMAP works of NCR which will be taken up during this field season.

D. Existing Data: Existing photos on 1:30,000 and 1:50,000 respectively of 1975 and 1983, in 4"=1 mile, 8"=1 mile maps and existing SOB BM data have been supplied to the consultants. Donor assistance for about $40 million will be necessary for large scale contour mapping for all FAP areas.

E. Revised TAPP incorporating Survey and Mapping instruments with German Commodity aid has been approved by the Government.

## 2. FAP 19 : GEOGRAPHIC INFORMATION SYSTEM

Geographic Information System (GIS) is an information technology used to obtain, store, manipulate and retrieve geographical and geo-referenced data. The objectives of this project are to: (a) provide a GIS facility (hardware and software) to assist management and planning of data and information needed for FAP, (b) assist FPCO to establish a distributed GIS network to serve other FAP activities, (c) promote and establish standardized data protocols and data bases, (d) assist cataloging and dissemination of data files by the FPCO, (e) promote unrestricted access to water resource management and planning data to all parties with legitimate needs, and (f) provide GIS Training for GOB officials.

### PRESENT PROGRESS:

A report "GIS Resources in Bangladesh" completed in June, 1991. GIS users group formed to provide a forum for technical presentations and exchange for persons with GIS interests.

The Jamuna River bank line changes studied from various maps and tables related to bankline changes as detected from satellite imagery over the period 1973-92 and from

historic mapping as long ago as the Rennels map of 1765. Data were analyzed and positions and movement of banklines and chars were located. The same analyses are being used in the charland study in collaboration with FAP 16. Numerous other satellite image data were output for various FAP components. A digital elevation model at about 1 km. resolution was constructed for the Southwest Region with results of MIKE 11 model runs being developed.

- Collaboration with FAP-2 on digital manipulation of soils information for Northwest Region completed. A new effort was initiated with FAP-16 for conducting EIA on Bhola.

- Numerous flood depth maps were created for the Tangail area as this GIS and modelling capability is now operational. The consultant submitted the Interim Report, December, 1992 covering the progress of various studies and work plan for the remaining period of the study. A Review Committee Meeting on the Interim Report held on 21.6.1993. The Review Committee accepted the Interim Report.

- The Interim Report FAP-19 identified several activities to be performed during 1993 which are: National Charland Inventory; Disaster Management and Relief; Digital Elevation and Spatial Interface for Hydrologic/Hydraulic Models, phase II; GIS Training; National Database, Phase II; Institutionalization of GIS; Application of Digital Radar Imagery to FAP etc.

- As output of GIS FAP-19 several Technical Reports and Technical Notes were prepared for circulation of different GIS users.

The consultant so far submitted the following Reports/Notes:

a) Draft Technical Report, June, 1991
b) Inception Report, August, 1991
c) Recommendation for Locating FAP-19 (GIS), July, 1992
d) Interim Report, December, 1992
e) GIS Atlas for TCPP, January, 1993
f) Application of Radar Technology for FAP in February, 1993
g) Technical Report on Comparison of Elevation data from BWDB and FINMAP in February, 1993
h) Technical Report on Comparison on Classification of Flood Depth and Extent using GIS and MIKE 11 in February, 1993
i) Technical Note on Area Elevation Curves for BWDB South-West Regional Project in February 1993
j) Proposed Workplan: Pilot study for GIS in Disaster Management in March, 1993
k) GIS Institutional Issues July, 1993. The comments on this report sent to Consultant for response.

## 3. FAP 21/22 : BANK PROTECTION AND RIVER TRAINING AFPM PILOT PROJECT

**The objectives of the project are:**

1) For the Bank Protection Pilot Project (FAP 21) to find improved solutions for the structural design, use of construction materials and methods of realisation by designing and constructing different types full-scale test protection works at some selected locations on the Jamuna River and by monitoring the behavior of these test works.

2) For the River Training and Active Flood Plain Management Pilot Project to find methods to influence the current in the river channels to control bank erosion, to accelerate the accretion of new land and to promote the agricultural use of new land by designing and constructing different types of full scale test works at some selected locations in the Jamuna and by monitoring the behavior of these works.

**PRESENT PROGRESS:**

The Consultant started work in December, 1991 and submitted the Inception Report on 20th March, 1992, Interim Report in July, 1992, FAP-22 Draft Final Report in Dec. 1992 and FAP-21 Draft Final Report in January, 1993. The Review Committee on 9th February, 1993 considered both Inception Report and the Interim reports along with consultants response to the comments and recommended to the Technical Committee for approval.

A. Output under FAP-21:

- Completed one-dimensional mathematical modelling, two dimensional modelling, morphological analysis by remote sensing studies for site selection for 1:1 model test at Jamuna River Bank protection test structure.

- Physical model tests in RRI and local scour physical model test in Delft Hydraulic Laboratory were done. Prepared final report in local scour test from the results of physical model test in Delft Hydraulic Laboratory.

- Held internal seminar with local and expatriate technical personnel on Filter Technology to mingle end users, designers, researchers and manufacturers of different kinds of filters.

- It is proposed to construct three permeable groynes at Kamarjani (Right Bank), north of Manas regulator and a stretch of revetments over a length of about 800m, south of Bahadurabad Ghat (Belgachia). Initially four test areas namely Kamarjani, Bahadurabad, Chandanbaisa and Nakalia were selected as test areas for study. But due to fund constraint, the areas Chandanbaisa and Nakalia were dropped. Two additional areas were also investigated in more details along the right bank of the Jamuna river at Sariakandi and Kazipur.

B. Outputs under FAP-22:

Submitted the Draft Final Report, Planning Study, December 1992 on the River Training/AFPM pilot Project of FAP-22. Floating screens and artificial channel cut-offs were selected as most promising recurrent measures and the Project concentrated on a study into these recurrent measures in terms of technical and financial feasibility. An International Experts discussion held from November 2-4, 1993 to finalise the recommendations on River Training works.

C. The Review Committee meeting on June 21, 1993 considered both the Draft Final Reports of Fap 21/22 and recommended for approval by the Technical Committee. The Consultant submitted the Final Reports of Planning study in June, 1993 which contains the following volumes:

| | | | | |
|---|---|---|---|---|
| Vol. 0 | - Executive Summary | Vol. VI: | Annex 11: | Remote Sensing Study of Morphological Processes |
| Vol. IA | - Main Report FAP 21 on Bank Protection | | Annex 12: | Surveys |
| Vol. IB | - Main Report FAP 22 on River Training/AFPM | | Annex 13: | Subsoil Investigations |
| | | | Annex 14: | Physical Model Tests |
| Vol. II - Annex 1: | River Training & Morphological Responses | Vol. VII: | Annex 15: | Special Scour Investigations |
| Annex 2: | River Morphology | | Annex 16: | Design of Cover Layers of Revetment |
| Vol. III - Annex 3: | Surface Screens | | Annex 17: | Design of Filter Layers of Revetment |
| Annex 4: | Simplified Mathematical Models for Investigation of Recurrent AFPM Measures | | Annex 18: | Dimensioning of Groynes |
| | | | Annex 19: | Constructional Aspects |

| | | | | | |
|---|---|---|---|---|---|
| | Annex 6: | Mathematical Model Tests (Part A) | | Annex 20: | Study of Alternatives Design Solutions |
| Vol. IV- | Annex 7: | Socio-economic and Administrative Assessment (Part A, B) | | Annex 21: | Preliminary Design of Test Structures |
| | Annex 9: | Economic Assessment | | Annex 22: | Financial Analysis |
| | Annex 10: | Navigation Study | Vol VIII: | | Preliminary Technical Study on additional Test Sites |
| Vol. V- | Annex 5: | Hydrologic Data | | | |
| | Annex 6: | Mathematical Model Tests (Part B) | | | |
| | Annex 7: | Socio-economic & Administrative Assessment (Part C) | | | |
| | Annex 8: | Ecological Assessment | | | |

Tests and Implementation Phase (Phase - II)

KFW and CFD jointly carried out the project appraisal of Phase - II from January 26 to February 07. 1993. The Mission, together with FPCO agreed with the overall concept of the Test and Implementation Phase. The commencement of the physical construction of bank protection test works was delayed by one year to scale down their magnitude. The Consultant has completed preparatory works like Site Survey, Soil Investigation for Kamarjani test site. Draft Design drawings and tender documents are under preparation.

## 4. FAP 24 : RIVER SURVEY PROGRAMME

**The objectives of the project are:**

1) To collect reliable all season hydrological and morphologic data at key locations on the country's main river systems with emphasis on collection of data during the monsoon season and introducing improved or new technology where appropriate;

2) To undertake special studies of the behavior of the river systems based on the new data that will be collected, existing data and through supplementary surveys;

3) To strengthen BWDB by providing on-the-job training to professional staff from BWDB, and where applicable BIWTA and staff of associated local consultants in the fields of river surveys and studies so that they can continue the data collection programme in the long-term.

4) To upgrade the institutional capability in Bangladesh for river hydrological and morphological data collection and study programme, vessels to undertake river

surveys in flood seasons, with specially equipped installation of new gauges where necessary and establishment of computerized data base.

**PRESENT PROGRESS:**

a) Surveys: Mobilization started on 22nd May 1992 in Europe which comprised the procurement of equipment including instruments and vessels. In the Netherlands a coastal patrol vessel was modified for survey purposes and in Singapore a new catamaran boat was constructed. The vessels were transported to Bangladesh. Since then equipment verification test as well as test measurements carried out. Four low water and ten high water routine discharge and sediment transport measurements made at Bahadurabad, Serajganj, Bhairab Bazar, Aricha, Hardinge Bridge and Gorai offtake.

Second order levelling for 47 BWDB water lever gauges has been completed in May, 1993. Three automatic water level recorders were installed by July, 1993 at Bahadurabad. A Pilot bathymetric survey was executed in the Jamuna near Bahadurabvad in June, 1993. Acceptance tests were executed in mid August, 1993 and thereafter a second bathymetric survey was done near Bahadurabad. Comparative discharge measurements were executed with the BWDB near Khulna and Bhairab-bazar.

b) Studies: Two types of studies are included: The Hydrological Study & the Morphological Study. Both types of studies started with collecting data and reports. The hydrological study started early September, 1992 & the morphological study started by the end of the year, 1992.

c) Training: Science training given to staff of BWDB, BiWTA, associated local consultants and contractors. Consequently training given both as an internal training (for FAP 24 & associated staff) and as an external training involving BWDB & BIWTA. The training comprised of Ship Handling, Maintenance & Manoeuvering, Data-processing, Sediment analysis, Surveying etc.

d) Data Processing and Reporting: By mid November, 1992 the installation of the data-processing office was completed along with hardware, system software, and general software. Special software for data analysis was written and tested by the end of the year. Further quality checking and reporting demands will lead gradually to the final methods and formats for processing and reporting. The sediment laboratory tests started in November and executed the analysis on concentration of suspended sediments, particle size, setting tube etc.

e) Reporting: The Consultant submitted the following reports in addition to the notes and reports:

. Inception Report, Revised Inception Report (22 August, 92), (20 October, 1992)
. Interim Report:

Vol. I - Main Report

Vol.II - Annexure on Survey Work: Annex 1 - Survey Review, Annex-2 Survey activities, Annex-3 Data Processing, Annex-4 Selection of Survey Techniques, Appendix-1 Equipment and Data.

Vol.III - Annexure on Studies etc. : Annex-5 Previous documents, report and comments etc. Annex-6 Hydrological Study, Annex-7 Morphological Study, Annex-8 Training, Annex-9 Work Plan and Staffing, Appendix-2 - Possible Study Topics.

. Final Report Phase - I- Selection of Study Topics for Phase - II, Hydrological study Phase - I, June, 1993
. Morphological Studies, Phase I - December, 1993
. Land Survey Wl Gauging
. Test Gauging Report

f) The Project Advisor Performed his third Supervisory Mission from 1-28 August, 1993. The Previous visits are from September 16 to October 30, 1992, January 18 to February 1, 1993 and 12-13 May, 1993. His main activities were to assist FPCO in supervising the works of Project Consultant and its management. Several meetings were organized between FPCO/PA and FAP-24 to analyze the survey results and discuss further implementation of the survey, study the training programmes.

g) An International Workshop on "Morphological characteristics of Alluvial Rivers and their behaviour with special reference to Bangladesh Rivers" held at Dhaka on 6, 8, 9, Nov. 1993.

## 5. FAP 25 : FLOOD MODELLING/MANAGEMENT PROJECT

A project to advise, assist and coordinate all activities involved in mathematical modelling with the objective of consistency with the SWSMP/MPO program funded by DANIDA. The overall objectives of this FAP component are: (1) to achieve consistency, compatibility and continuity in all related modelling activities; (2) to coordinate the supply of the models as tools to the various FAP projects and the feedback of relevant data and information from various FAP projects to SWMC; (3) to provide the

hydrological basis for establishing unified engineering design events for the FAP; (4) to develop a Flood Management Model (FMM).

**PRESENT PROGRESS:**

The Co-ordination Advisory Team (CAT) and Flood Hydrology Study (FHS) are coordinated by the Resident Model Coordinator.

(a) The coordination of model development and application is achieved through (i) day-to-day contacts between FAP25, the relevant FAP projects and SWMC; (ii) informal meetings at FAP25 with the hydrologists of relevant FAP projects and SWMC; (iii) Quarterly meetings in FAP Modelling Coordination Committee with representative authorities and relevant FAP team leader and (iv) biannual visit of a four member expatriate advisory team of short term experts (CATs) providing the overall guidance of the coordination activities and addressing particular technical issues as required. Since October, 1990, there had been four CAT visits. The CAT Mission visited for the 5th time from 1-15 November, 1992 and submitted fifth Mission Draft Report in Mid December, 1993. The Mission submitted following reports: Ist in September, 1991, 2nd in September, 1991, Third in March, 1992, 4th in April, 1993.

Findings of Coordination Advisory Team (CAT)

- The MIKE 11 modelling system is appropriate for the regional studies and has limitations in analysing long term morphological changes;
- Accurate topographic and hygrometric data are important for model development.
- An inter-regional component in FAP to study the combined effects of all FAP proposals on flood levels and river morphology is needed;
- A rolling annual updating of SWMC models is appropriate.

(b) The activity in Flood Hydrology Study (FHS) started in January, 1991. The draft report submitted by the Consultant in February 1992, was reviewed in FPCO and comments were communicated to the consultant. The Consultant submitted the final report, June, 1992 along with Annex-1 on 7th July, 1992. The Annex-2 was submitted by the consultant to FPCO on 10th September, 1992. Several discussions held on the report with the FPCO and others. Finally the consultant submitted the Annex-2 of FHS incorporating the comments in March, 1993. The report consists of following volumes:

. Main Report
. Annex-1 : Supporting 11 Appendices
. Annex-2 : Analysis of Country-wide Protection Schemes

(c) The consultant of FMM started work on 19-10-1992 for two years. The Consultant submitted the Inception Report in early part of February, 1993. A workshop was held from 9th-11th February, 1993 in which Inception Report was discussed. Comments on Inception Report were sent to Consultant. A meeting held in FPCO and discussed with representatives of BWDB, SWMC, FPCO, POE and Consultant. As per decision of the meeting the CAT mission provided comments on the report. the Consultant revised the report as per comments of FPCO, CAT Mission and Workshop and submitted the final version of the Inception Report. Subsequently the Consultant submitted an addendum of this report to cover the shortcomings pointed out by FPCO and BWDB. So far (i) Documentation of specifications for validation of software; (ii) Design of database links between MIKE 11 and ARC/INFO, (iii) Digitising MIKE 11 network, structure location and catchments, (iv) Creation of water surface GRID for generating flood surfaces have been completed. Additional data collection on Flood Plain information is continuing and FMM Training continued for FPCO, BWDB, SWMC personnel.

(d) The Consultant submitted first Interim Report along with MIKE 11 GIS Reference Manual in October, 1993 which was due in August, 1993. The report was reviewed and discussed. The Consultant arranged 2nd Workshop on 14 November, 1993 and discussed FMM Developments.

(e) Committee Reports on Development of Uniform Methodology on issue of data & model Sept. 93 approved and circulated to all concerned.

ANNEX IX/1

# SURFACE WATER MODELLING CENTRE[1]

## BACKGROUND

The Surface Water Modelling Centre (SWMC) has its origin in a UNDP grant allocated for ascertaining the surface water availability by the National Water Plan Project under the Master Plan Organization in July 1986. The Project at its Phase-I was called the Surface Water Simulation Modelling Programme (SWSMP-I), centred its activities in developing a Regional Model on the South East Region and a General Model of Bangladesh.

The requirements of further model developments for other regions was felt following the effective completion of Phase-I. Henceforth the Phase-II programme was initiated in December 1989 for further 4 years with the objective of modelling 5 new Regional Models (North West, South West, South Central, North East and North Central) and maintenance and further development of the South East and General Model. The Phase-II programme came into limelight when about 16 Flood Action Plan (FAP) components in their National, Regional and Sub-regional level studies utilized models developed at the SWMC. Through the effective use of these applications the worth of mathematical models in planning and design studies was established. The Phase-II programme of the study came to an end in November 1993.

With the effectiveness of the modelling work established a further Phase-III programme comprising of 3 years was taken. It involved maintenance of all models developed at the SWMC and at the same time taking up modelling of the Chittagong Region. In addition it also included Special Topics to be taken up such as Morphology and Sediment Transport, Environmental and 2-Dimensional Modelling activities.

## INFORMATION TECHNOLOGY AVAILABLE

The SWMC possesses some of most advanced information and analytical software in Bangladesh. It has a wide variety of sophisticated data collection equipments and some of the most convenient and powerful software to process, analyze and interpret them. The main field of data collected and used in modelling activities at the SWMC are the following:

1. Hydrometeorological Data (Rainfall, Evaporation, Ground Water etc.)
2. Hydrometric Data (Water Level, Discharge, Sediment data etc.)
3. Topographic Data (Survey, Cross-section, Flood Plain information etc.)
4. Miscellaneous (Structure Operation and Embankment information, abstraction data etc.)

