BANGLADESH FLOOD ACTION PLAN

Ministry of Water Resources
Flood Plan Coordination Organization (FPCO)

Environmental Study FAP 16
Completion Report

A Summary of Activities from 1991-1995

April 1995

Prepared by

Environmental Study

FAP 16

ISPAN

IRRIGATION SUPPORT PROJECT FOR ASIA AND THE NEAR EAST

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ENVIRONMENTAL STUDY FAP 16
COMPLETION REPORT May 1995

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ACRONYMS

ADAB	Association of Development Agencies in Bangladesh
ADB	Asian Development Bank
BADC	Bangladesh Agriculture Development Corporation
BARC	Bangladesh Agriculture Research Council
BARD	Bangladesh Academy for Rural Development
BAU	Bangladesh Agriculture University
BBS	Bangladesh Bureau of Statistics
BCAS	Bangladesh Center for Advanced Studies
BDG	Bangladesh Government
BELA	Bangladesh Environmental Lawyers Association
BIDS	Bangladesh Institute of Development Studies
BIWTA	Bangladesh Inland Water Transport Authority
BRAC	Bangladesh Rural Advancement Committee
BUET	Bangladesh University of Engineering and Technology
BWDB	Bangladesh Water Development Board
CIDA	Canadian International Development Agency
DAE	Department of Agricultural Extension
DANIDA	Danish International Development Agency
DDC	Development Design Consultants
DPC	Development Planners & Consultants
DOE	Department of Environment
DOF	Department of Fisheries
DPHE	Department of Public Health Engineering
DMC	Dhaka Municipal Corporation
EPC	Engineering & Planning Consultants Ltd
FAO	Food and Agriculture Organization
FAP	Flood Action Plan
FCD/I	Flood Control, Drainage and Irrigation
FCD	Flood Control and Drainage
FPCO	Flood Plan Co-ordination Organization
ICDDR,B	International Center for Diarrhoeal Disease Research, Bangladesh
ISPAN	Irrigation Support Project for Asia and the Near East
IUCN	International Union for the Conservation of Nature
IWTA	Inland Water Transportation Authority
JICA	Japan International Corporation Agency
LGED	Local Government Engineering Department
MIDAS	Micro Industries Assistance Society
MOA	Ministry of Agriculture
MOEF	Ministry of Environment and Forest
MOWR	Ministry of Water Resources
NGO	Non-governmental Organization
ODA	Overseas Development Agency
PRIP	Private Rural Incentive Program
PWD	Public Works Department

RRA	Rapid Rural Appraisal
RRI	River Research Institute
SIDA	Swedish International Development Agency
SOB	Survey of Bangladesh
SPARRSO	Space Research and Remote Sensing Organization
SRDI	Soil Resources Development Institute
SWMC	Surface Water Modelling Center
UNDP	United Nations Development Program
USAID	United States Agency for International Development
WARPO	Water Resources Planning Organization (formerly MPO)
WB	World Bank
WFP	World Food Program

PREFACE

The completion report that follows represents a summary of activities from 1991 through the completion of the last phase which ended April 30, 1995. The study was designed to provide environmental planning support to the Flood Action Plan (FAP) and the Flood Plan Coordination Organization through the development of EIA Guidelines, an EIA Manual, case and special studies. A second function was to create a cadre of trained engineers, planners, and scientists within the water sector as well as outside, and to create an environmental awareness among policy makers in the government.

FAP 16 was not just one study as many of the other FAP studies were. (ie FAP 17, 14, 23, regional studies etc.). Rather the environmental study was a collection of studies and activities which have led to the completion of more than 45 reports, numerous trained EIA reviewers, and of course EIA Guidelines, an EIA Manual, and a two volume EIA Trainer's Manual.

This completion report is a summary of the activities leading to the development and completion of the many studies and training programs conducted by FAP 16. If the final report were to include the final reporting for all these studies, the document would be too large to carry. Instead the report that follows summarizes the activities and outputs, and provides an annotated bibliography of the various studies conducted and documents produced. Should the reader wish to have additional information about the studies conducted, reference can be sought in the individual study documents.

ENVIRONMENTAL STUDY
FAP 16 PHASE IV COMPLETION REPORT, MAY 1995

1. Background

Following severe floods in 1987 and 1988 the Government of Bangladesh, with active cooperation of the World Bank, created the Flood Action Plan (FAP). The stated purpose of the FAP was to "investigate options for reducing damage caused by floods in Bangladesh and to set the foundations of a long term program to meet Bangladesh's objective of achieving a permanent and comprehensive solution to flood control in reducing the risks associated with economic activity on the floodplains and increasing the economic growth rate of the country".

The FAP was launched formally at a meeting of the G7 in London in July 1989. Their communique stated that "It is a matter of international concern that Bangladesh, one of the poorest and most densely populated countries in the world, is periodically devastated by catastrophic floods.... We stress the urgent need for effective coordinated action...in order to find solutions to this major problem, which are technically, financially, economically and environmentally sound." Following the spirit of the G7 communique, the FAP committed itself to developing environmentally sound projects. It established the Environmental Study component (FAP 16) which was designed to provide environmental support to the FAP regional and subregional studies. Its main objectives were to optimize the benefits of water development projects by reducing adverse environmental impacts and by specifying appropriate mitigation measures.

To achieve its objectives, the FAP 16 study team worked in close consultation with the Flood Plan Coordination Organization (FPCO) and with other FAP studies, especially the regional studies (FAPs 2-6), Town Protection (FAPs 8 and 9), FCD/I Review (FAP 12), the Land Acquisition and Resettlement Study (FAP 15), the Flood Response (FAP 14), Geographic Information System (FAP 19), and Flood Proofing (FAP 23). Advice was provided to other FAP studies as needed. Some of the resources required to undertake the study were shared with FAP 14 and FAP 23.

In addition to the FPCO, FAP 16 also maintained effective technical liaison with other BDG agencies (such as the DOE, BWDB, WARPO, BUET, SPARRSO, and BADC), as well as relevant donor experts to minimize duplication and to provide mutual support. The institutional support and collaboration with the BWDB, DOE, WARPO, BUET, LGED, and other government agencies not only improved the quality of the study output, but also developed cooperation, coordination, and understanding among the institutions. The FAP 16 team periodically reviewed and incorporated into the study guidelines and policy papers relevant findings and recommendations from the activities of international donor agencies such as the UNDP, ADB, CIDA, and the World Bank.

The FAP 16 Study which started on April 1, 1991 has completed four phases. The completion date for Phase IV was April 30 1995. During Phases I and II, (April 1991 - September 1992) FAP 16 developed the draft EIA Guidelines and Manual for the water sector as the first essential step in the implementation of sound environmental projects. It also undertook and completed three EIA case studies in three different hydrological regimes in Bangladesh to field test the Guidelines and Manual. In addition the FAP team completed five special studies on issues related to environmental management in flood control projects. (See Lists of FAP 16 Reports, Annexure 1)

Phase III activities were initiated in October 1992 and completed in October 1993. During

this phase, FAP 16 developed a training program to institutionalize EIA in Bangladesh. To this end, it conducted two EIA skills workshops and trained 32 local EIA practitioners. It also conducted a series of seminars on environmental management for senior BDG civil servants, and prepared a draft paper on the institutionalization of the EIA process in Bangladesh. In addition, it generated more than 30 technical, training-related and institutional reports, adding substantially to the available environmental knowledge in Bangladesh and in the region. During this phase, FAP 16 extended the original Charland studies on the one major river to the other three major river systems. (See List of FAP 16 Reports, Annexure 1 & 2).

Phase IV activities, initiated in March 1994, built upon the previous achievements of the project by continuing to provide training and institutionalization of EIA. Its overall objectives were to promote the EIA process in Bangladesh Government institutions, including the Planning Commission, DOE, MOWR, other ministries and line agencies. Effectively, its purpose was to assist FPCO in assuming the leadership role in developing a comprehensive plan for implementing EIA in the water sector in Bangladesh with support from DOE. Consequently, the emphasis of the extended Phase IV program was institutionalization and training. In addition, during this phase the Charland Study was completed, a large study of floodplain sediment was conducted jointly with FAP 19, the EIA Manual and the two volume Trainer's Manual was completed, and a series of small studies were conducted in the Chenchuri beel area.

2. Phases I - III

The Phase I - II was completed from April 1991 through September 1992. Phase III began in October of 1992 and was completed in October of 1993. As these phases have been reported on fairly extensively in the past, this completion report will only briefly highlight the expected work results, activities, and outputs during that period. A more extensive summary for the Phase IV period (April 1,1994 - April 30, 1995) has been provided in section 3. We begin with the expected results of Phases I - III, which is followed by the activities performed to produce the required outputs during that period.

2.1 Expected Results

Below the scope of work along with the objectives have been shown for the Phase I - III period. The environmental study was to assess the environmental impacts of water control projects and develop an Environmental Impact Assessment (EIA) Guidelines and a User's Manual for examining and assessing the impacts.

2.1.1 Scope of Work

As specified in the original terms of reference, FAP 16's scope of work also included (1) preparing an EIA Guidelines and user's Manual, (2) assessing the likely environmental impacts of flood control projects, (3) developing recommendations for impact avoidance, (4) undertaking special studies of specific environmental issues, (5) assessing and initiating a training program, and (6) organizing workshops to discuss the environmental implications of FCD/I projects. The scope of work also included liaising with BDG agencies and NGOs on environmental issues.

2.1.2 Objectives

Specifically, the objectives of Phases I through III were to:

- Identify environmental issues through a review of environmental literature and studies, consult with flood control project planners, and make field visits to completed flood control and drainage projects and proposed project sites.
- Prepare Guidelines and a user's Manual for IEE and EIA in regional and feasi-

bility studies of FCD/I projects for use in FAP projects.

- Assess likely environmental impacts of flood control projects and develop recommendations to eliminate adverse environmental impacts, as far as possible, from the design, execution and operation of the projects under the FAP.
- Conduct EIA case studies to develop and test the EIA Guidelines.
- Undertake special studies of specific environmental issues identified.
- Assess needs for training GOB personnel in EIA methods for FCD/I projects and develop an EIA training program to include the applications of new EIA tools such as GIS.
- Prepare a position paper on institutional development of the EIA process for FPCO and the Ministry of Water Resources.

2.2 Activities and Tasks

The activities during Phases I-III consisted of conducting a series of studies, providing support to other FAPs and relevant BDG agencies, enhancing the EIA capability of the study team, and developing the basic concepts of EIA training for professionals working in the water sector. These activities occurred in two stages.

Stage I activities consisted of (1) preparing an *Environmental Position Paper*, (2) identifying and designing 26 *Special Studies* based on the *Position Paper*, and drafting outline TORs for review by FPCO and POE, (3) preparing an *Inception Report* summarizing the findings of the first two tasks, and (4) developing a detailed work plan.

Stage 2 activities included reviewing the available Guidelines and Manuals on EE and EIA and preparing a draft EE and EIA Guidelines and Manual. The Guidelines specifically addressed EIA at the feasibility level, while the Manual, a companion document to the Guidelines, covered in greater detail the technical aspects of EIA. To test the appropriateness of the Guidelines and Manual, the FAP 16 study team conducted three EIA case studies on the Surma-Kushiyara FCD/I Project in the NE Region, the Tangail Compartmentalization Pilot Project (CPP) with FAP 20, and the Bhelumia-Bheduria Project in the Bhola district.

In addition, the study team conducted five special studies which involved extensive collection of field data and a detailed review of existing information. Two review studies, one on the *Wetlands Inventory* and an *Annotated Bibliography on Vegetation Ecology* were also initiated during this period.

During this stage, FAP 16 prepared the Final Report and TORs for Phase II and submitted them to FPCO. The report described the main FAP-related environmental issues that focussed on future policy, legislative and institutional development action needed in the water sector.

In addition to the reports produced during this period, the study team worked with FPCO and other FAP supporting studies and components. It provided advice and support to the Regional Studies, conducted a needs assessment for EIA training in the public and private sectors, conducted EIA Skills Workshops to train professionals in the water sector, particularly personnel from FPCO, DOE, and BWDB, NGOs and private sector, and developed course material that could be used for future training. The FAP team further extended the original Charland Study (which only covered the Brahmaputra-Jamuna) to include the Ganges, Padma, and Meghna rivers. Additional tasks included organizing a series of seminars on environmental management for senior BDG civil servants, and preparing a draft paper on the institutionalization of the EIA process in Bangladesh.

2.3 Outputs

FAP 16 met all of the objectives set for Phases I-III. The outputs included 32 EIA professionals trained as reviewers, 29 reports on policy and technical analysis, and support to BDG agencies and other FAP programs. Although the TORs only required the development of the EIA Guidelines and Manual, FAP 16 conducted three case studies to field test them. It also conducted seven additional studies and produced reports in support of the Guidelines. These reports were not specified in the original TORs but were produced in agreement with FPCO. The completed reports were submitted to consultants and review committees for comments. The reports were upgraded and were accepted by FPCO. Additional work was needed to upgrade the reports on vector borne-disease incidence and the kala-azar epidemic in Bangladesh.

A total of 1,400 copies of the different reports were sent to FPCO for distribution to government agencies, NGOS, and private organizations. All reports produced by FAP 16 during Phases I through III are listed below.

2.3.1 Reports

EIA Guidelines and Manual

1. Guidelines for Environmental Impact Assessment, October 1992.
2. Manual for Environmental Impact Assessment, April 1995.

EIA Training

3. Needs assessment report, January 1992.
4. Environmental impact assessment skills training workshop: Master training file. Volume I, II, and III, September 1993

Policy and Institution

5. Environmental position paper, October 1992
6. An outline of policy and legislation related to environment in Bangladesh, September 1993
7. Institutionalizing the EIA process for the water sector projects, a discussion paper, April 1995

2.3.2 Additional Reports

EIA Case Studies

7. EIA Case-Study: Surma-Kushiyara Project, June 1992.
8. EIA Case-Study: Compartmentalization Pilot Project, December 1992.
9. EIA Case-Study: Bhelumia-Bheduria Project, November 1994.

Special Studies

10. Potential impacts of flood control in the biological diversity and nutrition value of subsistence fisheries in Bangladesh, April 1995
11. Effects of flood protection on fertility of soils at the Chandpur Irrigation Project, July 1993
12. Special studies project: The kala-azar epidemic in Bangladesh and its relationship to flood control embankments, April 1995
13. Impacts of flood Control on vector-borne disease incidence in Bangladesh, December 1992
14. Vegetation ecology of the Sundarbans: Annotated Bibliography, January 1992
15. Wetland inventories and conservation, September 1992
16. Demographic, health and nutritional impacts of the Meghna-Dhonagoda Embankment, December 1992
17. The dynamic physical and human environment of riverine charlands: Brahmaputra-Jamuna, Ganges, Padma and Meghna River Systems (4 Volumes), April 1995

18. Charland study other reports (8 Volumes), April 1995
19. Charland flood proofing study, April 1995

3. Phase IV

Phase IV was originally scheduled to follow-on directly after Phase III ended in October of 1993. Due to procedural reasons regarding the signing of agreements between USAID and the Government of Bangladesh the Phase IV did not get under way until the end of March 1994. In fact as far as actual work time was concerned, FAP 16 had only 13 months to accomplish the 18 month scope of work. Below, as was done with section 2, the expected results, project activities, and outputs have been described. The activities have been described in somewhat more detail for this last phase as it has not been reported upon other than in quarterly reports.

3.1 Expected Results

As with section 2, the scope of work for Phase IV along with the objectives are shown below. The goal of the additional project effort during Phase IV was to improve the managerial and technical effectiveness of the country to plan and implement environmentally sustainable development programs. Specifically, the project's purpose was to refine and disseminate techniques and technologies for assessing the environmental impacts of FAP activities. The project, through its participatory EIA skills training program, EIA Guidelines, Manuals, Case Studies, and Special Studies, was able to successfully achieve this overall goal.

3.1.1 Scope of Work

In Phase IV, FAP 16 continued the activities initiated during Phases I through III. This involved finalizing the Charland Study, the EIA Manual, the two volume Trainer's Manual, the case studies, and the Kala-azar and Fisheries Special Studies. A major part of the scope of work involved EIA training and institutionalization of EIA in Bangladesh. The training activities included (1) identifying and training professionals in order to transfer the responsibility for EIA training to them, (2) conducting EIA skills workshops for EIA professionals from different BDG agencies, NGOs and private organizations, and (3) conducting a series of seminars to deepen understanding of specific environmental issues in the water sector.

In addition, the scope of work also included conducting a special study of the role and contribution of floodplain sediment to the formation of soils and their fertility, conducting a short EIA study (not required by the SOW) in the Chenchuri Beel area, and completing a POE Fisheries Technical Support Activity.

3.1.2 Phase IV Objectives

The broad objectives of the Phase IV program were to (1) assist other FAP studies, (2) strengthen and enhance government and private sector organizations' EIA capability by upgrading EIA training for the relevant agencies, and (3) conduct environmental studies, one of which was a special study on the effect of flood-borne sediments on soil fertility in the floodplains of Bangladesh. The specific objectives were to:

- Promote institutionalization of EIA through development of a sound long-term system that effectively incorporates EIA into the water resource project cycle, and provide support to the ongoing development of local environmental capabilities.
- Provide information and professional support to the FAP on specific environmental issues.
- Establish a sound working relationship with the Department of Environment.
- Establish a basis for long-term training in EIA in Bangladesh, especially to serve the needs of the water sector.

- Develop a cadre of EIA professionals capable of reviewing EIA documents.
- Conduct a sedimentation study to improve basic knowledge about the floodplain sedimentation processes in Bangladesh.

3.2 Activities and Tasks

The activities and tasks of the Phase IV program largely centered around training in support of institutionalization, improvement of the EIA guidelines and manual, and a continuation of the environmental awareness series. Below the activities and tasks have been shown by activity type which include institutional related, training and awareness activities, EIA Guidelines and Manual strengthening, and POE activities.

3.2.1 Institutionalization Process

Through the training of 108 scientists, engineers and planners of some 27 governmental and private sector institutions, ISPANs FAP 16 has built up a core group in government and the private sector that will grow as each of the individuals has an impact through training and transfer of the skills learned, to other individuals in their organizations. Environmental awareness among engineers, planners and policy makers has been strengthened through the series of 6 seminars held by FAP 16. A total of more than 500 policy makers, planners and engineers have been sensitized to environmental issues through participation in the six major environmental seminars held and conducted by FAP 16. Through FAP 16's efforts and through collaboration with FPCO and the DOE the idea of establishing an environmental cell or unit within the water sector has been readily accepted and steps are being taken for its eventual establishment.

The ISPAN FAP 16 program also sent six senior level government policy makers, engineers and planners to the US for training and awareness building on EIA and GIS technologies. Through the 3 week training and study tour program the participants were able to observe and work with top level environmental and GIS scientists using the tools of EIA and GIS on large water management problems similar to those found on the river systems of Bangladesh. The senior government officials who participated were, on their return to Bangladesh, active in the EIA and GIS training programs sponsored by FPCO, FAP 16, the DOE and USAID.

Due to the skill development in the environmental impact assessment procedures developed over the life of the project by the FAP 16 personnel, a very strong environmental training and environmental awareness delivery skill has been established. This skill and the ability to transfer it, will likely continue to support environmental awareness and impact methodology among organizations such as Dhaka University, Jahangirnagar University, BARC, IUB, and others that receive inputs from FAP 16 trained staff in the future.

From the very beginning of FAP 16 it became evident that institutionalization of the EIA process is essential to the development and investment process in the water sector. Equally important was developing sound institutional mechanisms for environmental assessment and management. FAP 16 began that process and it needs to be carried forward. It is expected that institutionalization of the EIA process in the water sector will lead to integration of environmental concerns in the entire water development planning system. FAP 16 seminars, skills workshops, supports to the planning process, and reports, have shown that EIA must remain as an integral part of water sector planning in the future. To maintain this momentum, a well-defined and officially-recognized framework within water sector planning institutions for the various stages of environmental assessment, must be firmly established.

The FPCO, through the efforts of FAP 16, has endeavored to institutionalize the EIA process

within FAP, but the EIA process has significance beyond FAP, and indeed even beyond the water sector. Institutionalization of the EIA process within the Government's recognized development planning process should be the ultimate objective. A beginning has been made within MOWR, and this is expected to widen the process further within the water sector, to include DPHE, WASA, BIWTA, MOA, MOFLS and even MOEF.

FAP 16 furthered the institutionalization process when it brought out "**Institutionalizing the EIA Process for Water Sector Projects, a Discussion Paper**" in April 1995. This paper outlined the present state of environmental assessment and institutional arrangements in Bangladesh, identified revisions to the procedures for project formulation, design and approval to ensure environmental examination, provided a timetable for implementation, and suggested modifications to the current institutional arrangements for this task. FAP 16 also drafted the PER proposal and defined the place of IEE in the EIA process.

Other elements of the Institutionalization Work Plan carried out by FAP 16 were as follows:

- Drafting of a proposal for setting up an EIA cell in FPCO including organizational diagram (Annexure 3).
- Training of IMED and Planning Commission officials in EIA review and monitoring
- Training on the EIA process for profess ionals in the private sector
- Promoting of graduate studies in envir onment in academic institutions (Notably in the Independent University.
- Conducting seminars on the EIA process and proceedings.

The institutionalization process has also been carried forward by FAP 16 through the following papers which have been annexed to the latest revision of the institutionalization discussion paper:

- Survey of selected institutions capable of long-term EIA training.
- Ways in which EIA training can be organized.

3.2.2 Training and Awareness

Since establishing a basis for long-term EIA training in Bangladesh (i.e. as part of the institutionalization process) was a major objective of Phase IV, the training activity during the period of March 1994 through April 1995 consisted of conducting and organizing (1) a Training of Trainers (TOT) workshop to develop a critical mass of EIA trainers capable of delivering EIA training to subsequent groups of EIA reviewers, (2) four EIA skills training workshops to train 60 professionals capable of reviewing EIA documents, (3) three weeks of EIA training in the United States for six senior and mid-level Government of Bangladesh (GOB) officials, and (4) a series of seminars on environmental studies to sensitize the GOB and private sector professionals to the future need for institutionalization of EIA in the country. Additional supporting activities included (1) conducting a series of rapid field surveys to generate reports that could be used during training, and (2) developing an annotated bibliography of environmental reference material to give to the workshop participants for reference.

3.2.2.1 Training of Trainers Workshop

A Training of Trainers (TOT) workshop was conducted in May and June of 1994. Sixteen professionals from FPCO, BWDB, Ministry of Water Resources, LGED, DOF, and FAP 16 participated in the workshop. Ten of the sixteen professionals trained were from the government and six were from FAP 16. Four of the participants were women. (The Participant List is provided in Annexure 4). All participants had previous experience with EIA; the participants from BDG agencies had attended the EIA skills workshops conducted in 1993,, and the FAP 16

team developed the EIA Guidelines and Manual and field tested them in three different BWDB project sites.

As the objective of the TOT was technology transfer, participants developed the skills, knowledge and aptitude to facilitate and train successive groups of professionals to review EIA documents. They learned to use the seven-step model, an integral part of the experiential learning methodology, and were sensitized to the importance of using adult learning techniques in training.

The TOT was conducted over a period of four weeks. Two ISPAN trainers, a training specialist and an EIA content specialist, conducted the training. They also integrated the EIA Skills Workshop course material developed during the 1993 workshops to develop a first draft of the Trainer's Manual that could be used by the TOT graduates for future training. This Manual has been subsequently revised to reflect the changes in the training program established through experience in carrying out the 4 EIA skills workshops.

3.2.2.2 EIA Skills Workshops

Following the Training of Trainers workshop, the graduates of the TOT took ownership of the training program. They conducted four EIA skills workshops from June 1994 through January 1995, and trained sixty-one professionals from 27 government and private organizations. Eighty percent of the trainees were from the government, while twenty percent were from NGOs and consulting firms (Table 1). Twenty percent of the participants were women. A large majority 33 percent were engineers, 16 percent were economists, 9 percent were chemists, 8 percent were fisheries specialists, 7 percent were agronomists, 6 percent were environmental specialists, five percent were sociologists, 3 percent were soil scientists, 3 percent were zoologists, 3 percent were specialists in forests, and 8 percent were from other disciplines (Table 2). The participant list is provided in Annexure 5.

The overall objective of the one month-long workshops was to enable participants to use the EIA Guidelines developed by FPCO/FAP 16 to study the potential environmental impacts of proposed projects and ensure that they are environmentally sound. The program design was based on sequential presentation of the elements in the EIA process. The program was implemented through eight modules which were based on the procedural steps of the EIA process developed in the Guidelines (See Figure 1, Steps in the EIA Process).

All four workshops were designed to stimulate interaction and sharing of information among participants. The format included short interactive lecturettes, followed by small group activities, country specific discussions and group presentations. The methodology used in the workshops was based on principles of adult learning which assume that adults learn best when they are actively involved in the learning process by doing things, discussing and analyzing concepts, rather than passively listening and observing. Consequently, the participants were involved in activities, reflected on them to gain insights, drew conclusions, and then applied what they learned to real life situations. In short, the workshop was experiential in nature and participant centered.

Workshop evaluations were overwhelmingly positive. Ninety-three percent of the participants said that the workshops achieved more than their objectives, while 79 percent said that they exceeded their expectations. Ninety percent said that the workshops achieved their expectations. (See EIA Skills Workshop, Final Report, Annexure 6).

Table 1: Number of Participants that Attended the EIA Skills Workshop by Organization

ORGANIZATION	NUMBER OF PARTICIPANTS
Government	
Bangladesh Water Development Board (BWDB)	17
Flood Plan Coordination organization (FPCO)	14
Department of Environment (DOE)	10
Department of Fisheries (DOF)	8
Ministry of Water Resources (MOWR)	7
Implementation, Monitoring, Engineering Division (IMED)	5
Planning Commission	6
Local Government Engineering Department (LGED)	4
Forest Department	4
Water Resource Planning Organization (WARPO)	2
Ministry of Land	1
Non-government Organizations and Parastatals	
Bangladesh Consultants Ltd. (BCL)	4
Petrobangla	3
Development Design Consultants Ltd	3
Bangladesh Engineering and Technological Services	2
Bangladesh POUSH	2
CARE-International	2
Bangladesh Agricultural Research Council (BARC)	1
BRAC	1
AQUA Consultants & Associates Ltd.	1
House of Consultants Ltd. (HCL)	1
Engineering and Planning Consultants Ltd. (EPC)	1
Bangladesh Unnanyan Parishad (BUP)	1
Kranti Associates	1
Dhaka University	1
Development Planners and Consultants (DPC)	1
Proshika Manobik Unnayan Kendra	1

Table 2: Professions of Participants that Attended the EIA Skills Workshops

PROFESSIONS	NUMBER OF PERSONS
Engineers	34
Economists	16
Chemists	9
Fisheries Specialists	7
Agronomists	6
Others	6
Environmental Specialists	5
Sociologists	4
Forestry Specialists	3
Soil Specialists	3
Zoologists	3
Geologists	2

The first three workshops were conducted in English because expatriate consultants were involved in either conducting the workshops or in monitoring them. The following three were conducted largely in Bengali. Participant involvement and interaction significantly improved after Bengali was used as a medium of instruction.

With each workshop experience, the FAP 16 team used the lessons they learned to improve the design of the program. For instance, at the end of each day the team met and critically evaluated the day's activities and drew insights into the strategies that worked or did not work, and the appropriateness of the content of the material that was taught, and accordingly improved the plans for the following day. At the end of each workshop, the team met and reviewed the course content and workshop design. The constant monitoring enabled the trainers to provide a more tailored approach to the training.

To better fit the revised course content and schedule, the trainers also upgraded the Trainer's Manual. The revised Manual and lesson-plans provide more comprehensive information than the previous edition. The exercises and examples more accurately reflect the Bangladeshi conditions and experience.

3.2.2.3 Awareness Training through Seminars

FAP 16 organized and conducted 3 one-day seminars on environmental studies. The seminars brought together professionals who were interested in environmental and water related issues from key BDG and private sector organizations. Their objectives were to provide a forum for exchange of ideas on environmental issues, to

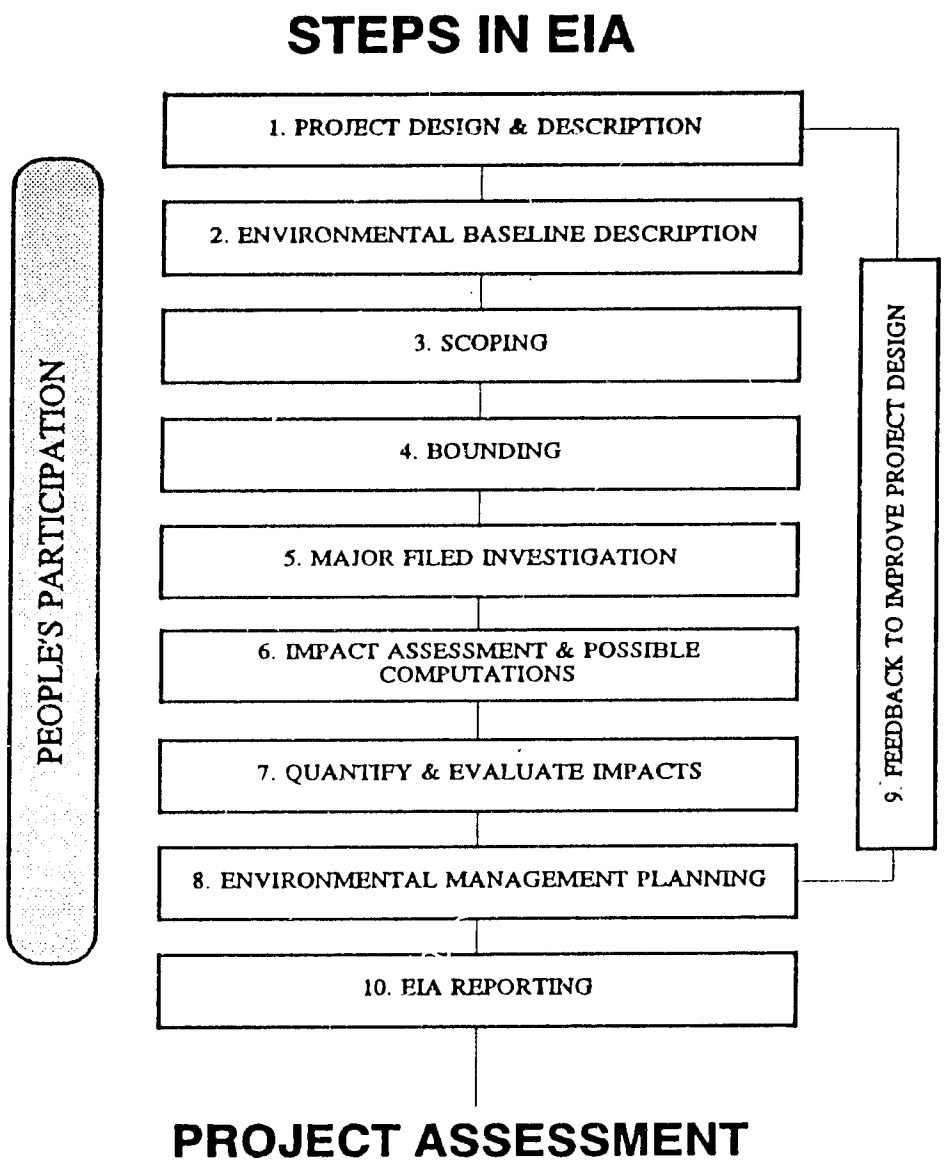


Figure 1 **Steps in the EIA Process**

give participants a better sense of policy direction, and to create greater awareness of the issues concerning policy articulation and implementation relating to the Charlands, EIA methodologies and the institutionalization of EIA in Bangladesh.

Consequently, the seminars focussed on the following topics: (1) the charland resources of Bangladesh, (2) EIA methodologies used in Bangladesh, and (2) institutionalizing the EIA process in Bangladesh. The seminars were inaugurated by the Secretary of Water Resources, the Secretary of Environment and Forest, the USAID Project Officer and ISPAN officials. All three seminars were well attended and participant involvement and interest were high. More than three hundred people attended the seminar series from sixty- one different organizations.

Seminar I

The technical session on the *Charland Study* followed the inauguration. Four ISPAN specialists who conducted the study presented the study findings on the resources available in the Charlands of the major river systems in Bangladesh, and the socio-economic condition of the people who live there. The seminar was attended by over ninety professionals from BDG and private sector organizations. They included policy makers, planners, scientists, engineers, and professionals working in other FAP studies.

Seminar II

The theme of the second seminar was *EIA methodologies and their use in Bangladesh.* Its primary objective was to promote discussion between the principal proponents using EIA in a number of sectors in Bangladesh, with the hope of addressing common problems related to implementation of the varied methodologies and to seek constructive solutions to these problems. The seminar began the process of bringing together concerned groups of EIA practitioners and reviewers from the government, consulting firms, NGOs and other FAPs who were interested in sharing their experiences and views. This is crucial to the improvement of existing Guidelines and for the future development of EIA Guidelines in sectors that do not as yet have them (e.g. agriculture, energy, industry, fisheries etc.).

The general nature of the discussion was that successful development of EIA Guidelines for different sectors was critically dependent on policy direction. There is a need for political will and legislative support if EIA is to be integrated in the planning process. The participants recognized that EIA methodology is complex in nature and that further studies are needed to improve it.

Seminar III

Seminar III brought together all EIA skills workshop trainees to determine how they had applied the skills they learned in the EIA skills training in their own jobs. A secondary objective was to determine the future training needs in the country and how the EIA process could be further strengthened and enhanced. The trainees represented were from the BDG, consulting firms, and NGOs that work in the water sector.

While some trainees affirmed that there was limited scope for applying their EIA skills on the job, most agreed that their training helped them to assess EIA documents, to plan projects, and to develop baseline data. To enhance the EIA capability in the country, the trainees felt that EIA training should be continues and extended to practitioners, EIA team leaders and policy makers. They also underscored the need for more stringent environmental policy and the development of government machinery to ensure the environmental sustainability of projects.

3.2.2.4 Overseas Study Tour and Training

One of the objectives of Phase IV of FAP 16 was to assist in the institutionalization of the EIA process and to strengthen the EIA capability of relevant government agencies. To accomplish this six senior level BDG officials were sent on a study tour training program in October 1994 to the USA. The participants were from the DOE, FPCO, MOWR, IMED/Planning Commission, and the BWDB. The Secretary of the Ministry of Water Resources and the Director General of the Department of Environment led the tour.

The objective of the training and tour in the US was:

- To review and become more familiar with the Environmental Impact Assessment (EIA) process in the U.S. and how it is used to ensure that water resources project options under consideration are environmentally sound
- To review and become familiar with Geographic Information System (GIS) technology and to see the extent to which GIS is being used for water resource planning and environmental studies in the U. S.
- To discuss and review the utility and the potential applications of both EIA and GIS in Bangladesh and how these tools can be used to strengthen national, regional and local water resources planning.

The study tour included visits and training sessions in Washington D.C., the Corps of Engineers environmental station in Vicksburg Mississippi, Champaign Illinois and the areas affected by the 1993 Mississippi River flood in Illinois, and Ft. Collins, Colorado. The total time for the tour and training was 3 weeks. The group met in Washington D.C with high level project planners of the U.S. Government and organizations such as the World Bank, U.S. Bureau of Reclamation, members of the Interagency Floodplain Management Review Committee, and the Institute for Water Resources U.S. Army Corps of Engineers.

Training occurred at the Corps of Engineers headquarters for the Mississippi River in Vicksburg Mississippi, at the Illinois State Water Survey in Champaign Illinois, and at the International School of Water Resources of Colorado State University in Fort Collins, Colorado.

3.2.3 Supporting Activities

The following activities have been completed in support of the training activities as well as in support of the goal of the project to refine and disseminate techniques and technologies for assessing the environmental impacts of FAP activities. The field studies and the annotated bibliography were activities in support of the training programs and the floodplain sedimentation study was an activity in support of the goal or purpose of the project.

3.2.3.1 Field Study for EIA Skills Workshops

The EIA skills training combined group activities and field work. Consequently, the participants of the EIA Skills Workshop visited BWDB project sites to apply the skills and the concepts they learned on the impact of projects on the environment. Some of the sites they visited were briefly studied by the FAP 16 team. The purpose was to learn *a priori* the situation existing in those areas so that the field visits could be properly designed. A report was put together on the findings of the brief studies made on the following FCD/I project areas:

- Dhaka-Narayanganj-Demra Project
- Narayanganj-Narsingdi Irrigation Project: Demonstration Unit
- Narayanganj-Narsingdi Irrigation Project: Block 'A'
- Patakhali-Konai Project

The combined report has been incorporated into Volume II of the Trainer's Manual in order that it can be used for future training.

3.2.3.2 Annotated Bibliography

To support the training objectives, the FAP 16 team members prepared an annotated bibliography on environment and environmentally related studies. The references were integrated to prepare a consolidated document that can be used for quick reference. The bibliography has been incorporated into Volume II of the Trainer's Manual for use as a supplemental handout during training.

3.2.3.3 A Study of Sedimentation in the Brahmaputra-Jamuna Floodplain

The study was undertaken to understand and interpret the role of sedimentation in maintaining soil fertility and the process of soil formation on Bangladesh's floodplains. It also attempted to gain an understanding of first-order estimates of the total sediment budget on the Brahmaputra based on analysis of existing hydrological records. The study built on knowledge gained from the earlier investigation conducted by FAP 16 (1993) in the Chandpur project area.

The study area occupies parts of the Jamuna and Old Brahmaputra floodplains which together cover 16,344 km2 (about 11 percent of the country). The alluvial sediments in the study area belong to the Brahmaputra-Jamuna system.

On the basis of the exploratory investigations in the study area, support from a GIS database, and results of a sedimentation zoning model, two study blocks were selected for detailed characterization and sediment sampling: one in Sharishabari thana under Jamalpur district; the other in Bhuapur and Kalihati thanas under Tangail district. Each block comprised a rectangular block approximately 5 km. by 2 km.

Within each of the study blocks, 13 sample plots measuring approximately 10m x 10m were selected to represent the major flood and sedimentation regimes identified. During the 1994 flood season few of the sampling sites received sediment, as areas typically flooded were not inundated by river water. This was due to extremely low flows in the Jamuna river system. On the sites that did receive flood water, sediment samples were collected from traps, and mats after the flood water receded. Soil samples were collected from soil profiles as well as the topsoil from each of the sampling sites. These sediment and soil samples were analyzed in the laboratory for nutrient content. Agriculture practices and inputs were recorded in the field for each sampling site.

In the study area, floodplain sedimentation rates were measured using the artificial radionuclide ^{137}Cs. Sediment samples for Cs analysis were collected with sediment cores and by hand sampling through trenches dug at the sampling sites.

The study findings show that within the study area:

- most sediment is deposited close to the active Jamuna channel, and amounts decrease progressively with distance from the channel
- average rates of sediment deposition correlate well with different geomorphic ages of floodplain identified on earlier soil surveys
- in general, sedimentation rates are up to 4 cm/year in the active floodplain and low(< 1cm) or negligible in the older floodplains, with some localized exceptions
- sediment contains more nutrients than the adjacent soils of the area. Data of the study indicate that the soils on the

active and young Jamuna floodplain which have received recent increments of new alluvium do not have higher nutrient content than the soils on the older floodplains which apparently have not received such sediment.

The findings of this study provided important new information on the rates and location of sedimentation on the Jamuna floodplain, on soil fertility, and on techniques of sediment sampling. Important lessons were learned that can guide future studies.

Because of the enormous significance of sedimentation and its benefits for river control planning, it is recommended that confirmatory studies be carried out on the Jamuna floodplain and be extended to other floodplains where flood protection works are already in place or are planned. The future studies should take into account the different kinds of protection, drainage, and irrigation works.

Because of the exceptionally low flood of 1994 and the fact that the study took place during only one dry season, it is recommended that the study be continued on the Jamuna floodplain in 1995. The study was undertaken to understand and interpret the role of sedimentation in maintaining soil fertility and the process of soil formation on Bangladesh's floodplains. It also attempted to gain an understanding of first-order estimates of the total sediment budget on the Brahmaputra based on analysis of existing hydrological records. The study built on knowledge gained from the earlier investigation conducted by FAP 16 (1993) in the Chandpur project area.

3.2.4 Activities in Support of Strengthening the EIA Guidelines and Manual

The EIA Guidelines and Manual are "living documents" and will from time to time require refinement, additions, and sometimes change. During the course of Phase IV, some activities were conducted at the request of FPCO which assisted in the strengthening of both. The following is a description of the activities leading to suggestions for strengthening of the documents.

3.2.4.1 Environmental Study of the Chenchuri Beel Area

In producing the EIA Guidelines, the FAP 16 team undertook a number of case studies in several parts of Bangladesh. Time and resource constraints did not, however, allow the team to cover all of the FAP regions. In the course of preparing material for the EIA Skills Workshops, and later during the actual training sessions, it was felt that more field testing of certain concepts and methods involved in EIA would help build and improve on the Guidelines. Consequently, based on the request from FPCO, a rapid environmental study was undertaken in the Chenchuri Beel area located in the southwestern region of Bangladesh. A report was produced on the study in April, 1995, which describes the important environmental issues related to water and water use. Comments suggested modifications to the Guidelines some of which have come out of doing the study and can be seen in Annexure 7.

3.2.4.2 Revision of the Bhelumia-Bheduria

Following the EIA skills workshops, the Bhelumia-Bheduria case study was revised. The first draft was produced in September 1993, and presented as a case study of an environmental impact assessment (EIA) of the proposed Bhelumia-Bheduria project on Bhola Island in the southwest region of Bangladesh.
The study addresses a small coastal project under consideration by the Early Implementation Project (EIP) of the Bangladesh Water Development Board (BWDB). The project as currently proposed would completely embank 5,306 hectares between the Tetulia and Jangalia rivers. The study assessed the beneficial impacts. These were increases in agricultural and horti-

cultural crops and income derived from these crops, as well as from the labor activities associated with project construction. Secondary benefits were improvements in the nutritional and health status of local communities, and a reduction in flooding risk to households. The most serious negative impacts were determined to be the blockage of the western canal openings by the embankment, with consequent obstruction of both boat passage and fish migration. Other potential negative impacts include loss of land and displacement of some homesteads affected by the embankment, and some loss in soil fertility. The study suggested an environmental management plan (EMP) to reduce or eliminate the adverse impacts of the project on various resource components.

As the Bhelumia-Bheduria Case Study was a typical full-scale EIA report of a proposed water development project, it was used during training by the workshop participants to review an EIA. Many of the comments made by the participants were found to be valid and were incorporated into the final document. The Bhelumia-Bheduria report was revised and reprinted in December 1994.

3.2.4.3 Revision of EIA Guidelines and Manual

Revision of EIA Guidelines

Since its approval by FPCO and the DOE, the FAP 16 team has used the EIA Guidelines (1992) to develop lecturettes and exercises for the EIA Skills Training Workshop. In the process, the team identified areas in the Guidelines that needed to be upgraded and revised. Additionally, an independent team of EIA specialists reviewed the Guidelines and provided valuable insights and feedback. The environmental study of the Chenchuri Beel area in the Southwest Region was undertaken by FAP 16 with one of the objectives being the development of material to enhance the Guidelines and the Training Manuals. The study identified additional areas in the documents which need revision.

Some of the suggested revisions relate to the basic approach of the Guidelines and raise some important issues which call for serious consideration. In addition, there are some procedural steps and methods in various sections of the Guidelines which would merit review and revision in the light of the experience gained. Moreover, the documents will need to be updated in view of the Environment Protection Act, 1995, the NCS, the NEMAP, and of course periodic updating of a living document such as this. Finally, the Guidelines should undergo periodic updating to continue to incorporate new legislation, and suggestions made on the basis of future experience to be gained.

Given that the EIA Guidelines is a living document, the suggestions and comments made to improve it should be incorporated. The suggestions and comments have been separately documented and can be found in Annexure 6.

Revision of EIA Manual

The Draft Final of the EIA Manual, prepared in July 1993, was thoroughly revised on the basis of extensive comments made by Dr. Patricia Lane, POE environmental specialist and ISPA-N's environmental team. Revisions were made after field testing the Guidelines and the Manual in the case studies. Major improvements have been made since the 1993 edition. The section on **Initiation of the EIA** in Chapter 2, has been simplified. The section on EIA Study Team has been redrafted and renamed. In Chapter 3, the Steps in EIA have been modified considerably so that they are more easy to read. Three new chapters have been developed, partly with the materials which were taken out from Chapter 3. These are Impact Assessment Methodologies, Environment Management Plan, Impact Assessment Report and Review Process. Chapter 14 has been developed to include the bibliography

and references which were in the 1993 edition cited at the end of each chapter.

3.2.5 POE Fisheries Technical Support to FPCO

Fisheries play a very important role in the economy of Bangladesh and the nutrition of its people. The initial studies under the Flood Action Plan have indicated that Flood Control, Drainage, and Irrigation (FCD/I) projects can negatively impact fish production by limiting the water surface area available for production and through blockage of fish recruitment pathways. Due to the importance of this sector and the potential negative economic impact of planning without knowledge of the fishery, the Bangladesh Government requested ISPAN to provide the services of a Fisheries Advisor to the Panel of Experts to the Flood Action Plan (FAP).

Support of a fisheries expert through ISPAN to the Panel of Experts (POE) of FPCO was provided during Phase III and Phase IV. The POE fisheries expert provided as needed support to FPCO on fisheries issues from late 1992 through the end of Phase IV on April 30, 1995. During this time technical support was provided in the review of numerous FAP study documents to improve the fisheries related sections of the studies. Among the studies critically reviewed were all the study documents under FAP 2, 3, 4, 5, 6, 17, and 20. Detailed comments and suggestions on the fisheries studies within these FAPs was provided to FPCO. The POE expert provided intermittent supervision to these studies through the POE meetings with the various studies

The POE fisheries expert provided support to FPCO in the preparation of the FAP synthesis document, reviewed and provided comments to many of the FAP 17 documents and the TOR for a Phase II of FAP 17's program. The POE fisheries expert also organized and acted as chairperson for the only fisheries seminar to be held during the third FAP conference.

A summary document was prepared for FPCO titled *Bangladesh Flood Action Plan Report, Fisheries 1994.* (See Annexure 8). This report summarized the various fisheries studies under the FAP and was provided to FPCO as a base document for FPCO's FAP report.

3.3 Outputs

The major output of Phase IV includes not only reports and trained personnel, but also support to other FAP programs, and effort to build the overall EIA capability in Bangladesh. All of the objectives of the Phase IV program have been met. In addition FAP 16 trained more individuals than originally required, and conducted studies and produced reports that were above and beyond what was required in the original scope of work (Table 3, 4, & 5). The tangible outputs of Phase IV are as follows:

3.3.1 Training of Trainers Workshop

- A group of 10 BDG and 6 FAP 16 trainers capable of conducting EIA skills workshops using the EIA Trainer's Manual.
- Trainer's Manual in two volumes that incorporate the EIA course material
- A report on the Training of Trainers Workshop

3.3.2 EIA Skills Workshop

- Sixty-one EIA professionals capable of reviewing EIA documents.
- Four EIA workshop reports, one for each skills training workshop; an interim report; and a final report.

3.3.3 Seminars on Environmental Studies

- Dissemination of information on the Charland Studies, EIA methodologies

used in Bangladesh, and need for institutionalization of the EIA process
- Over three hundred persons sensitized to environmental issues
- Report on seminar proceedings

3.3.4 Overseas Study Tour and Training

- A group of six BDG officials trained in use of EIA and GIS

3.3.5 Reports in Support of Training

- Short field reports covering the findings of five field surveys conducted to support the training program
- An annotated bibliography of environmental reference material which can be used as a training handout for the skills workshops.
- Environmental study report including special studies.

3.3.6 Special Studies Reports in Support of EIA Guidelines

- Report on the Environmental Study of the Chenchuri Beel Area
- Revised final draft of the Bhelumia-Bheduria Case Study
- Suggestions and comments to FPCO for upgrading the Guidelines and Manual
- A study of the sedimentation in the Brahmaputra-Jamuna floodplains
- POE Fisheries Technical Study Report
- Final EIA Manual
- Final EIA institutional report
- Final charland study report series
- Flood proofing report (charlands)
- Final kala-azar report
- Final impact of flood control and biological diversity and nutritional value of subsistence fisheries

Over 3,000 copies of the reports produced during this and the previous phases have been distributed during Phase IV. They were distributed to the following organizations:

- *Government agencies*, such as, WARPO, LGED, FPCO, DOE, DOF, Ministry of Environment and Forest, BARC, SPARRSO, IWTA, BBS, IMED, DPHE, RRI, SRDI, PWD, BARD, JMBA, SOB, DAE, and PC

- *Universities and other institutes*: BUET, BIDS, Dhaka University, MIDAS, ICDDR,B, BAU, FAP 6, FAP, 20, FAP 21/22, FAP 24, and FAP 25

- *Donors*: USAID, World Bank, ADB, Danida, CIDA, ODA, EEC, CFD, WFP, JICA, NORAD, SIDA, Ford Foundation, Dutch Embassy, KFW, UNDP, FAO, Swiss Embassy, and NORAD

- *Non-Government Organizations(NGOs) and Consultancy Firms*: BRAC, Grameen Bank, Proshika, BCAS, BETS, Care, DDC, DPC, EPC, SWMC, Aqua Consultants, ADAB, IEB, DMC, NOVIB, PRIP, and BELA.

Table 3 Summary of Outputs of Phases I through IV

Reports	**Number of Reports**
EIA Guidelines	1
EIA Manual	1
EIA Case Studies	3
Special Studies	27
Reports Related to Training	9
Reports Related to Policy and Legislation	4
Technical Notes	3
Training & Awareness Activities	**Number of Persons Trained**
One Training of Trainers Workshop	16 EIA professionals trained: 10 BDG personnel and 6 FAP 16 personnel
Six EIA Skills Workshops	109 professionals trained as EIA reviewers and practitioners: 80 BDG personnel and 29 persons from parastatals, NGOs and consultancy firms
In-house Training	19 specialists trained in EIA. Of these 6 have developed capability as EIA trainers
Overseas Training	6 senior and mid-level BDG officials from DOE, FPCO, BWDB, MOWR, PC and IMED sensitized and trained in EIA and GIS
Awareness Training through Seminars	1. A total of 42 high and mid-level BDG policy makers sensitized to environmental issues. 2. Information on charlands disseminated to a total of over 90 BDG and private sector policy makers, planners, scientists, and engineers. 3. Information on EIA methodologies disseminated to a total of over 90 BDG and private sector policy makers, planners, scientists, and engineers. 4. Over 100 trainees provide feedback on EIA training workshops and on how to institutionalize EIA in Bangladesh.

Table 4 Summary of Reports Produced and Distributed during Phases I through IV

Studies Conducted and Reports Written	*Name of Reports*	*Numbers Distributed*
EIA Guidelines EIA Manual	1. Guidelines for Environmental Impact Assessment, October 1992.	350
	2. Manual for Environmental Impact Assessment, April 1995.	260
EIA Case Studies	1. * EIA Case-Study: Surma-Kushiyara Project. June 1992.	50
	2. * EIA Case-Study: Compartmentalization Pilot Project, Dec. 1992.	70
	3. * EIA Case-Study: Bhelumia-Bheduria Project, November 1994.	220
Special Studies	1. * Potential impacts of flood control on the biological diversity and nutrition value of subsistence fisheries in Bangladesh, April 1995.	100
	2. * Effects of flood protection on fertility of soils at the Chandpur Irrigation Project, July 1993.	80
	3. * The kala-azar epidemic in Bangladesh and its relationship to flood control embankments, April 1995.	90
	4. * Impacts of flood control and drainage on vector-borne disease incidence in Bangladesh, December 1992.	55
	5. * Vegetation ecology of the Sundarbans: Annotated bibliography, January 1992.	50
	6. * Wetland inventories and conservation, September 1992.	50
	7. * Demographic, health and nutritional impacts of Meghna-Dhonagoda Embankment, December 1992.	100
	8. The dynamic physical and human environment of riverine charlands: PADMA, April 1995.	150
	9. The dynamic physical and human environment of riverine charlands: GANGES, April 1995.	150
	10. The dynamic physical and human environment of riverine charlands: MEGHNA, April 1995.	150
	11. The dynamic physical and human environment of riverine charlands: BRAHMAPUTRA-JAMUNA, April 1995.	150
	12. Upper Jamuna (Brahmaputra) charland socio-economic RRA, April 1995.	100
	13. Middle Jamuna charland socio-economic RRA, April 1995.	100
	14. Upper Meghna charland socio-economic RRA, April 1995.	100
	15. Meghna confluence charland socio-economic RRA, April 1995.	100

Studies Conducted and Reports Written	*Name of Reports*		*Numbers Distributed*
Special Studies	16.	Padma charland socio-economic RRA, April 1995.	100
	17.	Ganges charland socio-economic RRA, April 1995.	100
	18.	Charland summary report, April 1995.	250
	19.	Charland socio-economic summary report, April 1995.	120
	20.	Charland flood proofing study, April 1995.	140
	21.	Soil sedimentation study, June 1995.	140
	22.	Environmental study of the Chenchuri Beel, April 1995.	20
Reports Related to Training	1.	Needs assessment report, January 1992	5
	2.	Environmental impact assessment skills training workshop: Master Training File. Volume I, II, and III, September 1993	100
	3.	EIA Trainer's Manual. Volumes I & II, April 1994	85
	4.	Training of Trainers Workshop Report, June 1994	20
	5.	EIA Skills Workshop I Report, August 1994	20
	6.	Interim Training and EIA Skills Workshop II Report, November 1994	20
	7.	EIA Skills Workshop III Report, January 1995	20
	8.	EIA Skills Workshop IV Report, March 1995	20
	9.	EIA workshop final report, April 1995	20
Reports on Policy and Institution	1.	Inception report, 1991	4
	2.	Environmental position paper, October 1992	20
	3.	An outline of policy and legislation related to environment in Bangladesh, 1993	60
	4.	Institutionalizing the EIA process in water sector projects, *A discussion paper*, April 1995	15
	5.	Final report, April 1995	80

Table 5 Summary of EIA Institutional Activities

EIA Institutional Activities	
Support to other organizations	FPCO, DOE, WARPO, MOWR, MOEF, BUET, SPARRSO, BADC, BARC, IMED, PC, LGED FAP 2, FAP 6, FAP 8, FAP 9, FAP 12, FAP 14, FAP 17, FAP 19, FAP 20, FAP 21/22, FAP 23, FAP 24, and FAP 25
Personnel trained to strengthen the EIA capability in organization	*BDG Agencies*: FPCO, DOE, WARPO, LGED, IMED, PC, FD, DOF, MOL, BWDB *Other Agencies*: AQUA, BARC, BCL, BETS, BRAC, BUP, CARE, DDC, DPC, DU, EPC, HCL, Kranti Associates, POUSH, Proshika
Data and reports distributed to other organizations	*BDG Agencies*: WARPO, LGED, FPCO, DOE, DOF, Ministry of Environment and Forest, BARC, SPARRSO, IWTA, BBS, IMED, DPHE, RRI, SRDI, PWD, BARD, JMBA, SOB, DAE, and PC *Universities and other institutes*: BUET, BIDS, Dhaka University, MIDAS, ICDDR,B, BAU, FAP 6, FAP, 20, FAP 21/22, FAP 24, and FAP 25 *Donors*: USAID, World Bank, ADB, Danida, CIDA, ODA, EEC, CFD, WFP, JICA, NORAD, SIDA, Ford Foundation, Dutch Embassy, KFW, UNDP, FAO, Swiss Embassy, and NORAD *Non-Government Organizations(NGOs) and Consultancy Firms*: BRAC, Grameen Bank, Proshika, BCAS, BETS, Care, DDC, DPC, EPC, SWMC, Aqua Consultants, ADAB, IEB, DMC, NOVIB, PRIP, and BELA
Dissemination of information to organizations	USAID, World Bank, ADB, Danida, CIDA, ODA, EEC, CFD, WFP, JICA, NORAD, SIDA, Ford Foundation, Dutch Embassy, KFW, UNDP, FAO, Swiss Embassy, and NORAD

4. Conclusions and Recommendations

Conclusions

The objectives of the FAP 16 study program as specified in the TOR were briefly, to identify environmental issues, prepare EIA guidelines and a user's manual, assess the likely environmental impacts of flood control projects, develop recommendations for impact avoidance, undertake special studies of specific environmental issues, assess and initiate a training program, and organize workshops to discuss the environmental implications of FCD/I projects and to review project reports.

Despite the fact that the environmental study was out-of-phase with some of the key regional studies of the FAP the above objectives were well met. The study produced a large number of quality reports, guidelines and a manual which have been judged by experienced environmentalists and other scientists as being of high quality with much useful data and analyses. FAP 16 has conducted case studies and special environmental studies that have helped water sector planners develop more sustainable projects. The environmental study also has trained more than 100 scientists, engineers, planners and other professionals from 27 public and private sector organizations. The study has generated more than 45 reports to assist planners of the FAP and other water planning organizations, and it has the capability and the trained manpower to immediately become an active support to an environmental planning cell or unit within the water sector.

The local environmental team gained valuable and useful experience in EIA and in applied environmental research. They were also able to impart their experience and knowledge of EIA to many in numerous sectors both public and private through training programs and seminars. Regional FAP studies were provided with useful data and information. The basic goals and objectives of the study were achieved despite early difficulties and study sequencing problems.

FAP 16 has been closely linked to improved planning in the water sector, and the need for accurate, readily available geographic information and environmental impact assessments continue to be essential for sound planning, and for implementing and monitoring most physical and environmental resource development activities in Bangladesh. The data and capability developed under this FAP study is vital to improved future national water sector planning.

Recommendations

Dissemination of study results. As a supporting study, the basic objective of FAP 16 was to generate information and knowledge particularly about the EIA process, potential impacts, develop guidelines and manuals and assess and initiate training programs. The information and knowledge is contained in the numerous reports produced by FAP 16 and in the personal knowledge of those involved in FAP 16 and those trained by the studies professionals. The knowledge and information generated by the study in the form of reports have, as of the end of the last phase, been widely distributed. Over the project life more than 3,500 reports have been distributed to every concerned government and private sector agency. It is recommended that the data and reports be further distributed to those requiring them and that all of the findings of the study be open to the public for use in the future.

EIA comments and suggestions should be incorporated into EIA Guidelines by GOB. ISPAN FAP 16 through its use of the EIA Guidelines and through discussion and use of the Guidelines in training, have made further recommendations for their improvement. It is recommended that the suggestions (see annexure 7) be considered by both FPCO and the DOE for incorporation in the future.

Training. The six EIA skills workshops conducted under FAP 16 were very successful and have developed not only a group of EIA trainers but also a large group of trained EIA reviewers and skilled practitioners in a total of 27 public and private sector Institutions. It is recommended that the participatory training provided under the ISPAN FAP 16 program be continued and even expanded to include practical EIA implementation for practitioners as well as reviewers.

Environmental Support Project and Environment Unit/Cell in Water Sector. There appears to be a general consensus that WARPO and FPCO be merged to become the national water resources planning agency. In the October 1994 Flood Action Plan Report, recommendations have been made that reorganization of WARPO take place. The report recommends that " a reorganized WARPO may best absorb the GIS and the environmental study capabilities to cater to the needs of all water user agencies. It would be advisable to establish an environment cell in WARPO in line with the one suggested for FFPCO in 1993. External assistance would, however, be necessary initially."

It is recommended that an Environment Unit/Cell be established once WARPO and FPCO merge into National Water Planning Organization as suggested in the Bangladesh Water and Flood Management Strategy report of March 1995. ISPAN FAP 16 has also recommended the establishment of this unit in its institutional report and has suggested further that both the environmental and GIS capability currently existing in FAP 16 and FAP 19 be retained for a period to support the unit to be established in the water sector. The support of the FAP 16 capability will be needed for guiding water project planners/implementers in carrying out IEE, EIA and successfully carrying out and monitoring the success of the environmental management plans.