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[1] Prepared by SWMC for MIWDFC

## POTENTIAL USERS OF SWMC'S SERVICES:

The SWMC has to explore the avenues of services it can extend to the potential users within Bangladesh. Therefore, the projects which are involved in water resources development must be made aware of the modelling needs, it's utility and convenience in interpreting complex natural phenomena. The SWMC can work out its calibrated model for planning and design studies in these projects. Whether it is a polder case study or the study of the effectiveness of a irrigation system, models could be applied to study them. For example, agencies like BWDB, WARPO, FPCO, BIWTA, R&H, when they take up any development project or want to monitor the efficiency of an existing one, can use the models. Also specialized case studies such as sediment transport, morphology, environmental water quality or salinity intrusion etc. can be studied conveniently by use of models.

However, the users must be informed of these possibilities. Hence with this objective in the forefront the SWMC has started to hold seminars, and training programmes on developments in modelling activities. A quarterly news letter has also been introduced so that the information can be disseminated to possible users.

## SERVICES PROVIDED SO FAR

| No. | PROJECT | STATUS |
|---|---|---|
| 1. | Brahmaputra River Training Studies | both one and two dimensional models developed by BRTS have been taken over by SWMC; applications of the morphological model have been carried out at SWMC for BRTS |
| 2. | North West Region Study | pilot model has been used by the consultant to evaluate and screen design alternatives |
| 3. | North Central Region Study | |
| 3.1 | Jamalpur Priority Pilot Study | pilot model has been used by the consultant to evaluate and screen design alternatives |
| 4. | South West Region Study | regional model given to consultant who is adding more detail within the sub-model area<br>consultant has provided some assistance in model development and has done extensive model application |

| No. | PROJECT | STATUS |
|---|---|---|
| 5. | South East Region Study | model given to the consultant; model used to evaluate design alternatives with both tidal and non tidal boundaries. Further 25 year run of GM for boundary conditions |
| 6. | North East Region Study | consultant working in cooperation with SWMC and has assisted in development of the rainfall-runoff model with respect to catchments in India; additional finance provided for cross section survey and new contour maps for model set up |
| 8A. | Dhaka Town Protection | part of NCRM has been used by the consultant |
| 10. | Flood Forecasting and Early Warning | UNIX version of GM and NCRM calibrated and given to the consultant; used in flood forecasting during the current monsoon; specific NAM developed and provided to consultant |
| 16. | Environmental Study | The NCRM has been used to assess the impact of Tangail CPP proposals |
| 19. | Geographic Information System | MIKE 11 has been installed in the consultant's office to establish link between GIS and MIKE 11 |
| 20. | Compartmentalisation Pilot Project | NCRM provided to consultants who are adding more detail in the sub-model area |
| 21/ 22 | River Training and Bank Protection AFPM | GM provided to consultant who worked initially at SWMC<br>advanced features of morphological model incorporated |
| 25. | Flood Management Modelling | sixth run of GM for 25 years completed by SWMC; statistical analysis made of model results. Cooperation in field work for FMM for North Central Region. |

## PROGRAMME NOW UNDER DEVELOPMENT

The organogram of the SWSMP-III shows 3 working divisions. Each of the divisions has been restructured so that activities carried out in each of them can systematically contribute in modelling activities.

## SPECIAL TOPICS DIVISION

This division has the responsibility to carry out specialized field of studies such as:

i. Sediment Transport and Morphological behaviour
ii. Environmental Modelling
iii. Two Dimensional Modelling

## DATA ACTIVITIES DIVISION

Lack of good quality data is seen as a barrier in developing an effective model. Therefore this division has been created to supplement the need exclusively. Maintenance, installation and monitoring of specialized equipments in the field and processing the data effectively is the objective of the group. Use of FIELDMAN data base administration is to be used in SWSMP-III for effective data base maintenance. This division will work in close liaison with other parallel organizations involved in data collection.

## HYDROLOGY AND HYDRODYNAMIC DIVISION

The Hydrology and Hydrodynamic Division will be involved with the maintenance of six regional and the General Model. In addition it will take up modelling of the Chittagong area model which will be a new region to be modelled. Model developed earlier will be updated and any deficiency earlier not observed will be corrected.

The SWSMP-III has under its scheme scope for taking up application works possible clients. This is seen as a possible means of earning revenue and sustainability of SWMC as an independent organization. The Flood Forecasting and Warning System (FAP-10) is also to be supported from time to time from the SWMC. Apart from this, various specialized courses is to take place within the country while training abroad is also earmarked for developing the proficiency level of the modellers. The activity schedule is attached.

## NUMBER OF PERSONNEL INVOLVED IN THE PROJECT

The organogram of the SWSMP-III work force is attached. The engineering work force involved in the project includes the following:

| | | |
|---|---|---|
| i. | GOB personnel deputed from the BWDB | 31 |
| ii. | Local Consultants | 10 |
| iii. | Expatriate Staff | 11 |

Apart from this there are administrative 26 administrative staff who act as back-up staff, both for the GOB counterparts and the expatriate consultants.

### i. Engineering Staff

The Engineering staff will be engaged in the following activities:

1) maintaining the existing models by continued updating and verification;
2) taking over and maintaining for future operation of MIKE 11 models developed by various projects for specific applications;
3) giving appropriate training, absorbing new developments in MIKE 11 carried out by the Consultant;
4) carrying out model applications, field investigations and other studies for client organisations.

The GOB staff, who have received and properly assimilated the training provided by SWSMP-II, have been retained for work in SWSMP-III. The number of posts is given below:

| | |
|---|---|
| Superintending Engineer/Project Coordinator (SE/PC) | 1 |
| Executive Engineers | 3 |
| Assistant Engineers/SDEs | 16 |

Any shortfall in the number of permanent GOB staff may be made up by recruiting staff on "Work Charge" basis for the duration of the project. Such staff will be paid from GOB funds.

The engineering staff have the potential, capability and resources to carry out more than minor applications. The Centre then needs to be in a position to manage its own activities in respect of taking on additional work, receiving remuneration and obtaining the staff and equipment. Furthermore, there are also, among the ranks of the Local Consultants employed in SWSMP-II, a core of very highly trained and motivated engineers whose skills has been retained.

In order to supplement the GOB engineering staff strength the following local consultant staff have been included:

| | |
|---|---|
| Senior Consultants | 1 |
| Mid-level Consultants | 3 |
| Junior Consultants | 6 |

ii. **Administrative Staff**

To support the GOB engineering staff of the Centre, administrative staff has been supplied by GOB to manage the GOB finances and establishment matters.

The project shall however directly recruit the administrative and other technical support staff necessary to carry out the administrative functions with respect to the disbursement of DANIDA funds and operation and maintenance of equipments including vehicles.

iii. **Expatriate Staff**

The primary function for administering the modelling centre and overall responsibility for the progress and quality of the work is with the Superintending Engineer of SWMC under the guidance of Director General, RRI. The Chief Technical Advisor is in the position of an advisor on both technical and financial matters.

The requirement for expatriate staff is in the role of training, guidance and supervision of the modelling activities. In order that the local capability is retained and further developed, it is essential that the local staff continue to execute the modelling work.

The expatriate staffing of Phase III has the definite plan to gradually reduce the level of expatriate support. The Chief Technical Advisor is full time for the duration of the project with one Computational Hydraulics Engineer full time for the first two years. The remainder of the staffing is based on carefully scheduled short-term inputs.

The short-term staff will review the work carried out under all activities germane to their particular specialty. An activity schedule for tasks to be carried out in the period up to the next visit will be drawn up in consultation with the local staff, and additional training and guidance given as required.

iv. **Bangladesh University of Engineering and Technology (BUET)**

An advisor is to be appointed from the senior academic staff of BUET to be closely involved with the work of the Centre, attending technical meetings and serving in an advisory capacity.

The BUET shall encourage its Masters and Doctoral students to carry out research on topics relevant to activities of the modelling centre. The work would be supervised jointly by the BUET advisor and senior staff from SWMC.

## CURRENT EXPENDITURE LEVELS AND FUNDING SOURCES THEREOF
## SUMMARY OF COST ESTIMATE

Cost in Lakh Taka

| Sl. No. | ITEMS | PE | RPA | GOB | TAKA COST | PA | TOTAL | REMARKS |
|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 1. | Expatriate Consultant | 1,015.44 | - | - | - | 1,015.44 | 1,015.44 | Append A/1 |
| 2. | Local Consultants | - | 85.50 | - | 85.50 | 85.50 | 85.50 | Append A/2 |
| 3. | BUET Advisor | - | 4.50 | - | 4.50 | 4.50 | 4.50 | Append A/2 |
| 4. | Project Personnel (GOB) | - | - | 140.00 | 140.00 | - | 140.00 | Append A/3 |
| 5. | Project Personnel (others) | - | 64.80 | - | 64.80 | 64.80 | 64.80 | Append A/4 |
| 6. | Project Input Equipment | 120.00 | - | 120.00 | 120.00 | 120.00 | 240.00 | Append A/5 |
| 7. | Project Input Training & Seminars | 18.00 | 27.00 | - | 27.00 | 45.00 | 45.00 | Append A/6 |
| 8. | Project Input (others) | 4.50 | 337.50 | 5.00 | 342.50 | 342.00 | 347.00 | Append A/7 |
| SUB-TOTAL | | 1,157.94 | 519.30 | 265.00 | 784.30 | 1,677.24 | 1,942.24 | |
| Cost Escalation: | | - | - | 10.00 | 10.00 | - | 10.00 | |
| TOTAL: | | 1,157.94 | 519.30 | 275.00 | 794.30 | 1,677.24 | 1,952.24 | |

# SWMC: AN AUTONOMOUS CENTRE OF EXCELLENCE[1] FOR SURFACE WATER MANAGEMENT IN BANGLADESH

## 1. INTRODUCTION

This working paper is an informal concept proposal for the future institutionalisation of SWMC as an autonomous institute to be developed into a centre of excellence for water management in Bangladesh. The ideas presented in the paper are related to the overall concept of Bangladesh Hydraulic Institute BHI **(Annex XIII)**.

## 2. BACKGROUND

The Surface Water Simulation Modelling Programme (SWSMP) owes its genesis to the widespread recognition of the crucial role that mathematical modelling tools could play in planning the effective control and utilisation of water resources in Bangladesh. The programme has been in existence from 1986, first under the Master Plan Organisation (MPO) and presently under the River Research Institute (RRI). The programme has already been through two phases, the DANIDA funded second phase ending in December 1993. The Danish Hydraulic Institute (DHI) has been the consultants to the project throughout. The current third phase, which is expected to be the last, is also funded by DANIDA.

The Surface Water Modelling Centre was created to house the technical expertise which was being transferred to Bangladesh. A considerable reservoir of skill and experience in mathematical modelling and related disciplines has been accumulated at the Modelling Centre. In addition to its staff, the SWMC also possesses a very large and organised database containing field data collected for the creation of the General Model and six Regional Models, an extensive and powerful computer network, a good inventory of sophisticated field instruments as well as the models themselves. Even more important is the fact that the SWMC now has the capacity to undertake any type of river network model necessary for planning the distribution of surface water resources in Bangladesh. The ability to develop models of sedimentation and salinity intrusion processes is also reasonably well developed.

The productivity and the good working environment which made it possible to achieve so much progress is currently sustained by resources made available by the donor, and

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[1] Paper for discussion with POE (prepared by SWMC)

being complemented by a flexible and less formal management style which is possible under a Technical Assistance Programme. It has been possible to conduct business both internally and externally cutting across the traditionally long lines of communication and chains of command. The delegation of decision making with regard to technical matters to junior staff and the accessibility of staff at all levels and at all times for problem solving has made it possible to build a closely knit team of engineers and other staff. It cannot be taken for granted that GOB will provide the resources to run the organisation in the manner to which it has become accustomed. Neither can it be assumed that the senior managers will either possess the work attitudes or the management skills necessary to generate resources through exploiting the existing market for modelling services.

Even if the necessary attitudes can be inculcated and the management systems can be installed, it would be impossible for the activities of the Modelling Centre to stay free of the bureaucratic stranglehold which afflicts Government enterprises in every developing country. Hence there is no doubt that an independent institutional model must be found for the post-project SWMC.

## 3. PERFORMANCE OF SWMC

The performance of SWMC in the past has been mainly guided by the project objectives (e.g. SWSMP-I&II). In addition to delivering high quality models and data to clients, the "institutional performance" has been satisfactory. However, the on-going SWSMP Phase III program is expected to transform SWMC from a purely technical environment to a more business oriented institution with attractive outreach activities.

The establishment of the Surface Water Modelling Centre as an independent unit within the MPO was the first step towards establishing a longer term identity for what had so far been fixed duration project. SWMC has now been in existence long enough and interacted sufficiently often with other agencies and projects in the water sector that its continued existence as an institution is widely taken for granted. This apparent sense of stability allowed SWMC to maintain its integrity through the transformation of MPO into WARPO as well its transfer under the jurisdiction of the RRI.

The productivity and the good working environment which exists at SWMC is sustained by the resources made available by the donor, complemented by a flexible and less formal management style which is possible under a Technical Assistance programme. It has been possible to conduct business both internally and externally across the traditionally long lines of communication and chains of command. The delegation of decision making with regard to technical matters to junior staff and the accessibility of staff at all levels and at all times for problem solving has made it possible to build a closely knit team of engineers and supporting staff.

The decision by the donor and GOB to extend the project to third phase (SWSMP-III) makes it possible to build on the gains already made in the way SWMC is organised. It

is necessary to look further ahead to the time when SWMC will need to stand on its own without external assistance. It should be possible to evolve SWMC to a state where it can sustain itself by its own work, with only a modest grant from GOB. Whether this objective could be reached will depend greatly on the institutional strength of SWMC as well as how it relates to other institutions in the water sector of Bangladesh.

## 4. POST-PROJECT MANAGEMENT OF SWMC

The new institutional set-up of SWMC must be finalised well before the end of SWSMP-III in December 1996. The essential ingredients are:

a) The corporate structure and size of the organisation
b) Management skills and leadership
c) Marketing and financial viability

There is no doubt that the most obvious ingredient not mentioned above, viz. technical skills and equipment are already present to a great extent and will be consolidated during SWSMP-III.

### a) Corporate Structure

The management of organisations within the government system is subject to a very complicated set of regulations which, in practice, means that no decision of importance can be made without the prior consent of high officials in the Ministry. Furthermore, all communications are channelled very rigorously through every level of the bureaucracy and the communication may be delayed or diverted at any stage. Excessive reliance on this mechanism is due to the apparent inability or unwillingness of personnel to take responsibility for their own decisions and actions. A self-financing organisation would collapse very quickly under such a regime. It is therefore necessary to select an entirely different corporate structure for SWMC.

Autonomy is a very important characteristic to look for in the new corporate structure. Although statutory bodies such as the Bangladesh Water Development Board were originally intended to function independently, it is the normal fate of such institutions that they become themselves a large bureaucracy and become enmeshed within the bureaucratic structure of the parent Ministry. One of the main reasons for this is that such organisations are funded through the Ministry. On the other hand, if SWMC could generate all its income through the sale of services, there is no reason why it should remain within the direct control of the Government. There are, in fact, several examples of similar organisations from both the developed and developing world being taken away from direct government control and allowed to operate independently (eg. Delft Hydraulics

in the Netherlands, Hydraulics Research Ltd. in the UK, Water Research Centre in Iran and Lanka Hydraulic Institute Ltd (LHI) in Sri Lanka). These Institutes have been successfully "privatised", although this does not at all mean that they were sold to the private sector. Hydraulics Research Ltd., is a limited liability company which is administered by a Board of Trustees on behalf of the British tax payer. Lanka Hydraulic Institute is a public limited liability company almost all of whose shares are owned by the Government of Sri Lanka.

It should be mentioned at this point that every "Hydraulics Institute" in the world has been started through the investment of large sums by national governments. The profitability of such organisations is insufficient for them to have been started up using private capital. In fact, if private owners acquire such an asset, they would find it most profitable to liquidate it and sell off the component parts. Nevertheless, once such organisations have been created, it has been found that it is possible to sustain such organisations by running them like private sector consultancy organisations where the main commodity being sold is professional staff time and software and equipment time.

Therefore, one of the possible corporate structures for SWMC in the future would be to create a government-owned company. This company could be controlled by a Board of Directors appointed by the owners (in this case the Government) representing the major public and private sector interests in surface water in Bangladesh. The company would be managed by a professional Chief Executive appointed by the Board. Such a company would be sufficiently autonomous as long as the employees including the Chief Executive is not a member of the government bureaucracy and does not have a niche in its hierarchy.

**b) Management Skills and Leadership**

A privatised SWMC would depend a great deal on its senior managers for its success as an efficient self-sustaining organisation. It is therefore very necessary to select the senior managers with extreme care, particularly in the first few crucial years of independence. Such managers are not found in great numbers in the Government sector. Many senior managers who have spent a large number of years rising through the government bureaucracy are conditioned to have a particular mind-set and value system which would make it very difficult indeed for them to function effectively in an environment where initiative and risk taking are rewarded and promotions are not based on a time scale. Allowing junior staff maximum autonomy and delegating responsibility will be extremely alien to such persons. While younger staff might fit into such an organisation with relative ease, it would be very dangerous to assume that older staff would function well in this new environment even it they volunteer to leave the safety of permanent government employment and join a privatised SWMC.

c) **Financial Viability**

The viability of SWMC will depend entirely on whether it can generate sufficient income earning work to pay for its day to day operation as well as to keep it growing and up-to-date in its technology. It is particularly important not to be burdened with an excessively large establishment that cannot be justified by the market.

The Surface Water Modelling Centre needs in the long run to be viewed as a "Centre of Excellence" in hydraulic and mathematical modelling not only by the GOB but also by the large number of donors and by both foreign and local consulting firms operating in Bangladesh. Such a reputation has to be earned through sustained performance at a high level over several years. Generating this track record depends on many factors. The very specialised nature of the work of SWMC means that it will usually carry out a part of a larger study. SWMC will rarely undertake a study of its own. Most often it would be a contributor to a larger multidisciplinary study team.

The possibilities for using mathematical tools for more efficient planning and more accurate design has begun to receive more attention in Bangladesh. Much work can be generated for SWMC in the wake of the large investments connected with the Flood Action Plan. Subsequently, there should be a slowing down of demand to a more moderate level. Thus the optimal size of SWMC must be carefully planned. A self-sustaining organisation cannot afford to keep staff and equipment idle for any great length of time. On the other hand, the development of a Centre which matches up to international standards, would enable the eventual expansion of its activities into the region.

From every point of view, reaching and maintaining the highest professional and scientific standards appears to be an essential pre-requisite for sustainability. The other pre-requisites are those connected with productivity, cost effectiveness and good management. It might well be necessary to undertake a formal market survey to determine the most pragmatic initial size for a privatised SWMC.

ANNEX XI/1

# DRAFT Proposal[1]

# Transfer and Establishment of Flood Management Model at the Surface Water Modelling Centre

**Jointly Proposed by:**
**RIVER RESEARCH INSTITUTE (RRI)**
**FLOOD PLAN COORDINATION ORGANIZATION (FPCO)**

**Donor: DANIDA**

## FAP 25

[1] Prepared for POE study

# ANNEX XI/2

## 1 BACKGROUND AND INTRODUCTION

### 1.1 Surface Water Modelling Centre

The Surface Water Modelling Centre (SWMC) under the River Research Institute (RRI) was established to initiate and ultimately institutionalize local modelling capabilities. The modelling activities in Bangladesh evolved out of requirements identified in the National Water Planning Project under the Master Plan Organization in 1985 to account for the surface water availability in Bangladesh.

The SWMC has initiated the Phase-III programme with financial support from DANIDA taking into consideration all the requirements identified over the last 7 years of its evolution.

The catastrophic floods of 1987 and 1988 introduced a new dimension in modelling in its use as a flood forecasting tool. The follow up programme of these floods in the formulation of the Flood Action Plan (FAP) brought the modelling activities into the limelight by introducing mathematical models as planning and designing tools. Almost all the FAP components benefited directly or indirectly through modelling support from the SWSMP Phase-II. Recently, the surface water simulation models in integration with the Geographic Information System (GIS) have been further developed by FAP 25 to be used as flood management models in Bangladesh.

The four year second phase of the programme (SWSMP-II) concentrated on the development of very large models for regional and national planning. The needs of the Flood Action Plan were paramount and despite numerous difficulties connected with data availability, the project was able to meet the requirements of many FAP studies. The staff was fully engaged in the work at hand and very little time could be devoted to taking up other modelling assignments on a more commercial basis. Nevertheless at the end of SWSMP-II many well calibrated models of important national and regional river systems have been developed together with a group of engineers who are very skilled in hydrological and hydrodynamic modelling and other related activities such as field measurements and data collection.

The Surface Water Simulation Modelling Programme entered its third phase on 1st January 1994. In this new phase it is intended to re-orient the SWMC towards becoming an institution which can sustain itself through its own efforts. Over the next three years the SWMC will gradually shift the focus of its activities away from carrying out the tasks described in its donor-financed work programme towards the long term goal of providing services to paying clients.

The attainment of self-reliance will be based on organising the activities on a more outward looking and commercial basis so that the viability of the Modelling Centre can be demonstrated while the safety net provided by the donor is still in place. SWSMP-III will

continue staff development to the point where the staff can independently apply the knowledge and skills they already have with increasing self confidence. By the end of 1996 the SWMC is expected become a true Centre of Excellence in hydraulics and hydraulic modelling, able to sustain itself and develop without further donor assistance. The ultimate success will depend on its ability to maintain the highest professional and scientific standards and the ability to provide state-of-the-art technology in surface water modelling and management.

## 1.2 FAP 25 - Flood Modelling and Management

The Flood Modelling and Management Project (FAP 25) which started in October 1990 has three components. The Flood Hydrology Study (FHS) was designed to establish the hydrological basis for engineering design criteria along the major rivers and to develop common modelling standards and techniques for the FAP studies. A Coordination Advisory Team (CAT) has been set up to ensure consistency and compatibility in modelling, and to coordinate development of models for FAP at SWMC. SWMC has also been working closely with CAT missions giving advice on model applications to several FAP studies. In the meantime useful comments and feedback were received from the CAT, which has helped SWMC in model refinement. The third component is the development of a Flood Management Model (FMM) and the subsequent demonstration of its applicability.

The development of FMM is an on-going activity, based on the General Model and the North Central Regional Model (NCRM). The FMM is conceived as a decision support tool which integrates the MIKE 11 based flood modelling system with advanced graphical displays and analysis using the Digital Elevation Model (DEM) and the Geographic Information System (GIS). FMM will assist in flood management including planning and operation of flood control and drainage systems and in flood forecasting.

The objective of the FMM is to provide a management tool to assist in prediction and analysis of the behaviour of flood and the design and operation of flood control structures to limit loss of life and damage to agriculture, infrastructure, etc during floods. The MIKE 11 based simulation models developed at SWMC provide the basis for developing such tools; additional features have been developed at FAP 25, which are required for operational flood management purposes. In this connection FAP 25 has already developed the integrated MIKE11-GIS software for flood management.

The FMM study is being carried out in two stages. The main activity of Stage 1 was to develop the MIKE11-GIS interface. This allows improved river and floodplain modelling as well as enabling the generation of flood depth maps by directly integrating MIKE11 models with the DEM's. Stage 2 - Application Phase deals with the development of Flood Management Models for the GM, NCRM and the Tangail Compartmental Model and their illustrative applications.

FMM will be a very useful tool not only for flood management in Bangladesh but also for the development of MIKE11 based models at SWMC.

The project is executed by the Flood Plan Coordination Organisation (FPCO) with the Danish Ministry of Foreign Affairs (Danida) as the lead donor. The donor agencies of France and the Netherlands also contribute to the project. The FHS is now completed. The Flood Management Model component started in mid October 1992 and will continue until October 1994.

## 1.3 Institutionalization of the FMM

The FMM is a modelling and software tool to be used by a variety of government agencies and consultants. It has been developed and demonstrated at the national, regional and compartment levels in FAP 25. After the completion of the FAP 25 project the FMM will be documented and made ready for general application.

Like the surface water models at SWMC the FMM is a 'living tool', to be maintained, improved and upgraded over time as a result of user experiences and demands, as well as new and improved modelling, software and hardware technologies. Users need introductory training before applying the tool, and often some support and assistance during the application will be required. Experiences generated by users should be documented and fed back to the custodians of the FMM in order for subsequent users to benefit from them.

The FMM development in FAP 25, associated with a high level of ' outreach' activity in the form of workshops and training sessions, has generated considerable local expertise for the continuation of FMM activities in Bangladesh. However, for the sustainability of the FMM it is essential that a proper institutional framework exists for this expertise to be retained and further developed. Otherwise future maintenance and operation of the FMM as discussed above will not be possible, and the FAP 25 efforts may ultimately be wasted.

The logical institutional host for the FMM after completion of FAP 25 is the SWMC which maintains, distributes, supports and improves models in the same way as required for the FMM. The participants of the Second FMM workshop held on 14 Nov '93 as well as the Fifth CAT mission have strongly recommended the institutionalization of FMM at SWMC. Developed by interfacing the MIKE 11 with DEM and GIS's, the FMM is linked to the SWMC technology, and most users of the SWMC models are expected to use the FMM for pre-and post-processing of data and results. The SWMC is basically a service and consulting organisation capable of assisting many different users, as also required for the FMM. The SWMC is likely in the future to rely on charging users for the provision of models and services (both public and private); the FMM is a logical addition to the products of the SWMC and one which in the long run may contribute significantly to its financial sustainability.

The FMM hardware and software, as well as some of the key technical staff of FAP 25, can in principle easily be accommodated by SWMC. However, for the SWMC to assume this new responsibility some short term support will be required to absorb the FMM, both in terms of facilities and additional training of key staff.

The question of sustainability and future institutional framework for the SWMC and the FMM has been discussed throughout the FAP 25 preparation and implementation. A small group of senior GOB officials is now (as part of FAP 26) reviewing the general institutional structure of the water sector in Bangladesh, and no firm proposals have as yet been made. However, it appears that regardless of the overall structure to be adopted, the SWMC will continue as an entity, located in Dhaka. Thus, the recommendation of placing the FMM with the SWMC is made under this assumption.

FAP 25 will be completed in less than a year (i.e. in October 1994), and decisions on its future need to be taken in time for a proper handover to the host institution.

## 2 FUTURE NEEDS AND USE OF FMM

### 2.1 FMM Features

The FMM is based on MIKE-11-GIS, a flood modelling -GIS interface merging the two worlds of flood modelling and GIS as an engineering and planning spatial decision support tool for river and floodplain management.

FMM more clearly clarifies and disseminates impacts of flood management proposals on flood hydraulics, urbanisation, agriculture, fisheries and the environment.

Also, flood modelling benefits form a GIS by extracting MIKE11 floodplain topographic data from a DEM - traditionally a time consuming and laborious task.

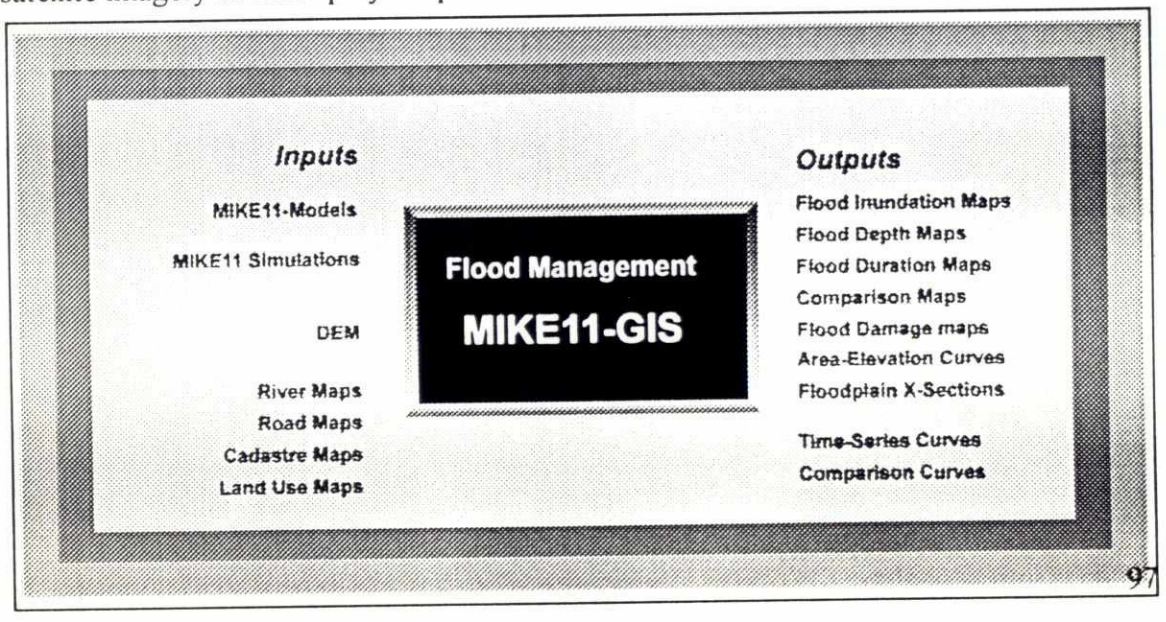
FMM requires input from MIKE11 models and a DEM and optionally GIS data such as river, road, land use maps, satellite images, etc. It outputs floodplain topographic data for MIKE11 models, and produces flood maps and other graphic displays.

***Inputs***

FMM imports MIKE11 flood model details, and flood simulation output for flood mapping and analyses. Calibrated MIKE11 models must be developed before or during FMM application.

The DEM is an important FMM input and critical to flood mapping accuracy. DEM floodplain elevations must be sufficiently accurate to yield reliable flood maps. The DEM should also be representative by including linear features such as rivers. levees, embankments and roads.

Optional FMM inputs are maps of rivers, infrastructure, cadastre, land use, agricultural use, satellite imagery or other project specific data.



***Outputs***

FMM's main outputs are flood maps and comparative flood maps. The flood maps show in graphic detail inundation depths, flood durations and flood extent.

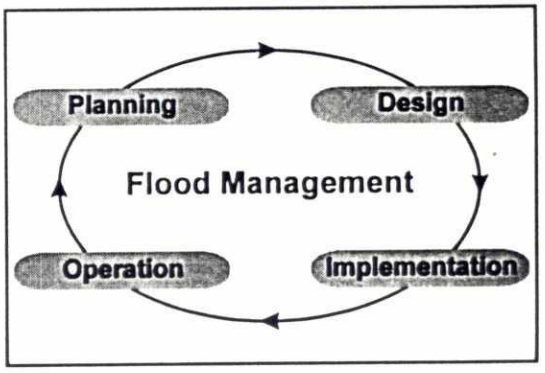
Comparative flood maps illustrate differences in flood depths resulting from proposed works, structure failure, embankment breaching and other artificial or natural causes. They also show areas which would become flooded and which would become flood free. Two MIKE11 simulations are needed for these maps, ie. "before" and "after" scenario simulations.

The flood maps may also be used for flood damage assessments on infrastructure, agriculture, fisheries etc.

## 2.2 Use of FMM in Flood Management

***Flood Management Cycle***

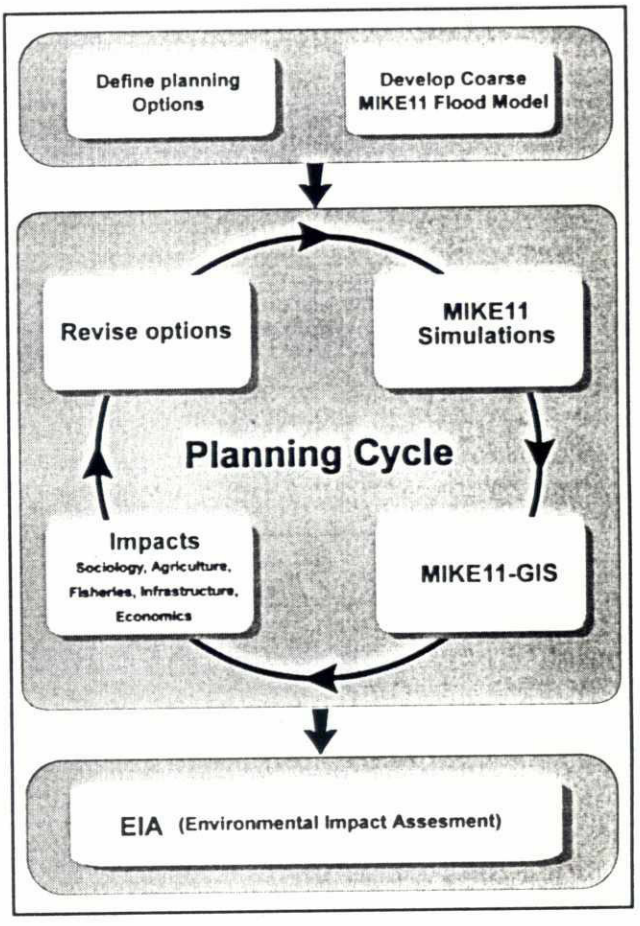
Flood management follows a cyclic pattern linking ideas, proposals, consultations, adopting proposals, preparing guidelines, designing proposals, constructing/ implementing proposals, operating and maintaining finished schemes. This is the flood management planning, design, implementation and operation cycle, in which, FMM plays an active and useful role.



*Planning*

At the planning level FMM helps assess proposed flood mitigation options and prepare environmental impact assessments.

Flood management planning activities may range from flood preparedness programmes to major civil works.




Planning options must be identified, a calibrated coarse (preliminary) mathematical flood model must be developed, and other preparations made. The planning cycle then commences: MIKE ll flood model simulations; FMM analysis and display; assessing impacts; revising options. Finally, an EIA and other documents are prepared for distribution to receive feedback, and to outline design, implementation and operation recommendations.

FMM is a useful flood management planning tool. Output from flood model simulations can be displayed as flood maps showing depths, inundation duration and differences in flood levels. These maps in turn can be used for impact assessments on socio-economics, agriculture, fisheries and infrastructure. They are also excellent media for communicating options during consultations, and for receiving feedback.

Similarly, FMM will have a very useful role to play during design and operation of Water Management/Flood Control & Drainage Projects.

*FMM for Impact Assessment*

The FMM is being developed as an instrument to be used for various purposes by different sectors - and at national, regional and compartment levels - each with their own characteristics and requirements. The mode of collaboration between the users and the FMM

providers is being developed and tested. By providing a detailed description of flooding patterns in time and space as output from the FMM, the concerned sectors are given the basic data for impact assessment or forecasting of floods.

Impact assessment may be carried out manually, or by superimposing overlays within the GIS structure to be combined with the flooding in pattern for calculation of damages or other impacts. The interpretation and analysis of such sectoral data and information will be made by the concerned sector specialists who have the required background for assessment of economic, social and environmental consequences of flooding events (such as cropping patterns and agricultural damages, effects of floods on inland water fisheries etc.).

## 2.3 Future Implementation

The sustainability of FMM is largely dependent on its future implementation in other projects. Because FMM is closely tied to and dependent on MIKE11 models, the custodian of MIKE11 models, SWMC, would be the most logical place to maintain and develop FMM models.

However, GIS for floodplain management extends beyond flood modelling and into other sectors such as agriculture and fisheries. These sectors are not particularly interested in the MIKE11 models, but in their output, especially flood maps.

The most logical process would be for flood modelling experts to use MIKE11 and FMM to produce flood maps and export these maps to other sectors for their own analysis. The export media can be in formats readable by other GISs or, if requested, just as hardcopy maps. Flood maps would be available in several forms, such as flood extent, flood depths, flood duration and the change or impact on flood extent, depths and duration because of man-made or natural causes.

The future custodian of FMM software will need to consider a practical arrangement for transfer of FMM output for use by other sectors. However, many agencies or projects may like the SWMC to carry out a complete analysis or develop dedicated models for specific areas. This will be seen as a practical and attractive arrangement from computer hardware-software expertise and financial considerations.