The multidisciplinary nature of FAP 16's staff will continue to be required in the water sector to strengthen the very fragile nature of existing EIA capability and provide direction in future water sector planning. It is recommended that an environmental studies component continue to assist water planners in FPCO and later WARPO as the two organizations merge. The environmental capability developed through more than 3 years of environmental work under FAP will continue to be required for further strengthening of the water sector planning process through the use of the tools developed at all stages of the planning process. There will also be a need for continued environmental data collection and database development and the provision of training for engineers in EIA. The program should continue to help alter or eliminate environmentally unsound investment alternatives early in the planning process.

The capability includes highly trained professionals, hardware, and data. If not retained, many of the new or improved planning tools developed under the FAP will be lost or unavailable to future national water planning efforts. The best possible solution is to retain the capability through a support project whereby the institutionalization process continues and the development toward a permanent national-level water resources planning environmental capability is ensured.

Institutionalization. The type of training carried out under FAP 16 should be continued with further emphasis on a field or practitioner level EIA training. The establishment of an EIA user network should be carried out along with the continuation of the environmental seminar series for policy makers and planners. Further it is recommended that long-term recommendations for the institionalization of the EIA process suggested in " Institutionalizing the EIA process for water sector projects, a discussion paper" be considered and implemented.

Establishment of environmental database and sampling protocols for environmental data collection. Little accurate and quantitative

information on the environmental and social effects of water development projects exists. This has consequences for the adequate prediction and quantification of environmental impacts. Improved and increased efforts need to be made in future environmental data collection and monitoring of environmental impacts. It is recommended that an environmental database be set up along the lines of the existing FAP 19 National Database to include all land, water and human resource data items. Certainly one data layer could be watersheds or river catchments originally developed at MPO.

Network of environmental practitioners and reviewers. One of the outcomes of the extensive training and awareness building, which took place under FAP 16's training and seminar series, was that a large group of government and private sector individuals exist, and they have expressed an interest in forming a network of environmental practitioners and reviewers. The list of individual participants of the ISPAN FAP 16 training can be seen in annexure 4 and 5. The Ministry of Environment and Forests has also expressed an interest in supporting such a network. Either the MOEF or the DOE could be instrumental in assisting the establishment of such a network.

ANNEXURE 1

LIST OF FAP 16 REPORTS

LIST OF FAP 16 REPORTS

EIA Guidelines and Manual

1. Guidelines for Environment Impact Assessment, October 1992.
2. Manual for Environmental Impact Assessment, April 1994.

EIA Case Studies

3. EIA Case-Study: Surma-Kushiyara Project, June 1992.
4. EIA Case-Study: Compartmentalization Pilot Project, December 1992.
5. EIA Case-Study: Bhelumia-Bheduria Project, November 1994.

Special Studies

6. Potential impacts of flood control on the biological diversity and nutrition value of subsistence fisheries in Bangladesh, April 1995.
7. Effects of flood protection on fertility of soils at the Chandpur Irrigation Project, July 1993.
8. The kala-azar epidemic in Bangladesh and its relationship to flood control embankments, April 1995.
9. Impacts of flood control and drainage on vector-borne disease incidence in Bangladesh, December 1992.
10. Vegetation ecology of the Sundarbans: Annotated bibliography, January 1992.
11. Wetland inventories and conservation, September 1992.
12. Demographic, health and nutritional impacts of Meghna-Dhonagoda Embankment, December 1992.
13. The dynamic physical and human environment of riverine charlands: PADMA, April 1995.
14. The dynamic physical and human environment of riverine charlands: GANGES, April 1995.
15. The dynamic physical and human environment of riverine charlands: MEGHNA, April 1995.
16. The dynamic physical and human environment of riverine charlands: BRAHMAPUTRA-JAMUNA, April 1995.
17. Upper Jamuna (Brahmaputra) charland socio-economic RRA, April 1995.
18. Middle Jamuna charland socio-economic RRA, April 1995.
19. Upper Meghna charland socio-economic RRA, April 1995.
20. Meghna confluence charland socio-economic RRA, April 1995.
21. Padma charland socio-economic RRA, April 1995.
22. Ganges charland socio-economic RRA, April 1995.
23. Charland summary report, April 1995.
24. Charland socio-economic summary report, April 1995.
25. Charland flood proofing study, April 1995.
26. A study of sedimentation in the Brahmaputra-Jamuna Floodplain, June 1995.
27. Environmental study of the Chenchuri Beel, April 1995.

EIA Training

28. Needs assessment report, January 1992
29. Environmental impact assessment skills training workshop: Master training file. Volume I, II, and III, September 1993.
30. EIA trainer's manual. Volumes I & II, April 1994.
31. Training of trainer's workshop report, June 1994.
32. EIA skills workshop I report, August 1994.
33. Interim training and EIA skills workshop II report, November 1994.
34. EIA skills workshop III report, January 1995.
35. EIA skills workshop IV report, March 1995.
36. EIA workshop final report, April 1995.

Policy and Institution

37. Inception report, 1991
38. Environmental position paper, October 1992.
39. An outline of policy and legislation related to environment in Bangladesh, September 1992.
40. Institutionalizing the EIA process for water sector projects, *a discussion paper*, April 1995.

ANNEXURE 2

ANNOTATED BIBLIOGRAPHY OF THE MAJOR FAP 16 REPORTS

ANNOTATED BIBLIOGRAPHY OF THE MAJOR FAP 16 REPORTS

EIA GUIDELINES AND MANUAL

1 **FPCO/FAP 16. 1992. Guidelines for Environmental Impact Assessment (EIA). FPCO/ISPAN, Dhaka.**

Based on past experiences with FCD/I projects the Guideline for Environmental Impact Assessment (EIA) was prepared by FAP 16 (Environmental Study Team) in consultation with and assistance from the Flood Plan Coordination Organization (FPCO) and, Department of Environment (DOE). The EIA Guideline was formally approved by the FAP Review Committee in October 1992, and has been adopted by the GOB as the national guideline for use in ongoing and future FAP and similar flood control, drainage, irrigation (FCD/I), and other water management projects. FAP 16 has prepared during Phase IV a series of suggestions to improve the Guidelines.

2 **FAP 16. 1995. Manual for Environmental Impact Assessment (EIA). ISPAN, Dhaka.**

The EIA Manual, a companion to the Guideline document, covers the technical aspects of EIA in more detail. The EIA Guidelines outline the steps in the EIA process of Water Resource Development and describe *what* is required for EIA. The EIA Manual details *how* to carry out these steps and procedures.

EIA CASE STUDIES

3 **FAP 16/FAP19. 1992. Surma-Kushiyara Project: Environmental impact assessment case study. ISPAN, Dhaka.**

The report presents a feasibility-level Environmental Impact Assessment (EIA) of the proposed Surma-Kushiyara Project in the northwestern region of Bangladesh. The main objectives of the study were to test the EIA Guidelines developed for use in the FAP, and to provide a basis for training of local consultants in EIA methodologies. The case study demonstrated the overall practicability of the EIA Guidelines to be used in the Flood Action Plan. However, it also demonstrated the need for adequate field study effort, continual interaction between environmental and engineering study and design teams, adequate and up-to-date baseline maps, and a clear appreciation of the scale and complexity of land and water interaction if high quality and quantitative EIAs are to be produced.

4 **FAP 16/FAP 19. 1992. Compartmentalization Pilot Project: Environmental impact assessment case study. ISPAN, Dhaka.**

This report presents an Environmental Impact Assessment (EIA) of the proposed Compartmentalization Pilot Project (CPP) at Tangail. The assessment was undertaken by the FAP 16 Environmental Study component of the Bangladesh Flood Action Plan (FAP) as a case study in undertaking EIAs of typical FAP projects. The main objectives of the case study were to apply the EIA process as specified in the FAP EIA Guidelines, to develop appropriate experience among local EIA practitioners, and to test the practical application of a Geographic Information System (GIS) to a typical EIA.

The CPP study area is located in the north central region of Bangladesh, close to the left bank of the Jamuna River, and bounded by the Dhaleswari and Pungli rivers, and transacted by the Lohajang River. The total area of the project is approximately 13,000 hectares. The study determined that the proposed project would aid agriculture, culture fisheries, homestead security, household income, and cereal-based nutri-

tion. In contrast, it found that the proposed project would reduce agricultural crop diversity, capture fisheries production, subsistence fishing income, fish-based nutrition, while increasing environmental contamination with more agro-chemical use. The study also recommends an Environmental Management Plan (EMP) to reduce or eliminate the adverse impacts of the project.

5 **FAP 16/FAP 19. 1994. Bhelumia-Bheduria Project: Environmental impact assessment case study. ISPAN, Dhaka.**

The report presents an Environmental Impact Assessment (EIA) of the proposed Bhelumia-Bheduria project on Bhola Island in the South-west Region of Bangladesh. The study addresses a small coastal project under consideration by the Early Implementation Project (EIP) of the Bangladesh Water Development Board (BWDB). The project as currently proposed would completely embank a 5,306 hectare area between the Tetulia and Jangalia rivers. The study found that the beneficial impacts would include increases in agricultural and horticultural crops and income derived from these crops as well as from the labor activities associated with project construction. Secondary benefits would include improvements in the nutritional and health status of local communities, and a reduction in flooding risks to households. The most serious negative impacts would be caused by the blockage of the western canal openings by the embankment, with consequent obstruction of both boat passage and fish migration. Other negative impacts would include the loss of land and displacement of some homesteads affected by the embankment, and a possible loss in soil fertility. The study suggested an Environmental Management Plan (EMP) to reduce or eliminate the adverse impacts of the project on various resource components.

SPECIAL STUDIES

6 **FPCO/FAP 16. 1992. Demographic, health and nutritional impacts of the Meghna-Dhonagoda embankment. ISPAN, Dhaka.**

The study examined the demographic, health and nutritional impacts of the Meghna-Dhonagoda FCD/I Project. The area inside and outside of the project was studied. The study found no appreciable difference in the above factors between the two groups of people who lived inside and outside of the embankment.

7 **FPCO/FAP 16. April 1995. Potential impacts of flood control on the biological diversity and nutrition value of subsistence fisheries in Bangladesh. ISPAN, Dhaka.**

Fish plays an important role in the economy of Bangladesh and serves as one of the primary food sources of the people. According to the study the average household eats fish 3.5 days per week, compared to 2.1 days for pulses, and 0.5 for meat. The Bangladeshi household also consumes a wide variety of fish, anywhere from 56 to 73 different species throughout the year. It is this variety that is provided by the floodplain fishery. In addition, fish provides a varied dietary intake of vitamin A and calcium for example, which can vary greatly between species.

The study of fisheries bio-diversity examined four areas of Bangladesh where flood mitigation projects have been planned or executed. Its purpose was to assess the direct impact of flood mitigation on fish populations and the indirect nutritional consequences of fisheries losses. The study established baseline data on fish consumption within the floodplain. It also measured the extent of community participation and use of fisheries, and developed methods for assessing household fish consumption. Additionally the study assessed the migration patterns of flood-

plain species and ascertained the seasonal variation of fish species and their market price.

8 **FAP 16. 1992. Impacts of flood control and drainage on vector-borne disease incidence in Bangladesh. Bangladesh Flood Plan Coordination Organization, Dhaka.**

Changes in floodplain ecology and resulting alterations in vector densities and associated disease transmission were identified as major potential health concerns of the FAP in 1991. The initial study was a survey of mosquito vectors. Later the study broadened its scope to include all major vector-borne diseases so as to provide the FAP with a basis for overall appraisal of disease risks.

The study examined the relationship between vector-borne diseases, such as malaria, filariasis etc. and the embanking of low lying land. Though a cause and effect relationship was not established between these two factors, the study concluded that a correlation may exist and further study could be recommended.

9 **FPCO/FAP 16. 1993. Effects of flood protection on fertility of soils at the Chandpur Irrigation Project. ISPAN, Dhaka.**

The study was conducted inside and outside the embankment of Chandpur Irrigation Project (CIP), and showed that the soil inside the CIP contains less potassium, nitrogen and manganese than the soil outside the project area. The sediment deposited outside the embankment had more organic matter, such as calcium, magnesium, potassium, nitrogen, phosphorus, sulphur and manganese than the adjacent soils outside the embankment. The study recommends controlled flooding for transferring of river borne sediments to agricultural lands at key periods in the cropping cycle.

10 **FAP 16. 1995. A study of sedimentation in the Brahmaputra-Jamuna Floodplain. ISPAN, Dhaka.**

The report analyzes the role of sedimentation in maintaining soil fertility and the process of soil formation on Jamuna and Old Brahmaputra floodplains. It also attempts to gain understanding of first-order estimates of the total sediment budget on the Ganges and Brahmaputra.

The study shows that most sediment is deposited close to the active Jamuna channel and the amounts decrease progressively with distance from the channel. Also the average rates of sediment deposition correlate well with different geomorphic ages of floodplain identified on earlier soil surveys. The study also found that the sediment deposited on the floodplains contains more nutrients than the adjacent soils of the area. The soils on the active and Young Jamuna floodplain which have received recent increments of new alluvium do not have higher nutrient contents than the soils on the older floodplain which apparently have not received such sediment. In general, sedimentation rates are up to 4 cm/year in the active floodplain and low (< 1 cm) or negligible in the older floodplains, with some local exception. The cutting off or reduction of such sediment supplied would have negligible effect on the soil fertility at least on short to medium-term time scales.

11 **FAP 16. 1992. Impacts of flood control and drainage on vector-borne disease incidence in Bangladesh. Bangladesh Flood Plan Coordination Organization, Dhaka.**

This study examined the relationship between vector-borne diseases, such as malaria, filariasis etc. and the embanking of low lying land. Though it was difficult to establish a cause and effect relationship between these two factors, because of a long chain of bio-physical changes that take place over decades, the study concluded that a correlation may exist between them.

12 **FAP 16. 1995. The kala-azar epidemic in Bangladesh and its relationship to flood control embankments. ISPAN, Dhaka.**

The objective of this study was to assess the relationship between kala-azar case distribution and flood control, drainage, and irrigation (FCD/I) projects. The principle means of doing this was through a review of all available information on the incidence of kala-azar in Bangladesh and relating it to the presence of FCD/I projects, and doing a case study analysis using data gathered by the Singra Thana Health Center. The distribution of kala-azar cases, when plotted on maps showing the location of embankments, roads, and rivers, clearly reveals that the cases were heavily clustered within areas protected by polders, in contrast to the origins of Health Center in-patients which were distributed more evenly over the thana. The data also show that risk increased according to exposure level. While there was no increased risk associated with living outside the embankment, living in a mouza that had villages both inside and outside the embankment moderately increased risk. Living in a mouza completely within the embankment substantially increased risk. People living inside the embankment were found to have a risk of developing kala-azar that was 17.69 times higher than among those living outside the embankment. The report makes recommendations for dealing with the spread of kala-azar, for conducting further studies over a wider geographical area and addressing eco-epidemiological, socio-behavioral, and demographic aspects.

13 **FAP 16/FAP19. 1995. The charland study series:**
The dynamic physical and human environment of riverine charlands: PADMA
The dynamic physical and human environment of riverine charlands: GANGES
The dynamic physical and human environment of riverine charlands: MEGHNA
The dynamic physical and human environment of riverine charlands: BRAHMAPUTRA-JAMUNA
Upper Jamuna (Brahmaputra) charland socio-economic RRA
Middle Jamuna (North) charland socio-economic RRA
Upper Meghna socio-economic RRA
Meghna Confluence socio-economic RRA
Charland: Socioe-conomic summary
Padma socio-economic RRA
Ganges socio-economic RRA
Charland: Summary report
Charland flood proofing study

The Charland study series was devoted to the understanding of the dynamic physical and socioeconomic environment of riverine Charlands in all the major rivers of the country (i.e. Brahmaputra-Jamuna, Meghna, Ganges and Padma). The study prepared an extensive inventory of resources and people of the chars, an exercise in which inputs from FAP 19 (GIS) played a large role. In addition to the creation of this extensive inventory database, in-depth socio-economic investigations were undertaken at six different locations covering all major rivers. A part of the Charland study was aimed at identifying potential flood proofing measures for different areas. All these components of the Charland study (resulting in a thirteen-volume report) had the major objective of assisting in policy formulation regarding overall development of the resources and people in the riverine Charlands of the country. The policy needs emerging out of the Charland study include the following:

Streamlining Land Ownership Laws and Records: It has been found that in the cycle of erosion and accretion, ownership of the Charlands is often controversial. In many areas the rural elite assumes control of a significant proportion of such land. More rational laws are

needed on alluvion and diluvion, and a mechanism of updating land records needs to be established.

Providing Basic Services: Partly because of the inaccessibility of many char areas, basic services provided to the char dwellers on health, education, communication, agricultural extension etc. have been rather poor. There is a need for a concerted governmental and non-governmental effort in providing these basic services. In the context of agricultural extension, it should be noted that char areas have as yet unexploited potential in crop cultivation as well as livestock development.

Providing Assistance in Mitigating the Impact of Flood and Erosion: Since the inhabitants of chars are extremely vulnerable to flood and erosion, special programs are needed to assist them in such hazards. The elements of such assistance would include: (1) improved flood warning, (2) flood proofing measures for homesteads, (3) provision of shelter (for people and animals), (4) transportation assistance, (5) water purification facilities, and (6) resettlement programs for those displaced by erosion.

14 FAP 16. 1992. Vegetation ecology of the Sunderbans: Annotated bibliography. ISPAN, Dhaka.

This document contains over 70 annotated bibliographical references comprising different sectors of the vegetation ecology of the Sunderbans. The references provide a general description of the vegetation in the region, vegetation and environment relationship, regeneration, hydrology, and soils.

15 FAP 16. 1992. A needs assessment for a national wetland inventory in Bangladesh. ISPAN, Dhaka.

The needs assessment proposed that a study should be undertaken using GIS technology to develop an inventory of the wetlands of Bangladesh. The assessment reviewed current wetland-related studies and inventories in Bangladesh and some neighboring Asian countries. The document reports that a national inventory would be a useful and key component of water resource management and wetland conservation in Bangladesh. The report also identified potential uses and users of the inventory, and developed an outline for it.

16 FAP 16. 1995. The environmental study of the Chenchuri Beel area. ISPAN, Dhaka.

The report presents the findings of a study conducted in the Chenchuri Beel area located in the district of Narail (spread over the thanas of Narail, Lohagara and Kalia) to understand the important environmental issues pertaining to the water sector in the area. Four different mouzas were selected as sample sites for gathering relevant information. Ten days of field-work involving RRA in all four locations, and household surveys in two locations was completed by the end of February.

The study found that the FCD project implemented by BWDB in the area had helped in preventing floods in certain locations. Those living in the southern part of the area felt that the project had helped to an extent in preventing salinity intrusion. In the face of narrowing of the Nabaganga river to the east, which gets quite dry except during the monsoon months, there is a problem posed by the reduced availability of surface water for people living nearby. The study also examined the impacts of surface water changes brought about by human interventions and otherwise in the different sectors such as agriculture, fisheries, livestock, navigation, health and sanitation.

Analysis of the existing situation in the study area brought out a number of important points to be used in improving the EIA Guidelines for the

water sector and also to develop the methodology for future training of EIA practitioners.

TRAINING

17 **FAP 16. 1995. Trainers Manual. Vol. I. Training procedures. ISPAN, Dhaka.**

Volume I of the Trainer's Manual provides a step-by-step procedure for conducting EIA skills workshops and is designed to assist those who will be engaged as trainers in delivering EIA skills training. It includes specific instructions for each portion of training, trainee handouts, and exercises. The Manual accompanies the EIA Guidelines for the water sector that was developed by the Flood Plan Coordination Organization. The Manual is designed for a four-week long workshop. The workshop focuses on the process outlined in the EIA Guidelines. The subject matter is divided into 10 modules, each module corresponding to a stage in the EIA process found in the EIA Guidelines. The introduction to the Manual provides an overview to the workshop and an introduction to the training methodology. The course content is designed to improve the skills of engineers, social scientists, environmental scientists, and other specialists working in the field of natural resources who perform and/or review environmental impact assessments.

18 **FAP 16. 1995. Trainers Manual. Vol.11: Supplemental handouts. ISPAN, Dhaka.**

Volume II of the Trainer's Manual is a companion document to Volume I. It includes all the supplemental handout materials that are associated with each module as they appear in Volume I. The materials contained in the Manual are separated according to module, and each module is indicated by a tabbed separator. These materials are given as handouts during the skills workshops. They include: an annotated bibliography of environmental reference materials, reports of three case studies conducted in selected geographical areas significant for EIA, EIA Guidelines, Guidelines for People's Participation, technical notes on the Environment and Development, Habitat and Ecosystem and other supplemental materials.

19 **FAP 16. 1994. Training of Trainer's Workshop Report. ISPAN, Dhaka.**

The report provides the background of the development of the training program, discusses the methods used to achieve its objectives, and provides an analysis of how effective the participants felt the training was in achieving its objectives. It provides a day by day description of how the course proceeded, a tabulation and description of the workshop results, and discusses the conclusions and recommendations. The report suggests that there is a need to articulate a policy regarding the role of EIA training and a need to find an institution that will take the ownership for training EIA professionals in the future.

20 **FAP 16. 1994-1995. EIA Skills Workshop I-IV Report. ISPAN, Dhaka.**

The reports provide brief overviews of the workshops' objectives, the methodology used during training, and briefly describe the participants and training team. They present the participants' comments/evaluation of the workshops which show that the workshop achieved their objectives. The reports also describe the lessons learned from each workshop and the changes that were incorporated in the schedule, workshop time, and course content to upgrade the training program.

21 **FAP 16. 1995. EIA Skills Workshop Final Report. ISPAN, Dhaka.**

The report reviews and describes the accomplishments of the four skills workshops that were conducted during Phase IV. It explains the

workshop objectives, the training methodology, and describes the workshop participants, the training team, and resource persons. Workshop evaluations show that they achieved their objectives and not only met but exceeded the participants' expectations. The report recommends that EIA training should continue and should target EIA practitioners, team leaders, and policy makers. It suggests that interaction between other agencies involved in EIA training is necessary to help compare programs, generate new ideas, and to ensure that duplication of effort does not occur.

POLICY AND INSTITUTIONALIZATION

22 **FPCO/FAP 16. April 1995. Institutionalizing the EIA process for water sector projects, *a discussion paper.***

This paper outlined the present state of environmental assessment and institutional arrangements existing in Bangladesh. It identified revisions to the procedures for project formulation, design and approval to ensure that environmental examination is ensured; provided a timetable for implementation; and suggested modifications to the current institutional arrangements of the EIA process.

23 **FAP 16. 1993. An outline of policies and legislation related to environment in Bangladesh. ISPAN, Dhaka.**

This document describes existing rules and legislation for conservation and sustainable management of various environmental resources such as fisheries, wildlife, forests, livestock, soils, and others. The aim and major provisions of the policies and legislation which appear to be relevant to EIA work, have been briefly discussed in the document.

TECHNICAL NOTES

24 **FAP 16. 1994. Habitat and Ecosystem. ISPAN, Dhaka.**

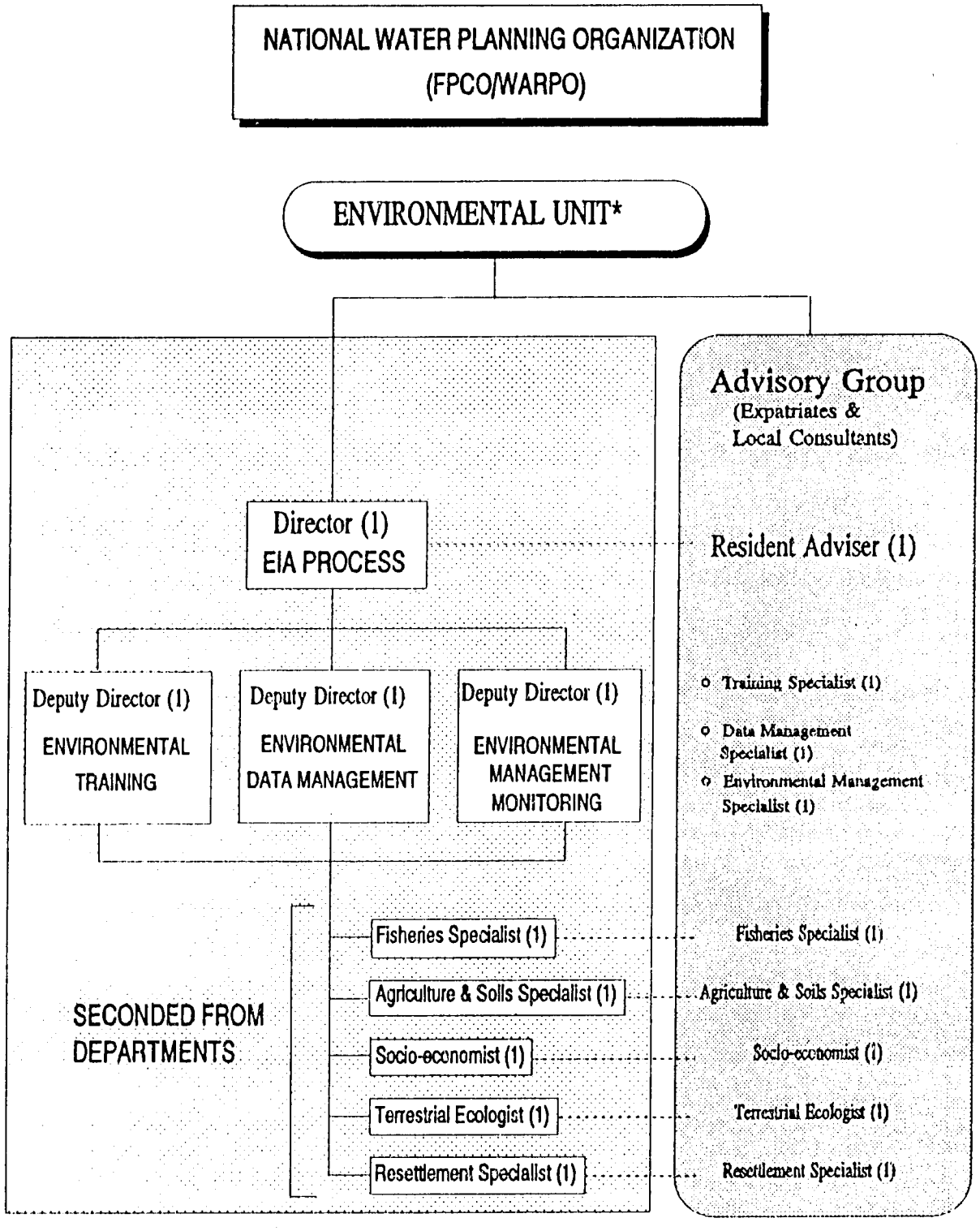
This document defines *habitat* and *ecosystem*. It describes the typical habitats and ecosystems in Bangladesh. Plants and animal species diversity along with the endangered and threatened species are noted. The paper recommends that project planning, construction, and follow-up activities should allow sufficient time and resources for the full incorporation of ecological considerations.

25 **FAP 16. 1993. Environment, Development and EIA in Bangladesh. ISPAN, Dhaka.**

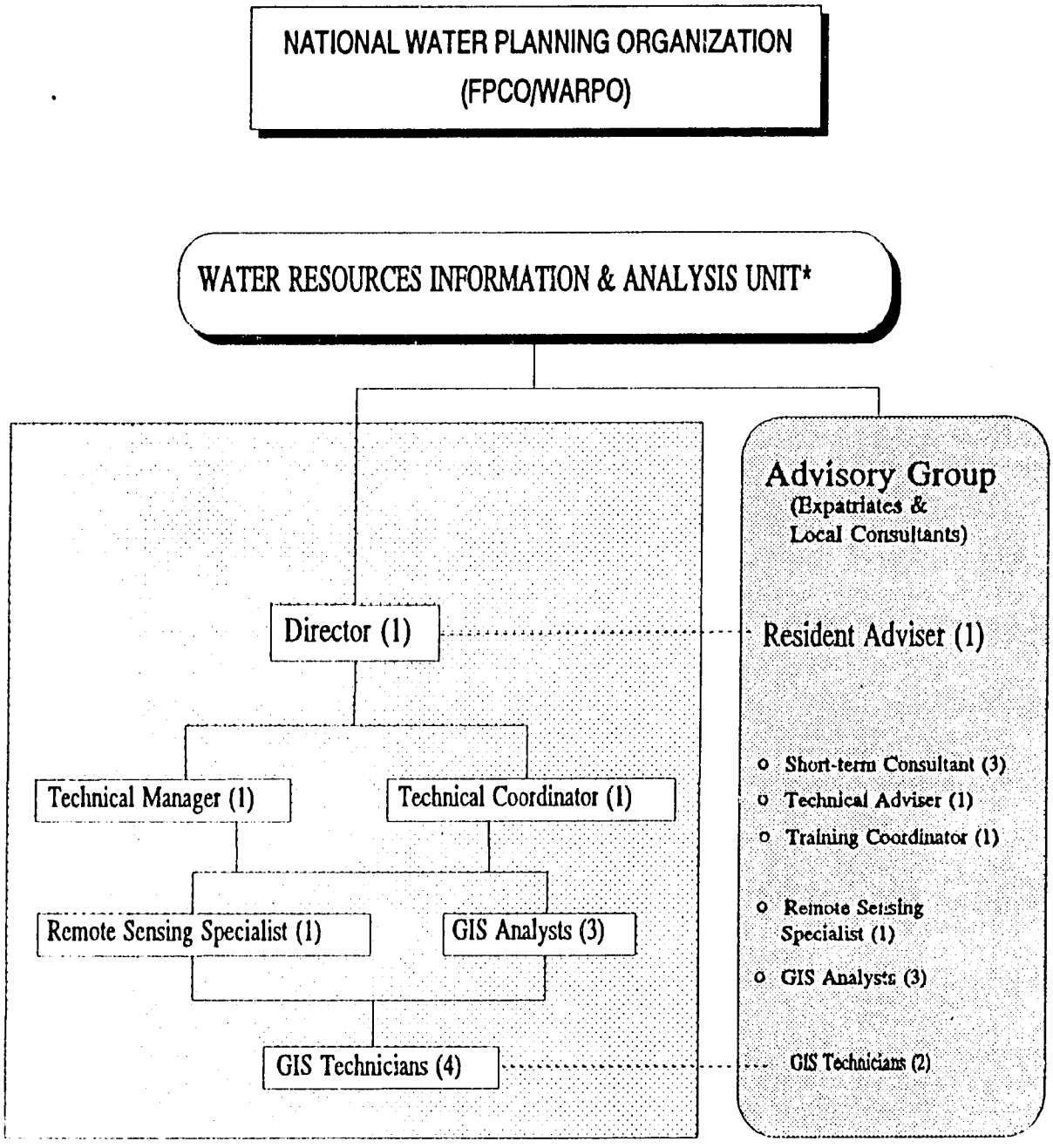
This technical note reviews the information on environment and development, in general, and EIA, in particular. The document explains the term *environment* and lists the treaties, conventions and agreements of environmental concern. The document recommends the necessity to institutionalize EIA in Bangladesh. It suggests that it is imperative for the GOB to make EIA mandatory through executive order or by Act of Parliament.