## 3. OTHER DONORS, PROGRAMS ACTIVE IN THE USE OF FMM

### 3.1 Detailed Studies in the North Central Region

While FAP 25 is demonstrating the application of FMM in the North Central Region on a regional level, more direct applications in detailed sub-regional studies are expected to derive the full benefits of FMM.

The terms of reference (TOR) for detailed studies in the North Central Region to be funded by CEC and France have indicated clearly to use the FMM technology in the very near future. Consultants are being selected for the Jamalpur Priority Project (FAP 3.1) and the TOR is being finalised for Bhuapur Feasibility Study (FAP 3.2).

These detailed studies intend to use the FMM in producing flood inundation maps and in carrying out impact studies of water management and flood control options. The FMM - graphic displays and flood maps are also proposed to be used in public participation during the detailed studies. Optimal operation of FCD structures will also be tried in conjunction with the FMM outputs.

In connection with the use of FMM by the project consultants, the French donor agency (CFD) as well as the bidding consultants have shown interests in using the FMM software as well as hardware. It seems that the major part of FMM work for these projects will be carried out in 1995.

Such arrangements will definitely be attractive to donors as well as consultants, since the financial requirements of the GIS software license and computer hardware could be a constraint for them.

### 3.2 Compartmentalization Projects

The concept of compartmentalization and controlled flooding is becoming a popular concept for flood management in Bangladesh. The facilities of FMM developed at FAP 25 are being used in the Tangail Compartmental Pilot Project in collaboration with FAP 20 - a joint project funded by the Governments of the Netherlands and Germany. Similar applications are expected to be carried out in the Sirajganj Pilot Project and other compartmental projects in the future.

As per the plan of FAP 20 - Tangail Compartmentalization Pilot Project, detailed modelling for 3 sub compartments (# 9, 10 & 11) will be carried out in 1995. Real-time operation of the pilot structures implemented during 1994 - 1996 will be done using the FMM facilities.

Expert manpower provision for the modelling work is being planned. The project, however, will not have the FMM due to hardware and software (GIS) limitations. Hence, a workable practical solution is that the modelling works of FAP 20 after October 1994 be carried out in SWMC with additional support from the project. The donor support for these activities is indicated later in this proposal.

### 3.3 Flood Forecasting and Warning System (FAP 10)

The TOR for the new phase of the FAP 10 project specifies that FMM be used for real-time inundation forecasting and for on-line flood management including providing input to disaster preparedness activities at various levels. DANIDA has already carried out the project appraisal and it is found that real-time inundation forecasting be done for selected pilot areas.

FAP 10 is required to use and adapt the FMM developed at FAP 25 for application in real time flood forecasting and management. It is also recommended to carry out the modelling works including FMM at SWMC.

### 3.4 North-East Regional (NER) Study (FAP 6)

The NER study is developing one of the most comprehensive regional water management plans. The consultants are carrying out flood management modelling using their own methodology but have approached FAP 25 and DHI on the possibility of using the FMM for the NER. Since it is not possible for FAP 25, under its TOR, to carry out the work for FAP 6, SWMC could well undertake such a task in the very near future.

### 3.5 Flood Management in the Greater Dhaka Area

FMM will be a very useful tool in the overall flood management for Greater Dhaka area including real-time forecasting and operation of the flood control and drainage system presently being implemented under the JICA support. The proposed UNDP support for metropolitan development planning will also need a comprehensive flood management system. As more accurate topographic data and detailed geographic information and maps are becoming available for this area, FMM will become one of the most attractive tools to be used in flood management decision making.

### 3.6 Geographic Information System -GIS (FAP 19)

The USAID funded GIS project (FAP 19) will come to an end in June 1995. The project has compiled useful GIS data related to land and water in Bangladesh. It has also developed image processing facilities for interpreting satellite imageries. RADAR images are also being used to analyze flood conditions in pilot areas. Simple flood mapping has also been carried out by FAP 19 in collaboration with SWMC. There are strong indications that the GIS data

and facilities will be handed over to SWMC. The Consultants of FAP 19 have already approached SWMC in consideration as a host for FAP 19 activities after June '95. If GOB decides on these lines, then it will be an obligation for SWMC to prepare themselves to develop and accommodate the GIS expertise within the Centre.

Since FMM is GIS based, this will further strengthen the modelling capability and provide an impetus towards the financial sustainability of the Centre.

### 3 .7 Fisheries Study Project (FAP 17)

The consultants of the ODA supported Fisheries Study project have expressed their interest to use FMM in their analysis. The project lacks the expertise on modelling and GIS. It is very likely that SWMC will carry out the modelling work (using FMM for them during the second phase of the project).

### 3.8 Other Projects

The following on-going studies and their future extensions are likely to collaborate with SWMC on the use of FMM.

* FAP-16 - Environmental Study

* FAP-11 - Disaster Preparedness

* Non FAP Projects and Agencies such as LGED, BWDB, WASA, RAJUK etc.

## 4. THE DEVELOPMENT OBJECTIVE

The long-term development objectives are:

- to achieve an on-line flood management/water management system in Bangladesh to provide an integrated spatial decision support tool to assist in effective planning, design and operation of water resources systems in Bangladesh

- to develop a self sustaining centre of excellence in surface water modelling and management in Bangladesh

## 5. THE IMMEDIATE OBJECTIVES

The immediate objectives are to transfer and establish a FMM unit in SWMC to continue the developments carried out by FAP 25, usefully apply it to important areas and to fulfil the need of FMM application by other clients (mainly FAP Consultants and GOB agencies).

## 6. ACTIVITIES

The list of activities included in the FMM transfer and maintenance would be, inter alia:

### 6.1 Training

A consolidated training program of 2 months will be conducted for four SWMC staff together with one official from FPCO and two staff from BWDB hydrology (FF&WC). The training will be conducted by expatriate and local staff of FAP 25 with additional input from GIS experts from outside.

The training course will follow a modular structure including the fundamentals of the FMM and its applications. Actual case studies will be taken during the training to develop dedicated flood management models. Examples of flood impact assessment will also be found.

### 6.2 Transfer of FMM

The activities carried out at FAP 25 including data, software and the applications will be transferred to SWMC. Computer hardware and other related equipment will also be transferred to SWMC subject to DANIDA and GOB approval. It is also proposed to transfer 4 local technical staff involved in the development and application of FMM from FAP 25 to SWMC.

### 6.3 Establishment of FMM Unit at SWMC

A dedicated unit/group - to carry out the flood management model activities will be established at SWMC. This unit will be responsible to undertake development of tailored FMMs on client request as well as apply the FAP 25 transferred models in actual studies.

During the initial stages, dedicated FMMs for selected pilot areas will be developed. The unit is also expected to maintain and update the flood management models developed by FAP 25 as new data become available. Adapting to new software updates will be a regular activity of the group. In addition to the flood management model it self, this unit will provide support to the hydrodynamic modelling group in refining the MIKE11 models. The topographic data module of FMM will produce area elevation functions for flooded areas and thus will help in restructuring the various models in flood plain representations. In addition, this unit will also be responsible for all the mapping and digitizing activities of SWMC.

There is also a possibility of SWMC ultimately taking over the GIS activities on water resources/FAP in Bangladesh. This will include the digital elevation models, various GIS data such as soils, catchments, infrastructure and land use data on GIS, maps and image processing facilities etc. The FMM unit will then be expanded to accommodate the GIS system. This will further enhance the surface water modelling capability in SWMC and integrated with the GIS will promote model applications to water resources planning, design and operation including environmental impact assessment. Additional resources needed to support the GIS activities will be worked out later when the institutionalization of the GIS becomes definitive.

The FMM unit/group will consist of the trained local staff and their work will be supervised by expatriate expert on a short-term basis.

The FMM group will also carry out marketing activities by developing ideas and advising prospective clients on the use of FMM. FMM demonstrations and presentation seminars will be organized regularly.

## 6.4 Pilot Studies

Pilot areas will be selected in consultation with relevant agencies. A pilot flood management model for the part of the Dhaka Area will be developed. In addition to urban planning, flood damage analysis and flood disaster preparedness the Dhaka - FMM will ultimately be used in real-time operation of the proposed FCD Schemes designed to protect the metropolitan area from flood disasters. SWMC will develop a pilot model for demonstration purpose. Collaboration will be sought with JICA, RAJUK, WASA and UNDP Metropolitan Development project for developing and implementing a prototype FMM for the Greater Dhaka Area.

Another pilot area will be selected for Drainage and Agricultural master planning in the South West Region where the donor interests are strong. Methodologies for flood impact assessment on agriculture will be further developed during the pilot study.

Detailed plans for the pilot studies will be developed during the first 3 months of establishment of the FMM unit at SWMC.

## 6.5 Data Collection

The data collection (topographic and hydrometric) program of SWMC will be reviewed and, if necessary, additional data will be collected for improving information on flood plain and the urban areas. Satellite images during floods including images RADAR will be procured and analyzed for verification of FMM generated flood maps.

## 6.6 Workshops

Two workshops will be organised for relevant GOB agencies and Consultants to further disseminate the FMM technology. Outcomes of the pilot studies and any other applications carried out will be presented in the workshops. Interactive decision making sessions using the FMM will also be organised.

## 6.7 Reporting and Documentation

Updated reference manuals, user guides, and model application reports will be released time to time. Other activities will be reported together with the SWMC's reporting system.

ANNEX XII/1

# FAP 24 RIVER SURVEY PROJECT[1]

# NOTE ON TRAINING AND INSTITUTIONAL STRENGTHENING

# APRIL 1994

[1] Prepared for POE

ANNEX XII/2

## CONTENTS



## ANNEXURE

## 1. Preamble

This document is prepared for the Flood Plan Coordination Organization (FPCO) to help in preparing its plan for ensuring longterm continuity of the activities of the River Survey Project. Its purpose is to identify the activities, discuss the different relevant institutions and sort out the methodology of transferring the knowledge. It focuses on answering the questions on (1) which part of the activities of the project should be considered for continuation, (2) whom should be entrusted for the job and (3) how the continuation can be ensured. The third question is dealing with methods of training or transfer of knowledge.

The questions are addressed in the Chapters 3 to 5, while distinguishing on the one hand the required training activities and on the other hand which part of these activities can be realized within the scope of the River Survey Project.

This document should be considered only as a preliminary suggestion of the River Survey Project for a comprehensive training programme which need much further elaborations.

## 2. Objectives of training

For a number of decades already vast data collection programmes have been realised on the main river system of Bangladesh. In this context the River Survey Project is only a short term exercise with expected output regarding amongst others

- Measuring techniques (review, improvement)
- Data (validation, critical review, storage)
- Better understanding of river behaviour.

The results of this output should not vanish after the Project. So the objective of the training is not the continuation of the River Survey Project but the implementation of the main output of the River Survey Project in the ongoing river engineering activities. This implies that training and possible institutional strengthening are very essential for FAP 24. Unfortunately the importance is not underscored in the ToR and other contractual documents of the River Survey Project.

## 3. Subjects of training in the River Survey Project

As outlined in the ToR the River Survey Project is engaged in *collection of reliable all season hydrological, morphological and hydrographic data at key locations on the country's main river systems with emphasis given to collection of data during the monsoon season introducing improved or new technology when appropriate and in special*

*studies of the behaviour of the river systems based on the new data that are collected, existing data and through supplementary surveys.*

The River Survey Project started in June 1992 as the 24th supporting project (FAP 24) of the FPCO. The project completed its phase 1, a test phase, by August 1993. The project is presently in a transition phase in which additional equipment (vessels and instruments) are mobilized to be used in phase 2. Phase 2 is expected to start in June 1994 and the project will complete its job by June 1996.

Its main activities on which training can be considered can be split into two major groups.

- **Survey or data collection :**
  - survey-vessel handling
  - hydraulic measurements
  - instrumentation
  - data processing
  - sediment laboratory
- **Study or data interpretation :**
  - hydrology
  - morphology
  - mathematical modelling

On part of these subjects training has been given or will given. The limitations of the present programme (see Annexure) are :

- Training on ship handling and sediment laboratory analysis are internal training only.
- External survey training is mainly on-the-job training for the field level (sub-divisional engineers), there is no in-depth training of the operational level.
- Training on instrumentation is no part of the programme.
- Training on modelling will focus on small spread-sheet type of modelling in the scope of the study programme.

## 4. Institutions

The question to whom training should be given can be understood in various ways:

- Which level should be addressed ? (e.g. decision level, operational level, etc.)

- Which discipline should be selected ? (vessel crew, hydrologist, etc.)
- Which part of the training is in-house (for staff of River Survey Project including sub-contractors) and which part is external training?
- To which institutions the external training should be given ?

The first three questions are treated in the Annexure. The last question is discussed hereafter.

Several institutions are engaged in river engineering related activities in Bangladesh.

**BWDB (Ministry of Irrigation) :**

The BWDB is an engineering organization actively involved in the implementation of water-related engineering structures. It has a hydrological directorate which does the similar activities as the FAP 24. Its two main types of activities are as follows :

- Collection of hydrological data on rainfall, water-level, discharge and sediment transport parameters.
- Measurements of river cross-profiles under the so called morphology directorate.

After collection of data, the organization does a first-hand processing of the data.

**BIWTA (Ministry of Shipping) :**

The BIWTA collects water level data in parallel with and complementary to the BWDB. It executes survey and publishes bathymetric charts of the navigational fairways to ensure safe navigation.

**RRI (Ministry of Irrigation) :**

The RRI is at a developing stage and engaged in water related research activities. Among other matters, its work involve scale modelling. It is located outside Dhaka. It does not have a data collection wing. It operates a sediment laboratory. SWMC is an operational unit of RRI engaged exclusively in numerical modelling.

**WARPO (Ministry of Irrigation) :**

The WARPO is entrusted with central water resources planning activities of Bangladesh. It does not have any data collection wing.

**FPCO (Ministry of Irrigation) :**

This organization was created to coordinate the several Flood Action Plan projects. It does not have any data collection wing.

**BUET/IFCDR (Ministry of Education) :**

The academic institution is engaged in basic and applied researches, mostly for academic purposes and some for consultancy services. It does not have any data collection wing.

An important drawback of most of these institutions is that they do not have any 'Research and Development' wing to consolidate experience, to improve and develop innovative thinking and new methods. They often lack a documentation mechanism with the result that gained knowledge are scarcely being propagated to the posterity. Absence of all these is a vicious circle of 'no-progress in knowledge built-up'.

Selection of institutions for training means that the question should be addressed which institution may give the necessary continuity provided.

- o A proper mechanism is developed for testing of new data collection techniques
- o A proper mechanism is developed for data validation and analyses,
- o A proper mechanism is developed for interpretation and studies,
- o A proper mechanism to have 'Research and Development' to consolidate experience and to provide a boost in innovative thinking.

Regarding the institutions to be trained a number of aspects have been considered.

- o As a first step the activities of the institutions are compared with the activities of the River Survey Project, looking for similarities.
- o From this as a rather obvious choice it comes out that BWDB is the logical institution for the main part of the survey training.
- o For the study part this choice is less obvious. Here the 'triangle' BWDB, RRI, BUET comes to the fore.

The possible new tasks for BWDB may lead to modifications in the organizational set-up. Some suggestions are:

- o SWH 1 get more tasks in data validation

- o A separate task force will deal with new measuring techniques and special measurements (thus not hampering ongoing vast routine measuring programme). Results may lead to changes in methods or modifications in equipment which should be an in-house affair

- o As sediment transport and morphology are very much linked more integration of activities of SWH and Morphology is desired.

- o SWH 2 will concentrate on data processing and studies including the morphological aspects. These activities may be done in two sections.

- o The need for studies within BWDB is to scrutinize the data to assess the accuracy of the measurements and applied methods, to suggest improvements of the network, the methods and the instruments.

- o The studies for a better understanding of the river system can be done by the RRI and sometimes BUET. This can be subcontracted by BWDB. Hence BWDB should have sufficient expertise to initiate studies and to guide these studies.

In such a new institutional set-up the training can be given as follows :

| | | Subject of training | |
|---|---|---|---|
| Institution | Data Collection | Data storage, validation and retrieval | Studies |
| Hydrology 1<br>Morphology | X | (X)<br>Sufficient for field validation | - |
| New measuring techniques | X | X | X |
| Hydrology 2<br>Morphology | - | X | (X)<br>Sufficient to scrutinize the collected data |
| Studies | (X) | X | X |
| RRI | (X) | (X) | X |
| BUET | | | X |

Whether such a training set-up is viable is difficult to say but may be some indications may be obtained from the results of the ongoing WRIS project, which aims at providing institutional support to BWDB.

Obviously training should not wait for possible new institutional developments. The main conclusion is that besides BWDB also RRI and BUET should participate.

This is reflected in the proposed training programme in phase 2 of the River Survey Project (see Annexure). However, this training programme is very light as the consultant is urged (by the PA) to restrict the project resources for training to:

- o 15 days hydrometric survey vessel
- o 10 manmonth Bangladesh staff
- o 2.5 manmonth expatriate staff

Comparing this with the size of the River Survey Project it is concluded that this amount of training is only marginal. So there is a large discrepancy between the importance and need for training and the possibilities of training within the River Survey Project.

The GOB should address this matter and investigate whether other funding can be found (as suggested by the PA in his draft mission report of April 1, 1994).

It is suggested to review the main subjects discussed in this note and assess the appropriate volume of training.

## 5. Methods of training

In the proposal stage of the River Survey Project a general framework was made on the method of training (see Annexure). The frame work indicates a systematic, phased setup of the training (realized by a training expert). In the first phase the training is outlined and the subjects are identified. The volume of training is assessed based on the differences between available skills (of the trainees) and the desired future skills. This will result in a proposal on training. It is suggested to apply this set-up to elaborate further training activities.

For the limited resources available in the River Survey Project, the above mentioned approach appeared to be too ambitious. To a large extent the training will be limited. to on-the-job training. It is proposed to extend the training activities in phase 2 with some seminars and study tours.

On-the-job training means for the survey activities, joining the surveys aboard our vessels.

On-the-job training in data processing means working together in close cooperation in the data processing office.

On-the-job training in studies means that staff from other institutions are working in the RSP office being directly involved for a major part of their time in our study programme.