ANNEXURE 3

SUGGESTED ORGANOGRAM FOR AN ENVIRONMENTAL UNIT AND WATER RESOURCE INFORMATION AND ANALYSIS UNIT



* This unit will strengthen and improve water sector planning capability through training and technical support in the EIA process.



* This unit will provide Remote Sensing, image processing and GIS capability for the water sector

ANNEXURE 4

PARTICIPANT LIST
TRAINING OF TRAINERS SKILLS WORKSHOP

TRAINING OF TRAINERS SKILLS WORKSHOP
May 7 - June 8, 1994

Participant List

Name	Organization
A. M. Shafi	FPCO
Md. Abdun Noor	FPCO
Md. Abdus Salam	BWDB
Md. Mustafizur Rahman Serniabat	BWDB
Mostafa Kamal Farooque	DOE
Mahmood Hasan Khan	DOE
Md. Badiuz Zaman	MOWR
Dilruba Akhter	LGED
Masrur Askar	LGED
Momtaz Begum	DOF
Khurshida Khandakar	FAP 16, ISPAN
Dara Shamsuddin	FAP 16, ISPAN
Muhammad Mustafa Alam	FAP 16, ISPAN
Raguib Uddin Ahmed	FAP 16, ISPAN
Asgari S. Ahmad	FAP 16, ISPAN

ANNEXURE 5

PARTICIPANT LIST EIA SKILLS WORKSHOPS

Participants List

EIA SKILLS WORKSHOPS

1993 - 95

ISPAN

IRRIGATION SUPPORT PROJECT FOR ASIA AND THE NEAR EAST

Sponsored by the U.S. Agency for International Development

PARTICIPANTS LIST: EIA SKILLS WORKSHOPS
1993 - 1995

A. *GOVERNMENT AGENCIES*

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			Office	Residence
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A. K. M. Shariful Islam	Design SEZ, Bangladesh Water Development Board (BWDB)	54 Motijheel C/A Dhaka	235622	324033
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NAME	INSTITUTIONS	ADDRESS: Office/Residence	TELEPHONE	
			Office	Residence
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Farida Begum	Department of Fisheries (DOF)	Matshya Bhaban 1 Park Avenue Ramna Dhaka	241592	
Momtaz Begum	Department of Fisheries (DOF)	3/5 Block B Humayun Road College Gate Dhaka	246103-4 Ext. 03	319453
Rahela Begum	Department of Fisheries (DOF)	Matshya Bhaban 1 Park Avenue Ramna Dhaka	249332	507536
Md. Nazrul Islam	Department of Fisheries (DOF)	Matshya Bhaban 1 Park Avenue Ramna Dhaka		894803
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Molla Ruhul Alam	Flood Plan Coordination Organization (FPCO)	7 Green Road Dhaka - 1215	315133	
Md. Ferdous	Flood Plan Coordination Organization (FPCO)	7 Green Road Dhaka - 1215	324450	812635

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Shahana Akhter	Local Government Engineering Department (LGED)	LGED H/Q, 5/7 Lalmatia Block B Dhaka - 1207	325564 326902	814316
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K. A. Khaleque	Ministry of Water Resources		241973	319763
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NAME	INSTITUTIONS	ADDRESS: Office/Residence	TELEPHONE	
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Note: The list has been organized alphabetically by institutions & by last names.

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1993 - 1995

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	North West Regional Study FAP 6			
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Note: **The list has been organized alphabetically by institutions & by last names.**

ANNEXURE 6

EIA SKILLS WORKSHOP
FINAL REPORT

BANGLADESH FLOOD ACTION PLAN

Ministry of Water Resources
Flood Plan Coordination Organization (FPCO)

EIA Skills Workshop
Final Report

April 1995

Prepared by

Environmental Study

FAP 16

ISPAN

IRRIGATION SUPPORT PROJECT FOR ASIA AND THE NEAR EAST

Sponsored by the U.S. Agency for International Development

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AND THE NEAR EAST

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TABLE OF CONTENTS

ATTACHMENTS

List of Acronyms

AQUA	AQUA Consultants & Associates Ltd.
BARC	Bangladesh Agricultural Research Council
BCL	Bangladesh Consultants Ltd.
BETS	Bangladesh Engineering & Technological Services
BRAC	BRAC
BUP	Bangladesh Unnayan Parishad
BWDB	Bangladesh Water Development Board
CARE	CARE International
DDC	Development Design Consultants Ltd.
DOE	Department of Environment
DOF	Department of Fisheries
DPC	Development Planners & Consultants
DU	Dhaka University
EPC	Engineering & Planning Consultants Ltd.
FD	Forest Department
FPCO	Flood Plan Co-ordination Organization
HCL	House of Consultants Ltd.
IMED	Implementation Monitoring & Evaluation Division, Ministry of Planning
KA	Kranti Associates
LGED	Local Government Engineering Department
MOL	Ministry of Land
MOWR	Ministry of Water Resources
PB	Petrobangla
PC	Planning Commission
PMUK	Proshika Manobik Unnayan Kendra
POUSH	Bangladesh POUSH
WARPO	Water Resource Planning Organization

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EIA SKILLS WORKSHOP FINAL REPORT

1. Introduction

During Phase IV the Environmental Study component of the Flood Action Plan (FAP 16) developed a training program to institutionalize the EIA Guidelines developed during Phases I and II. The training program's dual objectives were to (1) allow for technology transfer by developing in-country capability to conduct EIA training so that ownership of the EIA process was established and vested in professionals in public and private sector organizations in Bangladesh, and (2) to strengthen the institutional capability of relevant GOB and private sector agencies by training a critical mass of EIA specialists who were capable of reviewing EIA documents. Accordingly, the training plan developed during Phase IV included two types of activities: (1) a Training of Trainers (TOT) workshop to develop a core group of EIA trainers, and (2) skills workshops to develop EIA reviewers. The training of Trainers (TOT) workshop was conducted in May and June of 1994 by two ISPAN consultants Dick Wall, a training specialist and Joe Atchue, an environmental content specialist. They also developed the EIA Trainer's Manual which incorporated the course material developed during the skills workshops conducted in 1993. Following the TOT, the FAP 16 team took ownership of the training program and conducted a series of four EIA skills workshops. As training progressed, the team modified the course content and schedule where they deemed necessary, and restructured the Trainer's Manual according to the revisions made to the program.

The modifications made evolved gradually, and were based on participant evaluation of the workshops and trainer perceptions. For instance, as the workshops progressed, both modules and sessions were re-organized. In the 1993 workshops, the modules corresponded exactly to the stages in the EIA process outlined in the EIA Guidelines. However, the FAP 16 training team found that there was a need to re-order the logical sequence of the modules to enable the participants to better understand the stages in the EIA process and see the relationships between them.

The EIA stages, Developing Baseline Description, Scoping, Bounding, and Major Field Investigations were incorporated into one module on Baseline Development as the trainers felt that they were different processes involved in baseline development for EIA. Similarly, as Feedback to Improve Project Design and EIA reporting involves the process of documenting, communicating and reporting, they were combined into the module on Documentation and Communication. Table 1 shows the revised version that was developed and used.

Within modules also, sessions that needed more emphasis were expanded while others were combined into one. For instance, the module on Impact Assessment was modified several times. Following Workshop I 1995, two sessions were added to the module as the trainers felt that more explanation was needed on the impact assessing methodology. However, following Workshop II it was found that the teaching approach to impact assessment needed to be modified. Accordingly, the module was renamed and called "Impact Evaluation," so that alterative methods of impact assessment could be taught in addition to "scoring" and "weighting." Hence, the number of sessions on impact assessment was modified again.

GIS sessions also underwent several modifications. During the 1993 workshops, GIS was allocated eight sessions and the objectives were to help the trainees to learn the importance and limitations of remote sensing, the importance of GIS, and how to develop digital maps that could be used as outputs to EIA. The program that has

Table 1: Revised Modules

EIA Process Stage in EIA Guidelines	Revised Modules
Stage 1: Project Design and Description	Module 2: Introduction to EIA in the Water Sector
Stage 2: People's Participation	Module 3: People's Participation
Stage 3: Environmental Baseline Description	Module 4: Developing Environmental Baseline
Stage 4: Scoping	Module 4: Developing Environmental Baseline
Stage 5: Bounding	Module 4: Developing Environmental Baseline
Stage 6: Major Field Investigations	Module 4: Developing Environmental Baseline
Stage 7: Impact Assessment	Module 5: Impact Assessment
Stage 8: Impact Evaluation	Module 5: Impact Assessment
Stage 9: Environmental Management Planning	Module 6: Environmental Management Plan
Stage 10: Feedback to Improve Project Design	Module 7: Documentation, Communication, and Reporting
Stage 11: EIA Reporting	Module 7: Documentation, Communication, and Reporting
Stage 12: EIA Review	Module 8: EIA Review

evolved on GIS, focusses on understanding GIS as a tool for developing baseline for EIA, and basic cartography and map building skills.

Many extra sessions were added to the Baseline Development Module (Attachment 1). Two sessions on fisheries issues and baseline, and separate sessions on important resource components were added to provide a more comprehensive understanding of baseline development for EIA.

Field sites and exercises for the field trips were also modified. Initial field visits were made to the Dhaka-Narayanganj-Demra (DND) and Patakhali Konoi Projects. However, as the DND was not a Flood Control Drainage and Irrigation (FCDI) project, the trainers decided on an alternative field site, the Narayanganj Narshingdi Irrigation Project, located in the same area (Attachment 2). Similarly the Patakhali Konai field site was abandoned because the river was not navigable during the dry season. Participants were taken to Tangail Compartmentalization Pilot Project (CPP) instead. In short, the trainers used the lessons they learned from each workshop to improve the design of the program.

The team also upgraded the Trainer's Manual to better fit the revised course content and schedule. The revised lesson plans provide more comprehensive information than the previous edition.

Funding for the workshops was provided by the United States Agency for International Development (USAID). The workshops were organized by the Irrigation Support Program for Asia and the Near East (ISPAN), which worked in close collaboration with the Flood Plan Coordination Organization (FPCO) and the Department of Environment (DOE).

This report reviews and describes the accomplishments of the four skills workshops. It is divided into four parts. Part 1 and 2 introduce

the workshops and explain their objectives. Part 3 describes the training methodology, the participants, and the training team and the resource persons. Part 4 presents the workshop results, and Part 5 and 6 present the conclusions and makes recommendations.

2. Objectives

The twenty-day workshops were designed to address the objectives outlined below. The program design was based on sequential presentation of the elements in the EIA process. The program was implemented through eight modules. The objectives were to enable participants to use the EIA Guidelines developed for the water sector by FPCO in the review of EIA reports. The decision to train reviewers instead of practitioners was made because eighty percent of the participants were mid and high level professionals from the government. These officials are usually involved in reviewing project proposals. However, marginal shifts were made in the focus of the lecturettes and in the application questions used during Workshop III and IV, because participants in these workshops were drawn from both the public and private sectors. The participants were taught the key elements of the EIA process and the skills needed to review reports. This was done because private sector professionals usually do EIAs and write the reports, while public sector officials review these reports. In general, the workshop objectives were identical. Their objectives were to enable participants to:

- use the EIA Guidelines and Manual developed by FPCO and FAP 16 to study the potential environmental effects of proposed projects and to make them environmentally sound
- understand the importance of people's participation in the overall EIA process
- identify important environmental components (IECs) in order to develop the boundary of the study area and scope of the study
- understand the methodology for developing baseline data
- understand and assess environmental impacts
- document EIA activities in reports, and manage the exchange of information with team members, project officials and local people
- understand the relation between the EIA report and the Environment Management Plan (EMP)
- understand the mechanics of EIA review as part of the planning process, and determine whether an EIA has been adequately performed according to the Guidelines and Manual.

3. Methodology

All seven workshops were designed to stimulate interaction and sharing of information among participants. Short interactive lecturettes, followed by small group activities, country-specific discussions and group presentations were included in the ninety-minute sessions. The trainers made a concerted effort to push the responsibility of learning to the participants. Learning was experience based and participant centered.

The first three workshops (including two conducted in 1993) were conducted in English. The following three were conducted in Bengali and English. Participant involvement and interaction changed dramatically after Bengali was used as a medium of instruction. They were more willing to share experiences, more free with their opinions, and more comfortable during discussions and presentations.

Team training was an integral part of the program. During the first two skills workshops conducted during Phase III, two expatriate consultants shared the responsibility for every session. During the following four skills workshops, team teaching rotated between several teams of trainers. This was found to be extremely successful, because it created a sense of controlled informality, the trainers benefitted from the added support, and participants enjoyed the variation in trainer styles and perspectives.

Each workshop lasted four weeks. They were inaugurated and ended by formal ceremonies. Special guests from FPCO, DOE, USAID, the Ministry of Water Resources and the Ministry of Forests and Environment were invited to the inaugural and closing ceremonies. The daily schedule included four ninety-minute sessions which were divided by three breaks. Two field trips to water management projects were undertaken during each workshop. Trainer debriefing sessions were routinely held at the end of each day and at the end of the workshops. They provided opportunities to the trainers to review the days activities and to evaluate and continue to improve their work.

3.1 Participants

The training program targeted professionals in GOB, NGOs, and consultancy firms that work in the water resource sector. The needs assessment conducted in 1993 had indicated that both public and private sector agencies would send mostly engineers (80%). In reality, of the total number of participants who attended the EIA skills workshops, only 33 per cent were engineers. The others were from many different disciplines (Fig.1). 16 percent were economists, 9 percent were chemists, 8 percent were fisheries specialists, 7 percent were agronomists, 6 percent were environmental specialists, 5 percent were sociologists, 3 percent were specialists in forests, 3 percent were soil scientists, 3 percent were zoologists, 2 percent were geologists and 6 percent were from other disciplines. It should be noted that some of the professionals had a bachelors in engineering, but an advanced degree in another discipline.

Since EIA is multidisciplinary in perspective and orientation, the breakdown in the professions represented was appropriate. The needs assessment proved useful as it helped trainers to become aware of potential problems, and therefore made them more selective. Background information was collected for each group of participants (Attachment 3), and needs assessment were not conducted during the first two workshops.

Fig.2 shows that participants were drawn from 27 public and private sector organizations. Of the total number of participants (102) who attended the workshops, 76 percent were from government organizations, while 24 percent were from NGOs and consultancy firms. Since one of the primary objectives of Phase IV was to strengthen the institutional capability of GOB, it was a government decision to train more of their own professionals. Many of the organizations from which the participants were drawn have acquired the potential of developing EIA cells. Some have also developed the capability of training EIA professionals.

While women constitute only 1.1 percent of employees in technical professions in government/nongovernment organizations, (BBS 1993), twenty percent of the workshop participants were women. The enhanced role given to women in the workshops meets with the objectives of the Five Year Plan for women in development.

3.2 Training Team and Resource Persons

A major strength of the training program was that the workshops were conducted by a group of competent and experienced specialists. The group had helped develop the EIA Guidelines and Manual and field tested them in three case studies. They also participated in the TOT, and

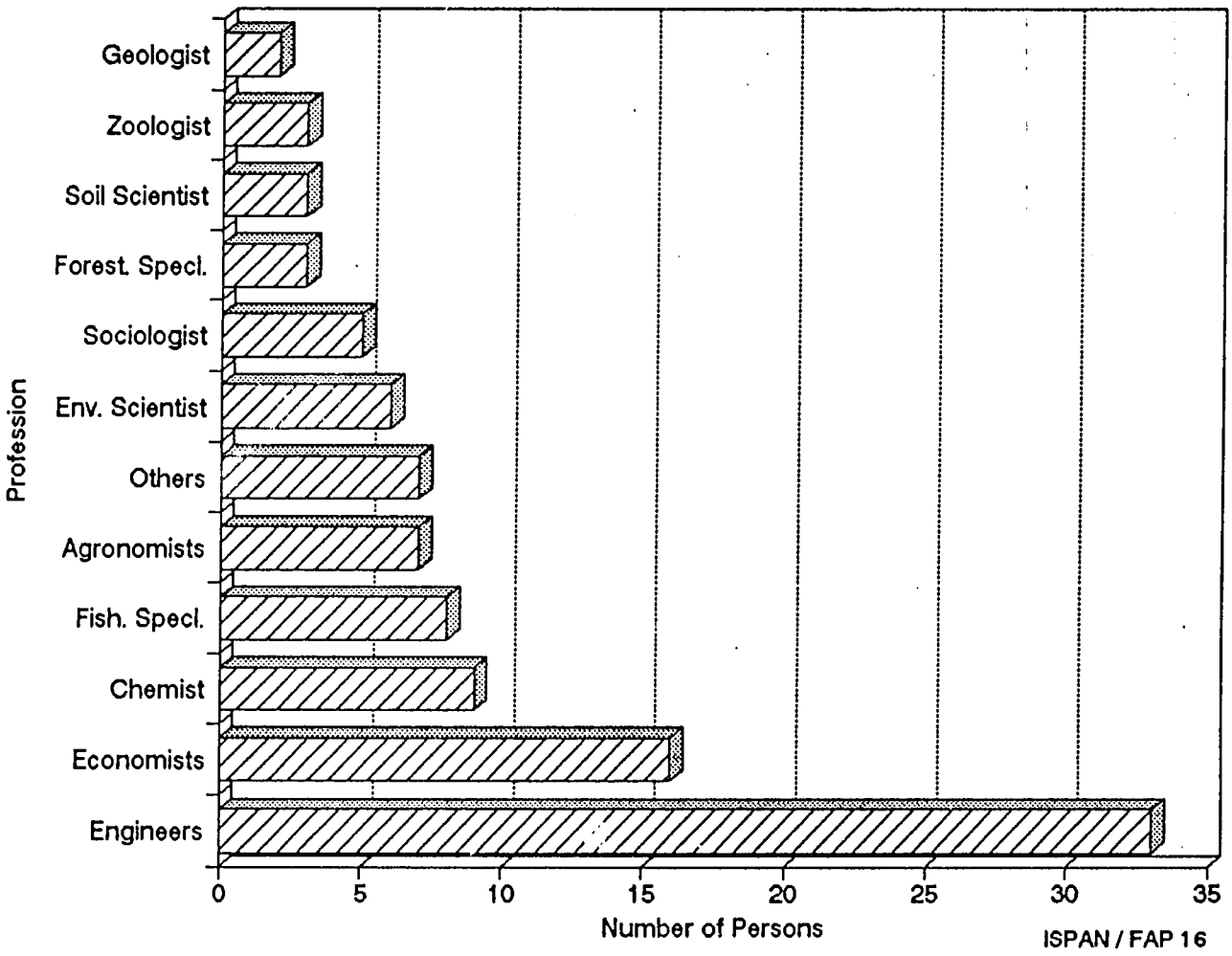

Fig. 1: Professions of Participants that Attended FAP 16's EIA Skills Workshops

during the initial phase of the program were coached and guided by a professional trainer and environmental content specialists. The core members of the team include: two geographers, a socio-economist, a plant biologist, a wildlife specialist, a fisheries specialist, and a communication specialist. The core training team included: Haroun Er Rashid, advisor to the team, Abu Md. Ibrahim, Dara Shamsuddin, Khurshida Khandakar, Mustafa Alam, Mokhlesur Rahman, Raguib Uddin Ahmad, and Asgari Ahmad.

In addition, Tim Martin, Iftekhar Ghani Choudary, Dilruba Aziz, Ahmadul Hasan, Micheal Emsh, Iffat Huq, and Nasreen Islam Khan of Geographical Information Systems (GIS) FAP 19, demonstrated and explained the use and application of GIS in the EIA process. They explained the basic GIS concepts, discussed spatial data bases, and elements of mapping, and showed how they were used in the Tangail Compartmentalization Pilot Project and Charland studies.

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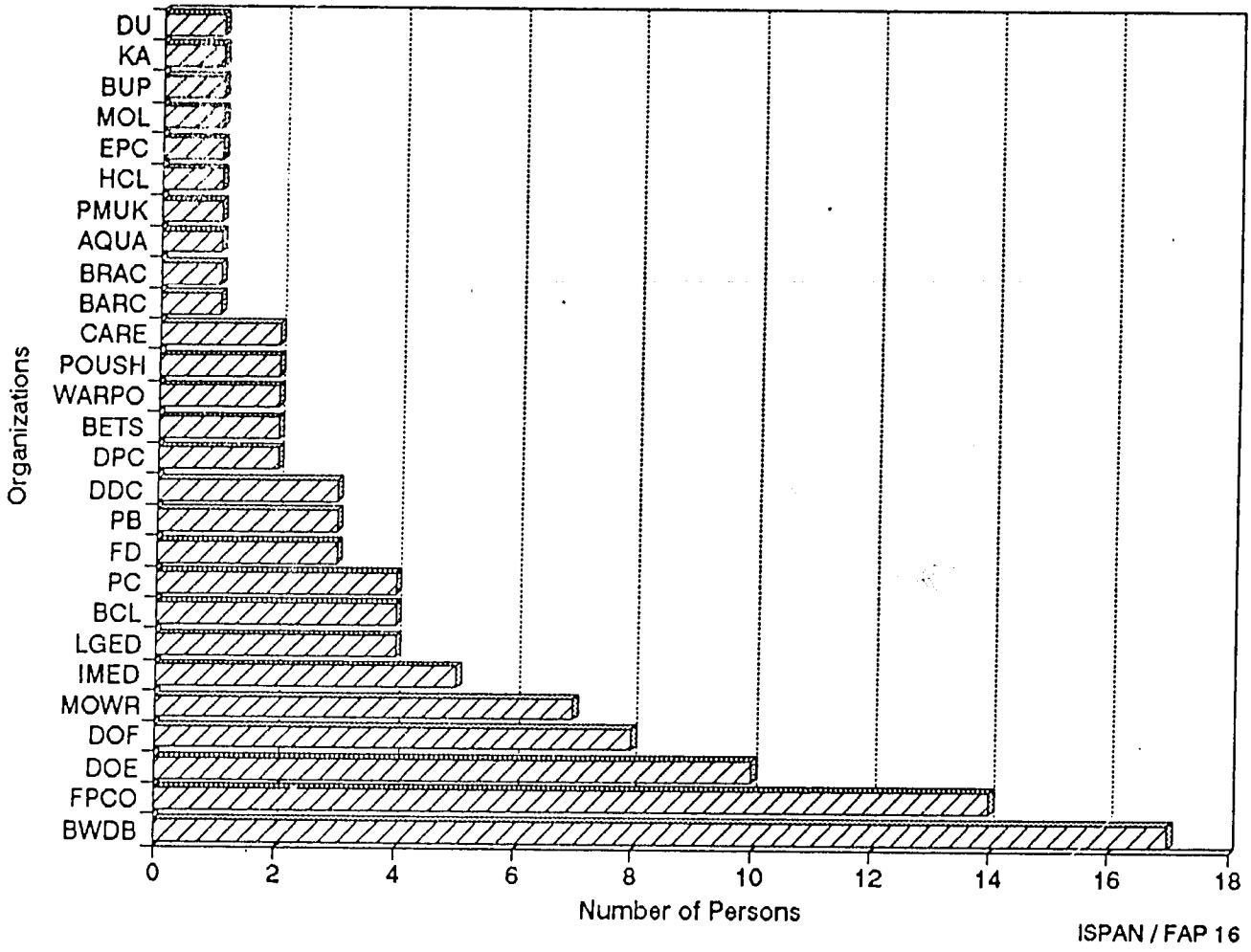

Fig. 2: Number of Participants that Attended FAP 16's EIA Skills Workshops by Organization

Many Bangladeshi specialists, nationally known for their work in water resource management and environment also served as resource persons during the workshops. They include: N. Islam of the Ministry of Water Resources, M.H. Siddiqi, A.M. Shafi, and A. Noor of FPCO, Syed A.N.-M. Wahed and M.K. Farooque of DOE. A. Nishat and F. Ahmad of Bangladesh University of Engineering and Technology, A. Khaleque of Surface Water Modelling Center (SWMC), Anwarul Islam of International Union for the Conservation of Nature and Natural Resources (IUCN), Iqbal Ali of Bangladesh Centre for Advanced Studies (BCAS), M. Ali of FAP 20 and A. Islam of Independent University. They made presentations on major environmental issues that were vital for the participants to understand Bangladesh-specific issues related to the EIA process.

4. Training Results and Impacts

4.1 Results

A critical mid-term and post workshop activity was the analysis of trainee evaluations (Attachment 4 & 5). The evaluations were designed to reflect trainee reaction to the program, and to help the trainers to modify their methods and materials accordingly. Table 2 presents a summary of responses to major questions on the final evaluation forms of the four skills workshops conducted in 1995. It allows for comparison across the workshops. Table 3 reports the responses of participants of all four workshops taken together.

As shown in Table 2, participant response to the first question were similar across the workshops. Their response was overwhelmingly positive. All 15 in each workshop said that the workshops achieved their objectives. Fourteen out fifteen participant in each workshop maintained that they achieved more than their objectives.

For question 2 of whether the workshop met the expectations of the participants, there was an upward trend in the positive response from Workshop I to Workshop IV. While nine out of fifteen participants in Workshop I said that the workshop exceeded their expectations, fourteen out of fifteen in Workshop IV responded in the same way. Most said that the workshop achieved their expectations.

Interestingly, responses to question 3 were similar across the workshops also. While a little less than 50 percent of the participants in Workshop I said that the pace of work was appropriate, a littie over 50 percent in Workshop IV made the same response.

There was a marginal difference across the workshops in participant response to the amount of information covered during the workshops. Most participants of Workshops I, II and IV said that they thought the information covered was appropriate. However, more than half (7 out of 15) participants of Workshop III said that it was too much.

Responses to questions 5 and 6 were consistently and overwhelmingly positive. Participants across all four workshops said that the handouts were helpful and that they would recommend the workshops to others.

Table 2: Summary of Responses to the Major Questions on the Final Evaluation; Workshops I - IV.

Questions	Participant Response			
	WORKSHOP I	*WORKSHOP II*	*WORKSHOP III*	*WORKSHOP IV*
Did the workshop achieve its objective?				
More than	14	14	15	14
Achieved	2	1	0	1
Less than	0	0	0	0
Did the Workshop meet you expectations?				
More than	9	12	13	14
Achieved	7	1	2	0
Less than	0	2	0	1
I thought the pace of work was:				
Appropriate	6	8	6	9
Slow	2	0	0	0
Fast	8	7	9	6
I thought the information covered was:				
Appropriate	13	10	6	13
Too Little	0	1	2	0
Too Much	3	4	7	2
Were the handouts helpful?				
Helpful	15(2 need more)	15 (2 need more)	15	15
Marginally Helpful	0	0	0	0
Not Helpful	0	0	0	0
Would you recommend the course to others?				
Yes	16	12	15	15
No	0	0	0	0
No Response	0	3	0	0

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Table 3: Participants Evaluation of the Skills Workshop [I - IV]
[Number of Participants/Respondents = 60]

Question	Percentage of Respondents		
	More than	Achieved	Less than
Did the workshops achieve their objectives?	93%	7%	
Did the workshop meet your expectations?	79%	16%	5%
I thought the pace of work was:	Slow	Appropriate	Fast
	3%	48%	49%
I thought the information covered was:	Too Little	Appropriate	Too Much
	5%	69%	26%
Were the handouts helpful?	Helpful	Marginally Helpful	Not Helpful
	100%	0	0
Would you recommend the course to others?	Yes	No	No Response
	95%	0	5%

Table 3 indicates that an overwhelming majority (93 percent) of the participants said that the workshops achieved more than their objectives, while 7 percent said that they achieved the objectives. A large majority (79 per cent) said that the workshops exceeded their expectations, while 16 percent said that they met their expectations. Only 5 percent said that the workshop outcome was less than their expectations. Almost half (49 percent) of the participants said that the pace of work was fast. Approximately the same number, 48 percent said that the pace was appropriate. Three per cent said that it was slow. In terms of the information covered during the workshop, more than half of the participants (69 percent) said that it was appropriate. Twenty-six percent said that it was too much, while only 5 percent said that it was too little. One hundred percent of the participants rated the handouts as helpful. Similarly an overwhelming majority said that they would recommend the workshop to others.

4.2 Impacts

The training program has had many direct and indirect impacts. Some of the direct results were: (1) the transfer of the ownership of training to Bangladeshi professionals. Training has become institutionalized in local professionals who can continue to conduct EIA training without external assistance; (2) a Trainer's Manual has been developed and can be used for future training. The manual has been upgraded three times to meet the needs and interests of local organizations. It also uses an innovative methodology that has proven extremely successful in Bangladesh; (3) EIA capacity has been strengthened in 27 local institutions. One hundred and nine professionals

are trained in EIA. This critical group of professionals have developed the capability to accommodate environmental concerns in project planning and designs, can participate as team members of EIA study teams, and can review water sector EIA documents.

The workshops provided a forum for professionals from private and public sector organizations to exchange views and to communicate with each other. The dialogue that occurred between the groups reflected their common concerns often about common issues. This helped to bridge many differences between them and in many ways helped them to appreciate and respect their different roles and responsibilities in project development.

A major shift in attitudes in both trainers and trainees occurred as a direct result of their workshop experience. The trainers who were primarily scientists have learnt that training requires special skills and a highly coordinated team effort to be successful. The trainees have learnt that EIA is an important planning tool and needs to be incorporated into the feasibility studies of projects when they are likely to have adverse impacts. This is a major achievement. Most trainees during the initial stage of the workshops were skeptical about the need of EIA. They felt that environmental concerns were unimportant when compared to poverty issues in the country. By the end of the workshops they not only learned that environment and poverty issues are very much related, but also learned that for development to be sustainable, natural resources of the country require proper assessment and these kept within the limits to ensure sustainability. The workshops sensitized them to the importance and need of EIA.

5. Conclusion

The final evaluations indicate that the workshops not only met the expectations of the trainees, but also achieved their objectives. Although ultimate proof of this can be obtained only through follow-up evaluation of participant performance on the job, observation of the training in action and informal discussion with the participants indicated that they had acquired a common terminology to discuss EIA problems and had learned the key concepts of the EIA process. What was also obvious from their independent evaluation of an EIA document and their individual presentations, was that they had acquired skills which would allow them to prepare and critically review EIA documents. Trainee participation was high throughout all four workshops and increased dramatically when the training was conducted in Bengali. Trainees not only enjoyed the workshops, but often stated that the workshops were unique and different from others they had attended in Bangladesh. This was largely attributed to the participative nature of the workshops and the fact that each trainee was actively involved in his/her learning.

Through all four workshops the trainees have consistently said that the pace of work was fast. A smaller percentage maintained that the information covered was too much. This is consistent and may relate to trainee educational background and experience and their ability to assimilate the information that was given. EIA is a new subject and, therefore, there may be a need to further extend workshop time in future training programs in order that even more time can be spent on difficult concepts, particularly on impact assessment, EMP and EIA review.

6. Recommendations

Many recommendations surfaced from the workshops. Some emerged from the need to achieve excellence. With each new experience, the trainers modified the course content and schedule, fine tuning them to serve the needs and interests of the participants. The trainers also felt an urgent need to institutionalize the training and to maintain the momentum they have developed. As a result their recommendations below relate to (1) future

training needs (2) the training content, and (3) curricula.

6.1 Future Training Needs

Training can become the basis for institutionalizing EIA in Bangladesh if it targets EIA team leaders, practitioners, reviewers, and builds awareness of EIA at high levels in government and private sector agencies. The attitude-change that occurs through training can help change the way the projects are planned. It can also bring about policy change so that EIA is fully integrated into feasibility studies.

The training component that has been developed under FPCO in collaboration with DOE needs to be maintained. To this end, it needs to find a home where it is permanently housed and continued.

There is a need to interact with organizations such as BUET, BCAS, BARD, North South University, Independent University, and Local Government Engineering Department (LGED) who are thinking of developing similar training programs. This will help to compare programs, ensure that duplication of effort does not occur, and to generate new ideas on how to improve the training program.

6.2 Course Content

Training courses need to be conducted that will address broad based needs. Courses, and workshops for policy makers, administrators, reviewers, trainers, practitioners, field level workers need to be developed. To this end collaboration with agencies that send participants to the training is necessary to ensure that the training given, matches their organizational need.

Future EIA training programs that target reviewers should have greater field orientation. This can be done in two ways: (1) materials and handouts that are distributed during the workshops should be based on actual field experience, (2) if possible, during the training participants should be taken on overnight field trips in order to better acquaint them with the study area, allow them adequate time in the field, adequate time in the evening to compare notes and for discussion, and time to return to the field to further verify their findings.

For practitioner training longer periods in the field will be necessary and additional time for impact assessment will have to be provided. Practitioners' training should include (a) mid-level and senior level participants, and (b) junior and field level professionals. These professionals should be drawn from both the private and public sector.

Workshop time should be extended. Trainer fatigue needs to be taken into account when planning the training programs. Four ninety-minute sessions per day for four weeks is strenuous for both trainees and trainers. The duration of the workshop may need to be extended in the future. However, a needs assessment will have to be conducted to find out if organizations, particularly NGOs, can spare their employees for longer periods of time.

An advance TOT is needed to enhance the skills of the trainers that were not covered in the TOT, such as skills to conduct a needs assessment, develop a training plan, and develop a curriculum for a particular target group. Thought should be given to identifying a master EIA content and training specialist who can demonstrate different ways of teaching the EIA concepts. In addition, TOTs should be conducted to increase the number of EIA trainers at the national level.

6.3 Curriculum Development

There is a need to develop new curricula if training is to be extended to EIA practitioners,

field workers, and team leaders. If the training materials have to meet the needs of the particular groups, there may be a need to review secondary material that already exists in the subject area and further field-test some of the issues and methods.

There is similar need to develop trainer manuals for all regularly recurring training workshops that will form the core curriculum for EIA training.

Transalation of the Trainer's Manual into Bengali should be considered.

ATTACHMENT 1

SCHEDULE

EIA SKILLS WORKSHOP, 1995

SCHEDULE
EIA SKILLS WORKSHOP, 1995

Day	Time	Session
1	08:50 - 09:00	Registration
		MODULE 1: Workshop Introduction
	09:00 - 10:00	Inauguration
	10:00 - 10:30	Break
	10:30 - 12:15	Workshop Opening
	12:15 - 12:45	Break
		MODULE 2: Introduction to EIA in the Water Sector
	12:45 - 14:15	Need of EIA
	14:15 - 14:30	Break
	14:30 - 16:00	Habitat & Ecosystem
2	08:50 - 10:30	Place of EIA
	10:30 - 10:45	Break
	10:45 - 12:15	EIA Process
	12:15 - 12:45	Break
	12:45 - 14:45	Impacts of Structures Module Synthesis Journal
	14:45 - 15:00	Break
		MODULE 3: People's Participation (PP)
	15:00 - 16:30	Importance of PP
3	08:50 - 11:00	PP Methodology Module Synthesis Journal
	11:00 - 11:15	Break
		MODULE 4: Developing Environmental Baseline
	11:15 - 12:45	Scoping & IECs
	12:45 - 13:15	Break
	13:15 - 14:45	Bounding
	14:45 - 15:00	Break
	15:00 - 16:30	Interdisciplinary Nature of EIA

Day	Time	Session
4	08:50 - 10:30	Field Data Planning
	10:30 - 10:45	Break
	10:45 - 12:15	Socio-Economic Baseline
	12:15 - 12:45	Break
	12:45 - 14:15	Water Resource Baseline
	14:15 - 14:30	Break
	14:30 - 16:00	Land-Use Baseline
5	08:50 - 10:30	Forest & Vegetation Baseline
	10:30 - 10:45	Break
	10:45 - 12:15	Wildlife Baseline
	12:15 - 12:45	Break
	12:45 - 14:15	Fisheries Issues
	14:15 - 14:30	Break
	14:30 - 16:00	Fisheries Baseline
6	08:50 - 10:30	Hazard & Risk Baseline
	10:30 - 10:45	Break
	10:45 - 12:15	Data Analysis
	12:15 - 12:45	Break
	12:45 - 14:15	GIS
	14:15 - 14:30	Break
	14:30 - 16:00	GIS
7	08:50 - 10:30	GIS
	10:30 - 10:45	Break
	10:45 - 12:15	GIS Debriefing
	12:15 - 12:35	Break
	12:35 - 14:05	Interviewing Skill Field Briefing
8	08:50 - 17:00	F I E L D - I

Contd...

Day	Time	Session
9	08:50 - 10:30	Field Debriefing
	10:30 - 10:45	Break
	10:45 - 12:45	Field Debriefing Module Synthesis Journal
	12:45 - 13:15	Break
		MODULE 5: Impact Assessment
	13:15 - 14:45	Seasonality Model
	14:45 - 15:00	Break
	15:00 - 16:30	Trend Analysis
10	08:50 - 10:30	Identify & Assess Impacts
	10:30 - 10:45	Break
	10:45 - 12:15	Impact Evaluation
	12:15 - 12:45	Break
	12:45 - 14:15	Impact Evaluation
	14:15 - 14:30	Break
	14:30 - 16:00	Impact Evaluation
11	08:50 - 11:00	Assess Alternatives Module Synthesis Journal Mid-term Evaluation
	11:00 - 11:15	Break
		MODULE 6: Environmental Management Planning (EMP)
	11:15 - 12:45	Introduction to EMP
	12:45 - 13:15	Break
	13:15 - 14:45	Mitigation & Enhancement
	14:45 - 15:00	Break
	15:00 - 16:30	Compensation
12	08:50 - 10:30	Disaster Management
	10:30 - 10:45	Break
	10:45 - 11:45	Monitoring
	11:45 - 12:00	Break
	12:00 - 13:00	Legislation
	13:00 - 13:30	Break
	13:30 - 16:30	Institutional Setting

Contd...

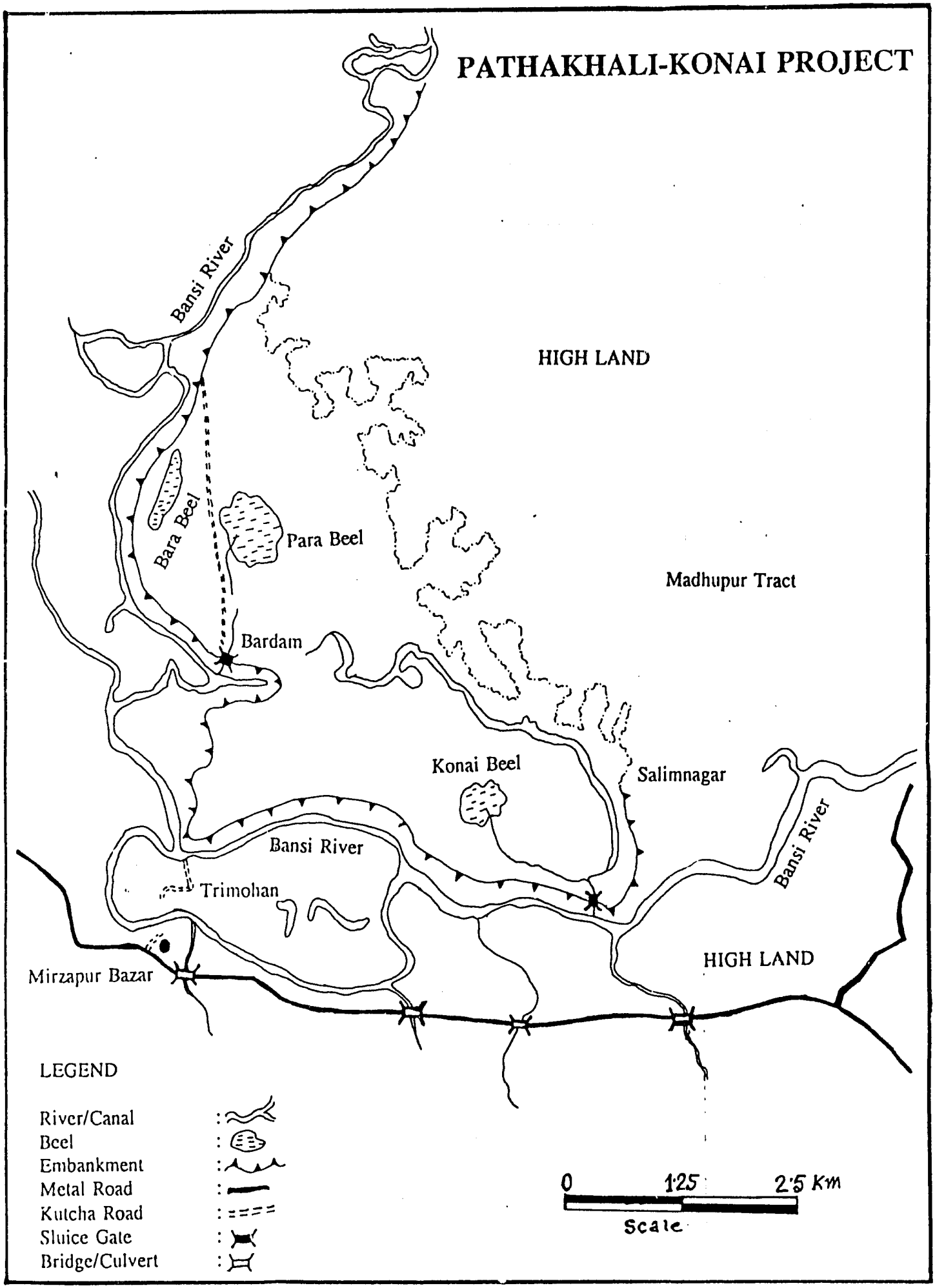
Day	Time	Session
13		**MODULE 7: Documentation, Communication & Draft Report**
	13:00 - 14:30	Documentation & Communication
	14:30 - 14:45	Break
	14:45 - 16:45	Draft Report Module Synthesis Journal
	16:45 - 17:00	Field Briefing
14	08:50 - 17:00	F I E L D - II
15	08:50 - 10:30	Field Debriefing
	10:30 - 10:45	Break
	10:45 - 12:45	Field Debriefing Module Synthesis (EMP) Journal
	12:45 - 13:15	Break
		MODULE 8: EIA Review
	13:15 - 14:45	EIA Review Mechanism Introduction to Document
	14:45 - 15:00	Break
	15:00 - 16:30	Review of Document
16	08:50 - 10:30	Review of Document
	10:30 - 10:45	Break
	10:45 - 12:15	Review of Document
	12:15 - 12:45	Break
	12:45 - 14:15	Review of Document
	14:15 - 14:30	Break
	14:30 - 16:00	Review of Document

Contd...

Day	Time	Session
17	08:50 - 10:30	Presentation & Discussion
	10:30 - 10:45	Break
	10:45 - 12:45	Presentation & Discussion Module Synthesis Journal
	12:45 - 13:15	Break
	13:15 - 14:45	Guest Speaker: Secretary Ministry of Water Resources
	14:45 - 15:00	Break
	15:00 - 16:30	Workshop Synthesis Post Test Evaluation
18	13:30 - 14:30	C L O S I N G
	14:30 - 15:30	Lunch

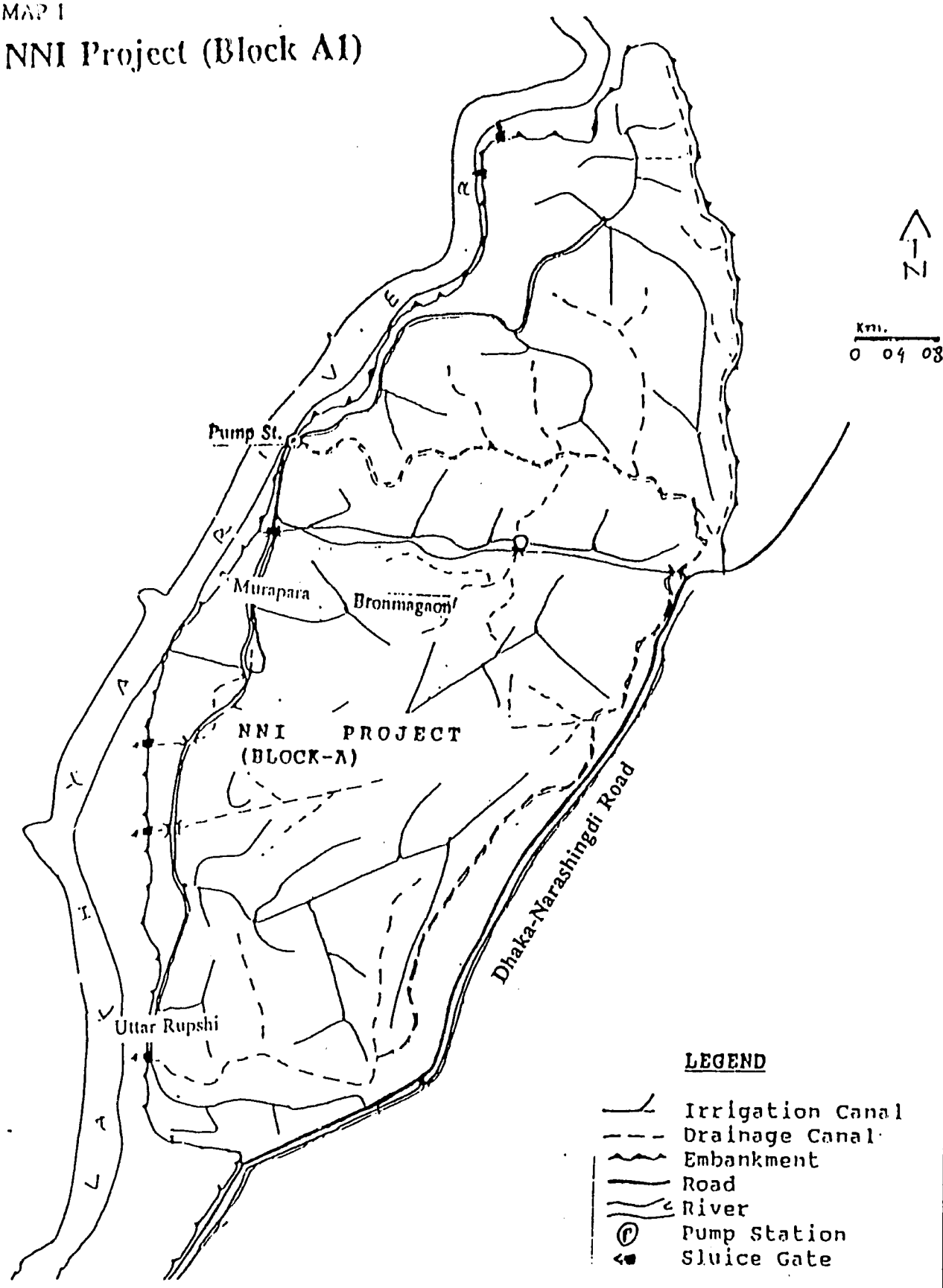
ATTACHMENT 2

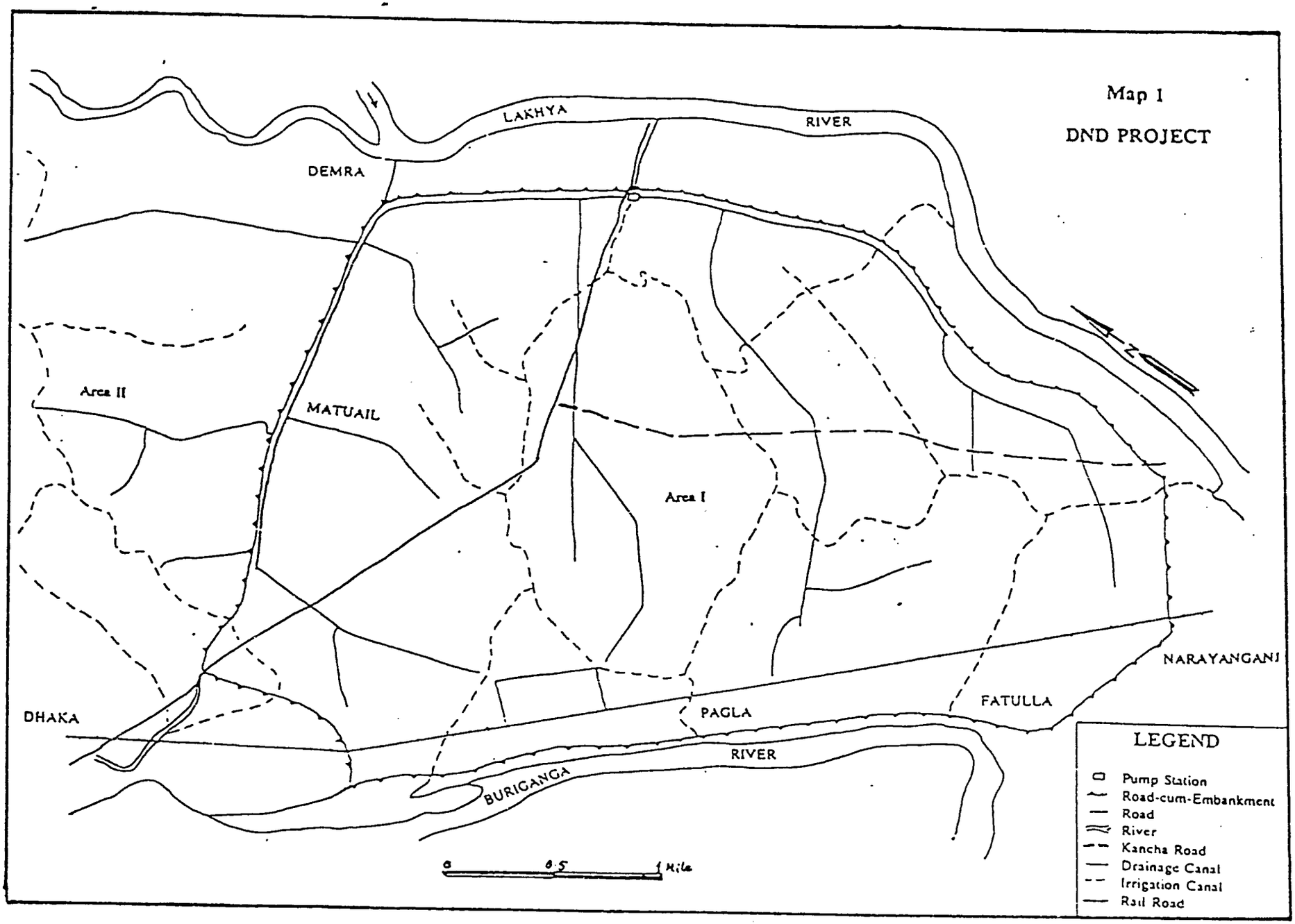
MAPS: FIELD VISITS


PATHAKHALI-KONAI PROJECT
Bansi River
HIGH LAND
Bara Beel
Para Beel
Madhupur Tract
Bardam
Konai Beel
Salimnagar
Bansi River
Bansi River
Trimohan
HIGH LAND
Mirzapur Bazar
LEGEND
River/Canal :
Beel :
Embankment :
Metal Road :
Kutcha Road : ====
Sluice Gate :
Bridge/Culvert :
0 1·25 2·5 Km
Scale

MAP 1

NNI Project (Block A1)




Map 1
DND PROJECT
LAKHYA
RIVER
DEMRA
Area II
MATUAIL
Area I
NARAYANGANJ
FATULLA
PAGLA
DHAKA
RIVER
BURIGANGA
0
0.5
1 Mile
LEGEND
Pump Station
Road-cum-Embankment
Road
River
Kancha Road
Drainage Canal
Irrigation Canal
Rail Road

ATTACHMENT 3

PARTICIPANT BACKGROUND QUESTIONNAIRE

ISPAN
IRRIGATION SUPPORT PROJECT
FOR ASIA AND THE NEAR EAST

PROPOSED EIA TRAINING PROGRAM
PARTICIPANT BACKGROUND QUESTIONNAIRE

The purpose of this questionnaire is to help us collect information so that we can adjust the curriculum to your levels of experience and areas of interest. Please answer the questions listed below.

1. Name _____ Date _____

2. Phone Number: Office _____

   Home _____

3. Age in Years. Between ( ) 20-30 yrs.
   ( ) 30-40 yrs.
   ( ) 40-50 yrs.
   ( ) 50-60 yrs.

4. Please list the last two academic degrees you received, the names of the institutions you received them from, and the year of graduation

   a. Degree _____ Institution _____

   Year of Graduation _____

   b. Degree _____ Institution _____

   Year of Graduation _____

5. Name of Organization you are working for _____

   _____

6. Position in Organization _____

7. What is your Profession? _____

   _____

8. What responsibilities do you have in your present position?

   _____

   _____

   _____

   _____

9. To whom do you report?

Name _____

Designation _____

Telephone Number _____

10. How long have you worked in your present organization?

Years_____ Months_____

11. Have you done any environmental planning, social development, project reviews, project planning or environmental impact assessment.

( ) Yes ( ) No

If yes, specify the number of years in each

	years
Environmental management	_____
Environmental planning and social development	_____
Environmental impact assessment	_____
Project review	_____
Project planning	_____

12. What exactly did you do in:

1. Environmental Management _____

_____

_____

2. Environmental Planning and Social Development _____

_____

_____

3. Environmental Impact Assessment _____

_____

_____

4. Project Review_____

_____

_____

5. Project Planning_____

13. What are your reasons for wanting to take this training course?

14. How do you see this training helping you deal with problems that you face in your work at the present time?

ATTACHMENT 4 & 5

MID-TERM & FINAL EVALUATION
EIA SKILLS WORKSHOP, 1995

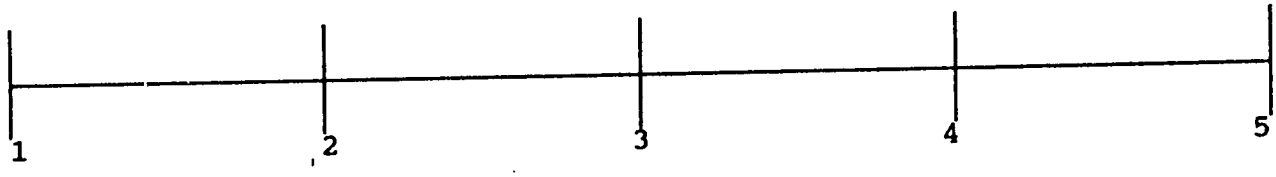
EIA SKILLS WORKSHOP, 1995

MIDTERM TRAINING EVALUATION

To help us structure a workshop that responds to your needs, we would like you to share your thoughts and feelings about the workshop to date.

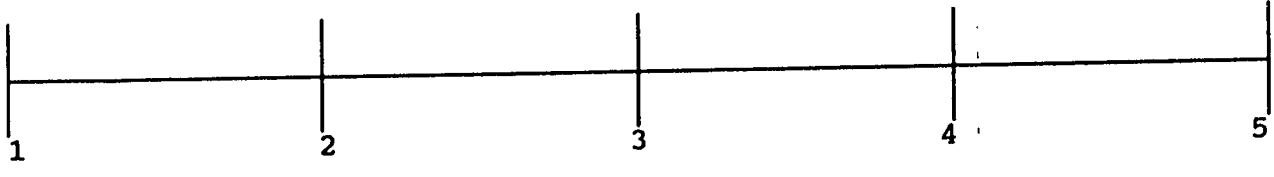
Instructions: Please mark an X on the scale provided.

1. Is the workshop achieving its objective, that is, to use the Guidelines to learn about EIA?



not at all — for the most part — completely

2. Were you clear about what the trainer wanted to accomplish in each session?



not at all — for the most part — completely

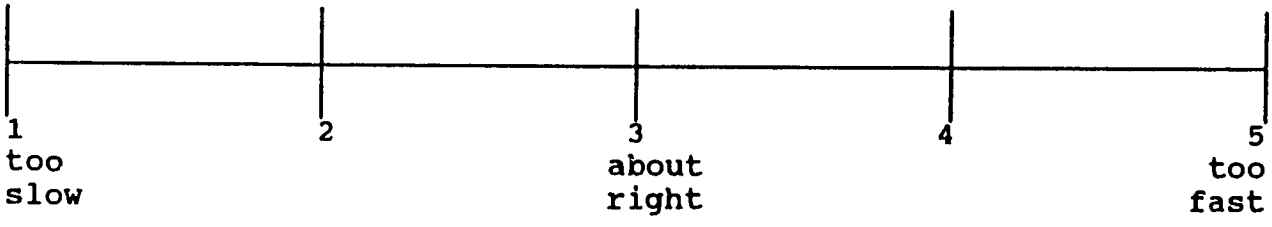
3. Which concepts are you not sure or clear about?

4. Are you beginning to enhance your skills in the areas specified below. Put a tick mark.

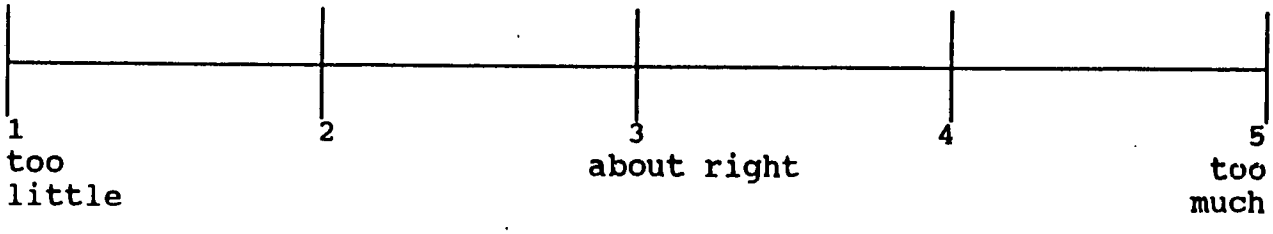
	Not much	Somewhat	Very much
Recognizing the need of EIA in project development			
Recognizing the components of the EIA process			
Appreciating the importance of habitat and ecosystem			
Understanding the concept of scoping			
Understanding the concept of bounding			
Using scoring and weighting to evaluate impacts			

5. I would like to learn more about:

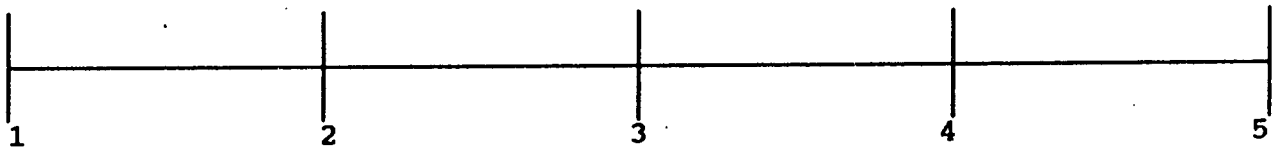
6. I think the speed of the work is:



7. I think the amount of information covered is:

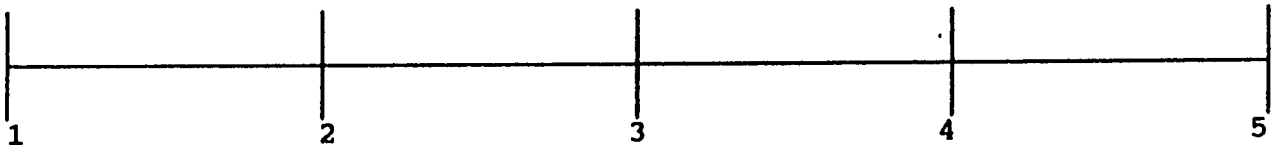


8. I think the exercises are:



not useful — useful — very useful

9. I think the handouts are:



not helpful — helpful — very helpful

10. I think the trainers could do more of:

11. I think the trainers could do less of:

12. I think the facilities are:

13. Other Comments:

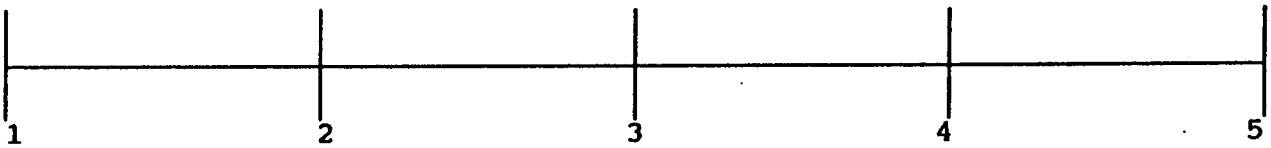
EIA SKILLS WORKSHOP, 1995

FINAL TRAINING EVALUATION

In order to help us design future workshops that respond to your needs, we would like to ask you to share your thoughts and feelings about the workshop you have just completed.