# Training proposal 1991
# River Survey Project

## (Source : Technical Proposal September 1991)

## 5.4 Training

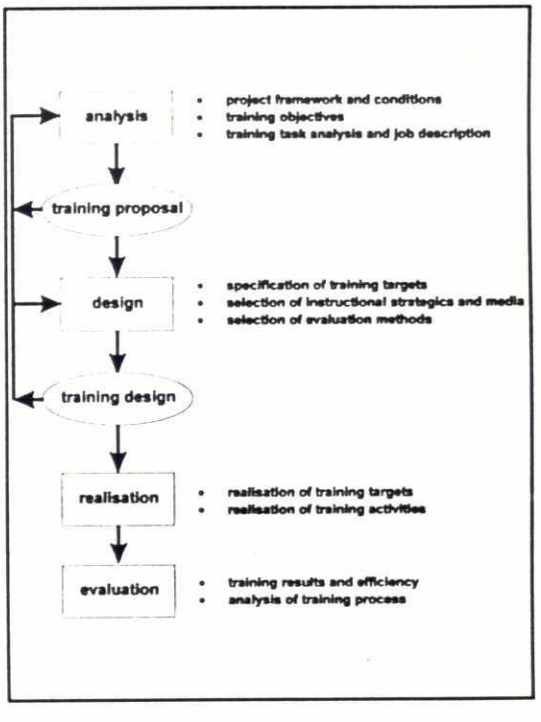
### 5.4.1 General

Based on a long experience in developing countries with training and institutional support (see project lists A and B), the Consortium considers the training component of the project an important medium for all activities. The training must cover the entire scope of the project and the transfer of knowledge must promote interest, involvement and enhancement of capability. In addition, a well-defined training programme will meet the long-term project objective to guarantee sustained upgraded capabilities in the fields covered by the project. Technology transfer is the covering activity for the two other project components, and these are all mutually interrelated. Technology transfer implies transfer of knowledge and skills, in combination with available and developed tools, to institutions and individuals, with the aim to contribute to the sustainable development of Bangladesh.

In order to control the training activities and to realise a set of quality objectives, a methodology for training is defined. This methodology comprises a framework for the set-up, the realization and the evaluation of training activities. The training activities will be distinguished in phases.

### 5.4.2 Training phases

During the first phase, the training outline including all subjects is identified. This training outline is assessed as the difference between the particular future tasks of the trainees and the current skills within the potential training framework activities. The proposed training scope is also influenced by the logistical conditions and other external factors. During the second phase, the design phase, the training activities are worked out as instructional strategies and media, based on specific training targets. Subsequently appropriate evaluation methods can be selected.




In the realisition phase the required training materials are selected, modified and finalized, based on ergonomical recommendations. The actual training activities are carried out based on a sound educational approach.

In the last - evaluation - phase, training results and efficiency of the technology transfer are assessed and the training-process is evaluated.

A central item during the whole procedure for training development is the group of trainees, within their institutional framework. Basically, the decisions to be made are adjusted to their needs.

The control of the above mentioned process is effectuated by training documents which contain specific information on the training particulars for each phase. These documents enable quality monitoring of the training activities. The outcome of this process will be condensed in practical handbooks.

Initial uncertainties, likely tensions and communication difficulties will be tackled by techniques aimed at overcoming hesitation and at establishing rapport. National counterparts and Consultants will be stimulated to and assisted in joining discussions and to contribute in a very practical manner to the final selection of approaches and methods.

### 5.4.3 Training approach

Many of the required skills might effectively be transferred through close and cordial collaboration during the survey activities themselves. However, a full programme of on-the-job training during the actual surveys is anticipated not to come in effect because of the pressure of workload and lack of regular attention paid to the subject of training. Therefore, separate training sessions are suggested as well, in which the survey techniques and related items will be reviewed and more theoretical background information can be dealt with.

In addition, separate training surveys can be conducted, focused on instructional training and self-practice. Field trips can also be fruitful in that they present instructive examples of problems and solutions of applied techniques to deal with the extreme Bangladesh conditions and to exchange experiences with other professionals and instructors.

Overseas training for counterparts, e.g. at international institutes as the Asian Institute of Technology in Thailand (AIT) and the International Courses on Hydraulic and Environmental Engineering in the Netherlands (IHE) are not expected to be essential for the project; however, if the need arises such a training might be slotted in as well.

The transfer of technology aimed at will capitalize as much as possible on the presence of short-term experts.

In addition, separate training activities will be concentrated on the low-intensity measurement periods (i.e. well beyond the monsoon periods).

During the first phase initial training will be given on introductory items and attention will be paid to the institutional enhancement aspects of the related parties. The positive spin-off of such an early training is the possibility of "team building" through joint discussions and participation of the trainees in the subsequent approach for training of phase II.

The training methodology as outlined in the above is suggested to be applied throughout the first phase so as to arrive at recommendations for the second phase training activities. In turn, the second phase training can also be controlled by the proposed methodology.

# Training realised in phase 1 and proposed for phase 2 River Survey Project

## (Source : Final Report Phase 1 in preparation)

# 8. Training

## 8.1 Rationale

### 8.1.1 Introduction

One of the components of the River Survey Project FAP 24 consists of training. In the first phase of the project the training consisted mainly of on- the-job training and in-house courses on river engineering. At the end of phase 1 a training programme for phase 2 has to be elaborated.

In this section the scope of the training is given. Thereafter the realized training programme of phase I is presented (Section 8.2) and in the last section the programme for phase 2 is described (Section 8.3).

### 8.1.2 Objectives and scope

In the ToR of the River Survey Project the objectives and scope of the training are described hereafter.

**Quote:**

- *Objectives of training (Section 3. 1)*

  *"To strengthen BWDB by providing on-the-job training to professional staff from BWDB, and where applicable BWDB and staff of associated, local consultants in the fields of river surveys and studies so that they can continue the data collection programme in the long term and to upgrade the institutional capability in Bangladesh for river hydrological and morphological data collection and study programme"*

- *Training phase I (Section 4.2 c)*

  *"In conjunction with FPCO and BWDB prepare and outline a programme for training BWDB and, where applicable BIWTA staff and staff of associated local consultants. Initial training of all local and counterpart staff will be carried out on phase 1. Initial recommendations for upgrading of technology and equipment will be made. "*

o *Training phase 2 (Section 4.3 c)*

*"Prepare and carry out programmes for training BWDB and, where applicable, staff of other Bangladeshi Organizations, including the staff of associated local consultants and contractors in the use of modem equipment, instruments, techniques and technology so that they are able (a) to carry on with the surveys after completion of the project and (b) to upgrade the routine survey programmes being undertaken by those organizations. This would mostly take the form of on-the-job training, but would be supplemented, by some training seminars and workshops.*

**Unquote.**

In the Technical Specifications (TS) the training activities are described in a slightly different way.

**Quote:**

*No formal training is included in phase 1. It is however expected that the Consultant, when assessing the data acquisition and processing performed by the local organizations, will give useful guidance and will consider the participation of local hydrographers in its field experiments.*

*The on-the-job training to be achieved during phase 2 must lead to a transfer of technology to make possible the continuation of part of the routine activities at the end of phase 2.*

*The training programme will be agreed on in consultation between FPCO, the BWDB, the involved local authorities, the Consultant and the Project Adviser.*

*As the Consultant has the final responsibility of the results, the training programme has to be set up in such a way not to hamper his activities. The Consultant must therefore propose in his tender document the minimum training activities, their frequency, duration and content.*

**Unquote.**

### 8.1.3 Constraints

There are in fact two problems limiting the training activities:

- o There is no budget for training
- o The equipment is only temporarily imported in Bangladesh and will be taken out of the country at the end of the project.

The present absence of a budget is initiated by the ToR where the following is stated under staffing for training.

**Quote:**

*The Consultant would have to show his experience in this field and the staff he intends to employ, but he is not required at this stage to give an estimate of the number of manmonths involved. "*

**Unquote.**

On the other hand the ToR and the Special Conditions of the Contract suggest that at a later stage quantification of training work is required. Moreover in the Financing Memorandum an amount of 0.1 mio ECU is mentioned for training.

At the moment only limited on-the-job training is possible. Limited, as the training activities may not harm project results (Subsection 8.1.2, last para).

During the pre-bid meeting of August'91 it was decided that the project equipment is only temporarily imported. As discussed earlier (Interim Report, Annexure 5, page 5.23) this may affect the training programme. For the type of instruments, only used by the River Survey Project in Bangladesh, training on the operational level does not make sense.

### 8.1.4 Outline

**Target disciplines**

The following disciplines may be considered for training:

- o Survey vessel crew
- o Surveyors, Hydrographers
- o System analysts, data handling specialists
- o Sediment analysts

- River engineers, Hydrologists, Morphologists

The main subjects of training, obviously closely related with these disciplines, are respectively as follows.

**Main subjects**

- Ship handling, maintenance, manoeuvreing
- Surveying; water-levels, bathymetry discharge and sediments.
- System operation and management, data storage, data processing
- Laboratory analysis of sediments
- Hydrological and Morphological study topics

**Target organizations**

- BWDB, Hydrology
- BIWTA
- RRI
- BUET
- Approtech, Hydroland (Associated local consultants)
- Other local staff of the River Survey Project

**Subject/organization matrix:**

In the following matrix it is indicated which subjects of training will be given to which organisation

| Main subject / Organisation | Ship | Survey | Data | Lab | Study |
|---|---|---|---|---|---|
| BWDB | - | + | + | - | + |
| BIWTA | - | + | - | - | - |
| RRI | - | - | - | - | + |
| BUET | - | - | - | - | + |
| Approtech | - | - | + | - | + |
| Hydroland | - | + | - | - | - |
| RSP | + | - | + | + | - |

**Table 8.1 : Subject/organisation matrix**

The training for the last three groups is considered to be in-house training.

**Methods of training:**

The methods to be considered for external training depend strongly on the subjects:

- o Survey :
  - short term on-the-job (days)
  - special exercises in the field
  - seminars, courses, lectures
  - study tour
- o Data :
  - mid term on-the-job (weeks)
  - courses, workshops on packages
- o Study :
  - long term on-the-job (months, years)
  - short field visits, participation in surveys
  - conferences
  - long term abroad (AIT, IHE)

Obviously, the methods chosen are strongly depending on the available resources, see Subsection 8.1.3

**Target level**

The degree of detail in which certain subjects will be handled depend on the level of the target group. See for example the levels of personnel involved in the hydrological service.

| | Officers/Employees | Level |
|---|---|---|
| 1. | Chief Engineer, Hydrology | Decision Level |
| 2. | Superintending Engineer/Director | |
| 3. | Executive Engineer/Deputy Director | Implementation Level |
| 4. | Sub-divisional Engineer | Field Level |
| 5. | Assistant Engineer | Operational Level |
| 6. | Sectional Officers/Assistant Director | |
| 7. | Surveyors | |
| 8. | Gauge Readers | |
| 9. | Vessel crews | |
| 10. | Survey crews | |

**Table 8.2 : Levels of personnel**

The decision level need general info, on survey techniques, possibilities, pros and cons. The objective of the training for this level is to provide the background data required for an appropriate selection of survey techniques.

The implementation level and the field level need to have more details. Especially the physical background should also be known. It is assumed that the field level will train the operational level. Therefore the field level will be the prime target level for training by the River Survey Project.

## 8.2 Training activities phase I

The training programme implemented in phase 1 is summarized in the following schedule:

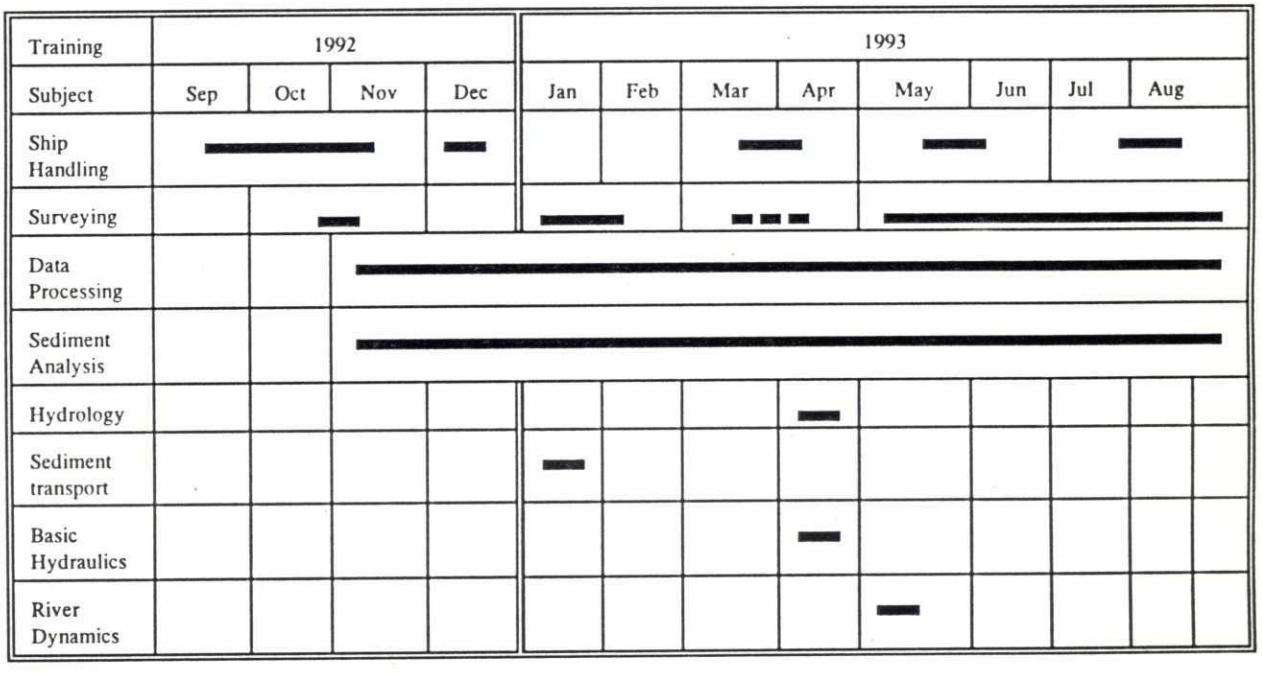



**Figure 8.1 : Training programme phase I**

### 8.2.1 Ship handling

On-the-job training was given by a professional master Mr. L.P. Schoonenberg to the crews of the two survey vessels. In 1992 the training focussed on the basics of ship handling, maintenance and repair, including the use of the computerized autopilot and communication systems. During the monsoon of 1993 much attention was paid to manoeuvering in high currents including anchoring.

This training is completed, the crews are fully capable to operate and maintain their vessels independently. In case of fleet expansion the training will be repeated.

### 8.2.2 Surveying

The training on surveying in phase I was mainly on-the-job training in the field given by expatriate surveyors, hydrographers and electronic engineers. The main part of the training was given to the own survey staff including staff of the sub-contractor Hydroland. Main survey training activities are summarized as follows:

- o In October, November 1992 the training emphasized the use of the new equipment, especially the instrument range for velocity, discharge measurements may be mentioned such as the ADCP, the EMF, the S4 and the Ott propellor current meter.

- o A lot of attention was also paid to the on-line data processing aboard the vessels.

- o In January, February 1993, the training focussed on the DGPS positioning system and on other land survey activities such as second order levelling and the use of the so-called total stations for topographical work.

- o In March special attention was paid to the sediment measurements.

- o Measurements were executed simultaneously with the BY-IDB survey team to compare techniques and give introduction to the equipment of the River Survey Project. Such simultaneous measurements were done a number of times and at various locations:

| | | |
|---|---|---|
| Bahadurabad | January | 1993 |
| Khulna | April | 1993 |
| Bhairab Bazar | April | 1993 |
| Bahadurabad | August | 1993 |

- o On May, June 1993 training emphasized the water line survey and the bathymetric work. Also instruction on the installation, operation and maintenance of the Automatic Water-level Recorders (AWLR) was given.

- o In July and August the training focussed on the HW routine measurements and the test gaugings.

### 8.2.3 Data processing

The training on data processing started in November 1992 when the data processing office became operational. Training was given on:

- o System software such as SCO UNIX, E-mail system, Oracle and GKS (Graphical package).

- o DELFT/DHI software such as Fieldman, MIKE 2 1, HYMOS and various plot and load programmes.

This mainly in-house training for the own staff of the data processing office is in fact completed. Only in case important modifications in software are implemented some additional training is envisaged.

### 8.2.4 Sediment analysis

Training was given to the staff of the sediment laboratory to execute the following types of analysis:

| Samples / Type | Suspended Load | Bed Load | Bed Material |
|---|---|---|---|
| o Concentration | + | - | + |
| o Dry sieving | + | + | + |
| o Wet sieving | - | - | + |
| o Settling tube | + | - | + |

**Table 8.3 : Training sediment laboratory**

This training is completed. Additional training is envisaged when new types of analysis are introduced in phase 2 of the project.

### 8.2.5 Courses on river engineering

As indicated in Figure 8.1 some refreshment courses were given

| | | |
|---|---|---|
| January | 1993 | Sediment transport |
| April | 1993 | Hydrology |
| April | 1993 | Basic hydraulics |
| May | 1993 | River dynamics |

These were mainly in-house courses organised in the office of the River Survey Project. Via FPCO also staff from other organizations were invited to participate.

Most of the material used in the courses is collected in lecture notes. For the content of the various courses reference is made to the 1° Interim Report Annexure 8.

### 8.2.6 Other training related activities

- o Presentations on seminars
- o Advise to BWDB/WRIS on selection of survey equipment
- o Assistance to BIWTA with positioning systems

## 8.3 Training programme phase 2

### 8.3.1 Introduction

As shown in Table 8.1 it is proposed to give the external training in phase 2 on survey techniques, data handling and river engineering (studies).

To overcome the limitations mentioned in Subsection 8.1.3 two measures are taken:

- o Cooperation is sought with the UNDESD project Water Resources Information System (WRIS) of the BWDB in order to strengthen our training activities

- o It is indicated which activities can be undertaken within the present contract of the River Survey Project. Additional funding is proposed for the remaining activities.

In this section first the cooperation with WRIS is briefly discussed (8.3.2), then the main training subjects are outlined (8.3.3 to 8.3.5) leading to the programme of phase 2 (8.3.6).

### 8.3.2 WRIS

Simultaneously with the River Survey Project (from mid 1992 to mid 1996) the UNDESD project Water Resources Information System (WRIS) started. The duration of WRIS is three years from mid 1992 to mid 1995. As there are interesting overlaps between the River Survey Project and WRIS, especially in the field of training, some project characteristics of WRIS are outlined hereafter.

**Objectives**

"Training of Trainers" as directed in the Project Document. Emphasis will be placed on transfer of new appropriate technologies and on correcting perceived deficiencies in current field practices of Hydrology Service.

**Participants**

Subdivisional Engineers of the Hydrology Service, BWDB (in principle)

**Related project activities** (not necessarily in sequential order):

- Defining training needs. (The Hydrology Service through River Morphology Directorate runs the current training programme at Bhagyakul. They must submit to the Project their current Annual Training Programme and the training material (texts) used as part of this activity).
- Adoption of standards for the full range of data collection activities within the Hydrology Service
- Selection and purchase of equipment (such as moving boat system, GPS) which require special training to operate
- Coordination with related projects such as FAP 24 of training scope and division of responsibilities
- Formulation of the Hydrology Service Training Programme for Trainers (Subdivisional Officers who will instruct field technicians)
- Drafting the "Training for Trainers" manual
- Implementing the training programme in Bhagyakul
- Feedback from trainers from experience of applying what they learned from the programme
- Revision of programme and/or manual

**Approximate timetable:**

- Preparatory (defining needs, setting standards, purchasing equipment, etc): May-September 1993
- Formulation of courses structure and content, preparation of manuals: October-December 1993
- Implementation of training programme in Bhagyakul: January-April 1994
- Feedback and adjustment of training programme: October-December 1994
- In 1995 training by the trainers to the operational level.

**General scope of training programme**

Coverage of procedures performed by Sectional Engineers and other field technicians and for which they will be instructed by the Subsectional Engineers. The courses will include additional material that will strengthen the conceptual and practical background of Subdivisional trainees. Ideally this should also facilitate their envisioned role as primary checkers of data quality.

**Tentative topics:**

1. Measurement of water-level

- Water-level instruments
- Site investigations for location of staff gauges and water-level recorders
- Field procedures and precautions
- Possible errors

2. Measurement of water discharge

- Selection of measuring sites
- Velocity measurements (methods, instruments, applicability)
- Cross-sections
- Methods of discharge quantification (area-velocity and others)
- Positioning methods
- Conventional current-meter measurement (fixed station)
- Moving-boat systems
- Discharge measurements under tidal conditions
- Discharge measurements under flood conditions (applicability of floats?)

- o Typical problems in large alluvial rivers (multiple channels, when a section becomes inadequate, relocation of stations)
- o Discharge measurements of flashy rivers
- o Stage-discharge relationship
- o Possible errors

3. Measurement of sediment discharge

- o Concepts of sediment transport, relevance to Bangladesh
- o Instruments for direct measurement
- o Field procedures and precautions
- o Elements of sediment analysis
- o Possible errors

4. Measurement of rainfall

- o Siting/maintaining a rainfall gauging station
- o Rainfall gauges (types, use and maintenance)
- o Field procedures and precautions
- o Possible errors

5. Measurement of water quality parameters including salinity

6. Measurement of climatolozical variables

- o Evaporation (equipment, procedures, errors)
- o Temperature (instruments, procedures, errors)
- o Sunshine hours (instruments, procedures, errors)

**Similarities and differences**

Comparing the future training activities of FAP 24 and WRIS a number of similarities and differences can be detected.

- o The training in both projects is directed towards river surveying of hydrological and morphological parameters. There is also a possible overlap in training on data-processing depending on future similarities in software.

- o The training may include all staffing levels

- o Both projects will give training to BWDB staff; FAP 24 will also give training to BIWTA and BUET staff

- o WRIS is focussing on execution of routine measurements, while FAP 24 will emphasize more on the physical processes and special measurements
- o WRIS training is concentrated in 1994 and FAP 24 continues up to mid 1996

**Fields of cooperation**

The fields of cooperation are especially in training on subjects of surveying and data processing and perhaps studies.

A special staff member is nominated to elaborate and implement the common training activities. He is working parttime in the WRIS office and parttime in the office of the River Survey Project. The following outline on training is drafted in cooperation with WRIS.

### 8.3.3 Survey

The external survey training is given to BWDB and BIWTA staff. The main part of the training will be given to trainers, which are staff members at the field level : sub-divisional engineers.

Methods of survey training comprise

- o Introductory training Special exercises in the field
- o Seminars, courses, lectures
- o On-the-job training
- o Study tours

**Introductory training**

It is proposed to organize introductory training for the decision level (see Table 8.2). The training consists of a combination of a few lectures on principles of measurements combined with survey demonstrations aboard the vessels.

The differences of the various available techniques to measure either water or sediment transport will highlighted. The possibilities, pros and cons will be discussed in order to assess the sustainability in Bangladesh.

In principle an introductory training will take one day. It is envisaged to have two of such days per year, if possible one during the monsoon.

**Special exercises**

Special survey training will be organized for the trainers (the field level, see Table 8.2). In the field a number of exercises have to be elaborated and carried out using available equipment and vessels. Training sessions with a duration of one week in combination with lectures (see hereafter) are envisaged.

Possible training topics are:

- Set up of AWLR station location versus morphology; case studies; slopes and other hydraulic effects; comparison of various instruments.
- Importance of bathymetric and topographic measurements
- Bathymetry and remote sensing
- Optimization of hydraulic measurements; data density and accuracy
- Optimization of suspended sediment measurements; effects of bed forms
- Methods of bed load measurements including dune tracking

Training packages will be developed together with WRIS. A distribution of work will be elaborated in detail. Probably different packages need to be prepared for BIWTA and BWDB.

It is proposed to organise two training sessions one of 5 days and one of 3 days with special exercises per year (dry season).

**Lectures**

Lectures, seminars, courses will be organized as part of the introductory training for the decision level or more extensively as part of the field exercises for the trainers.

The lectures will compare different available techniques and elaborate the physical processes of water and sediment transport.

The lectures for the trainers are given in the BWDB training center in Bhadyakul. The subjects are mentioned above. The time for lecturing is included in the time mentioned under exercises.

**On-the-job**

On-the-job training is possible throughout the year. It means that a very limited number of people say 2 per boat may board one of the vessels of the River Survey Project to participate in the survey work. There are a few practical restrictions:

- The training should not hamper the on-going survey work (therefore only two trainees per boat are allowed)

- o There is no extra accommodation aboard for trainees, which implies that trainees should disembark at the end of each day. This means that on-the-job training for more than one consecutive day is only feasible at survey locations with a nearby guesthouse
- o Special land transport need to be organized. Participation upto one month per year is envisaged

**Study tours**

Study tours to some rivers where special measurements are carried out are of interest for both decision level and trainers. River surveys of interest are amongst other expected on the Mississippi, the Rhine and the Yangtze. Three tours of 8 persons are proposed. Study tours are not included in the Contract of the River Survey Project. Hence additional funding is required, see Subsection 8.3.7.

### 8.3.4 Data handling

The training characteristics regarding data handling in general and off line data processing in particular are as follows:

- o Training will focus on operational staff of BWDB/WRIS dataprocessing office
- o Training topics will concentrate on the use of several common (both WRIS and FAP 24) software packages.
- o Timing will depend on actual realization of the BWDB/WRIS dataprocessing facilities and staff availability.
- o Use of FAP 24 facilities may be considered

Two methods of training are proposed :

- o Workshop
- o Long term ad hoc assistance

In 1994 two workshops will be organized of one week each to familiarize the BWDB software engineers with the common software packages.

During one year ad hoc assistance will be given by FAP 24 to BWDB staff in getting their data processing office started. In total one manmonth will be used for the purpose.

### 8.3.5 Studies

For training on study subjects various possibilities are distinguished here.

- o Lectures, seminars (short term) in Bangladesh
- o Seminars abroad
- o Long term participation of BWDB and BUET staff in RSP studies
- o Study abroad

A number of lectures seminars and workshops held by other organizations/projects in Bangladesh will be attended. Especially FPCO, BUET and FAP projects can be mentioned in this context. Besides that the River Survey Project wing organize lectures and workshops to discuss project results.

Some international seminars are of high interest for the project, for instance the one in Australia in December 1994 on flow variation and sediment transport. One such seminar per year for a small group of about 4 persons is recommended.

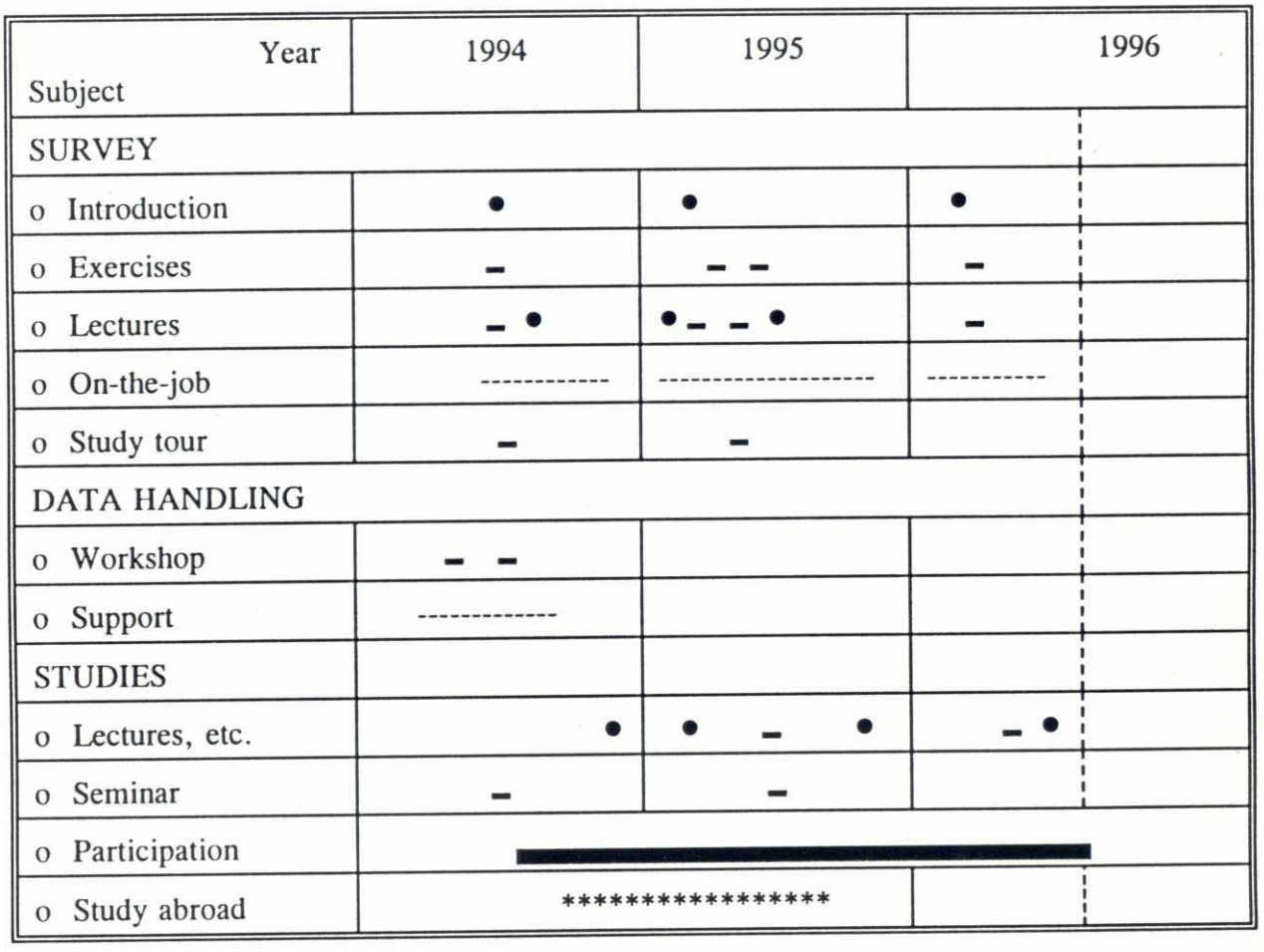
Both BWDB Hydrology and BUET expressed their keen interest in transfer of knowledge from the River Survey Project. Especially in some parts of the study programme including the related special surveys, trainees like to participate. For this reason some BUET staff members of the Department of Water Resources Engineering visited the River Survey Project office to explore the possibilities.

Consultant is of the opinion that substantial transfer of knowledge is only possible via long term participation. It is therefore proposed to involve BUET and BWDB staff in the study programme of the River Survey Project. We think of active, daily participation in selected study topics under strict control (in progress and quality) of our own study team. It is proposed to have in phase 2 rather continuously upto a maximum of 4 trainees working at least 50% of their time in the FAP 24 office. To make it a success, sufficient FAP 24 time needs to be allocated for the transfer of knowledge. 4 manmonths expat staff and 8 manmonths local staff is proposed.

Training abroad is of interest for the project in the 94/95 season. It is proposed to send one man of our study team to the IHE course in the Netherlands.

### 8.3.6 Training programme

An outline for the proposed training programme in phase 2 of the River Survey Project is given in the following figure




Legend:

| | |
|---|---|
| • | day |
| – | up to one week |
| --- | on ad hoc basis |
| ▬ | at least 50% of time |
| **** | full time |
| ¦ | end of project |

**Figure 8.2 : Training programme phase 2**

Some particulars regarding this training schedule are mentioned hereafter:

- o Introductory training is given during one day per season
- o One exercise for BWDB staff and one for the BWDB staff will be organized in the lean season
- o Lectures coincide with the previous introduction and exercises
- o On-the-job training will total one month per year
- o For the study tour one destination per year is assumed
- o The timing for training in data processing is somewhat uncertain and depends on the progress in the WRIS project.
- o Study abroad to be scheduled for 94/95 in order to let the project profit from the result.

The size of the training programme (excl. data handling) is given in the following table.

| Type of training | Duration | Nos. participants |
|---|---|---|
| Exercises on the river | 3 * 4 days | 12 |
| On-the-job in surveys | 2 * 30 days | 2 |
| Study tours | 2 * 7 days | 6 |
| Seminars | 2 * 5 days | 4 |
| Participation in studies | 2 years | 6 |
| Study abroad | 1 year | 1 |

ANNEX XIII/1

# BANGLADESH HYDRAULIC INSTITUTE (BHI)

**Programme and Perspectives for the Development of**

**River Research Institute (RRI), Surface Water Modelling Centre (SWMC) to become BHI**

**Dhaka, March 1994**

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## 1 INTRODUCTION

River Research Institute (RRI) is an institution with a mandate for undertaking studies related to hydraulics. In the past it has received foreign technical assistance designed to increase its capacity for fulfilling its mandate. It has, however, not been able to have an impact proportionate either to its mandate or to the size of its establishment. The few major tasks it has undertaken recently have been in the nature of executing testing assignments, where the technical and scientific control has been mostly in other, mainly expatriate, hands.

In accordance with its mandate RRI should be the lead partner in all but the largest hydraulic investigations, external assistance being sought only in areas where in-house expertise is inadequate. In order to reach this ideal, it is necessary to make radical changes not only in the mode of operation of RRI but also in the way it is perceived by its own staff and by outsiders. This goal cannot be realised with the existing institutional framework.

This has been recognised by GOB in the decision, vide Ministry's No. FC-VI/8P1/90/23 dated 26.01.1993 to bring, SWMC under the administrative responsibility of RRI on 26 January 1993.

It is now the plan that the merger of RRI and SWMC should lead to the establishment of a new institution named Bangladesh Hydraulic Institute (BHI). Similar organisations have proven successful in both developed countries such as Delft Hydraulics, Danish Hydraulic Institute, Hydraulics Research and in developing countries, as for example Lanka Hydraulic Institute (LHI).

The future of the SWMC branch of RRI in the post-donor era is very uncertain. Merely institutionalising it within a government framework would bring it to the operational status of RRI and create another organisation dependent on scarce GOB funds for its survival. The placing of SWMC under RRI will create a cadre of trained professionals who can pursue careers within their specially.

In many instances in the past the question of "institutionalization" of projects was considered from the point of view of how the entity under question fitted into the larger scheme of things. Very little attention was paid to how the institution would function internally. Absence of clear direction with regard to management usually results in the institution being subjected to all the possible bureaucratic rules and regulations.

The concept of Bangladesh Hydraulic Institute (BHI) will introduce an entirely new approach to the management of a small but important part of the water sector in Bangladesh. BHI should be a tightly knit, efficiently and cost effectively run organisation. It should be possible that BHI would eventually become a financially

independent institution able to finance its operation and future expansion through its income. The income would be generated from hydraulic studies which comprise broad investigation of hydraulic problems involving one or more of the activities listed below, where the full professional and scientific capability will be brought to bear. Such assignments will be less frequent in the initial stages, and will become more frequent as the reputation of BHI grows.

1. **Physical Model Investigations:**

BHI will carry out physical model tests for clients using the most modem technology appropriate for a given study.

2. **Mathematical Model Studies:**

BHI will develop and apply mathematical models, adapt existing models for clients.

3. **Field Measurements and Monitoring Programmes and Data Analysis:**

BHI would negotiate medium term contracts with GOB and other Clients to collect and process field data for different purposes.

4. **Desk Studies:**

Desk studies related to hydraulic problems will be carried out for clients.

5. **Data Sales and Equipment Hire:**

This is a self financing operation which will procure data, organise databases and supply quality assured data to clients at a small profit. Equipment hire rates will also be designed to comfortably include the cost of maintenance and eventual replacement with a superior model.

6. **Basic and Applied Research:**

Such work will be either externally or internally funded.

7. **Geotechnical Research:**

Geotechnical research (applied and basic) including soil, concrete and water quality testing.

It is envisaged that BHI should sustain its operation mainly from funds earned from carrying out commissioned work for GOB and other Clients. The basic approach is to

build a national "Centre of Excellence" which will be able to not only sustain itself but also develop further without assistance from the Government Exchequer.