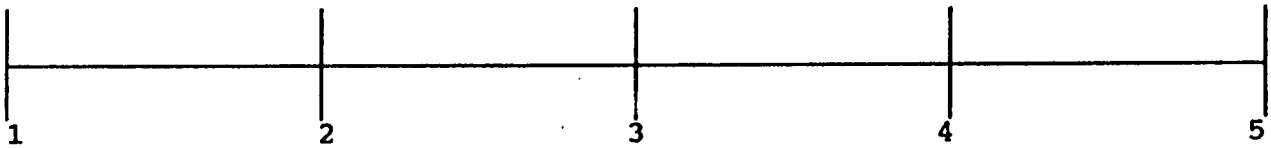
Instructions: Please mark an X on the scale provided, or use the space provided for your comments.

1. Did the workshop achieve its objective of helping you to use the Guidelines to learn about EIA?



1 not at all — 2 — 3 for the most part — 4 — 5 completely

2. Did the workshop meet your expectations?



1 not at all — 2 — 3 for the most part — 4 — 5 completely

3. How do you think you will apply the lessons you have learned in the workshop?

4. What area(s) did you learn the most about?

5. What area(s) did you learn the least about?

6. Module by module which topics would you add, delete, emphasize more, emphasize less.

Module 1: Introduction of EIA

Module 2: People's Participation

Module 3: Developing Environmental Baseline

Module 4: Impact Assessment

Module 5: Environment Management Plan (EMP)

Module 6: Documentation & Communication & Draft Report

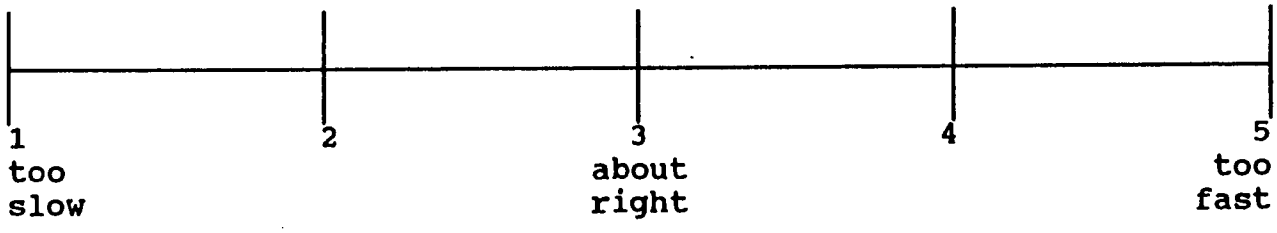
Module 7: EIA Review

7. Which techniques of instruction (lecturettes, practical exercises, group discussions, case study, field trips, journals) did you learn:

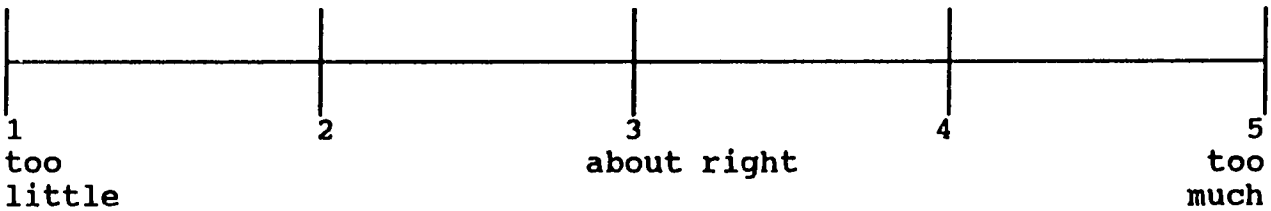
   a. The most from:

   b. The least from:

8. I thought the speed of the work was:



9. I thought the amount of information covered was:



10. Were the handouts helpful? If no, why not?

11. In what ways could the instructors improve their performance?

12. Would you recommend the workshop to others?

13. Please add other comments you would like to make about any aspect of the workshop.

ANNEXURE 7

COMMENTS AND SUGGESTIONS FOR IMPROVING THE EIA GUIDELINES

COMMENTS ON AND SUGGESTED CHANGES TO THE EIA GUIDELINES FAP 16/ISPAN

1. Background

The Guidelines for Environmental Impact Assessment (EIA), commonly referred to as the EIA Guidelines, was prepared by the FAP 16 team of ISPAN with assistance from the Flood Plan Co-ordination Organization (FPCO) and the Department of Environment (DOE) for the Bangladesh Flood Action Plan (FAP). The EIA Guidelines was to be used as a planning tool specifically for projects identified under the FAP and generally for future water sector projects. It was approved by FPCO in October 1992 and is now the official document of the Government of Bangladesh.

In the preface of the EIA Guidelines, ISPAN/ FAP 16 and the supporting institutions of FPCO and the DOE have suggested that the document should be modified and updated from time to time to incorporate the benefits of experience gained from actual environmental studies and EIAs.

Since October of 1992, FAP 16 has conducted a series of EIA Skills Training Workshops to transfer the Guidelines to those in the public and private sectors who would most likely be using it. The material for the workshops came mostly from the EIA Guidelines and the Manual, which is a companion document to the Guidelines. During the preparation of this material, and during the training sessions, some of the procedural steps and methods contained in the Guidelines have been used in more depth and it has been found that the Guidelines could be revised/ modified in certain areas. Additionally, FAP 16 conducted an independent review by various EIA specialists who have also furnished fresh insights into the Guidelines. In the meanwhile, the FAP 16 team conducted an environmental study of the Chenchuri Beel area located in the southwestern region of Bangladesh to further field-test some of the concepts and methods included in the Guidelines.

The Guidelines is a "living document" and as such continues to be subject to modification as more appropriate procedures are defined and can be incorporated. In the light of the independent reviews, and continued use of the Guidelines in training and field studies, the following recommendations and suggestions have been made for modifying the EIA Guidelines which remains a "living document".

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2. Comments and Suggestions Relating to the Basic Approach

2.1 The Guidelines for Preliminary Environmental Review (PER) and Initial Environmental Evaluation (IEE) should be incorporated into the document specifying their place and role in project formulation. The level of detail to be covered in the PER and IEE should also be indicated, as well as the level of effort required for each.

2.2 The role of the IEE in regional planning and development should be clearly identified and distinguished from the role of the IEE at pre-feasibility level of an individual project.

2.3 A statement at the very beginning of the document needs to be made emphasizing that the IEE is not always the final decision making tool. That the EIA review team can decide to (a) proceed with the project, (b) proceed with alternative designs, or (c) cancel the project (as stated on page 38) needs be put up front in the document so that the reader does not infer that the EIA process will not determine whether a project should or should not go forward.

2.4 Positive impacts are mostly identifiable benefits directly associated with proposed projects. Assigning values to positive impacts risks double counting of the benefits as they have already been accounted for in project assessment as benefits. Since the purpose of an EIA is to describe and measure the environmental costs of the project benefits, it may be useful to compare the costs incurred in the IECs to project benefits for determining whether the project is worth the level of environmental degradation it may cause.

2.5 The list of negative impacts in Annex A of the Guidelines does not include biodiversity as a separate category and it should.

2.6 Can EIA, as a decision making tool be used to stop/ hinder a project, or is it just to make a given project as environmentally acceptable as possible? If the mitigation cost is too high (by implication the environmental costs as well), should the project still go ahead? Where and how to draw the line? And who draws the line? These issues are not clear, but should be made clear in the document.

2.7 Should the EIA be done only with a given project option and with the no project as the only alternative, or should the Guidelines specify that there should be more than one project alternative so that alternative interventions of the project can be assessed? It would seem that suggestions for alternatives would be appropriate.

2.8 The concept of trade-off may need to be reviewed. Is the trade-off to be between positive and negative impacts, or between negative impacts and the cost of mitigation? The Guidelines seems to suggest the first alternative, whereas the second alternative merits serious consideration.

2.9 Some of the regions in Bangladesh have had more interventions than others with regard to surface and/ or ground water. This makes it almost a prerequisite to develop a regional IEE prior to taking up project level EIA. The Guidelines should direct the practitioners to be sensitive to this.

3. Comments and Suggestions on the Procedural Steps, and Methods of the EIA

3.1 **Sequence of the "Ten-Plus-One-Steps":** It has been found in practice that some of the steps need to be retraced or fedback to earlier steps. There are other feedbacks in addition to the one shown as step number 9. In practice, feedback between the EIA team and the engineering feasibility team has to be a continuous process.

3.2 **Project Design and Description:** The last phase of the project is to be "abandonment or renewal" instead of simply abandonment. In reality, projects in Bangladesh are likely to be renewed/ rehabilitated rather than abandoned (see page 19, paragraph 4.1).

3.3 **Impact Mitigation:** The practice of financial mitigation for loss of personal property is well understood. However, mitigation for the loss of common property resources, for example a wetland habitat, is more difficult to achieve. The Guidelines needs to more adequately address ways of dealing with this issue.

3.4 **The EIA Review Process:** During the EIA Skills Training Workshops, the lines of authority in the context of the review procedure were discussed. The Guidelines is not clear about such lines of authority. It is necessary that the document explicitly states who is responsible for what.

3.5 **Assessing Alternatives:** The Guidelines does not specify that a proposed project could include a preferred alternative as well as other alternatives. Only the preferred alternative is presented for comparison with the no action alternative. It would be advisable for the EIA team to consider alternatives. The methodology for assessing alternatives could be further developed in the Guidelines. In particular, how the Impact Matrix is to be used in assessing project alternatives and alternative interventions.

3.6 **Consensus Agreement on Environmental Management Plan (EMP):** The Guidelines states that the EMP should have the consensus agreement of EIA practitioners, design and planning engineers, government ministries, and the local community. What is not adequately specified is what if a consensus cannot be reached. The statement that local people are ".....granted the right to decide whether or not a particular program will be implemented" (see page 35) needs to appear after the discussion of gaining consensus on EMP, so that the reader is clear that failing a consensus, the people will decide. In the section on EMP (on page 28), the text refers to the "pre-feasibility EIA". Since an IEE is done at pre-feasibility and if necessary an EIA follows at feasibility, it should be correctly stated throughout the text.

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3.7 **Unmitigated Negative Impacts or Residual Impacts:** The Guidelines indicates (page 25) that when an impact cannot be mitigated to an acceptable level, the impact must be identified for specific attention of reviewers and decision makers. It is not sufficient for the EIA team to bring this to the notice of the reviewers or decision makers. If an impact cannot be mitigated, it would mean an irretrievable loss of some resource. The Guidelines should specify how to take this factor into consideration in arriving at decisions.

3.8 **Trade-offs:** How to decide on the trade-offs if the positive impacts are on one type of resources and the negative impacts on another? The classical example is of rice and fish. Is one of these to be traded for the other? From the nutritional standpoint these two are complementary resources for Bangladesh. In understanding trade-offs, there should be more flexibility regarding how income groups are defined (see page 27). It should be made clear that trade-off is a legitimate concept but only in relation to mitigation. One should not get the impression that it is possible to buy off impacts.

3.9 **Consultation Process:** Another element that needs to be stressed further in the Guidelines is consultation. While Chapter 6 describes a review process, it does not cover consultation as such. It is necessary that private and public comments on a draft EIA are responded to in a section on consultation in the final EIA document. In the absence of such a section, there would be no record of suggestions, concerns, criticisms, and requests coming from the people. The chapter on people's participation is not clear either on the role of people in the consultation process. Therefore, the Guidelines should be modified to more clearly indicate the sequence of a draft EIA, a period of consultation to collect comments and respond to them, followed by a final EIA. It is the Final EIA that decision-makers should review.

3.10 **Record of Decision (ROD):** The Guidelines do not specify the mode, media, or format decision makers must follow to announce their decision. Normally, the review team (typically the decision makers) publishes a Record of Decision (ROD) that not only announces their choice, but also provides justification for their decision and formalizes (mandates or makes voluntary) the EMP. Thus ROD becomes a very important document at the implementation stage. It is therefore very important that the EIA Guidelines indicates how the EIA team should present recommendations. The section will describe how the team can use alternative analysis to arrive at recommendations.

3.11 **Impact Area:** Impacts can be calculated for the project area, and also for areas outside the project. Sometimes it would be necessary to show these impacts separately. This point needs to be stressed in the Guideline.

3.12 **Cumulative Impact:** This type of impact may be classified into three categories. The first is the project-on-project impact, the second is the environment-on-project impact, and the third is the accumulated impact of a number of projects. This should be discussed in the Guidelines.

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3.13 **"Scoring" and "Weighting":** In countries with comparatively more experience in performing EIA (such as the USA), the concept of "scoring" and "weighting" have come under criticism and have been virtually abandoned. In the absence of any national standard, "weighting" is almost an impossible/ indefensible task. Numerical values used for "scoring" and "weighting", if used for mathematical manipulation gives a false sense of exactness. The "scores" and "weights" represent only the best professional judgement of specialists and experts made on the basis of available information and is subject to personal opinion and biases. Besides, there are confusions regarding whether "scoring" and "weighting" are mutually exclusive concepts, and whether it is appropriate to multiply the two in obtaining impact values. Therefore, this particular step in the Guidelines may need to be reconsidered and possibly restructured.

3.14 **Bounding:** There can be more than one boundary of the study area, depending on whether the criteria used are hydrological, agro-ecological, socio-economic or administrative. How to arrive at one common boundary needs to be made clear.

3.15 **Impact on Employment and Occupation:** The Guidelines need to emphasize more the impacts of projects on employment in agriculture and other sectors. There should be clear indication as to how one would separate impacts of FCD/I projects on occupation from impacts of demographic changes and urbanization.

3.16 **Role of Government and Non-government Agencies in EMP:** The role of government and non-government agencies in generating employment opportunities in the post-project scenario should be elaborated in the Guidelines, covering particularly the aspects of mitigation and enhancement opportunities.

3.17 **Common Property Rights in Fishing:** Issues concerning common property rights in fishing and the access arrangement, particularly for subsistence fishing in leased water bodies, need to be incorporated. It may be noted that the poor get some access to the leased-in water bodies for subsistence fishing. This section should also include indigenous systems, if any, of fisheries resources conservation and management.

3.18 **Livestock:** The Guidelines should be more explicit regarding the importance of surface water availability for livestock, particularly for bathing and drinking purposes. The Guidelines should deal with the issues relating to changes in land type and cropping pattern and critically assess their implication for livestock in terms of availability of grazing land, fodder diversity and its abundance, draft power, and milk production.

3.19 **Forest and Vegetation:** The Guidelines should indicate the need for understanding the impact of changes in surface water on terrestrial and aquatic vegetation. The need to extend the linkage to the availability of fuel wood is to be emphasized. There is a need for more explicit indication that profiles of both terrestrial and aquatic vegetation should be prepared to reflect species diversity and their abundance so that their importance for the ecology and the economy can be better understood.

4. Specific Edits and Updating

- All references to "FAP projects" in the document should be changed to "water resource projects".

- On page 6, reference should be made to the Environmental Protection Act, 1995, the National Conservation strategy (NCS), and the National Environmental Management Action Plan (NEMAP) documents.

- In the monitoring section, references should be made to Compliance Monitoring.

- Paragraph 1.3 appearing on page 8 under figure 1 should be placed on page 7.

- On page 9, paragraph 1.5 ,"two-volume" should be replaced by "one-volume".

- The fourth paragraph on page 24 should be placed under paragraph 4.7.1.

- The first three paragraphs on page 27 should be placed under paragraph 4.7.1.

ANNEXURE 8

POE FISHERIES TECHNICAL SUPPORT REPORT

BANGLADESH FLOOD ACTION PLAN REPORT

1994

FISHERIES

by

Mark Hill and Darrell Deppert

Bangladesh Action Plan for Flood Control

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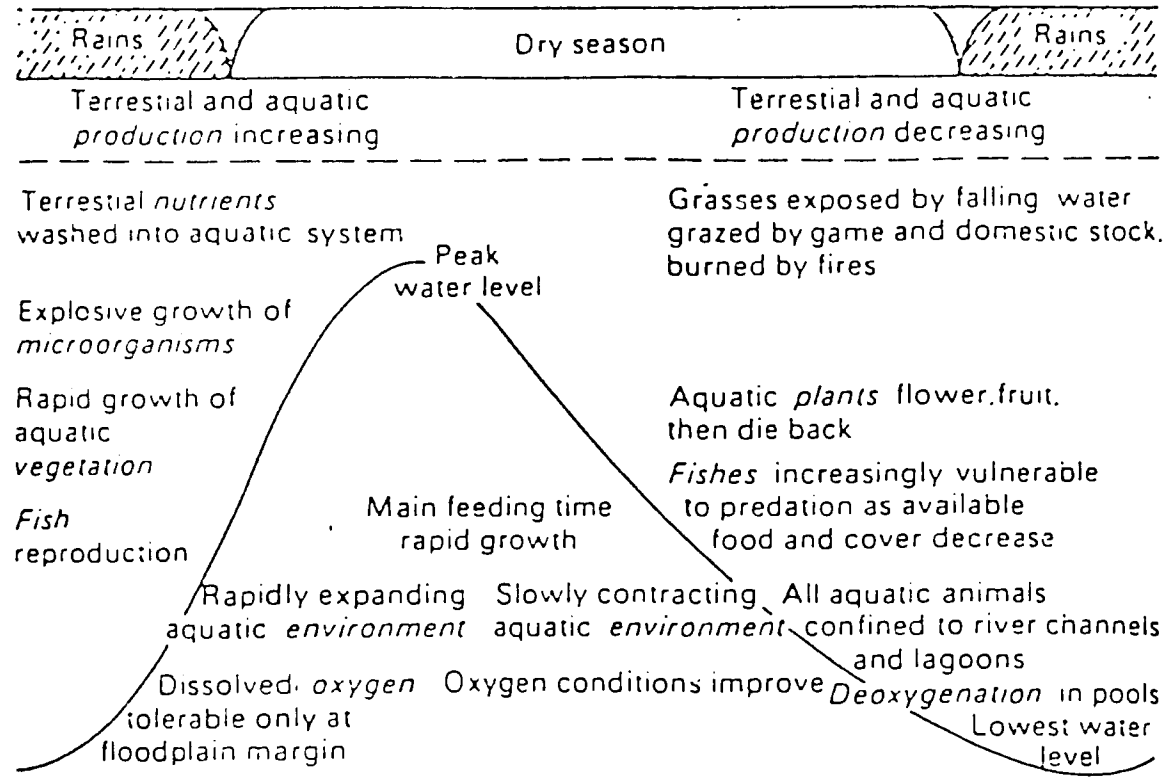
ECOLOGY OF BANGLADESH FISHERIES

Bangladesh receives two of the world's largest rivers, the Ganges (Padma) and Brahmaputra (Jamuna), which meet the Meghna before discharging into the Bay of Bengal. The flat alluvial lands through which the rivers run form part of the floodplains of these rivers and are susceptible to extensive seasonal flooding at high water during the monsoon season. The flood cycle typically extends from July through December. The fact that three rivers are involved provides an additional element of unpredictability to the flooding regime.

All three rivers have independent cycles so consequently the flooding in Bangladesh is the result of the combination of all three. The fact that the sources of the Ganges and Brahmaptura rivers lie within the same mountain range contributes to the similarity of their flood cycle. In addition, during the monsoon season of June to September, amongst the highest records of rainfall for the world are recorded in Bangladesh and the upstream catchment areas of the major rivers.

The net result of direct rainfall within Bangladesh, together with rainfall and snow melt within the Ganges and Brahmaputra river basins, is a general flood season which coincides with the monsoons. The waters tend to diminish during October and November. Since rising discharge rate and water levels signal upstream spawning migrations for many fish species, the period April until June is a critical period in all rivers of the country. In fact, the area of floodplain under water varies from year to year according to the inter-annual variation in river discharge.

A generally similar annual sequence of events occur throughout the tropics, with severe fluctuations in drought and flood with the cyclical physical, chemical, and biological changes that this induces. Figure 1 illustrates the basic patterns of activity typical of floodplain rivers. The conditions, processes and characteristics



Fish movements	Up channels	Disperse on floodplain	Down channels back to river	Fish restricted to dry season refuges
Fishing activity	For upstream migrants (often illegal fishing)	Fish difficult to catch (much cover)	Intensive fishery as fish migrate	Fishing in pools and river bed
Fish biomass	Production of young by most species	Rapid growth: rapidly increasing ichthyomass	Heavy losses from predation and stranding	Much reduced populations

FIGURE 1. The seasonal cycle of events in a floodplain river.

of the river floodplain complex are unique and differ considerably from those of other wetland ecosystems. Of particular significance to fisheries is the extreme temporal variations in physical, chemical, and ecological conditions and a greatly expanding and contracting aquatic environment. In essence, it is this expansion and contraction of habitat that dictates fisheries productivity.

The flood cycle is an essential element in the life history of most of the fishes of the rivers. The inundation of the floodplain provides the spawning grounds, nursery areas and the major feeding opportunities for a wide range of fish and prawn species. Some 256 species of indigenous fish and over 20 species of indigenous prawns have been recorded in the open inland water system. Many of these species migrate considerable distances upstream, under the stimulus of rising waters, to reach the spawning areas, and then move out over the floodplains as the waters extend laterally. Throughout tropical ecosystems, a direct relationship between the magnitude of the annual flood event and total fish production has been shown. Bangladesh is no exception to this as shown in Figure 2 for the Northeast region. As annual discharge in the upper Meghna River increases (i.e., greater floodplain inundation) the total fish catch increases.

The breeding, multiplication, and sustenance of inland fish and prawn populations are intimately bound to the sequence of annual flooding. The monsoon floods join the primary habitat types (rivers, floodplains, beels and the estuaries) of the inland open waters, producing a single integrated biological production system where the fish and prawn populations breed and grow in both numbers and biomass. Within this ecosystem, the inundated floodplains play the most significant role because a large number of the fish and prawn species are dependent on breeding over the floodplains. Further, the nutrient- and food-rich floodplains provide nursery and feeding grounds for hatchlings, fry, and juveniles of

a number of river-breeding, estuary-breeding and floodplain-breeding species. Young fish may utilize floodplain nursery and grow-out habitats for 4 to 5 months before entering riverine or estuarine habitats.

The nature of the fisheries in a river with an extensive floodplain system is necessarily dictated by the seasonal changes in water level and discharge rates, and the movement of fishes that these stimulate. The situation on the floodplains associated with the Padma, Jamuna, and Meghna rivers in Bangladesh appear typical in this respect. As the floodplains become inundated by rainfall and overbank flooding, many species of fish begin a longitudinal migration upstream to spawn. Once the river begins to flood most fishes make lateral migrations into the many distributory channels of the river. From there they move to the floodplain proper to exploit the food resources of the flooded area and to spawn. The productivity of a floodplain can be correlated with the area inundated, since the flood season represents the major period of growth for all sizes of fish. As the floodwaters recede, the fishes migrate off the floodplain, usually the adults first, followed by the large numbers of juveniles produced in the spawning season. During this phase, fish populations are at their peak, and they become concentrated into the channels and tributaries leading back to the main river. At this point they are most vulnerable to fishing activities.

As the water retreats from the floodplain, some is retained in lower lying beels and haors. The fish left in these depressions fall into two categories. A few species are adapted to life in the semi-isolated waterbodies; other, more mobile species, migrate on to the floodplain, though they may occasionally become trapped in the depressions. The extent to which the more migratory species become trapped is due to chance and the rapidity at which waters recede, and once in the depressions they are very vulnerable to fishing activity.

Life in the shallow, floodplain depressions is precarious and the fish are exposed to a wide variety of predators and the water may even dry up. Consequently, survival of fish in beels and haors during the dry season is a direct function of the water surface elevation in the depressions. In a particularly hot, dry season water surface elevation will be less, exposing fish to greater predation and increased susceptability to being caught. For those species whose life history is to hold over the dry season in beels and haors (often called "black" fish), water surface elevation is a critical determinate of how many spawners will be in the breeding population in the following wet season. Fewer spawners in a given year means less recruitment into the adult population the following year. The same phenomenon occurs with riverine fish species. Those species (sometimes called "white" fish) whose adults and juveniles intentionally evacuate the floodplain with receding floodwaters back to the river, experience the same survival stresses associated with wet/dry year cycles. For all species, the dry season represents the most critical season when the mortality rate is high and populations are at their lowest levels because habitat is limited, predation is at a peak, growth is slowed and competition for food is keen, while, concurrent with these natural stresses, fishing pressure remains high.

In the past, agriculture and fisheries were complementary activities in the floodplain areas, but with the population pressure and intensive agriculture these activities are now often in conflict. Beels have been drained to provide additional land for dry-season cropping, and their waters used for irrigation. River embankments have been built to protect both dry-season and monsoon-season rice crops from unwanted flooding. Natural fish habitats and migration routes have declined with these interventions.

Many of the control structures already in place on Bangladesh rivers are essentially dams which cut across the main flow of the river, while those required

by the FAP will be along the banks of the river to prevent the lateral movement of water. Nevertheless, the principles are the same for migratory fish seeking access on to the floodplains. The greatest consideration is the height of the obstacle to be overcome. Dams can be huge barriers which require elaborate and expensive passes to circumvent them. In the case of FAP embankments, however, the main consideration is not the height of the embankment but is the difference in water level between the river outside and the embankment and floodwater inside.

FLOOD CONTROL AND FISHERIES IMPACTS

Control of floodwaters and improvement in the agriculture sector of Bangladesh is an important objective. No less important is the protection of floodplain and river fisheries that are subject to impacts from FCD and FCDI schemes. The anticipated fisheries impacts from FCD and FCDI projects are based on actual case studies in Bangladesh, such as the Chandpur Project and the Cauline Beel Project. The following impacts are attributed to FCD/I projects:

Open water fish production declines due to general reduction in the area (hectare-months) of floodplains and beels (such as reducing the area of nurseries and feeding grounds).

Regulators prevent migration and recruitment of migratory species, especially major carps.

Small sized fish and prawn species replace large sized species.

Elimination of oxbows by channelization destroys prime carp spawning grounds.

Cross dams on rivers prevent migration upstream, and consequently the

upstream fishery disappears.

Embankments cut off channels (khals) which connect beels to rivers thus preventing both water and fish stock replenishment of beels.

Submersible embankments delay spawning migrations, resulting in resorption or ova and milt in frustrated brood stock or force migratory stocks to other, perhaps less desirable, spawning grounds.

These potential impacts must be taken into consideration with other, non-FCD/I project impacts, such as:

Overfishing from use of jal *and other illegal nets.*

Overfishing from increasing effort and entrance of more people into the open catch fishery.

Siltation of beels and rivers.

Annual harvesting of katha.

Deforestation.

Fish disease.

Exotic species introductions and induced competition.

Industrial water pollution.

Plant poisons, dynamite, and other poaching methods.

Decomposition of rice and plant residue.

Short term jalmohal *tenure (i.e., leasing)*

Effects on habitat of reduced dry season stream flows from upstream diversion, damming, or other water use activities.

Effects of wet year-dry year cycles on fish production and catch.

All of these factors (FCD/I and non-FCD/I induced) result in cumulative impacts to the fisheries and fisherfolk of Bangladesh. It might be possible to quantify the losses due to individual non-FCD/I factors, but it would be difficult to separate the effects of two or more factors operating simultaneously. Few fisheries in the country appear to be under only a single stress (or limiting) factor. Typically, most non-FCD/I fisheries are being impacted by several factors simultaneously. Thus, FCD/I projects stand to add tc or exacerbate existing limiting conditions on fish production and yield. It is arguable whether FCD/I impacts are additive or multiplicative.

FAP 6 provided an example of the importance of evaluating future impacts in light of current and historical fisheries degradation. If it is accepted that subsistence and commercial floodplain catch statistics underestimate the real level of yield then the real overall Northeast regional yield may currently be in the range of 55-70 kg/ha/yr. If yield had indeed been declining over the last two decades, then yield several decades ago may have been as high as 70-100 kg/ha/yr before overfishing and environmental degradation from FCD/I and non-FCD/I factors began impacting the fish stocks.

Another complication when evaluating the fisheries of non-FCD/I areas is the importance of remote effects of both nearby and distant FCD/I projects (singly and in combination). For example, FAP 6 showed that a high density of FCD/I projects/embankments transform rivers into corridors which direct migrating fish to remote, un-embanked areas further upstream. FCD/I projects also induce sedimentation in non-FCD/I areas, both upstream and downstream, as a consequence of altered stream geomorphology that results in aggradation.

In view of the existing impacts to Bangladesh's river and floodplain fisheries and the potential additive or multiplicative impacts from FCD/I projects, the key

questions for each habitat type and region of the country are *what is the floodplain production of fish in kg/ha, how much will FCD/I projects reduce production, what effect will this have on fisherfolk, and how can impacts be mitigated?*

Results of fisheries studies associated with FCD/I projects throughout the country confirm some of the anticipated impacts. However, not all FCD/I projects result in all of the anticipated impacts. It appears that all FCD/I projects have impacts in common such as blockage or inhibition of spawning migration and loss of habitat (spawning, nursery, rearing) associated with reduced area (hectare-months) of floodplains and beels. On the other hand, in many studies it was difficult if not impossible to show a change in fish production correlated with these two types of impacts. It is very doubtful that total fish production was not adversely affected by impaired or blocked migration and reduced habitat. Rather, it is very likely that limited study designs and short-duration studies were simply unable to measure changes in fish production. Some fisheries studies were so limited in scope, time and budget that no empirical data were collected and existing, suspect data were used to attempt to predict, not measure, changes in fish production. Most important, rarely could a FAP fisheries study isolate FCD/I impacts from non-FCD/I impacts; consequently, there has been no evaluation of cumulative impacts. Given the inability to clearly define floodplain fish production and to predict impacts on fish production (and consequently fisherfolk) in relation to FCD/I and non-FCD/I causes, it is difficult to identify mitigation measures that could be commonly applied to all FCD/I projects.

In general, future projects will have to be designed to allow controlled flooding of floodplains without causing damage to crops, fisheries, infrastructure and urban land. Within compartments behind major river embankments, intake regulators and drainage sluices need to be managed to control the timing, depth and duration of flooding within limits that ensure secure growing conditions for

crops. At the same time, fish must be free to migrate to and from their natural floodplain spawning and feeding areas. This is easier said than done, given the annual and seasonal vagaries of weather and floods in Bangladesh. Management plans for compartments, regulators and sluices will need to be prepared on the basis of maintaining adequate fisheries habitat for migration, spawning, and rearing and environmental quality.

In evaluating the impacts of the FCD/I projects in the five regions of the country, it is of importance to bear in mind that many FCD/I projects did not behave according to design plan during the fisheries studies. Problems frequently seen were:

* too early overtopping of submersible embankments;

* too much breaching of submersible and full embankments either by floods or by public cuts to drain or flood fields;

* too many drainage and irrigation structures inoperable due to mechanical damage and siltation;

* river channel siltation contributing to all the above and limiting navigation.

The relevance to fisheries studies of these failures is profound because it implies partial reversions to pre-FCD/I conditions (in effect, natural or community initiated mitigation). Clearly, the impact of any particular FCD/I project has the potential to vary from one year to the next. Furthermore, as there is an overall decline in the maintenance of structures throughout the country, the general direction of drift is towards pre-FCD/I conditions. In conceptualizing and assessing the impacts of FCD/I projects one must clearly distinguish between what might happen over the long term if the structures performed perfectly, and what has actually transpired given the highly imperfect behavior of many projects.

REGIONAL FISHERIES STUDIES

Patterns of fisheries in any area develop from the combination of fisheries resources, the configuration of local waterbodies, the social and cultural history of surrounding communities and the other economic activities carried out. While it would be easy to assume a homogeneous pattern for floodplain fisheries in Bangladesh, there are in fact very important regional differences which have a major influence on the kinds of impacts which flood control will have. These differences have been clearly distinguished in the five FAP regions based on primarily hydrological considerations.

Northeast Region

Many of the characteristics of fisheries in the haor region of the Northeast are unique to that area. The patterns of flooding in the haor are quite different from other areas. The proximity of the Meghalaya Hills to the north and the Tripura Hills to the south, both areas which experience some of the highest rates of rainfall in the world, creates marked peaks in run-off. These cause frequent flash-flooding, particularly during the pre-monsoon period from March through June. The depth and extent of flooding in the haor is also unparalled anywhere else in Bangladesh. The areas of perennial water are more extensive than in most other parts of the country and early flash floods mean that beel and residual waterbodies are frequently flooded out before harvesting can be completed. These factors contribute considerably to the richness of fisheries resources in the area.

Annual fish production in the Northeast region is close to 100,000 tons. About 10% comes from the rivers, 40% from the floodplains, 40% from the beels, and 10% from culture ponds. FAP 6, in various reports, exhibited total catch data

for the Northeast region as shown in Figure 3 that would indicate increasing fisheries productivity. However, one must examine such data carefully. First, the data shown in Figure 3 only reflects five years of catch data which in itself indicates a cyclic nature (a decline in catch in 1984-85). Five years is a relatively short temporal presentation for fisheries resources. Recent research into the phenomenon of biomass fluctuation shows that fish populations are highly cyclic, frequently lagged but correlated with climatic cycles, and that only long term, empirical studies provide meaningful interpretations of production trends. Also the data shown in Figure 3 is based on FRSS files which may not be always reliable particularly since this catch data was not normalized for increasing, annual fishing effort (i.e., more people spending more time fishing).

The general perception is that the overall fish catch and fish biodiversity have been declining in the region over the past 50 years. There are a number of reasons for this, but the main ones are as follows. First, the aquatic environment has been modified by water control works. Second, there has been deforestation of flood-tolerant wetland trees which support fisheries production. Third, industrial effluents harmful to fish are discharged into the Surma and Kushiyara rivers. Fourth, sedimentation of many beels has converted them from permanent to seasonal status thereby reducing fish production.

With a few notable exceptions (e.g.,the full flood control Manu Irrigation Project), flood control measures tend to be oriented towards the provision of temporary protection by submersible embankments. These generally aim at protecting boro crops from early floods just long enough for them to be harvested, usually at the end of April or in early May. Then embankments are designed to overtop and allow normal flooding for the rest of the season.

Case studies carried out by FAP 6 had difficulty separating the effects of FCD/I projects on fisheries production from non-FCD/I factors. However, the

following appear to be the principal impacts of different FCD/I project types on fish production:

* Partial protection projects tend to have positive and no impacts more frequently than negative impacts. Benefits are associated with higher water levels which improve pile fisheries and with prevention of siltation. Submersible embankments increase the surface area of beels during the dry season. Reduced production is associated with obstruction of fish migrations. Submersible embankments impede fish migration in either direction for about 10-20 days during the early monsoon until the embankment is overtopped. As fish stocks may include early spawners, submersible embankments will select for late spawners. Early spawners overwintering in rivers will probably swim farther upstream to headwaters and tributaries.

* Full flood protection projects (both with and without pumped drainage) have only negative effects - caused by reduction in flooded area and obstruction of fish migration - or no impacts (frequently because the area was not fish producing prior to project construction).

* River channelization projects can have very mixed impacts. River loop-cuts have a severe negative impact on carp reproduction as ox-bow bends are a favored spawning habitat. Sedimentation of duars is another negative impact.

* River and khal re-excavation projects have positive or no impacts. Benefits are probably due to greater habitat depth, better flow regime and improved connection with other channels and their fish stocks. Greater use is probably also made of the re-excavated khals by migrating fish stocks.

* Water retention schemes have no impacts. However, such projects in the region are not performing well.

* Floodplain area will decrease by 86,000 ha, or 4% of the total area. Assuming average floodplain productivity of 44 kg/ha, this corresponds to an annual production loss of 3,800 tones of fish.

* Beels will decrease by 560 ha, or 9% of the total beel area in the region. Assuming average beel productivity of 410 kg/ha, this corresponds to an annual production loss of 230 tones.

* River and channel area will decrease by 2,700 ha, or 7.5% of the total river and channel area, reflecting excavation of 70 million cubic meters of channel sediment. Assuming average river/channel fisheries productivity of 175 kg/ha, this corresponds to an annual production gain of 472 tons.

* The number of river duars will increase by 42 or 14%, reflecting mitigation of duars that will be lost due to siltation in the Baulai and Kushiyara rivers. Impacts on fisheries production will be positive, but have not been quantified.

* Five major channels and many minor channels will be closed permanently, thereby eliminating fish migration along those routes.

* The Surma-Kushiyara-Baulai Project includes dredging for habitat rehabilitation in the Khaliajuri mother fishery and key wetland site: flood control works were designed to preserve the ecological character of the fishery with migration routes left open. Net fishery impacts will be positive, but have not been quantified.

* The Manu River Improvement Project will adversely affect the Hakaluki Haor mother fishery and key wetland site. Information currently available on project design, mother fishery ecology, and mitigation and management options is incomplete. Some mitigation appears to be possible, in the form of structural confinement of sediment deposition to selected areas. Regional spawning could be significantly affected. Assuming a 5% reduction in spawning implies lost open water fisheries annual production of 4,500 tones. This would be in addition to floodplain, beel, and floodplain habitat losses given above. This issue requires further study during the feasibility stage.

* Mechanical dredging impacts on fish populations are not known and need to be investigated during feasibility studies. Dredging would be performed in the dry season (wet season velocities are too high) when turbidity under normal conditions is low and stresses on fish populations are already at their highest. A key issue will be possible disruption, particularly of benthic biological communities, due to sedimentation and high-velocity turbid plume flows; and the spatial and temporal scale of the fisheries impact. Some methods are in use to mitigate aquatic impacts of dredging, for example, use of booms and curtains to protect valued areas.

* For manual excavation, fisheries impacts occur during the site preparation

when channels are drained resulting in total catch of fish populations in the affected reach. The regional biophysical and economic impacts of this activity are not readily distinguishable from fishing activities, however.

* The overall quantifiable impact on open water fisheries annual production would be a decrease of 8,100 tones or 9% of the total, over half due to mother fishery impacts are Hakaluki Haor.

* Secondary impacts of FCD/I-induced water quality changes cannot be quantified, but, given the emphasis on drainage improvement which would lead to improved water quality, the net effect on open water fisheries production will likely be positive.

* No impact on the three fish species thought to be threatened is anticipated, but further study of these species will be needed.

Northwest Region

The Northwest region is bounded on its lower sides (south and east) by the Ganges and Brahmaputra rivers. Elevations range from less than 10m above sea level in the southeast corner to just under 100m in the far northwest; most of the region lies below 30m. In the southern part, 1m contours are typically 5km apart, and even in the northwest of the region average slopes rarely exceed 1 in 1,000. These low gradients cause the rivers and drainage channels within the region to be heavily meandered, and their flood conveyance capacity to be limited. Average annual rainfall ranges from less than 1,500mm to just over 3,00mm, with a regional average of about 1,900mm. Well over 80% of the annual rainfall occurs during the five month monsoon season between May and September.

Flood control development has been extremely widespread in the region. Much of the Chalan beel area, which used to constitute a major regional wetland, is now protected by polders, and the remaining outside have been drastically

affected by the changes in hydrology which these polders and other local flood control works have caused. Many perennial waterbodies are reported to be silting up and large numbers of traditional fishermen from the area have moved out or migrated to India.

The fish stocks in this region consist of a complex of species groups of differing behavioral characteristics. The more important of these groups include anadromous fish such as *Hilsa ilisha*, which migrate up the main rivers from the brackish water estuarine zone to spawn in freshwater before returning to the sea; and Indian major carp species which as fry are swept involuntarily by mid-monsoon floods onto the floodplains to grow and overwinter in the beels for two or more seasons until, on attaining maturity the survivors return to the rivers and migrate upstream during the very early monsoon in order to spawn. Other lesser riverine species move from river to floodplain in order to feed or reproduce, while others are again resident floodplain/beel species. A group of commercially important freshwater prawns (*Macrobrachium* spp) have to migrate downstream to the brackish inter-tidal zone in order to spawn, after which the juveniles return up-river and into freshwater khals and floodplain areas to feed and grow.

Both FAP 2 and FAP 12 performed fisheries studies in the Northwest region. FAP 2 did not collect empirical data but relied upon data retrieved from Upazila Fishery and the District Fishery office. Consequently, impacts, changes in fish production, quantified with this data may not be accurate enough to draw definitive conclusions. A less rigorous approach to analyzing impacts is shown in Table 1. In this table impacts caused by each FCD/I project in the Northwest region are rated on a scale from +2 to -2. The primary impacts of FCD/I projects on the fisheries have been summarized as follows:

* There is a potentially positive impact by effective flood control on culture fisheries in closed water bodies, such as ponds, borrow pits and canals, whereby the protection against over-flooding encourages regular restocking,

improved culture methods and where necessary, pond rehabilitation. Unfortunately these benefits have not always materialized because of ineffective flood control caused by poor maintenance and in some cases faulty design of FCD/I infrastructure, coupled with inadequate fisheries extension back-up and lack of credit.

* Negative impacts on capture fisheries arise from FCD/I works which reduce the areas of perennial beels and floodplain for fish breeding, feeding and nursery grounds; which block essential fish migration routes from beels to and from the rivers and which thereby alter and diminish the fish stock size and species composition of the faunas both within and outside the FCD/I project boundaries and with detrimental effects on fishermen's catch rates and earnings.

* Reduction of the areas of open water remaining within FCD/I developments has severely restricted access for subsistence fishing, especially by the poorer sections of the rural community who have relied on their former traditionally free fishing rights to provide the bulk of their animal protein food. This has adverse consequences for nutrition in the population groups concerned who mostly lack the financial means to purchase fish which previously they were able to catch for themselves.

* Reduced fish stocks and lower catch rates endanger the livelihood of fishermen, many of whom have been forced to emigrate from the areas concerned in search of alternative employment. Reduced catches also encourage the use of harmful fishing methods in the absence of any effective means of enforcing controls, as a response by fishermen in an effort to maintain their production and income levels. This is part of a vicious circle which only contributes even further to the collapse of the capture fisheries.

* Expansion of the areas of irrigated crops within FCD/I developments has led to increased use of chemical fertilizers and pesticides and thereby to contamination of the residual water bodies. This may lead to higher mortality rates especially of the juvenile stages of resident species and other fish which are able to breed in the beels or adjacent flooded areas.

Mitigation of FCD/I impacts throughout the Northwest region includes fish pond development, stock enhancement in rivers, development of borrow-pit

fisheries, and modification of FCD/I sluices and regulators to allow fish passage in both directions.

Northcentral Region

The flooding and drainage system of this region is defined and influenced by the three major rivers forming its boundary; the Jamuna, the Padma, and the old Brahmaputra-Lakhya-Meghna system. The old course of the Brahmaputra River forms the northern and part of the eastern boundary of the study area. The mouth of this river has been steadily silting over since the river changed its course and the flows down this branch are a fraction of the original. The remainder of the eastern boundary of the study area is delineated by the Lakhya River, a distributary of the old Brahmaputra River. There are three interior river systems; the Dhaleswari-Kaliganga in the southwest, the Bangshi-Turag in the center, and the Banar-Lakhya in the east.

Several features distinguish fisheries in the Northcentral region. Even without formal flood control schemes, the area is experiencing many of the changes which are generally associated with flood control due to siltation of waterways. Practically all beel and floodplain areas inundated by the Dhaleswari and Kaliganga rivers are growing steadily shallower and many local rivers have become seasonal. This is steadily reducing the areas under lease and restricting the use of waterbodies that support traditional open-catch fishing.

In spite of these changes, there are still a considerable number of small perennial waterbodies, particularly the many baor and rak (old river courses isolated from the mainstream) which support most of the fishing activity. This region is also an important carp fishery and the source of carp fry used to supply the

numerous fish ponds throughout the country.

FAP 3 investigated the fisheries of the Northcentral region. However, this study did not include collection of empirical data but, like other FAP fisheries studies, relied upon FRSS data. It is recognized by the Department of Fisheries that FRSS is in need of improvement, particularly in terms of increasing the sample size of its various components and strengthening the supervision of field staff to ensure good quality data. Consequently, as noted previously, FRSS data should not be taken as definitive but, perhaps, as an indication of trends in fisheries.

The region has considerable fishery resources. Capture fishing goes on throughout the year but peaks during the monsoon when river and rainfall flooding connects the various parts of the aquatic system: main rivers, tributaries, canals, beels, ditches, and floodplains to provide an integrated biological production system when fish and prawns breed and increase in numbers and biomass. Culture fishing is also practiced in numerous small ponds scattered throughout the region which are stocked with various species of carp. Fry are obtained either from natural sources such as traditional fry collection centers on the Jamuna, old Brahmaputra, and Dhaleswari rivers or, increasingly in recent years, from private and government hatcheries. The total catch is on the order of 35,000 tons; the floodplains account for 40%, rivers and beels 35%, and culture ponds 25%.

Over many years in the Northcentral region, a variety of flood protection measures have been introduced and include embankments along the main rivers (Jamuna and Padma), the establishment of numerous small-scale FCD/I schemes, the raising of major roads in flood-prone areas, and the construction of embankments to protect towns lying adjacent to river. FAP 3 assessed the impacts of FCD/I projects on the fisheries using a method that combined estimates of the yield per unit area of floodplain-dependent fish in rivers, beels and floodplains. The assessment used takes into account not only the direct loss of

fish from the affected floodplain within the FCD/I area but also the consequential reduction in productivity of adjacent river and beel habitats. Results of this model are shown in Table 2 for each FCD/I project. The method is fairly crude but, in the absence of more reliable information on fish productivity and biomass at different water depths on the flooodplain, it offers the only approach.

FAP 3 concluded that the general fisheries impacts from FCD/I projects could be categorized as follows:

* The reduction in floodplain area results in a decrease in the size of spawning and nursery grounds, and the area available for fish growth. This in turn leads to a reduction in fish production, not only within the FCD/I area but also in areas outside it.

* FCD/I structures such as embankments and regulators on rivers disrupt or prevent the seasonal migration of fish (adults, juveniles, fry) and shrimp between rivers and floodplain habitats. This results in a decrease in fish production and diversity and a change in catch composition, with the loss of highly valued migratory species such as major carps, and a predominance of small miscellaneous species of lower commercial value.

* The loss of floodplain areas leads to a reduction in or disappearance of the open-access subsistence fisheries which are especially important in terms of nutrition for the poorest sections of the rural community. The livelihoods of professional fishermen are also endangered by a reduction in the area of seasonal and perennial fishing grounds and a decrease in catch rate.

* Within FCD/I areas the introduction or expansion of irrigated crops has led to the increased application of chemical fertilizers and pesticides. The potential toxic effects of the latter on various components of the aquatic ecosystem including fish are well known but as yet, no environmental monitoring programs have been established in Bangladesh.

Impacts induced by FCD/I projects exacerbate existing, degraded habitat (siltation from erosion and deforestation), overfishing, and possibly epizootic ulcerative disease commonly infects fish throughout the region.

Southeast Region

The southeast region is bounded by the rivers Feni to the southeast, the Meghna and Lower Meghna to the west, the Titas to the north, and the Bay of Bengal to the south. Almost the entire region is low lying and flat. The northern part of the region is dissected by a number of rivers which carry waters from the hills above the Indian border to the Meghna. These rivers flow in well defined channels but are flashy and carry large quantities of sediment. These conditions create problems for both irrigation and drainage development in this part of the region.

There is an extensive network of seasonal and perennial rivers with Khals criss-crossing the region making it an important capture fishery. A large proportion of the region lies within the annual flooding area of the country and, as such, is believed to play an important role as fish habitat, especially in those areas isolated during the dry season which often merge into one vast expanse of water during the floods. The extensive flooding enhances the fisheries every year by carrying those species which migrate from the main rivers into the floodplain aquatic habitats for breeding, feeding, and spawning. In addition, the man-made khals and other types of artificial depressions (estuaries, road-side borrow pits, and canals) act as fisheries production sites and are good settings for the cultivation of commercially important species. However, ecological and biological data regarding fish and their utilization are lacking, especially for the smaller species and it is thus not possible at present to assess the fisheries situation of the region in detail.

Therefore, it is vital that an evaluation of the existing fish diversity and fisheries in the region and the potential ecological impacts that any flood control project might have on their life cycles and on the natural environment be carried out, taking into account the lessons learned from existing FCD/I schemes in the

region, as well as the experience gathered from the more recent feasibility studies in the Gumti Phase II and Noakhali North areas.

The Gumti Phase II area, in the northern part of the region, has been identified as one of the most important fishery areas in the country benefiting directly from the Upper Meghna and Titas rivers. Within the Gumti Phase II, the northern, central, and western areas are especially important because of the early flooding from the fish-rich Meghna River entering the northern part and extending rapidly throughout the basin. In the Norakhali North area, the most important fishery areas appear to be the Dakatia River and its floodplain.

Freshwater shrimp polyculture with fish is not known in the greater Comilla area; however, shrimp as a capture fishery in the Meghna, Dakatia, Gumti, and Titas rivers is important. As the study area is bounded by the Meghna from north to south, a considerable shrimp fishery does exist in the area.

FAP 5 examined the fishery of the southeast region relying upon FRSS data. Consequently, fish production and catch rates (for reasons discussed previously) are not reliable and empirical data are required before any conclusions can be made regarding changes in fish population caused by FCD/I schemes. Nevertheless, the loss of access and habitat in this region indicate similar fishery impacts identified in other regions. These impacts are summarized from FAP 5:

* Reduction of migratory open water species such as major carp and hilsa.
* Reduction of nursery area for growing natural fish and prawn stocks.
* Reduction of overall fish crop available for harvest.
* Reduction of catch of fish within the area over time.
* Reduction of fish consumption in the area.
* Reduction of average size of fish in the waters in the area.

* Exacerbation of over-fishing.

* Increased growth of aquatic vegetation and changes in habitat types.

Southwest/Southcentral Region

The southwest region is bounded by the three major rivers (Ganges, Padma, and Lower Meghna) to the north and east, the Indian border to the west, and the Bay of Bengal to the south. About 4,000 km^2 are covered with coastal mangrove forests known as the Sundarbans and about 13% is water area, including rivers and beels.

The fisheries of the region comprise capture fisheries, culture fisheries, and brackish water shrimp farming. The open water fisheries comprise the rivers and floodplains (mostly seasonally flooded farmland) with a small area of beels. The catch has declined about 30% in both rivers and floodplains as shown in Figure 4. This is due to overfishing, epidemics of fish diseases, and the effect of water control works. The total catch is around 120,000 tones, with 65% from rivers, 33% from floodplains, and 2% from beels.

Culture fish production has grown rapidly in recent years, with the largest increase in shrimp farming. Current production is 73,000 tones composed of 48,000 tones from freshwater ponds, 17,000 tones of shrimp and 8,000 tones of fish from brackish ponds. Although shrimp farming is a major foreign exchange earner it is a source of social conflict. Small landowners or sharecroppers are sometimes forced by more powerful interests to turn over their land, without adequate compensation, for shrimp production between December and May. Conflicts also arise in some areas when rice farmers want freshwater and shrimp farmers want to bring in brackish water.

Investigations by FAP 4 led to conclusions of FCD/I impacts on fishery resources simllar to those found in other regions. Most of the spawning grounds for the more important migratory fish species are located upstream in northern Bangladesh or India. The problem is that relatively few mature fish from the diminishing beel areas are now able to migrate into the rivers, and thence upstream to spawn, because so many of the beel/river connections have been blocked. Fewer spawners inevitably result in reduced stocks of many riverine and floodplain fish species.

It is recognized that there have also been other contributory factors involved, such as fish disease, continually escalating demand for fish and over-fishing. In addition, there are direct benefits from FCD/I schemes to freshwater pond aquaculture and in some cases to brackish water shrimp farming, resulting in increased production from ponds no longer at risk of being inundated.

However, overall fish production in the southwest region is on a distinct downward trend. Fishermen interviewed by FAP 4 pointed to beel drainage, embankments, excessive river siltation in recent years, and interference with river flows such as by the Kumar River regulator near Faridpur, as the primary causes of decline in fish stocks, catches and fishermen's earnings.

In contrast, the Sundarbans estuarine fishery appears to have remained fairly stable, around a mean annual catch of about 7,00mt but with indications of a declining trend beginning in 1989/90. With the exception of shrimp larvae and possibly the fry of some fin-fish species, the estuarine fish fauna are much less vulnerable to changes such as might be caused by FCD/I projects. The capture fisheries of other coastal districts in the southwest region are characterized by large estuarine areas and, therefore, relatively unaffected by FCD/I changes.

SPECIAL PROJECTS

Fisheries Study (FAP 17)

FAP 17: Fisheries Studies and Pilot Project, is one of the supporting studies of the Flood Action Plan. It is the only FAP project entirely devoted to inland fisheries issues in five of the six regions. FAP 17 is divided into two phases. Phase I, the Fisheries Studies, is a biological and socioeconomic investigation of impacts on fish production and fishing communities caused by a range of FCD/I schemes. Phase II, the Pilot Project, will develop mitigation strategies to compensate for the predicted loss in capture fisheries.

FAP 17 collected an enormous volume of data that is significant spatially but not temporally. While the data collection effort spanned four of the country's five regions and several FCD/I types of projects, a variety of catch methods, and differing socioeconomic conditions, the effort only covered 12 months and in some cases 18 months so that two wet seasons were included in the data base. However, these were two quite different water years - one unusually dry year followed by one wet year. Fish populations follow cycles, particularly in relation to the hydrologic cycle. During high water years fish production and recruitment is high while in dry years it is low. A one year sampling program cannot account for the position of fish populations in these cycles. Nor can a one year study account for any of the other cyclic environmental variables that affect fish populations. Not only do fish populations respond to climatic cycles but this can be seen in fish market values as well. In 1988, an extreme high water year, market prices approached TK10/kg while in a drought year, 1994, fish sold at roughly TK250/kg.

FAP 17 also attempted to perform a comparative test of fish production inside and outside FCD/I projects, essentially test and control sites. Nevertheless,

all sites were selected on the basis of preordained criteria rather than a stratified random sampling design. An important constraint was the inability to find proper control sites that would satisfy the criteria set for comparability and could be regarded as "unaffected" by flood control. These limitations in the study design injected bias in several ways and cannot provide a true picture of fisheries in relation to FCD/I projects or establish the historical condition and context of fish populations or fisherfolk dependency.

The variability and error associated with length-frequency distribution, catch and effort (due to sample design, variable catch methods, etc) is so large that one-year's effort cannot be taken as definitive. Fish biomass, density, standing crop, catch rate, etc. cannot be measured in a one-year study; if fish numbers are the focus of a study it must be performed over multiple years. The project should have measured differences in habitat not fish numbers or catch if FAP 17 only had one year. Hydrology data for some study areas was incomplete and therefore fish/unit area data have limited meaning. The study sites were not properly quantified on an areal basis, consequently any relationship of fish to area (kg/ha for example) may have substantial error associated with it.

Another factor hampering measurement of impacts - for both fish production and fisherfolk - was the dysfunctioning of flood control schemes. Either because of poor design or poor maintenance and operation, many FCD/I schemes were subject to frequent breaching during the study period.

It is imperative that an assessment of the impact of flood control on fisheries relate the data on fish stocks to changes in timing, extent, duration, and magnitude of flooding. Unfortunately, it is precisely this type of information that was unavailable for most study areas. While the hydrology model, MIKE 11, was eventually verified for high stream flows, it is still unreliable for low flow modeling in rivers. MIKE 11 also lacked the resolution necessary to adequately predict the

extent, depth, and duration of landform flooding throughout the seasons studied. Recently it has been possible to obtain wet season remote sensing imagery in floodplains from radar receiver data from the ERS 1 satellite. This was not available for the FAP 17 work.

Most importantly, FAP 17 did not present detailed evaluations of historical impacts to fisheries and habitat in relation to current and future impacts from FCD/I projects. Thus, one cannot establish where in a clearly downward spiraling fishery a particular FCD/I lies or what the cumulative impact (additive or multiplicative) is or will be.

Floodplain fishery yields were found to be greater than previously reported in other studies throughout the country. Project planning has variously used 30-60 kg/ha as a standard floodplain production figure. FAP 17 estimated a mean floodplain yield of 107 kg/ha from floodplain and beel data pooled for each region. This approach did not include river and canal production even though those fish are dependent on floodplains during a portion of their life cycle. Consequently, this yield figure will be higher if river and canal catches are included in the total estimate. By comparison, FAP 5 results from the Gupti area found a per hectare yield during a low water year (1992-93) to be 196 kg/ha while time series analysis of Bangladesh Fishery Resource Survey System (FRSS) floodplain fishery data results in 152 kg/ha.

Clearly, floodplain fishery production is greater then conventional wisdom would lead one to believe. Nevertheless, the preliminary data reported here indicates a substantial variation between regions of the country as well as between years. Thus the questions - what is the production of fish in kg/ha and how much will FCD/I projects reduce production - remain unanswered. Using yield estimates from FAP 17, FAP 5, or FRSS are no more reliable then using the generally low estimates cited in planning studies. Any or all of these estimates could be

absolutely wrong because none of the studies, by themselves or in combination, exhibit appropriate spatial-temporal application and statistical power. Until a multi-year, rigorous stratified random sampling design with an emphasis on habitat quantification is implemented, the issue of FCD/I impacts will remain unclear.

Estimates of floodplain fishery yields do not include 1 in 5, 1 in 10, or 1 in 25 year flood events. As stated previously it is in these flood years that fish production reaches its highest levels. For example, effects of flooding can be seen in the FAP 17 data that covered two high water periods in the Tangail area. Between the 1992/93 dry year and the 1993/94 normal water year, fish yields from the floodplain more than doubled. Biologists do not know how important these flood years are to the overall fish population levels. It is quite reasonable to expect that fish capitalize on these high water years to compensate for low water year recruitment in order to maintain some long term stasis in total fish production. Only studies long enough to capture high-normal-low water years can shed light on this important influence on yields. One must recognize that fish production or yield is simply the manifestation of greater and lesser amounts of habitat in wet and dry years. Productivity is greater and recruitment into the adult fish population is greater when more habitat is available for incubation and nursery stages and to allow better predator avoidance. Consequently, the definitive, and far less error prone, approach is to focus on habitat changes within floodplains (and rivers and canals) as the key indicator of FCD/I impacts. Cumulative impact assessment (historic plus current habitat loss) is more accurate and reliable when it too is habitat based.

FAP 17 results also indicated that there may be no difference in catch between inside and outside of FCD/I projects only because effort increases inside embankment areas as catch declines. Also, the effectiveness of flood control schemes was less than planned. Catches from secondary rivers and canals were

so variable as to make generalizations impossible. The contribution of migratory species to the catch was consistently lower inside FCD/I projects (particularly the Manu River, the Brahmaputra Right Embankment and Pabna projects and submersible embankments). This may have been due to blockage of fry movement into poldered areas or blockage of spawning adults. These are certainly confounding problems and difficult to verify without more data. However, it does illustrate the need for a habitat based approach to impact analysis over catch, yield, or production estimates for fisheries.

The strongest indication from the FAP 17 studies was that species composition declined inside FCD/I projects. Any time there is a measurable decline in species diversity (biodiversity) it is a red flag that an ecosystem, even at the biome level, is in trouble. FAP 17 only showed that there could be up to 50 percent fewer fish species inside existing FCD/I schemes. While non-migratory species exhibited some decline inside projects, the greatest reduction was noted for migratory species. It is not known if this is due to simple passage problems that might easily be mitigated or if it represents a long term and more serious indication of irretrievable habitat loss.