BHI should have a strong presence in Dhaka for easy communication with the various GOB Ministries and Agencies as well as with the other users of the services of BHI.

With respect to SWMC the GOB and DANIIDA have in November 1993 approved a programme for a Phase III of the project which started on 1 January 1994 upon completion of the Phase II (extended by one month) at 31 December 1993.

Besides the merger of RRI and SWMC, it has been decided in the second Workshop of the 'Flood Management Model, FAP 25' in November 1993, that the technology developed in this project should be transferred to SWMC for ensuring its long term sustainability.

The present programme as described in details in the following thus concentrates on the merging of RRI, SWMC for establishment of the 'institutional framework for the two institutions to become: Bangladesh Hydraulic Institute (BHI).

The programme for RRI and SWMC to become BHI comprises three phases as described in Section 7.

In conclusion the development of the SWMC for the 3 years 1994, 95 and 96 is secured by the DANIDA funding. However the RRI traditional unit requires a similar assistance. Such a programme is presented in Appendix 1 to this document.

## 2 BASIC CHARTER OF BHI

The basic charter of BHI should be to bridge the gap between basic research and practical applications, i.e. provide the necessary and up-to-date technology to GOB and others with the water sector of Bangladesh for assessing the consequences of man-made interventions and natural occurring changes in the water regime. This can further be spelled out:

"The BHI has as its primary objective to be instrumental in the application of scientific methods and results in solving practical hydraulic problems".

This aim should be achieved by the Institute by:

1. Carrying out practical hydraulic and related investigations for GOB and other private and governmental institutions in Bangladesh and abroad.

The field of work comprises:

- o Assessment by desk studies and modelling of designs of river training, river erosion control structures, flood control schemes and structures, irrigation & drainage structures, sea-dikes and coastal embankments,
- o Investigations of river flow, flow distribution, morphology, surface and ground water use,
- o Investigations pertaining to water quality, environmental aspects and saline water intrusion,
- o Investigations of quality of construction materials and geotechnical properties of all soils.

2. Carrying out practical hydraulic research related to the present field of work and possibly in other areas with the aim of broadening its field of work when there is a need for such services in the country.

3. Serving the GOB as a knowledge and resource - centre within the field of hydraulics whenever the GOB requires these services including assistance for training programmes.

4. Publishing of results of practical and scientific investigations that will be of general interest to the public or the engineering community.

5. Participating in and conducting Conferences, Seminars & Workshops and other information/public relationship activities.

It is the aim that BHI shall constitute an independent centre within an institutional framework which provides the institute with the necessary guidelines, support and freedom to develop and operate within particular and adequate regulations.

The Institute shall serve for the overall benefit of the whole society and its knowledge and experience are thus available for everybody that might need it, which means that the Institute cannot in principle enter into exclusivity agreements.

It is the long-term aim that BHI shall develop into becoming an organisation relying for its financing to a large degree on funds earned by work for governmental and private clients.

## 3 THE PRESENT SITUATION

The present situation for the institutions that by merger will form the new institution, BHI, is as follows:

### 3.1 River Research Institute

The River Research -Institute (RRI) was established in 1977 by merger of the Hydraulic Research Laboratory (HRL) (founded back in 1948) and the Directorate of Soil Mechanics/Materials.

The newly established Institute received until 1982 assistance from UNDP/DTCD.

Further assistance was provided by UNDP/DTCD from 1985 to 1990 (programme BGD/81/046). In addition to the UNDP project DANIDA provided additional training in Denmark and at BUET and RRI in Bangladesh.

Danish Hydraulic Institute (DHI) was the sub-consultant for this Technical Assistance terminated in the autumn of 1990. The UNDP programme was reviewed in October 1990 by a joint UNDP/UNDTCD/GOB Evaluation Mission.

The following five points of the "Summary and Conclusions" of the report pertains - to the situation of RRI:

(1) An institute of hydraulic engineering in Bangladesh is strongly justified by the severe problems which the country experiences in the field of water resources. The most urgent needs relate to flood protection, bank erosion, siltation, irrigation, cyclone damage and salinity intrusion.

(2) The technical assistance was mainly provided by the Danish Hydraulic Institute (DHI), which was appointed by UNDTCD as Sub-Contractor under contract TCD CON 14/84. The Sub-Contractor advised on the choice of equipment, provided specialist training at RRI and in Denmark, assisted in the design of the new test facilities at Faridpur, and gave advice on hydraulic model studies and field work. The supply of equipment and the provision of fellowships were dealt with directly by UN agencies. Training in mathematical modelling and additional fellowships were financed by DANIDA. Despite some specific shortcomings, the principal objectives of the project were positively met.

(3) As a result of the positive actions of GOB and UNDP, the capabilities of RRI have been increased considerably in terms of equipment, manpower and technical training. It is the opinion of the mission that RRI is now capable of fulfilling its

potential and of making a significant contribution to the implementation of the Flood Action Plan by providing assistance to Government agencies and consulting engineers in the design and testing of hydraulic works.

(4) Certain areas of RRI require to be strengthened in order to produce a balanced organization and improve its level of technical ability and performance. Based on its evaluation, the mission recommends the setting up of a new UNDP/UNDTCD project to:

(a) Strengthen and develop RRI so that it can make a full contribution to the implementation of the Flood Action Plan;

(b) Enable the new organisation to demonstrate its effectiveness and

thereby establish with its clients the credibility necessary for its long-term development;

(c) Maximise the investment made during BGD/81/046.

(5) It is suggested that the project should be targeted at those areas most relevant to the Flood Action Plan; improved capabilities in the physical modelling of rivers and hydraulic structures; better facilities for testing of materials samples; improved workshops and support facilities. The use of computers in data handling and analysis should be promoted, and a capability for mathematical modelling should be further developed. Most of the mathematical modelling required for the Flood Action Plan will be carried out at the Surface Water Modelling Centre (SWMC), so the RRI capability should aim to complement and not duplicate that at SWMC.

In the more than three years since the mission report was written, RRI has been on its own without a Technical Assistance Programme. In this period RRI has, as sub-consultant, provided assistance to a number of FAP-projects of which FAP 9B (Meghna River Study), FAP 1 (Brahmaputra River Training Project) and FAP 21/22 (Bank Protection and River Training Pilot Project) are the most important within the hydraulic modelling sector. RRI has through the execution of the important model study component of these FAP-projects proved that it has benefitted substantially from the UNDP and DANIDA financed assistance. It is however also evident that the need of technical assistance and upgrading of staff and equipment and workshops as recommended by the UNDP - mission is required. The present GOB fund allocations for RRI does not allow it to purchase from abroad the necessary equipment items; the workshops still need instruments and equipment. The present level of expertise of the staff within the various fields of hydraulic is not high enough to ensure the Institute's scientific development. Therefore further assistance is required. Appendix 1 presents a programme targeted on the development of RRI and SWMC to become BHI.

### 3.2 Surface Water Modelling Centre

The Surface Water Simulation Modelling Programme (SWSMP) was established in 1986 with the World Bank as Executing Agency and UNDP and DANIDA as donors. This Phase I terminated in December 1988, after which a bridging project was made until start of Phase III in November 1989. The project was in 1990 established as: Surface Water Modelling Centre (SWMC).

The purpose was to develop numerical 1-D models of the river network as an instrument/tool for comprehensive planning of water resources.

SWSMP, Phase II, was financed by DANIDA and GOB.

This four year project started in December 1989 and was completed ultimo December 1993. Upon successful completion of Phase I, the Phase II aimed at developing models for all regions of Bangladesh. The project further had elements of environmental modelling, salt water intrusion in the SW - Region, I-D sediment transport (morphological) modelling as well as a substantial field programme for data collection. In two monsoon seasons 1991 & 92 substantial support was also given to BWDB - Hydrology.

In order to properly Store and manage the huge amount of data, the project is also setting up advanced field data system based on DHI - FIELDMAN - Software.

In conclusion the SWMC has obtained substantial proficiency in 1-D numerical modelling and is today the most advanced Centre in Bangladesh for this type of modelling. Hence the GOB wishes to make SWMC a permanent institution to sustain, what has already been achieved for the future benefit of the society in the' field of hydraulic studies within the water sector.

Phase III of SWMC concentrates on sustainability of the achievement of Phase I and II. It was started on 1 January 1994 and has a duration of three years.

## 4 BHI's ORGANISATION AND TECHNICAL AREAS OF COMPETENCE

### 4.1 General

BHI's technical areas of competence will be concentrated around specialized knowledge in a number of areas of hydraulics and soil mechanics, with special emphasis on physical modelling of rivers and related structures, numerical modelling of river networks, flood management modelling, performance of related field measurements, management and

analyses of data, soil mechanics testing, materials testing and sediment and water quality analyses.

The development of the technical areas of competence takes place at two levels:

1. The fundamental knowledge of the physical phenomena in the various fields of hydraulics

2. The development and use of improved methods (physical & mathematical as well as computer analyses) of impacts, effects and response of man-made or natural occurring changes in the hydraulic regime.

BHI's present and future areas of competence are spread over a number of fields, that each is using a multiplicity of methods. A description of the areas of work and the methods will be presented below.

## 4.2 Areas of Competence

The present areas of technical competence can briefly be divided into the following main areas:

| | **Field of Works** | **Present Competence** |
|---|---|---|
| 1. | River Hydraulics in general | (RRI & SWMC) |
| 2. | Physical Modelling of Rivers & related structures | (RRI) |
| 3. | Soil Mechanics Testing | (RRI) |
| 4. | Sediment and Water Quality Analyses | (RRI) |
| 5. | Materials Testing | (RRI) |
| 6. | Numerical Modelling of River Networks | (SWMC) |
| 7. | Execution of Field Work and Collection of Data | (SWMC) |
| 8. | Data Analyses & Management | (SWMC) |
| 9. | Water Resources & General Hydrology | (SWMC, RRI) |
| 10. | Environmental Engineering | (SWMC) |
| 11. | Coastal Engineering & Wave Problems | (RRI) |
| 12. | Flood Management Modelling | (SWMC, presently FAP25) |

The main components of these technical areas will remain the same after the merger of the institutions and their re-organisation. It is the plan that the re-organisation of the present services of RRI and SWMC will result in a strong and more qualified organization which will better be able to meet the challenges of the future than would

RRI and SWMC alone. The following briefly outlines the areas of services of BHI. Figure 4.1 shows the planned new basic set-up.

## 4.3 Board of Governors

The BHI is headed by a Board of Governors with members from Government, Research (University) and Private Organisations.
The Board of Governors is responsible for the overall policy of the Institute and ensures that it performs its services in agreement with its charter. The daily management of BHI is performed by a Director General (DG).

## 4.4 Director General

The Director General (DG) is responsible to the Board of Governors for all matters and business of the BHI.

## 4.5 Accounts and Audit Division

The Accounts and Audit Division is in charge of all financial matters and controls the budget. The division monitors both the overall budget of the Institute, its individual Divisions and Sections and performs budget control of individual projects.

## 4.6 River Research Division

The River Research Division (RRD) is a Division of BHI taking over the activities of RRI's present River Hydraulics Division.

The division has three sections with the following specialties:

### River Hydraulics Section

This is the largest of RRI's sections and in charge of the physical modelling activities in Faridpur including the following:

- River Hydraulics & Morphology in general
- Physical Modelling of Rivers & River Erosion Control Schemes
- Flood Control
- Sedimentation Control Engineering
- Flow Distribution Studies

**Estuarine & Coastal Hydraulics Section**

This section has the following tasks:

- Estuarine & Coastal Engineering in general
- Wave studies in general
- Coastal & Embankment Structures

**Structures & Irrigation Section**

This section has the following task:

- Hydraulics & Irrigation structures in general
- Studies of River Training and Bank Protection Works (Structures)
- Studies of Hydraulic structures, gates, locks, barrages etc.
- Drainage & Irrigation Schemes

## 4.7 Computational Hydraulic Division, SWMC

**Numerical River Modelling Section and Flood Management Modelling (FMM)**

This section will be responsible for maintaining the models developed under SWMC, Phase I & II in operative conditions, and further to develop new MIKE 11 based models and use all the models for applications work. It is further responsible for maintaining and use of the FMM technology developed under FAP 25 that will be transferred to SWMC at the end of the FAP 25 project (October 1994).

**Environmental Hydraulics Section**

This new section will be responsible for environmental studies with special emphasis on the use of the modules of MIKE 11 for transport and dispersion of pollution and affluents in the rivers of Bangladesh.

The section should further develop its capabilities to be able to advice on field measurements to be used as basis for numerical simulations.

In addition the section should develop its experience within theoretical aspects of environmental hydraulics & engineering with special emphasis on the problems encountered in Bangladesh.

**Data Management Section**

This section will be responsible for storage and management of all data originating from BHI's own field studies and numerical application work.

**Hydrology & Water Resources Section**

Presently the SWMC is heavily engaged in evaluations of hydrology parameters as part of the preparation of input parameters to their models. Presently the DHI-Software, the NAM - model, is used to derive run-off discharges for catchments.

The SWMC also measures and performs numerical simulations of ground water levels.

The country is in urgent need of knowledge and studies within the field of hydrology and water resources especially pertaining to ground water problems. It is the plan to start with one section in this field of work. The section can later on be upgraded to become a full division.

**Computational Modelling Section (CMS)**

The Computational Modelling Section will be in charge of all models other than MIKE 11 models. As an example CMS will be responsible for receipt and storage for future use of all non MIKE 11 models developed under the FAP - projects and other projects. With SWMC the section is especially responsible for running the MIKE 21, Bay of Bengal Model to provide boundary data for simulations of tides and salt water intrusion in the SW-region and up to the Meghna River in the major network of rivers in the country.

Furthermore the section is responsible for all hard-ware systems within SWMC and BHI in general, and 2-D modelling in connection with specific investigations.

## 4.8 Technology and Services Division

The Technology and Services Division has two sections with the following tasks.

**Maintenance & Security Section**

The section is in charge of all buildings and property of BHI including the maintenance and security staff required.

**Technical Support Section**

The Technical Support Section is responsible for the following activities/tasks:

- Workshops for Model Construction etc.
- Metal, Wood & Electrical workshops
- Libraries in Dhaka & Faridpur
- Transport including maintenance of all vehicles & organization of drivers

### 4.9 Field Measurements Division

The field measurements division has as its main objective to maintain and service the field equipment of the entire BHI.

It has further as its task to deploy the equipment for practical measurements in the field.

All BHI's surveyors belong to this department. The department also has a repair workshop for all field equipment in BHI

### 4.10 Soil, Materials and Water Quality Research Division

The Soil, Materials and Water Quality Research Division of BHI comprises three sections (laboratories), as it is presently the case at RRI in Faridpur. All sections carry out laboratory testing and possesses their own laboratory and equipment in Faridpur. However their capacity for field/work surveys and monitoring will be developed.

**Soil Mechanics Laboratory**

- Execution of Soil Tests as per selected international standards.

**Sediment & Water Quality Laboratory**

- Execution of Sediment and Water Quality Tests as per selected international standards.

**Materials Testing Laboratory**

- Execution of Materials Testing as per selected international standards.

## 5 POTENTIAL MARKET FOR BHI'S SERVICES

Presently hydraulic studies for projects in Bangladesh are performed both in Bangladesh and overseas.

### 5.1 Physical Modelling

With respect to physical modelling all modelling in recent years were performed in Bangladesh except for the Jamuna Bridge where the studies were performed in the Netherlands.

Many projects in Bangladesh are not presently made subject to model testing although the designs in many cases could benefit from the performance of model studies.

It appears that in the foreseeable future there will be a market for physical modelling the size of which depends on the GOB activities in the water sector.

Besides model studies for specific projects more general research projects would be relevant to develop standard type hydraulic structures including scour-protection and standard type groynes and revetments for river training and bank protection tailored for the special conditions and materials available in Bangladesh.

### 5.2 Numerical Modelling

In the field of numerical modelling the market has rapidly expanded in recent years both within the FAP projects and for other water sector projects.

The rapid development in computers has had the result that most modelling can now be done in Bangladesh using detached PC's and work-stations either alone or in networks. Only FAP 21/22 have been carrying out major modelling work outside Bangladesh (in the Netherlands).

The majority of the work carried out to date at SWMC deals with development of the models; however more and more practical applications are being made as well.

The modelling work in the various FAP projects were/are in most cases carried out using SWMC-models running on powerful PC's in the individual FAP project offices.

Now at the start of 1994 when SWMC moves into its Phase III, the main focus of the Centre will be on sustainability of the models already developed and application of these on practical projects paid for by outside clients.

It is therefore the intention of the GOB that from 1994 practically all numerical modelling should be performed at SWMC (BHI) either by SWMC alone or in joint - venture or cooperation between SWMC and other local or foreign Consultants and Institutions.

This will greatly enhance the engagement of the Centre with respect to application work for clients and will be the best and fastest way to further strengthen its already good knowledge and experience in numerical modelling. Besides MIKE 11 modelling, it is planned to set-up a section (Computational Modelling Section) that will be in charge of other types of models and thereby be the ultimate host of all numerical models developed under FAP and other projects.

With respect to numerical modelling of rivers Bangladesh offers an abundant number of problems and challenges. The capability of the staff of BHI in numerical river modelling will in the near foreseeable future reach international standard. On this basis it is a possibility that BHI alone or in joint-venture with foreign consultants will also be able to attract commissioned work for overseas clients especially in the neighbouring countries in Asia.

## 5.3 Field Studies & Measurement

Up to now the RRI has not on its own carried out field data collection. At SWMC this activity has been established as a consequence of the crucial need for acquiring quality data for calibration of numerical models.

It is the plan that the Field Measurements Division shall carry out studies whenever necessary for specific projects and make short period data collection programmes for other clients in the same way as SWMC is presently doing.

It is expected that the market for this kind of services will continue and most likely expand especially within the field of measurements of data on water quality near urban centres and industries and with respect to salinity especially in the SW - region presently suffering from salt-water intrusion in the dry and pre-monsoon season.