Species composition can be very misleading and is not usually a reliable indicator of real change. Species diversity, on the other hand, is a measure of both differentiation and distribution of observations and provides a far more statistically reliable indication of true impacts on species. Biodiversity is an expression of the number of species according to geographic size: (1) alpha diversity is the number of species at one habitat in one locality, (2) beta diversity is the rate at which species number increases as nearby habitats are added or deleted, and (3) gamma diversity is the totality of species in all habitats across the entire study area. FAP 17 results were only presented as species composition thus one cannot predict how meaningful the changes really are except to conclude that migratory species

are likely to be excluded from floodplains inside FCD/I schemes.

The FAP 17 socioeconomic studies suffered many of the same limitations described for the fisheries studies; i.e., poor test and control sites, one year of data that lacks historical perspective or incorporation of existing, non-FCD/I impacts, etc. Again, results from socioeconomic studies can only be taken as indicators of impacts not as absolute changes from which conclusions can be drawn and mitigation recommended.

These studies found that fish production on the floodplain is considerably more valuable than previously assumed and most floodplain fish production comes from species that do not have to migrate to and from rivers. Thus subsistence and commercial fishing is dependent upon mostly non-migratory species. However, this may well be misleading unless one is able to account for non-FCD/I impacts that for the past two decades have forced a decline in production and, hence, catch, species composition, and market value. Humans are as opportunistic as the next species. If overharvest plus habitat degradation have led to the demise of more desirable species like major and minor carps, it is only natural to assume that fishing effort would shift to whatever species is available. If this is the case, then fishing pressure has shifted to those species most accessible in the floodplain but not necessarily of the greatest economic value.

The socioeconomic studies also showed that where flood control reduced the extent and depth of flooding the professional fishermen were the principle losers. Normally deep flooded areas inside FCD/I schemes became more shallow which allowed greater access to subsistence fishermen with smaller gear. Professional fishermen also lost out when landowners extended cultivation on khas land thereby establishing de facto claim to fish concentrating on these plots.

In general, as flood control schemes increased over an area there was a change in the ownership pattern of the fishery. Flood control also dictates the type

of gear that could be used and, consequently, the types of fishermen. As floodplains inside an FCD/I project became more shallow the fishery changed from open access to a closed one with access restrictions on privately owned bottomland.

Given the limitations of the study design and the potential error and variability associated with the data, one must not draw definitive conclusions from the FAP 17 results. The project must be viewed as merely baseline data, the first year effort, that simply indicates fisheries and socioeconomic impacts. However, FAP 17 results must be used to refine the study design, improve habitat typing, data collection methods, and focus on reliable test and control sites for another three to five years of sampling. Less intensive sampling will not provide definitive data on FCD/I impacts or arrive at reliable estimates of fisheries productivity. Phase II of FAP 17 cannot be implemented until cumulative impacts can be identified.

Jamalpur Project

As a result of an economic comparison of the Jamalpur Project, a land and water development plan was selected (Option B) which provides for controlled flooding in the mainland project area and includes the construction of embankments and drainage infrastructure.

The fisheries study of the FCD/I option quantified the present fisheries situation in the study area, to assess the potential effects of the proposed land and water development plan and to propose appropriate mitigation measures. The main factors affecting the productivity of fisheries in the floodplain, beels, and rivers would appear to be average depth, duration, area inundated and the quantity of residual broodstock left over from the previous year to repopulate once the

monsoon season begins. A simplistic empirical flood model was used which considered monthly stream levels and some notion of topography all set within the framework of the existing compartments of the area. Although of questionable accuracy, the figures obtained from FRSS were of sufficient validity to provide an order of magnitude estimate of fisheries impacts as shown in Table 3.

The primary fishery impacts of the FCD/I option will be as a result of providing both controlled flooding of inflow into the area and increased drainage provision within it. It was predicted that this will produce a three major effects: (1) a reduction in fish habitat, (2) a reduction in carp size at capture, and (3) a reduction in fish recruitment from the river.

Possible mitigation measures include:

* Mitigation of reduced recruitment may be modified (to a limited extent) by use of sensitive regulation structure design, configuration, and location, particularly the type of gates and their operation.

* Reduction of the speed of drainage, particularly at the end of the wet season.

* Other mitigation includes catch replacement measures and fisheries management measures.

TABLE 3. Estimated fisheries impacts from the Jamalpur FCD/I

AREA	PRESENT (tones)	WITHOUT PROJECT	WITHOUT MITIGATION	WITH MITIGATION
Floodplain	902	582	231	500
Beels	1100	710	183	1335
River	508	328	105	533
Ponds	408	1305	1498	1740
Main Rivers	1445	932	932	932
TOTALS	4363	3857	2949	5040

Tangail Compartmentalization

The need to protect large areas from flooding almost always entails the use of embankments. This led to the "compartment" approach for the development of areas protected by continuous lengths of river embankments. In this approach, a section of river embankment forms one side of a block of land totally enclosed by other embankments and is provided with the structures to control water inflow and drainage. The concept has much in common with polders, which already exist in many parts of Bangladesh. In principal, the concept is to protect large areas from uncontrolled flooding through structures with controlled flow, along with measures to drain excess rainfall from the protected areas (FAP 20 1993).

The use of embankments to control floodwater will inevitably restrict the access of wild fish and restrict their movements between the rivers to the floodplain. It would be expected that embankments will restrict their opportunities for feeding and reproduction while also limiting the numbers of fish available to floodplain households.

The compartment approach is perhaps the most extreme mechanism for controlling floodwaters within the FAP. Water access will be controlled so as to enable greater use of dry season crops in compartment and there will be an inevitable loss of flood area within the compartment. Nevertheless, the controlled water inflow should allow some water for fish production, providing the fish are available within the compartment. The construction and operation of compartments is the subject of FAP 20, the Compartmentalization Pilot Project at Tengail. Fisheries productivity estimates developed by FAP 20 were inconclusive because of underestimates and other errors associated with floodplain hydrologic models.

FISHERIES IMPACT SUMMARY

Based on paired studies conducted by FAP 17 (inside/outside) on representative FCD/I projects, the following general fisheries impacts caused by Flood Action Plan projects are summarized. These impacts, however, are only *indicated* by FAP 17 and other fishery study results. No fisheries study was performed with appropriate scientific rigor to allow for any *definitive* conclusions of impacts.

1. **Total loss of yield.** The mean value of total catch from all outside sites sampled during 1993/94 was 107 kg/ha. If areas of floodplain are entirely excluded from flooding, either controlled or otherwise, this is the average yield which would be lost.

2. **Relative loss of yield.** Inside empoldered schemes, it was expected that there might be a relative loss in yield compared to outside. Though this was the case in some places, the average fish production per unit area of floodplain/beel habitat was not significantly different in control areas and within embankments. This was true both when all schemes studied by FAP 17 were taken into account, and when only projects considered to be working fairly well were included. Thus no consistent relative loss of fish yield due to empolderment was demonstrated.

3. **Reduction in biological productivity.** This was difficult to ascertain, but statistical analysis of fish abundance inside and outside schemes, after removing effects of effort, indicate that while in some cases there was no significant difference in fish abundance or density inside and out, on average density was around 10% less inside. Compartmentalization, therefore, does have a significant biological effect on fish populations inside compared to outside.

4. **Differential deployment of fishing effort.** In some cases the empolderment of an area had reduced the options for fishing, with the result that low effort inside leads to correspondingly low catches compared to outside. However, in others the agricultural and social changes inside appear to encourage more people to fish, with the result that total yield inside is greater than that

outside, effectively swamping any negative biological effects. It is not necessarily the same class of people, however, who benefit from the fishing inside, compared to those outside who benefited from compartmentalization. The question also remains as to the extent of the ability of the fish stocks to sustain these rather higher levels of exploitation.

5. Differential status of fish stocks. The high fishing effort levels inside compartments, leading to higher catches inside compared to out, may have the effect of impairing the long-term capability of the fish stocks to sustain this level of exploitation, particularly if recruitment and replenishment from outside is restricted by water control measures.

6. Reduction in species number and biodiversity. One of the most consistent differences between catches inside and outside working empoldered schemes was the reduction in number of species inside. The number of species was sometimes reduced by 30-40%. The same dominant species also keep recurring in catches. The bulk of the fishery is therefore sustained by a relatively few sedentary species nationally, twenty to thirty in all, several of which are closely related.

7. Reduction in migratory species. The contribution of migratory species, such as major carps and several river catfishes, to catches is relatively small in the Northcentral and Southwest regions but greater in the Northeast and Northwest regions. However, their contribution to catches is consistently lower inside embankments and frequently negligible. The hatchling survey showed how eggs and fry spawned upstream are often prevented from drifting into empoldered areas due to the sluice gates being closed at critical times.

8. Reduced recruitment. While compartmentalization and controlled water flow does not necessarily exclude the entry of the downstream drift of eggs and larvae into the schemes, the hatchling survey does show that some species can be excluded, depending upon the timing of gate closures. This effect has undoubtedly contributed to the much lower number of species occurring in catches inside schemes.

The socio-economic impact depends on who is exploiting the fishery prior to flood control and the types of hydrological and biological effects anticipated. Where flood control reduces the extent and depth of flooding, there can be multiple

losers:

9. **Professional fishermen lose from intensified competition with local agricultural communities.** They are likely to lose out both as production declines and as the remaining stocks become increasingly accessible to subsistence or part-time fishermen whose patterns of gear ownership previously excluded them from the more deeply flooded areas. Such losses will be most dramatic where traditional Hindu fishermen find themselves in competition with members of local Muslim communities; but traditional Muslim fishermen would also be at a disadvantage, in both numbers and status.

10. **Professional fishermen lose from the decline in khas land.** The extension or cultivation onto khas land will establish *de facto* claims to fish, concentrating on farmer's plots during the drawdown, particularly if the residual stock is of sufficient value to encourage the development of *kua*. This will, again, be to the detriment of professional fishermen (and leaseholders).

11. **Subsistence and part-time fishermen can sometimes gain but will more usually lose.** The overall impact on subsistence and part-time fishermen will depend on the balance between the overall decrease in the stock and the increased fishing opportunities which they enjoy due to changed hydrology; if changes in stocks are significant or professional fishermen played little role in the fishery prior to flood control, these groups are likely to lose out.

12. **Leaseholders are likely to lose, but can sometimes gain if greater water control allows more complete harvesting.** Wherever there is a significant decline in the value of the stock, leaseholders are likely to lose out (as will the government, due to reduced revenue). However, in some circumstances, reduction in the depth of flooding may benefit leaseholders (in the short-term at least), if they are able to secure greater control of eater levels in beels following the drawdown. Low water levels increase fish catchability; thus allowing them to harvest a larger proportion of the residual stock with lower labor costs. Such effects may offset a reduction in the total stock (at least partially) for the leaseholder but will compound disbenefits for the professional fisherman.

13. **Professional fishermen lose most from changes in species composition but there may be benefits to the poor.** Where the timing of the flood is

affected, but area and duration change little, the principal fishery impact is likely to be on species composition and so on the average value of the catch per kilogram. Professional fishermen (and leaseholders) are more likely to be affected by this than other groups. To the extent that they then choose to fish elsewhere, this will benefit subsistence fishermen and local consumers, for whom fish will become more abundant/cheaper.

FISHERIES MITIGATION MEASURES

The provision of fish access routes to and from an area subject to compartmentalization or empolderment has been the subject of a special study by FAP 17 and has also received considerable attention from FAP 6. More details of potential fisheries mitigation measures are provided in FAP 17's main report than are given here.

There are two reasons why access might be provided as specific mitigation. First, access into and out of FCD/I projects will offset any reduction in yields through lack of natural recruitment and, second, access will allow as many species as possible to persist in the modified conditions, maintaining biodiversity.

The species that would benefit most from maintaining open access routes are those for which movement between river channel and the floodplain is essential for successful reproduction, feeding, and growth. Prominent here are the major carps and certain catfish species, all of which are traditionally highly valued in Bangladesh.

Mitigating fisheries impacts can be achieved through upstream entry, downstream drift, exits from compartments, stock enhancement, refuges and closed seasons, aquaculture, and fisheries management information as summarized below:

Upstream Entry - Reviews of fish pass designs conducted by FAP 17 and FAP 6 suggested that the most appropriate for Bangladesh would be a "pool

and weir" type, with vertical slots to allow passage of less active and bottom-dwelling fish. However, most regions of the country are flat and fish ladders need an elevational difference of 2 to 3 m between the head and toe of the ladder. The preferred approach for upstream entry is to open the sluice gate at the right time to let water out during the pre-monsoon season. This would allow migratory fish to enter the compartment. To induce fish to pass through, the current velocity of the water flowing through the sluice must be sufficient to stimulate the fish to swim against it but not so fast as to block passage. Hard data on the swimming response of critical species are not available but FAP 17 reported a suitable range of current speeds between 0.3 and 1.8 m/sec. However, there are marked differences between species and sizes of fish. Further studies will be required to test whether the management of drainage sluices produce currents within the desired range.

Downstream drift - There is a substantial downstream drift of eggs and hatchlings during the monsoon season. In virtually all sites outside empoldered schemes two peaks in hatchling drift were found. It is apparent that the initial peak (from June to July in the northwest and northcentral regions and March to May in the northeast) is the largest and also that major carp hatchlings are principally to be found in the first wave. It is important, therefore, that if recruitment and colonization of the compartment from outside it are to take place, then provision must be made for some sluice gates to allow inflow during the critical period as the first wave of hatchlings pass.

Exits from Compartments - Adults of most migratory species must leave the compartment on the floodplain for their dry season habitats in the rivers and canals. As a rule this is not a problem, since normal use of polders for agriculture involves drainage towards the end of the flood season. There is also the question of sedentary species which provide the bulk of the catch. There is considerable evidence that fishing effort tends to be greater inside and FCD/I scheme compared to outside. These sedentary stocks are, therefore, under considerable pressure. It may therefore be significant that, while they are able to reproduce inside the compartment, they may also depend upon a proportion of individuals escaping to refuges outside the compartment to enable recolonization, assuming hatchlings or adults can enter during the following monsoon. But not all exits from the scheme are desirable: mode and timing are also critical. A forcible exit, particularly for hatchlings, may be caused by pumping stations. Studies show that

hatchling exits through pumps causes high levels of mortality. Some form of screening across pump intakes will reduce this loss.

Stock Enhancement - Sock enhancement by restocking is a method of offsetting potential losses in fish production or even increasing fisheries yields. This technique, however, does require a considerable investment and, in the short run, when the supply of fingerlings is less than completely elastic, entails an opportunity cost of lost production from aquaculture, the use from which such fingerlings may be derived. As a mechanism for offsetting fisheries losses and for rehabilitation of certain sections of the fishery, restocking is technically feasible for the type of compartmentalization envisaged by the FAP and can be economically viable. However, it is clear that species composition, stocking density, and size of fingerlings are variables which need adapting to environmental circumstances and considerable study before restocking is implemented.

Refuges and Closed Seasons - The sedentary species which make-up the bulk of the catch have been shown to persist in the canals and any residual water remaining in beels. For the fishery to be maintained, sufficient adults must survive the dry season to repopulate the flooded area in the monsoon. The most obvious way to conserve the sedentary species is to give their refuges (beels and canals) some protection, or to construct more refuges. Refuges may vary in form and size depending on size and seasonality of eater bodies. An alternative way of providing refuge is to declare a closed season on certain canals or beels and other water bodies. This, of course, would require policing, but would only be necessary in a discrete area.

Fisheries Management Information - Virtually nothing is known of the population dynamics of the species which form the bulk of the catch inside compartmentalized systems, and their interaction with hydrological variations and increase in fishing effort. The ability to diagnose whether the fisheries are under-exploited or over-exploited remains limited. This, however, is critical for a full evaluation of the long-term effects of compartmentalization on fish stocks. As a specific mitigation measure, the population dynamics of these groups could be investigated and introduced into the various available predictive models to determine the levels of effort beyond which the fishery cannot be sustained, the likely interaction of hydrology and effort which could cause a collapse of the fishery and the limits to resilience of the populations. This would contribute to the integrated management of the compartments as agrofisheries systems.

Aquaculture - The development of fish culture is an obvious way to replace the tonnage of fish lost due to construction of flood control schemes. Flood protected areas have substantial advantages over "outside" areas for pond culture in Bangladesh, because they enjoy better security against fish losses through escapement during seasonal flooding.

FISHERIES PLANNING GUIDELINES

The data base remains a planning tool for use in future comparisons and projections. The main patterns and planning estimates have been extracted in the present report. These estimates and the overall experience gained need to be channeled into guidelines whereby the pre- and post-project impacts on fisheries and communities of any subsequent implementation of some or all of the schemes proposed under the FAP can be assessed in a way which can assist decision-making by planners, managers, scientists, and engineers.

There are two types of baseline data essential for any analysis of fisheries impacts and mitigation resulting from existing or proposed FAP schemes; static and dynamic. Static baseline data is that information which describes critical components of the fisheries that do not necessarily change from one year to the next. Static data are essentially fisheries criteria that define biological requirements of life stages and habitat. Dynamic baseline data are those data that describe conditions that do change from season to season and year to year. Such data includes fish productivity, standing crop, catch rate, etc. An analysis using reliable static and dynamic baseline data within the Environmental Impact Assessment (EIA) process developed by ISPAN can adequately describe existing conditions, expected fisheries impacts, and appropriate mitigation for existing and proposed FAP projects.

The elements of static and dynamic and FCD/I analysis are briefly described as follows; the reader must be aware that this is only the briefest explanation and that static and dynamic baseline data and EIA procedures must be developed in much greater detail:

STATIC BASELINE DATA

* **Delineation of Watersheds** - The regional approach utilized by FAP analysis to date is too broad and lacks resolution thus discrete fisheries impacts and cumulative impacts that occur in relatively small geographic areas cannot be adequately measured. We suggest delineating watersheds within each region using the information and data base generated by FAP 19. Protecting biodiversity at the watershed ecosystem level is perhaps our most holistic tool for managing sustainable development, multiple resource use, and endangered species. Watershed ecosystems incorporate spatio-temporal scales and levels of complexity that couples biodiversity with social, economic, and environmental conditions. The relationship of biodiversity to environmental conditions and economic and social pressures, and the consequential threats to diversity, has been described and it is now recognized that long-term sustainability of public resources and conservation of biological diversity is dependent upon management of watershed ecosystems. Biotic and abiotic patterns characteristic of a watershed can evolve in many different ways; thus, management of one watershed can be quite different from another. Therefore, land classification that delineates ecologically distinct watersheds is the logical first step. We suggest that for all fisheries impact analysis, including mapping, production of overlays, and data management, a geographic information system is essential.

* **Selection of Target Species** - We suggest that biodiversity be expressed in three ways according to geographic size: (1) alpha diversity is the number of species at one habitat in one locality, (2) beta diversity is the rate at which species number increases as nearby habitats are added, and (3) garnma diversity is the totality of species in all habitats across the entire watershed. From this ordering of biodiversity an assemblage of target species is selected that will exhibit the most sensitive response to changes in biotic and abiotic patterns. The assemblage of target species should not simply be the rarest species present in the watershed or be selected from single taxonomic

groupings or guilds. Rather, the assemblages should represent critical habitat types and trophic levels. There are five categories of species that warrant intensive monitoring: (1) ecological indicators, species that signal the effects of perturbations on a number of other species with similar habitat requirements, (2) keystones, pivotal species upon which the diversity of a large part of the community depends, (3) umbrellas, species with large area requirements, which if given sufficient protected habitat area, will bring many other species under protection, (4) flagships, popular, charismatic species that serve as symbols and rallying points for major conservation initiatives, and (5) vulnerables, species that are rare, genetically impoverished, of low fecundity, dependent upon patchy or unpredictable resources, extremely variable in population density, persecuted, or otherwise prone to extinction in human-dominated landscapes.

* Habitat Quantification - Within each watershed the floodplain, river, canal, and beel habitat types can be delineated and quantified using the information from FAP 19. However, these four habitat types are too broad and must be categorized into finer detail for proper impact analysis. For example beels should be classified by size, rivers by order, floodplains by extent and duration. Habitat is relatively static within a year but there are some changes between years. However, habitat quantity is a function of precipitation in Bangladesh (wet years create more habitat, dry years less), thus habitat quantification must be performed over several years to account for natural, climate related, cycles.

* Biological Criteria - There are many gaps in our knowledge base of fish life cycles and biological criteria of Bangladesh fishes. Research must focus on the relationship of fish (target species usage) and habitat availability particularly in floodplain habitats. The hydrologic cycle of flood extent-duration-depth must be correlated with fisheries immigration, spawning, nursery and juvenile rearing, and emigration to build a stock recruitment model that allows prediction of biomass or population by habitat quantity. Also, swimming speeds of fishes relative to sluice-way velocities and the timing of upstream entry and downstream drift of migratory species into compartmentalized areas must be determined. This type of basic biological research can be performed on target species in representative types of watershed in representative types of habitat selected by random stratification methods to minimize the magnitude of such research in terms of scale and time required.

* Limiting Factor Analysis - Within each watershed and habitat, fisheries experience some factor(s) that limit habitat usage, growth rate, population size etc. Such limiting factors can occur in combination or singly and may be natural or man-induced. Fisheries production cannot be predicted for any habitat, watershed, or region without knowledge of limiting factors that induce mortality or retard population development. This could be water quality conditions, dewatering or diversion effects, habitat reduction, disease, predation, competition, over-fishing, and a host of other conditions. Those conditions which limit fisheries must be determined for each designated, representative watershed and habitat type.

* Identification of Refuges - As shown in many FAP studies, there are sensitive and particularly critical areas in each region of the country where designated fishery refuges or closures would provide practical protection. In the Northeast we now know that the role of haors as "mother" fisheries are extremely critical to the long-term health and survival of the regional fisheries. Such areas and important habitat must be identified and designated as refuges or closure guidelines established to protect fisheries.

DYNAMIC BASELINE DATA

* FRSS Data Base - The Department of Fishery's, Fisheries Resource Survey System is an excellent program to generate long-term and detailed data on catch by habitat type. However, as shown in the FAP studies this program is in need of substantial improvement in terms of data collection methods, data collection locations, data types, and data storage and retrieval. These are relatively simple problems to overcome with small investments of money to assist the DOF in infrastructure improvement and support. Such improvement and support must begin at the Upazila Fisheries Office and extend right-up to the headquarters FRSS office. FRSS data collection could be improved with designated, representative watersheds and habitat types within each region or even thana.

* CPUE Monitoring - The catch per unit effort (CPUE) program established by FAP 17 must continue in order to create a long-term data base of catch and effort by gear type. Estimates of the CPUE can be further improved by the survey teams taking more direct observations of fishermen's catches in the

field or at the landing areas to augment those estimates based on interview. It is usually unreasonable to ask fishermen how much they caught more than two or three days earlier. The ultimate survey structure would optimally be a household survey to provide both catch and socio-economic indicators, augmented by limited field surveys to obtain catch per unit effort data more directly. In addition, household surveys often underestimate the rarer gear types which are often the larger ones, such as lift nets, which can take a significant portion of the catch. Larger gears such as lift nets, kua, and katha can censured directly in the field by direct counting or subsampling. This can still be carried out in a much more economical fashion than by a purely gear dependent program. Again it could be targeted at the declining phase of the flood in designated, representative watersheds and habitat types.

* **Water Quality Monitoring** - Water quality monitoring stations must be established in designated and representative watersheds and habitat types to track important changes in environmental conditions that would affect the results of limiting factor analysis and prediction of standing crop by habitat types. Deleterious changes in water quality will affect all elements of fisheries data bases (static and dynamic) as well as signal changes in biodiversity.

* Fisheries Management - Goals and objectives for target species must be identified. Management should include not only guidelines to protect threatened species but reflect a need to maintain biodiversity within the total fisheries of Bangladesh. Such management guidelines would assist the analyst during the EIA process when impact predictions are weak or mitigation methods are being debated.

EIA ANALYSIS

* **Engineering Criteria** - Fundamental to the implementation of the EIA for a proposed FCD/I project are specific engineering requirements and criteria for the project. In order to adequate predict impacts and identify appropriate mitigation the following, minimal information is required; total site area, lengths and widths of major embankments, area elevation curves, detailed contour mapping, total areas inundated at different depths for specified durations under pre-determined conditions of flood control, number and area

of perennial beels (pre- and post-project), lengths of canals and rivers, number of drainage canals and sizes which connect to out-side the project, seasonal changes in drainage patterns, technical specification of sluice-ways, and operational plans for sluice-ways.

* **EIA Process** - Using the project data described above along with the static and dynamic data for the watershed and habitat where the project is to be located, the analyst must determine fisheries impacts that are or long-term, short-term, or an irretreivable loss nature in relation to existing conditions and in synergy with other projects and activities within the habitat type and watershed. From the impact analysis, mitigation methods can be explored that ameliorate the individual and cumulative effects.

* Monitoring - The mitigation plan developed from the EIA must include a monitoring component for the project for a specified period of time to ensure that impacts are within the range of predictions and that the selected mitigation is effective. The FCD/I project design must include enough flexibility in operation that, in the case of failed mitigation, alternative approaches can be taken.

ANNEXURE 9

LEVEL OF EFFORT SUMMARY

Annexure 9

I S P A N - EWI/FAP; DHAKA

List of Local Professionals & PM Worked - FAP 16 (Envt.)

Period: December '90 - April '95

SL. NO.	N A M E	TITLE/ DESIGNATION	ACTIVITY NO.	TOTAL PM WORKED TO APRIL 95
1	Haroun Er Rashid	Co-Team Leader	Envt.	16.10
2	Mojubul Huq	Sr. Consultant/Agro Advisor	Envt.	15.78
3	Lutful Huque	Sr. Advisor	Envt.	3.25
4	Md. Mustafa Alam	Sr. Advisor	Envt.	28.10
5	Ansarul Karim	Environmental Scientist	Envt.	1.94
6	Mohibur Rahman	Environmental Hydrologist	Envt.	8.86
7	Khurshida Khandakar	Training Co-ordinator	Envt.	39.63
8	S. Dara Shamsuddin	Geographer/Ecologist	Envt.	31.14
9	Abu Mohammed Ibrahim	Soil Scientist	Envt.	38.94
10	Kazi Sadrul Huq	Social Anthropologist	Envt.	21.45
11	Mohir Uddin Ahmed	Hydrologist	Envt.	16.41
12	Asgari S. Ahmed	Training Co-ordinator	Envt.	25.00
13	Aminul Islam	Environmental Scientist	Envt.	26.80
14	Afsana Wahab	Sociologist	Envt.	8.60
15	Raguib Uddin Ahmed	Terrestrial Ecologist	Envt.	34.49
16	Mokhlesur Rahman	Wetland Ecologist	Envt.	33.22
17	Sachindra Halder	Survey Specialist	Envt.	23.10
18	Mahmudur Rahman	Survey Specialist	Envt.	7.61
19	S. Reazur Rahman	Health/Epidemiology Specialist	Envt.	7.29
20	Afroza Begum	Fish Biologist	Envt.	4.41
21	Mir Abdul Matin	System Analyst	Envt.	4.81
22	Dabes Halder	System Analyst	Envt.	2.50
23	Q.A.B.M. Salimullah	System Analyst	Envt.	28.00
24	Mamoon Hamid	System Analyst	Envt.	12.21
25	Golam Monowar Kamal	Case Study Co-ordinator	Envt.	35.09
26	Jesmin Akter	Jr. Sociologist	Envt.	5.62
27	Mostafa Kamal	Inst. Survey Supervisor	Envt.	9.00
28	Md. Jakariya	Jr. Social Scientist	Envt.	23.78
29	Subrata Kumar Mandal	Jr. Social Scientist	Envt.	23.94
30	Md. Faruque	Jr. Social Scientist	Envt.	19.91
31	Md. Masuduzzaman	Civil Engineer/Hydrology	Envt.	19.01
32	Shah Newas Siddiqui	Jr. Survey Specialist	Envt.	16.71
33	A.T.M. Shamsul Alam	Jr. Social Scientist	Envt.	10.00
34	Various (Persons)	Field Assistant	Envt.	294.60
	Total Environment			897.30

File: 2.4/PMLP.16

ANNEXURE 10

ESTIMATED BUDGET

MB

Annexure 10

Estimated Budget and Expenses
Bangladesh FAP Projects & other activities
December 1990 - April 1995

BUDGET & EXPENSES

ISPAN Activities		Budget	Budget Sub-Total	Expenses	Expenses Sub-Total
704C	Flood Response -Phase I (FAP 14)	$214,599		$214,599	
705C	Flood Response -Phase II(FAP 14)	$429,539	$644,138	$429,539	$644,138
706C	Environment - Phase I (FAP 16)	$194,951		$194,951	
707C	Environment - Phase II (FAP 16)	$1,285,101		$1,285,101	
737E	Environment - Phase III (FAP 16)	$1,152,710		$1,152,710	
767G	Environment - Phase IV (FAP 16)	$916,740	$3,549,502	$898,365	$3,531,127
708C	G.I.S. - Phase I (FAP 19)	$913,681		$913,681	
709C	G.I.S. - Phase II & III (FAP 19)	$735,459		$735,459	
768G	G.I.S. - Phase IV (FAP 19)	$997,828	$2,646,968	$945,391	$2,594,531
710C	Flood Proofing (FAP 23)	$236,672	$236,672	$236,672	$236,672
702C	International Meetings	$44,582	$44,582	$44,582	$44,582
672B	Management & Coordination	$1,198,029		$1,198,029	
736E	Management & Coordination	$551,641		$540,692	
766G	Management & Coordination	$581,519	$2,331,189	$569,031	$2,307,752
701C	Advisory Group	$216,427	$216,427	$216,427	$216,427
684C	Nepal Policy D. & Basin R.	$7,254	$7,254	$7,254	$7,254
711C	Panel of Experts	$202,006	$202,006	$202,006	$202,006
670B	Program Management	$657,760		$657,760	
674B	Program Management	$7,451		$7,451	
735E	Program Management	$79,034	$744,245	$79,034	$744,245
697C	TSC Support Services	$232,912		$232,912	
698C	TSC Support Services	$134,815		$134,815	
699C	TSC Support Services	$35,133	$402,860	$35,133	$402,860
Total ISPAN/EWI		$11,025,843	$11,025,843	$10,931,594	$10,931,594

File: 6.2/EWI-0695