## 5.4 Soil Mechanics & Materials Testing

Soil Mechanics & Materials Testing are presently performed in RRI and in other laboratories in the country. It is the plan to review the national scene in this field with the aim of avoiding unnecessary overlapping

It is expected that there will be an increasing need for geotechnical investigations in the country both due to the implementation of the FAP studies and as a consequence of

national development programmes in many sectors as well as for construction projects in the private sector.

### 5.5 Conclusion on Market Potential

In conclusion the market potential for the planned services to be offered by BHI appears adequate to support the important institutional set-up and development of resources within the Institute.

It is however also clear that the market will be very variable and it is, therefore, very important that the staff of BHI is highly qualified and flexible and hence able to change between for example numerical and physical modelling or between modelling and field work. In this way the Institute will better be able to deal with the variation in the work load on different types of studies.

## 6 STRATEGY AND INSTITUTIONAL DEVELOPMENT

BHI's strategy concerning areas of work and methods (strategy for technical development) is based on the description of technical capabilities in Chapter 4 and the Market possibilities in Chapter 5.

The general strategy for developing RRI and SWMC to become BHI is the following:

i) Sustainability of what has already been achieved in recent years in all fields of work.

ii) Highest priority on improving the technical experience & expertise and innovative skills of the staff including its flexibility to cope with varying work assignments and challenges. High priority shall thus be given towards training (on-the-job and theoretical) of the staff.

iii) New methods and techniques should only be introduced when absolutely necessary, i.e. as expressed above sustainability and improvement of staff competence is highest priority.

iv) The re-organization of RRI and SWMC to become BHI will require a big effort on the part of the Institute's management on all levels in order to develop BHI into one coherent and efficient organization able to provide high quality services.

In order to achieve this, it will further be necessary that BHI obtains possibilities for development into a self sustaining organisation.

This will require the willingness of GOB to consider new ways of organizing and controlling the activities of BHI which allows a high degree of freedom in the daily management of the Institute.

It is envisaged that BHI must provide a considerable part of its financing from income generated by selling consultancy services.

Further to this income it will be necessary to secure research and development funds from GOB.

The daily management shall have the freedom to establish employment rules and regulations which in competition with the private sector can attract the highly qualified staff that will be necessary for reaching the professional level necessary for attracting clients.

The daily management will be responsible to the Board of Governors in which the GOB and the private sector have the power to control and guide the management.

There will be alternative ways of setting up a new institutional framework for BHI. These alternatives should be studied in details and considered in combination with a detailed study as to which extent BHI would be able to provide self-financing on commercial terms:

i) BHI should be open towards cooperation with organisations and companies domestically and abroad with the aim of improving its technical competence and position in society.

ii) BHI shall seek donors and development partners to enhance its development plans.

iii) BHI shall do its utmost to publish research results for the benefit of society.

## 7 TIME SCHEDULE FOR THE DEVELOPMENT OF RRI AND SWMC TO BECOME BHI

The development of RRI and SWMC to ultimately become BHI is planned in Phases as shown in Fig. 7. 1.

- Phase I covers the whole year of 1994 coinciding with the first year of SWMC, Phase III. This phase comprises the formulation of BHI requirements and detailed

development plans as well as the administrative procedures of GOB and donor country for funding for RRI.

- Phase II also of one year duration coincides with the first year, ending December 1995, of the New Technical upgrading programme for RRI -Faridpur. It hence includes the implementation of the upgrading of personnel and equipment at RRI, Faridpur.

- Phase III from January 1996 to June 1997 coincides with the last one year of the SWMC, Phase III, but extends further six months. This third phase is thus characterized by being the transition from RRI/SWMC to BHI.

- The new BHI will according to this plan be in operation from July 1997 without major donor financed technical support and assistance programmes.

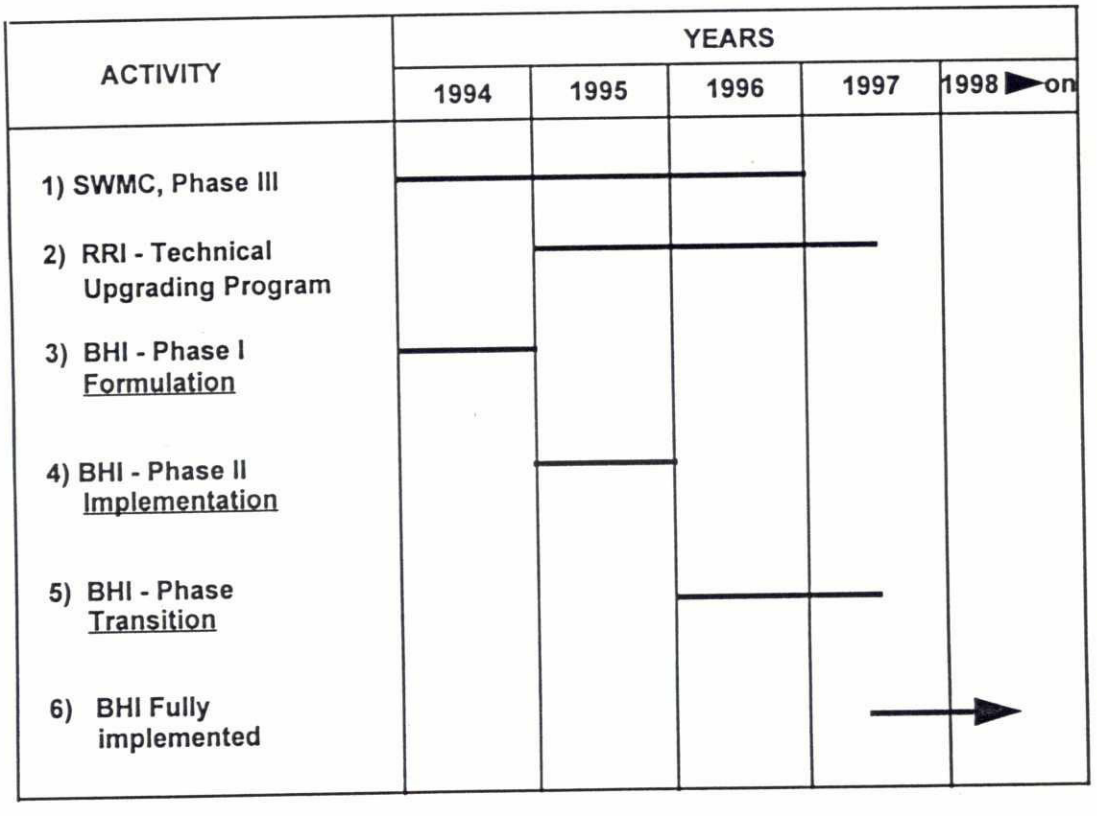


**Fig. 7.1 Time schedule for development of RRI and SWMC to become BHI**

# BANGLADESH HYDRAULIC INSTITUTE

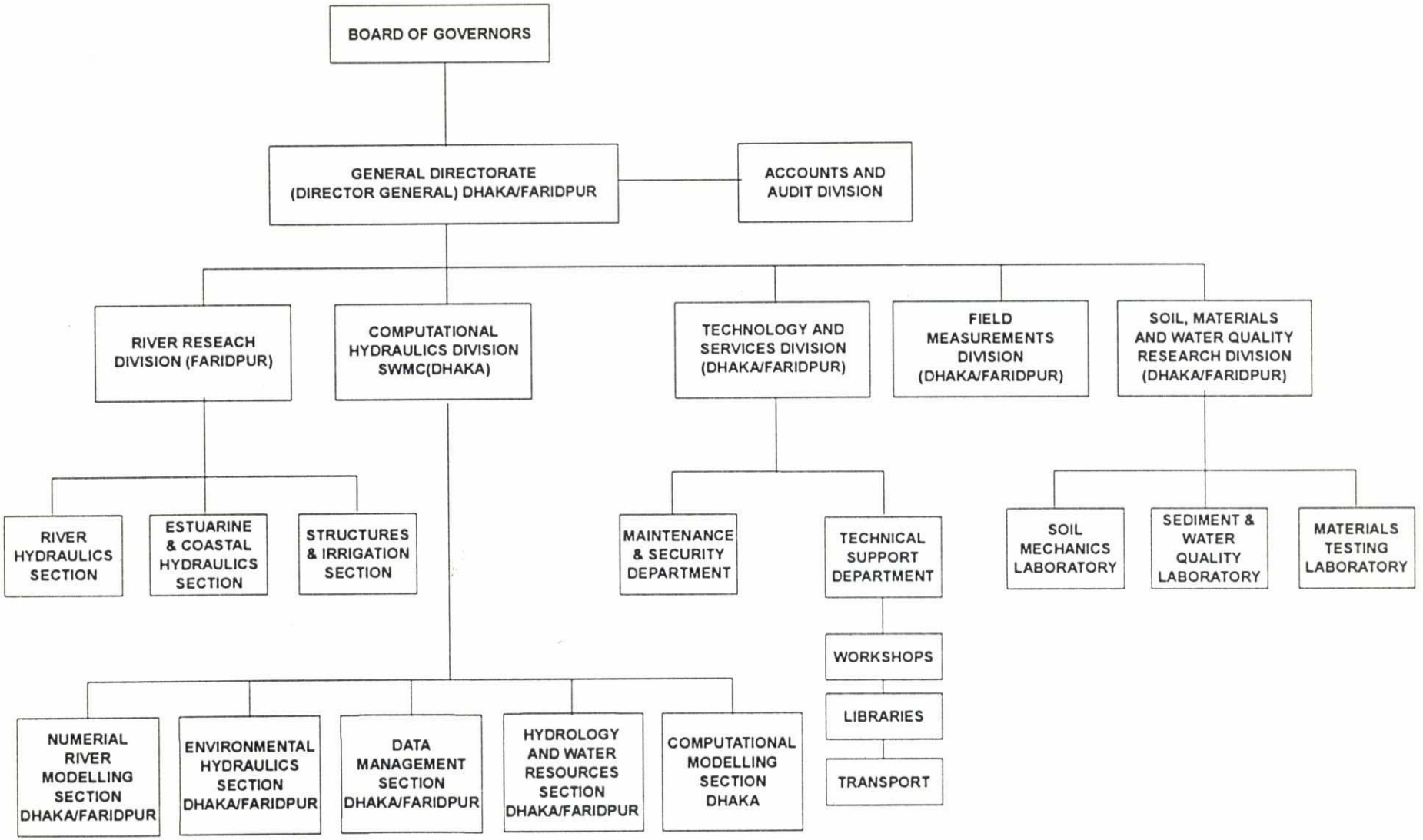


*Fig. 4.1 Plan of Basic Organisation*

# APPENDIX

# PROGRAMME FOR UPGRADING OF

# RIVER RESEARCH INSTITUTE

# TO BECOME BHI

## 1. INTRODUCTION

The River Research Institute (RRI) and Surface Water Modelling Centre (SWMC) is planned to develop to become Bangladesh Hydraulic Institute (BHI) under the Ministry of Irrigation, Water Development and Flood Control of the Government of Bangladesh. The Institute moved to its present location in Faridpur in the South West Region between April and June 1989. By Government order of 26 January 1993 the Surface Water Modelling Centre (SWMC) came under administration of RRI.

RRI has as its mandate to perform hydraulic studies for the design of river training works, bank protection, dikes and embankment structures, hydraulic structures in general and for assessment of flow conditions for all kinds of hydraulic structures.

RRI is also equipped with instrumentation for performing soil mechanics testing, material testing and water quality analyses.

RRI received earlier from 1985 to 1990 technical assistance from UNDP and DANIDA including delivery of various equipment. A technical assistance programme and training in Bangladesh and abroad were undertaken. For a duration of about 5 years, Danish Hydraulic Institute (DHI) was the main consultant for transfer of technical know-how in association with other Danish and Norwegian specialised institutions. As a result of the technical assistance programme, RRI has since 1990 undertaken work as sub-consultant to a number of Flood Action Plan Projects including FAP 9B (Meghna River Study), FAP 1 (Brahmaputra River Training Project) and FAP 21/22 (Bank Protection and River Training Pilot Project).

During the execution of these very important FAP projects RRI has proven that it has developed the expertise of its staff and that the organisation has benefitted from the previous UNDP and DANIDA financed assistance.

However, the funds which it is presently possible for GOB to make available for RRI's development and day-today running costs do not allow for the necessary sustainability of what has already been achieved and for making updating etc. where required.

The present document outlines a programme for remedying this situation. The duration of the programme is 21/2 years which is tailored to the development programme for SWMC, Phase III and the plan is to create at mid 1997 a fully operational Institute (BHI) principally based on the merger of RRI and SWMC.

## 2 PROJECT OBJECTIVE

The present programme has the objective of upgrading the technical capabilities of RRI and ensuring its sustainability as a future important and integral part of BHI.

It is the aim that RRI after the 2½ year project period should have developed its human and equipment/physical resources to a point that will make the joint RRI/SWMC, ie BHI the natural "Centre of Excellence" in Bangladesh with respect to Hydraulic Modelling (Physical and Mathematical) and Soil Mechanics Testing with special reference to the problems encountered in the deltaic and riverine Bangladesh.

Besides technical upgrading the strengthening of RRI/SWMC to become BHI requires the assistance of external expert assistance in setting up proper management procedures and methods of conducting business in an effective and cost effective manner. This activity forms part of the present programme for upgrading of RRI in the process of becoming BHI.

## 3 PROJECT DESCRIPTION

### 3.1 General

The present scope of work of RRI can be divided into four main areas: Physical Modelling, Soil Mechanics Laboratory and Materials Testing, Water Quality Analyses and Numerical Modelling. The following description follows this division.

### 3.2 Physical Modeling

New test halls and other facilities of RRI have recently been completed.

With respect to general running costs and maintenance (O & M), RRI lacks sufficient funding. Likewise funding is not available for the required technical & scientific back-up that is necessary in order for RRI to perform its work up to the required international standards for hydraulic laboratories.

RRI also needs funds for a number of items necessary for conducting the model studies including instruments and other apparatus such as electromagnetic flow meters, flow meters for measuring point velocities, levelling instruments, photographic equipment etc.

The work for the test halls and outdoor facilities for physical model testing comes presently mainly from two sources, namely the FAP-Projects and from the GOB (Water Development Board). With respect to work for FAP Projects (and other similar projects) RRI enters into agreements as subcontractor and carries out the work as per the instructions given by the project. All these projects have had experienced experts on their teams to guide and supervise the work and as mentioned above the RRI performance has been good on these projects. However, the present staff needs more training before it can operate more independently without the supervision of external experts.

The work performed for GOB has previously been rather scarce and of an intermittent nature. However, in the last year, 1993, more and more project work has been commissioned to RRI by the GOB.

This is an area where further improvements could be made when BHI (RRI) is made "A Centre of Excellence" in the sense that all new works such as river training structures and similar should be made subject to review or model testing and subsequent approval prior to implementation and construction.

This would require two things. First that RRI gets an upgrading of its staff through a new technical assistance programme and secondly that GOB enhances as much as possible its use of RRI and commission more work to the organisation than done previously.

The commitment on the part of GOB for the development of RRI is of utmost importance for RRI's development, because only by increasing the work load can the staff obtain more work experience and the organisation develop. A GOB plan to increase RRI's work-load should come out of the necessity of using modelling as a tool to ensure safety and long-term integrity of structures and development schemes within the water sector.

### 3.2.1 Details of Programme for Physical Modelling

The planned programme includes the following

- o One Senior Hydraulic Expert/Consultant permanently for the 2½ year period.
- o Short Term Experts to be fielded when required. This item can include also electronic engineers etc. when required.
- o Training abroad of the newly recruited staff. Detailed programme should be outlined in the inception phase. The training can be either on-the-job training overseas or post graduate studies in Universities (BUET or for example overseas at AIT).
- o Purchase and installation of equipment and instruments required for the laboratory and subsequent training of staff in its use.
- o Allowance for operation and maintenance of existing equipment and new purchase.

## 3.3 Soil Mechanics (Geotechnical) Laboratory

The soil mechanics laboratory is presently better equipped than the hydraulic laboratory. This laboratory has previously received technical assistance under the above mentioned TA-project 1985-90 and has proved its capabilities by performing work for many clients, including a number of the FAP projects. The soil mechanics laboratory is presently in

the need for supervision by a senior expert to maintain its working knowledge and standards. Furthermore there are a number of newly recruited staff who would highly benefit from obtaining working experience abroad. Also some new equipment will be required for the laboratory.

The Soil Mechanics Laboratory requires also the commission of more work from GOB. This is a prerequisite for sustainability of the previous training to maintain the experience and abilities of the present staff.

### 3.3.1 Details of Programme for Soil Mechanics

The proposed programme for soil mechanics comprises the same basic elements as the programme for physical modelling.

With respect to soil mechanics, however, the emphasis will be more on sustainability of the progress that has already been made and on "on the job training" in Bangladesh and abroad of the staff that has been recruited since the previous training in Bangladesh and Denmark.

An important element in the performance of standardised tests is the reporting. It is highly important that the staff obtains knowledge in how best to present the results of testing of many soil tests in a way that is consistent and easy to comprehend for the receiving client. For the soil mechanics it is not envisaged that an expert/consultant is present for the full project duration but that a detailed programme for supervision is defined in the inception phase that in total amount to 18 man months input of outside expertise.

## 3.4 Numerical Modelling

The present programme does not include numerical modelling in RRI as this aspect is covered by the SWMC Phase III training programme.

## 3.5 Institutional and Management Expertise

As mentioned in Section 2 this programme for upgrading of RRI comprises also assistance to the Director General and the management team of RRI/SWMC on its road to become BHI. It is the plan that a total of about 1 year (12 man month) assistance will be required over the 2½ year project period. The tasks for this assistance comprise but is not limited to:

- Assisting in setting up an effective organisation with associated technical control systems.

- Assisting in setting up effective systems for budget control of the Institute as a whole and of the individual technical, research and development projects conducted by the Institute

- Assisting in setting up procedures for the Institute to operate as an independent or semi-independent cost effective and competitive entity in a commercial environment

- Assisting in setting up consistent procedures for writing of reports

- Assisting in setting up procedures for calculation of unit prices for services and for writing high quality proposal which can attract the potential Clients to commission more application and research work to BHI.

## 4 TIME SCHEDULE

The following is a tentative time schedule for the implementation of the programme: