BANGLADESH FLOOD ACTION PLAN

DRAFT INTERIM REPORT

FAP - 23 FLOOD PROOFING STUDY

Prepared for :

The Flood Plan Coordination Organization (FPCO)

Ministry of Irrigation Water Development and Flood Control

SEPTEMBER 1992

ISPAN
IRRIGATION SUPPORT PROJECT FOR ASIA AND THE NEAR EAST
Sponsored by the U.S. Agency for International Development

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EXECUTIVE SUMMARY

1. The overall objective of the Flood Proofing Study (FAP 23) is to identify and implement effective flood proofing measures to avoid or reduce the adverse effects of flooding on the social and economic activities of communities, and on infrastructure, particularly in those areas which are not protected by more comprehensive flood protection measures.

2. Flood proofing is the provision of long-term, non-structural or minor structural measures to mitigate the effects of floods. The objectives of flood proofing are to avoid the loss of human life and reduce the disruption to normal activities during and after a flood. The purpose of flood proofing is to provide people with the security and motivation necessary to make and sustain improvements in their economic and social welfare and achieve prosperity in an environment that frequently floods.

3. The Flood Proofing Study is being carried out in two phases. During Phase I, existing flood proofing measures were identified, along with constraints on implementation of more comprehensive flood proofing measures. During Phase II, comprehensive flood proofing measures for individuals, commercial and industrial enterprises, local government and other institutions will be planned and implemented in a number of pilot areas using private, commercial and institutional funds. In addition, the methodology for planning and implementing flood proofing measures nationwide will be developed.

4. This Interim Report is the concluding report of Phase I, and in the Report, the requirements for Phase II are discussed and the Terms of Reference for Phase II are given. Phase I of FAP 23 has been financed by USAID and Phase II is to be financed by other donors who are as yet to be identified.

5. Flood proofing is an integral part of the government's present initiative to implement comprehensive flood plain planning. Flood proofing together with flood protection and flood preparedness are complementary components of the flood mitigation measures being planned and implemented under the Flood Action Plan. The type and extent of flood proofing measures required for a particular area will depend on whether or not flood protection facilities are available but in all flood-affected areas, some degree of flood proofing will be required.

6. People and institutions in Bangladesh already use their own resources to undertake flood proofing measures. The purpose of a flood proofing programme would be to use the resources and technology available to the government to make individual, community and institutional actions more effective, and to oversee

their actions to ensure that they do not harm the physical, social or economic environment.

8. The FAP regional studies and the related feasibility studies are macro level planning of water resources while successful flood proofing requires micro or community level planning focused on the needs of individuals and communities. Flood proofing measures should be planned by communities because local needs are influenced by several local factors including flood characteristics, socioeconomic conditions, physical conditions and the characteristics of formal and informal institutions. Hydrological information and analysis available from the higher level planning can be used during the community planning process. In addition, the flood preparedness requirements and capabilities of a community need to be integrated into the flood proofing planning process.

8. To reinforce the involvement of local people in flood proofing activities, local people or local institutions should contribute to construction costs and take some responsibility for operation and maintenance of completed measures. Contributions from local communities could be complemented with funds provided by government (in the form of cash or wheat) or by non-government organizations, some of whom are presently implementing flood proofing programmes successfully.

The point is well taken but how local institutions to be energized and or motivated

9. A comprehensive flood proofing program would make a significant contribution to the success of flood mitigation measures being implemented under the Flood Action Plan. During Phase I of FAP 23, the broader issues of flood proofing have been considered and existing flood proofing measures have been reviewed. The requirements for Phase II is to apply the principles of flood proofing in a number of areas on a pilot basis. The pilot projects would develop flood proofing measures that could be adopted nationwide by individuals, commercial and industrial enterprises and government and non-government institutions, using private, commercial and public funds.

10. The purpose of Pilot Projects undertaken in Phase II will be to show the benefits of applying flood proofing principles efficiently. The Pilot Projects will involve the comprehensive planning and implementation of flood proofing measures to specific areas. The Pilot Projects will be monitored and evaluated over time to determine the achievements and constraints and the results would be used to develop a flood proofing program for application nationwide. Training programs for those involved in flood proofing will also be developed.

It will be interesting to know what the Phase II consultants have to say?

11. As flood proofing measures are being identified and developed under some of the FAP regional studies, a two-fold approach to Pilot Flood Proofing Projects is proposed:

Who are they?

a) Five pilot projects would be undertaken as part of the development of the priority areas identified by the FAP regional studies; and

b) Additional pilot projects would be undertaken in a number of other areas to cover a broader range of flood conditions.

12. Possible locations for the pilot projects are those areas where there are on-going rural development projects. Linking the pilot projects to existing projects will speed up the implementation of Phase II as the time required for donors to commit funds to new activities in new areas tends to be long. Possible locations for Pilot Projects would be greater Rangpur, Faridpur and Comilla districts where community planning and rural works programs are being funded by various donors at present. The specific location of Pilot Projects should be determined from discussion with the donors and FPCO.

CONTENTS

ACRONYMS & ABBREVIATION

ADB	Asian Development Bank
BIDS	Bangladesh Institute of Development Studies
BRAC	Bangladesh Rural Advancement Committee
BUET	Bangladesh University of Engineering and technology
BWDB	Bangladesh Water Development Board
CARE	Cooperative for American Relief Everywhere
CIDA	Canadian International Development Agency
DANIDA	Danish International Development Agency
FFWP	Food for Works Programme
FPCO	Flood Plan Coordination Office
GIS	Geographic Information Systems
GOB	Government of Bangladesh
ISPAN	Irrigation Support Project for Asia and the Near East
JICA	Japan International Cooperation Agency
LGEB	Local Government Engineering Bureau
MCC	Mennonite Central Committee
NORAD	Norwegian Agency for International Development
SCI	Service Civil International
RESP	Rural Employment Sector Programme
SIDA	Swedish International Development Authority
UNDP	United Nations Development Programme
USAID	United States Agency for International Development
WB	World Bank

Chapter 1

INTRODUCTION

1.1 Scope

The overall objective of the Flood Proofing Study (FAP 23) is to identify and implement effective flood proofing measures that will reduce the adverse effects of flooding on the social and economic activities of communities, and on infrastructure, particularly in those areas which are not protected by more comprehensive flood protection measures.

The Flood Proofing Study is being carried out in two phases. During Phase I, flood proofing measures taken by individuals, commercial and industrial enterprises, non government and other organisations and local and central government agencies were surveyed and analyzed to identify successful flood proofing measures and constraints on implementation of more comprehensive flood proofing measures. During Phase II, comprehensive flood proofing measures will be planned and implemented in a number of pilot areas that are representative of the different hydrological conditions in the country. It is expected that flood proofing measures successfully tested and demonstrated during Phase II will be adopted by individuals, commercial and industrial enterprises, local government and other institutions using private, commercial and institutional funds.

Phase I of FAP 23 has been financed by USAID and Phase II is to be financed by other donors. This Interim Report is the concluding report of Phase I of the Flood Proofing Study.

1.2 FAP 23

1.2.1 Terms of Reference

The Flood Proofing Study (FAP 23) is divided into two phases. Phase I is a preparatory phase to identify flood proofing measures, while Phase II is focused on detailed planning and implementation of flood proofing measures.

Phase I comprised of three main tasks:

Task 1 Review national and international experience of flood proofing, conduct a reconnaissance survey, and prepare an Inception Report.

Task 2 Design and conduct a rapid appraisal survey of urban experience and response to flooding; conduct a workshop to discuss the affect of flood proofing on rural poverty, infrastructure and economic production systems; and analyze results and present the findings of the survey and the workshop in an Issues Report.

Task 3 Prepare the Terms of Reference for implementing a flood proofing program under Phase II and identify areas where Phase II could take place.

The Terms of Reference for FAP 23 are given in Appendix A.

1.2.2. Phase I Activities

Under Phase I, a field survey was undertaken to determine the response of individuals, government and non-government agencies, and industrial and commercial establishments to the 1988 flood and the impact of the flood on their activities. Respondents were also asked to identify possible flood proofing measures that could be taken in future. The survey found that many flood proofing measures have been developed and successfully implemented. However, further development of flood proofing measures was constrained by the lack of systematic exchange of information and promotion of flood proofing concepts, present centralized government policies, lack of trust between officials and residents, and limited coordination between government ministries.

A very useful observant so relevant for the proposed involvement of local institutions in FAP.

The survey undertaken by FAP 23 was complementary to the Flood Response Study (FAP 14) which focused on determining the response to floods of individuals and communities in rural areas. Findings of the Flood Response Study have been used to develop flood proofing strategies for rural areas.

A two-day workshop was conducted on 25-26 September 1991 to discuss flood proofing concepts in general and to discuss specific flood proofing measures in detail. Workshop participants were mainly from other FAP studies and government technical personnel. Representatives from local government officials, non-government organisations, private companies and industries were also present.

1.2.3 Project Reports

The Inception Report for FAP 23 was prepared and submitted for review by the Flood Plan Coordination Office (FPCO) in July 1991 (ISPAN 1991).

The findings of the FAP 23 field survey were given in the Briefing Notes prepared for the Flood Proofing Workshop in September 1991 (ISPAN 1991). General concepts related to flood proofing and specific flood proofing measures were also discussed in the Briefing Notes which were circulated to all workshop participants.

The findings of the FAP 23 and the FAP 14 field surveys and issues discussed by workshop participants were used to prepare this Issues Report in which flood proofing measures already practised in Bangladesh are described and the components of a possible flood proofing program are discussed. An initial draft of the FAP 23 Issues Report (dated December 1991) was subsequently extensively rewritten and restructured to form the

draft final Issues Report dated August 1992 (ISPAN 1992).

This Interim Report is the concluding report of Phase I and in the Report, the requirements and Terms of Reference for Phase II are given.

1.3 Organization of this Report

The objective of this Interim Report is to present recommendations for Phase II of the Flood Proofing Study. In Chapter 2, flood proofing measures are described and the requirements of pilot projects for implementing flood proofing measures are discussed. In Chapter 3, the proposed pilot projects are described in more detail, including possible locations and methods of funding.

This may be the interim report for both the phase I & II, but for reasons by two consultants for phase I this report may considered as final jointly with the Issues Report.

Chapter 2

DESCRIPTION OF A FLOOD PROOFING PROGRAM

People and institutions in Bangladesh already use their own resources to undertake flood proofing measures but their efforts have been less successful in recent years due to diminishing resources at their disposal and the changing characteristics of floods. The lack of adequate resources results partly from economic growth not keeping up with population growth. The characteristics of floods have changed for a number of reasons including changes in land use, changes in settlement patterns, and man-made alterations to natural drainage channels and rivers. The severity of recent floods has also been influenced by unusual combinations of contributing factors such as flood peaks in different major river systems occurring at the same time. The net result is that many people are less able to continue their normal lives during floods and more comprehensive flood plain planning is required to reduce the disruption caused by floods and optimize the effectiveness of flood mitigation measures.

The inadequacies of the present flood mitigation measures were highlighted in 1987 and 1988 when the magnitude and extent of the monsoon floods had disastrous consequences over large areas of the country and caused widespread disruption of normal social and economic activities. Floods in 1987 inundated about 40 percent of the land area (57,000 km^2), affected about 30 million people, and caused about 1800 deaths. In 1988, the floods inundated about 60 percent of the land area (82,000 km^2), affected 45 million people, and caused about 2,330 deaths. Damages from the 1987 and 1988 floods have been estimated to be about $US 500 million and $US 1,200 million respectively (World Bank 1989). In the 1988 flood, about 7.2 million houses were totally or partially damaged, accounting for 66 percent of total damages, while infrastructure accounted for 29 percent, agriculture 2 percent, industries 2 percent and health and sanitation 1 percent of damages. Thus, the main facilities damaged by the flood were housing and infrastructure.

Flood proofing is the provision of long-term, non-structural or minor structural measures to mitigate the effects of floods. The objectives of flood proofing are to avoid the loss of human life and reduce the disruption to normal activities during and after a flood. The purpose of flood proofing is to provide people with the security and motivation necessary to make and sustain improvements in their economic and social welfare and achieve prosperity in an environment that frequently floods.

Structural flood proofing measures include raising floor levels of homesteads and industrial facilities above flood levels, provision of refuge areas or flood shelters, ensuring that water supplies and other health related facilities operate throughout floods, designing roads to be above peak flood levels, provision of additional bridges or culverts to improve water flows through an area and also to ensure embankments or structures are not washed away. Non-structural measures include institutional measures to coordinate development activities related to flood control and drainage, planning controls on developments in flood-prone areas and ensuring

hydrological data and analysis are available to those involved with the design and construction of infrastructure and other facilities.

2.1 Purpose of a Flood Proofing Program

The purpose of a flood proofing programe would be to use the resources and technology available to the government to make individual, community and institutional flood proofing actions more effective, and to oversee their actions to ensure that they do not harm the physical, social or economic environment.

2.2 Requirement for Flood Proofing

Flood proofing is an integral part of the government's present initiative to implement comprehensive flood plain planning. Flood proofing together with flood protection and flood preparedness are complementary components of the flood mitigation measures being planned and implemented under the Flood Action Plan. The requirement is to move away from the present *laissez faire* or unrestricted planning to more comprehensive flood plain planning aimed at reducing the social and economic disruption caused by floods.

People will continue to live outside protected areas and comprehensive planning and implementation of flood proofing measures can reduce the negative impact of floods and improve their standard of living. If more flood protection embankments are constructed or existing embankments are made to function more effectively under the Flood Action Plan, those living outside protected areas will be subjected to increased depths and duration of flooding. Communities which are presently not too adversely affected by floods may become more vulnerable to flooding. Planning of effective flood proofing measures in advance of the construction or improvement of flood protection facilities will lessen the impact of increased flooding on these communities and should be an integral part of planning of flood protection projects.

The extent of possible increases in flooding depths in non-protected areas resulting from proposals being made by FAP studies and other government projects are being calculated by the Flood Modelling and Management Study (FAP 25).

In all flood-affected areas, some degree of flood proofing will be required but the type and extent of flood proofing measures required for a particular area will depend on whether or not flood protection facilities are available. Flood protection is the provision of major long-term structural measures that physically prevent or control some or all flood water from entering a designated area. Under the Flood Action Plan, flood protection does not necessarily mean the provision of complete protection from all floodwater but can also mean the provision of controlled flooding and drainage facilities wherein floodwater can still enter the protected area in a controlled way. The objective of flood protection is to ensure normal or improved social and economic activity can continue within the designated area throughout a flood event. In Bangladesh, flood protection measures involve the construction of earth embankments and

appurtenant structures or improving the flow in drainage channels, as there is no scope for mitigating floods by the provision of storage reservoirs.

An essential component of flood protection measures is effective operation and maintenance of the facilities constructed. Operation and maintenance procedures include the development of effective institutional arrangements, the allocation of the funds required to ensure the integrity of facilities, and continuous assessment of the performance of facilities during floods (for example patrols to identify erosion of the embankments).

The main purpose of most existing flood protection projects in Bangladesh is to improve agricultural production. Secondary benefits include flood protection for communities within the embanked area and utilization of the flood embankment as a refuge by those people not within the protected area.

Flood protection facilities are designed to protect areas from floods up to a specific flood event (for example, the 1 in 100 year river flood or the 1 in 20 year flash flood). For people living inside protected areas, the flood proofing measures required will depend on the design and the reliability of the protection offered. For example, in coastal areas, embankments are designed to give protection against high spring tides and not from cyclonic storm surges. Therefore, in coastal areas, appropriate flood proofing measures are cyclone shelters and making basic infrastructure (roads, schools etc) resilient to storm surges. Similarly for flood protected areas inland, the requirement is to flood proof basic facilities from more extreme floods or from catastrophic failure of the protection facilities. One complicating factor inland is that different design criteria are applied to different flood protection projects. For example, in the lower Atrai basin in the North West, projects on the right side of the Atrai river have been designed to give protection from 1 in 100 year floods while on the left bank, projects have been designed to give protection from the 1 in 20 year flood. Flood proofing requirements will be different on either side of the river, although local people have resolved this inequitable distribution of resources by cutting the larger embankment during high river flows, thus making the flood proofing requirements the same on both sides.

Another factor influencing the selection of flood proofing measures in protected areas is the reliability of the flood protection. During the 1988 flood, 1,990 km of flood protection embankments were damaged and facilities inside those embankments were not protected from the flood. The findings of the FAP 12 study indicate that a number of existing flood protection projects are unreliable. Some projects have failed during floods against which the protection facilities were designed and the effectiveness of several projects was diminished by the lack of adequate resources and institutional support for operation and maintenance. The net result is that those inside embankments are sometimes more at risk to flood damage than those outside because the consequences of failure of flood protection facilities tend to be severe. Water levels within protected areas rise rapidly when the protection fails, giving people inside limited time to respond. In addition, those inside are often less prepared for inundation.

The reliability and availability of flood protection facilities may improve after the implementation

of the Flood Action Plan but it will probably take several years before the institutions have been developed and resources identified for effective operation and maintenance to be established. Furthermore, new or improved flood protection facilities constructed under FAP may take several years to complete. In both cases, flood proofing measures could reduce the impact of floods until the new facilities or institutional and fiscal arrangements are complete and operating effectively.

2.3 Components of a Flood Proofing Programme

Flood proofing is the provision of long-term non-structural and minor structural measures to mitigate the effects of floods.

Possible non-structural flood proofing measures can be grouped together and include the following:

a) Legal Measures comprising of planning controls and building codes. Land -use planning and zoning laws could be introduced to restrict development activities on land where the risk of flooding is too high or where activities interfere with flood flows. Building codes would be established to specify required standards of safety and also serve to develop public awareness.

b) Provision of Incentives Inducements could be available to encourage people to adopt flood proofing measures. Grants could be paid to private firms or individuals to flood proof their buildings. Tax incentives could be used in a similar way.

   Insurance could also be used to spread risks and providing funds to enable owners to re-build after floods.

c) Training and Education. Training and education could be used to show people how to integrate flood proofing into their daily lives. Training programs could be developed for public officials, technical students, small builders and craftsmen and school children.

d) Public Awareness. Government could demonstrate sound flood proofing measures by ensuring public buildings, public infrastructure and public services can function throughout floods.

e) Institution Building. Institutions play a vital role in various aspects of flood proofing such as promoting public awareness programs, training at community levels, linking government resources to individuals, communities and the private sector and implementing flood preparedness programs including flood forecasting and warning systems.

Non-structural measures yield long-term benefits as they require many years to implement effectively. Many non-structural measures need to be initiated by government as they require regulations and public institutional support for their implementation.

Possible structural flood proofing measures include:

- raising floor levels of houses/homesteads
- improving the quality of housing
- provision of flood or cyclone shelters
- provision of storage areas
- local small-scale flood protection and drainage schemes
- protective embankments and drainage for small urban areas
- protection of commercial premises
- raising ground levels at markets, schools and other communal areas
- ensuring key infrastructure (roads, railways, public buildings etc) are above specific flood levels
- ensuring different modes of transport can operate effectively during floods.

Many structural measures can be implemented in the short-term but the main constraints on their more wide-spread application have been the shortage of resources for their implementation and the lack of information on hydrological changes.

There is no 'definitive list' of flood proofing measures because effective flood proofing is based on local needs and the availability of public and private resources to undertake different measures.

2.4 Implementation Of Flood Proofing Measures

Flood proofing programs are part of the flood mitigation measures being implemented under the Flood Action Plan (FAP). The FAP regional studies and the related feasibility studies are macro level planning of water resources while successful flood proofing requires micro or community level planning focused on the needs and the resources available to individuals and communities. Local needs are influenced by several local factors including flood characteristics, socioeconomic conditions, physical conditions and the characteristics of formal and informal institutions. Resources available from government will be insufficient for all flood proofing requirements and resources will have to be mobilized locally for flood proofing to be widely effective. Hydrological and other information available from the higher level planning process can be used during the community planning process where appropriate.

An essential requirement when planning effective flood proofing is to integrate the flood preparedness requirements and capabilities of a community into the planning process. Flood preparedness is the provision of short-term measures for individuals or institutions

to undertake with the objective of reducing the disruption and damage caused by floods. Flood preparedness is primarily the development of service delivery systems for people or institutions to use before, during or after a flood event. Flood preparedness measures are designed to ensure the readiness and ability of a society to forecast and take precautionary measures in advance of a flood and to respond to and cope with the effects of a flood by organizing and delivering timely and effective rescue, relief and other appropriate post-disaster assistance. Flood preparedness measures include the development and regular testing of both flood forecasting systems (prediction of the timing, magnitude and location of floods) and flood warning systems (delivery of usable and believable advanced information on expected flooding) to inform people of an impending flood event. The latter systems would also include plans for evacuation or other activities to be undertaken during a flood alert period; the education and training of officials and the population at risk; the establishment of policies, standards, organizational arrangements and operational plans to be applied following a flood; the securing of resources (possibly including the stockpiling of supplies and the allocation of funds); and the training of intervention teams. Flood preparedness measures are being identified and developed under FAP 11.

2.4.1 Community Planning for Flood Proofing

Community involvement in the planning of flood proofing measures will result in the more efficient allocation of resources by ensuring that investments are based on local needs. Furthermore, community involvement should reinforce existing flood proofing practices and assist in the mobilization of local resources that will be required to undertake comprehensive flood proofing measures.

Flood proofing measures should be planned on the basis of an assessment of the flood hazard and defining the flood hazard at a particular location requires an assessment of numerous parameters. Rational assessment of flood hazards (and many planning activities) in rural Bangladesh is constrained by the absence of reliable data and maps in most upazilas and unions. The planning of flood proofing measures need to be based on locally-determined parameters such as the depth of flooding during specific events

Government community planning is presently focussed on the union and upazila levels of local government. Non-government organisations may plan on slightly different bases but generally they coordinate with the local government staff and officials to some extent. Infrastructure development for rural roads and markets is planned by upazila staff under the guidance of the Local Government Engineering Bureau (LGEB) and implemented by upazila and union staff and officials as appropriate. There is an existing system of union and upazila plan books showing five year plans for the development of roads, irrigation facilities, flood control embankments, and water and land use, although, in practise, many of these plan books are incomplete for a number of reasons including the poor quality of maps available and uncertainties over funding (see Section 3.3.3 of the FAP 23 Issues Report (ISPAN 1992)).

Complicating local planning is the absence of an official structure for local government. The upazila parishads were dissolved in early 1992 and the government is presently undertaking a complete review of the local government system. The findings of the review and the new structure for local government is expected later this year. In addition, the institutional arrangements for implementing the Flood Action Plan have not been defined and the relationships and responsibilities of those involved with flood proofing have not been determined.

In the absence of an official structure for local government it is not possible to be too specific about the institutional arrangements for planning of flood proofing, but the union would be a suitable focus as it is likely to remain as part of the local government structure. Flood proofing programs for unions could be prepared with active participation of the union chairperson, supported by the upazila engineer and staff of BWDB and other government departments and agencies. The Upazila Nirbahi Officer (UNO) could coordinate the activities of the the different parties involved.

Many projects have started with detailed planning at the upazila or union level but too often the planning process has resulted in plans that were too costly or technically too complicated to implement and the plans have been put to one side without implementation of the schemes proposed. The planning of flood proofing measures developed in FAP 23 should be based on the human and financial resources available in upazilas and unions as the methodology developed for flood proofing will be applied nationwide. The resources available in most of the upazilas and unions are limited and the planning method should be based on a gradual improvement of planning skills of those involved.

2.4.2 Design Considerations

The critical parameter in the design of flood proofing measures is the expected depth of flooding at particular locations. Other parameters to be considered include the timing and duration of flood events, the rate of rise of water levels, prevailing weather conditions, resources available to the local people, wave action, erosion potential, velocities of the flood water, water quality, sedimentation etc.

Depth of flooding maps can be prepared by combining information on flood levels that is available from the regional and the related feasibility studies and information on topography. Depth of flooding maps are being prepared for Tangail under FAPs 19 and 20, using GIS to combine topographic maps and flood levels calculated by hydraulic modelling.

As statistical (risk defining) flood level data is not readily available throughout the country, depth of flooding maps can be based on a specific flood event (for example the 1988 flood) to which local people can relate. Depth of flooding maps can be prepared by combining local experience of the selected flood and topographical information. This approach takes into account local conditions that alter flood levels in ways that cannot

be determined from analysis of hydrological data from a few gauging stations.

Flood proofing measures should be designed to ensure protection against specific events but it is more practical to prepare one depth of flooding map and then vary the freeboard specification for different measures depending on the extent of protection recommended. More sophisticated flood hazard assessment can be used at a later stage when reliable data on the relevant parameters are more readily available.

Specification of the level of protection for specific measures will depend in part on economic, financial and environmental considerations, but for planning purposes the following specifications are suggested:

Measure	Freeboard above 1988 Flood Level
Raising level of houses/homesteads area subject to erosion	0.0 m
other areas	0.5 m
Flood shelters	2.0 m
Raising ground level at	
main hats/markets/growth centers (flood shelters)	1.0 m
minor hats/markets	0.5 m
schools	0.5 m
Feeder Road Type B	
embankment	0.5 m
structures	1.0 m
Food storage facilities	1.5 m
Fuel storage facilities	1.0 m

In addition to depth of flooding maps, an inventory of resources and facilities is required to identify flood-prone communities, buildings, and infrastructure. The inventory should include houses, roads, markets, community facilities (mosques, schools, health centers etc), water supplies, public buildings and local council facilities. The key facilities and infrastructure which need flood proofing should be identified during preparation of the inventory.

2.4.3 Economics

The economics of specific flood proofing measures should be assessed but, as the benefits of saving lives, reducing suffering and improving the quality of life in rural areas are difficult to quantify, it may not be possible to be too precise about whether particular measures are economically justified. Furthermore, the assets of individual households tend to be quite small but it is the large number of households affected by severe floods that results in financial damages being so significant.

Flood proofing measures reduce the risk of flooding. To comprehensively flood proof all facilities and infrastructure within a flood-affected area may require a significant part of the available investment capital and recurrent resources. The result may be that implementing the measures may divert resources away from economically more efficient activities which would produce more benefits to the community than flood-proofing.

The economics of non-agricultural interventions like flood proofing are discussed in the 'Guidelines for Project Assessment' (FPCO 1991).

The economics of cyclone shelters, a flood proofing measure appropriate for coastal areas, are being studied as part of the Multi-Purpose Cyclone Shelter Programme. The final report of the preparatory phase should be available by mid-1992 (BUET/BIDS 1992).

2.4.4 Environmental Impact

Flood proofing is a hierarchical process in that people act to protect themselves and their actions are coordinated to make sure that the self-interest of one party does not harm others. Local actions must be reviewed to make sure that they do not make matters worse at upazila, zila or regional level.

Flood proofing measures are minor structural interventions and the scale of flood proofing measures usually means that they have a neutral impact on the physical environment and a positive impact on the social environment.

Possible impact of flood proofing measures on the human environment may be:

-employment	*(improved employment opportunities)*
-community/social benefits	*(improved community facilities, markets, schools, health centers as well as flood shelters)*
-water supply and sanitation	*(improved health)*
-nutrition	*(improved health and welfare)*

Possible impacts on the physical environment include

-forestry	*(use of trees etc for hydraulic protection)*
-fisheries	*(use of borrow pits as fish ponds)*
-livestock	*(sustainability during floods)*
-surface drainage	
-loss of land to raised house/flood shelters	*(for material to raise ground levels)*

Guidelines for Environmental Impact Assessment have been prepared for use by the FAP regional studies (ISPAN 1992).

2.4.5 Social Considerations

Flood proofing measures are focused on allowing people to live and improve their lives in an environment that frequently floods and flood proofing measures can directly assist all sections of society including the rural and urban poor. For example, a program to flood proof poor households will improve the self-esteem and self-confidence of the householder. Flood proofing houses will allow people to become more able and less dependent on relief. An example of a targeted flood proofing measure is the program implemented by the non-government organization Mennonite Central Committee (MCC) to raise ground levels at a flood-prone sweeper colony in Tangail.

The Example is useful for any recommendation

Similarly, a derived benefit of flood shelters is the confidence that a well-constructed and well-kept shelter creates in the local populace because the shelter will be present in their times of need. The productive implications of such confidence while difficult to describe in quantitative terms, should not be underestimated. The shelter allows local people to overcome the fatalism that is inherent in flood-prone societies.

2.4.6 Measures for Women

Observations on women in general is not acceptable. The women of large and medium land holding house holds are not necessarily involved in the kinds of activities as described here. It is more relevant in case of manji and char

Women face many problems during floods because many of their activities are centered on their houses and houses are particularly vulnerable during floods. Amongst the problems faced by women are the lack of access to dry space, shortage of potable water, inadequate sanitation facilities, shortage of fuel, and restricted space for child rearing. Flood proofing houses would directly benefit women. Flood proofing water supply and sanitation facilities would also benefit women as they are primarily responsible for collection of potable water and they have more sanitation problems during floods due to social customs.

Another major impact of floods on women is caused by the shortage of income earning opportunities for family members. The burden of internal adjustments required to be made due to the shortage of cash and food seems to fall disproportionately on women, particularly by eating less and going hungry. This tendency has been observed in even more prosperous households (Hunting Technical Services 1992). Flood proofing incomes would remove this burden.

2.4.7 Implementation and Funding

Flood proofing will involve multiple sectors and many different government agencies could be involved. In the past, funding of multi-sector programs has been difficult and the results of such programs have been disappointing. Allocating funds for a specific task (in this case for flood proofing) may not coincide with the other interests or priorities of those involved. Coordination between government departments and agencies is difficult to achieve and now many individual development programs involve only one

government institution.

Pilot Flood Proofing Projects will be implemented under the overall framework of the Flood Action Plan but as yet the institutional arrangements for implementing the Plan have not been decided. The institutional requirements of the Plan are being studied under FAP 26 but progress has been slow. The institutional difficulties are compounded by the absence of a system of local government (see Section 2.4.1). The institutional arrangements and the related methods for funding the implementation of a flood proofing program will have to be determined later when these two issues have been resolved. Hopefully, some of the broader institutional issues will be clarified during Phase II of FAP 23.

2.4.8 Financing

Past government interventions in flood proofing have not been too successful for a number of reasons including the lack of involvement of local communities and unclear responsibilities for operation and maintenance.

Flood proofing interventions should be designed with active participation of local people to identify the needs and resources of individuals and the communities. To reinforce their involvement in flood proofing activities, local people or local institutions should contribute to construction costs and take some responsibility for operation and maintenance of completed measures. Contributions from local communities could be complemented with funds provided by government (in the form of cash or wheat) or by non-government organizations, some of whom are successfully implementing flood proofing programmes at present.

2.5 Activities of FAP Regional Studies

The FAP Regional Studies (FAP 2 - North West Regional Study; FAP 3 - North Central Regional Study; FAP 4 - South West Regional Study; FAP 5 South East Regional Study; and FAP 6 - North West Regional Study) were started in 1990/91 and are due for completion later in 1992 or in 1993. Accompanying the regional studies, there are feasibility studies of areas that have been identified for priority development under the Flood Action Plan.

In the North Central Region, the feasibility study for the Jamalpur Priority Area is being prepared under FAP 3.1 and is scheduled for completion by the end of this year (Sogreah 1992). In the North West Region, the area selected for priority development is in the northern part of Gaibandha district beside the confluence of the Teesta and Jamuna rivers (Mott MacDonald 1992). The feasibility study of the Gaibandha Improvement Project is also scheduled for completion by the end of this year. The South East Regional Study submitted its draft Regional Plan in May 1992 and the area for priority development has yet to be decided. The South West Regional Study submitted its Inception Report in early

1992 and has yet to identify a priority area. Similarly, the North East Regional Study is in its early stages and the priority development area has yet to be identified.

In the feasibility studies for both the Gaibandha and Jamalpur priority areas, flood proofing is being considered as one of the possible development options (with no flood protection) and, under a different option, as a complementary component to flood protection. It is likely that flood proofing will be recommend for at least the area outside the main embankments in both studies.

The two priority areas have many similar physical and hydrological features as they are on opposite banks of the Jamuna river, although each have their own particular problems. For example, there is more extensive river erosion in the Gaibandha area and in Jamalpur there is a significant area of higher ground which is relatively flood-free.

In the Jamalpur Study, the flood proofing measures being considered are flood shelters (raised mounds, buildings plus water and sanitation facilities), improved houses adjacent to the shelters and provision of boats. In the Gaibandha Study, the flood proofing measures being considered are multi-purpose flood shelters, flood proofing of government buildings and flood warning and evacuation systems and rehabilitation packages, although these last two items are flood preparedness measures by the definition of mitigation measures used in FAP 23.

2.6 Other Related Programs

Flood proofing is primarily an exercise in community planning and development and the other government programs of most relevance to flood proofing are those involved with rural development and rural and urban infrastructure development. Since the 1980's, the Planning Commission has numbered rural development projects sequentially with respect the time when they were initiated and the rural development that are currently active are listed in Table 3.1. The government agencies and the donors involved with the respective projects are also shown.

Since 1974, extensive rural infrastructure works have been constructed under the Food for Works Programme (FFWP) with food-aid supplied through the World Food Programme and CARE. In the 1970's and 1980's, construction of rural roads was one of the main activities undertaken by FFWP, but the development impact of the roads constructed has been limited and presently schemes with more identifiable development impact are being undertaken. Such schemes include flood shelters and the raising of ground levels at schools which are flood proofing measures.

Chapter 3

PILOT PROJECTS

A comprehensive flood proofing program would make a significant contribution to the success of flood mitigation measures being implemented under the Flood Action Plan. During Phase I of FAP 23, the broader issues of flood proofing have been considered and existing flood proofing measures have been reviewed. The requirements for Phase II is to apply the principles of flood proofing in a number of areas on a pilot basis. The pilot projects would develop flood proofing measures that could be adopted nationwide by individuals, commercial and industrial enterprises and government and non-government institutions, using private, commercial and public funds.

3.1 Description of Pilot Projects

The purpose of Flood Proofing Pilot Projects would be to show the benefits of applying flood proofing principles efficiently. The Pilot Projects would involve the comprehensive planning and implementation of flood proofing measures in specific areas. The Pilot Projects would be monitored over time to determine the achievements and constraints and the results would be used to develop a flood proofing program for application nationwide. Training programs for those involved in flood proofing would also be developed.

In the Pilot Projects, local and international experience of flood proofing will be combined to show people and communities the flood proofing measures that they can undertake personally or collectively. Comprehensive measures to flood proof individuals and communities will be evaluated and programs for phased implementation of appropriate measures will be prepared. The flood proofing measures adopted will be aimed at increasing community self-reliance. Communities will be involved in identifying and implementing suitable flood proofing measures. Participation in the planning and implementation process will move people away from the fatalism that accompanies floods by showing how comprehensive flood proofing of communities can improve their personal economic and social position.

The planning and implementation processes developed during the Pilot Projects should be uncomplicated as the intention is to apply the processes nationwide. The technical and financial resources available in most upazilas and unions are very limited and the approach developed should be based on measures that can be implemented using the resources available.

The Pilot Projects will have two distinct parts as follows:

Part 1: **Pilot Studies** in which the flood proofing measures for specific locations are identified and a program for their implementation is developed; and

Part 2: **Pilot Implementation** in which the flood proofing measures identified

under Part 1 are implemented on a pilot basis.

The Terms of Reference proposed for Part 1 are given in Appendix B. The focus will be on identifying appropriate minor structural flood proofing measures. Non-structural flood proofing measures can be evaluated during the Pilot Projects. Implementation of non-strutural measures will follow a different process as the regulations and directives governing non-structural measures will have to be processed by central government with presumably active participation of the Flood Plan Coordinating Office (FPCO). For example, flood proofing different government services will require government to direct those providing the services to flood proof their activities. There will be predictable resource constraints on implementing effective flood proofing programs on government services, but donors who are supporting the Flood Action Plan and funding activities of different government services under separate programs, should raise the issue of flood proofing the service as part of their overall support to the Flood Action Plan. Similarly, donors should ensure that infrastructure development funded by their other projects is flood proofed adequately.

3.2 Location and Funding

The purpose of the Pilot Projects is to develop flood proofing techniques for application nationwide, and Pilot Projects should be located in areas with different flood characteristics to illustrate the range of measures required to mitigate the effects of different types of flood.

Planning of flood proofing measures is primarily an exercise in community planning and the scale of planning required means that initially the Pilot Projects should be undertaken in 2-3 unions of the areas selected.

As flood proofing measures are being identified and developed under some of the FAP regional studies, a two-fold approach to Pilot Flood Proofing Projects is proposed:

a) Five pilot projects would be undertaken as part of the development of the priority areas identified by the FAP regional studies; and

b) Additional pilot projects would be undertaken in a number of other areas to cover a broader range of flood conditions.

Possible locations for the latter areas would be those areas where there are on-going rural development projects. Linking the pilot projects to existing projects would have the advantage of reducing the time required to start Phase II as the time required for donors to commit funds to new activities in new areas tends to be lengthy.

Possible locations for Pilot Projects would be greater Rangpur, Faridpur and Comilla districts where there are active community planning and rural works programs being

funded by various donors (see Table 3.1). The coastal area is being adequately covered by FAP 7 and the Multi Purpose Cyclone Shelter Project. The specific location of Pilot Projects should be determined from discussion with the donors involved with rural development projects and FPCO.

Pilot projects could also be linked to the development activities of non-government organizations who have implemented flood proofing activities of their own. Such organizations include Rangpur Dinajpur Rehabilitation Service (RDRS) who have the Char Development Program in Kurigram, Service Civil International (SCI) who have a Development Programme in the char areas of Bhuapur upazila in Tangail and CARE who have implemented flood proofing measures in Bogra and Tangail districts.

3.3 Implementation

The strategy for implementing flood proofing program would be to identify and plan appropriate flood proofing measures on the basis of local needs and the availability of private and public resources.

As discussed in Section 2.4 1, because of the absence of a system of local government and the absence of institutional arrangements for implementing the Flood Action Plan, Phase II of FAP 23 would be starting in an institutional vacuum.

However, Part I of the Pilot Projects are primarily an exercise in community planning and an appropriate institution to oversee the preparation of community flood proofing plans is the Local Government Engineering Bureau (LGEB). Linkages to other government and non-government rural development projects will be investigated during Part 1.

Table 3.1

Rural Development Projects

Number	Title	Location	Main Government Agency	Donors	Main Activities
RD-4	Rural Employment Sector Programme (RESP) Infrastructure Development Programme	Kurigram, Greater Faridpur	LGEB	SIDA/NORAD	Construction of rural roads, market facilities and small-scale water resources schemes and maintenance
RD-5	Rural Employment Sector Programme (RESP) Production and Employment Programme	Kurigram, Greater Faridpur	BRDB	SIDA/NORAD	Promotion of production and employment activities
RD-6	Infrastructure Development	Manikganj, Greater Dhaka	LGEB	SDC	Construction of Feeder Roads (type B) and market (growth centre) facilities
RD-7	Infrastructure Development	Rajshahi, Bogra, Pabna	LGEB	IDA, SDC	Construction of Feeder Roads (type B) and market (growth centre) facilities
RD-8	Infrastructure Greater Rangpur District	Gaibandah, Lalmonirhat, Nilphamari, Rangpur	LGEB	European Community (EC), Netherlands	Construction of Feeder Roads (type B) and market (growth centre) facilities
RD-9	Production and Employment Programme, Greater Rangpur District	Gaibandah, Lalmonirhat, Nilphamari, Rangpur	BRDB	European Community (EC), Netherlands	Credit and Training
RD-10	Rural Infrastructure	Greater Kushtia District	-	UNDP	-
RD-11	-	Nationwide	BRDB	IDA, UNDP, ODA, CIDA	-
RD-12	Rural Poor Programs	6 Old Districts	BRDB	CIDA	
RD-13	Rural Infrastructure Development Project	Greater Dinajpur/Jamalpur	LGEB	ADB	Construction of Feeder Roads (type B) and market (growth centre) facilities
RD-14	Infrastructure, Tangail District	Tangail	LGEB	KFW/GTZ	
RD-15	Rural Poor Cooperative Support Project	Noakhali	BRDB	DANIDA	Employment and production project for rural poor
RD-16	Patuakhali and Borguna Infrastructure Programme	-	LGEB	DANIDA	Construction of Feeder Roads (type B) and market (growth centre) facilities

Notes: RD-1, RD-2, and RD-3 have been completed.

Appendix A

Terms of Reference - FPCO 1990

1. Background

1.1 The disastrous floods of 1987 and 1988 stimulated the Government of Bangladesh to carry out a comprehensive review of flood policy. A number of studies were undertaken and, in June 1989, the GOB requested that the World Bank (WB) coordinate donor activity on flood-control assistance.

1.2 The need for coordinated, international action, in support of the GOB, to find solutions to the flood problem that are technically, financially, economically and environmentally sound was endorsed at the G-7 Summit in Paris in July 1989.

1.3 In December 1989, the WB proposed the development and implementation of a five-year Flood Action Plan (FAP, 1990-95) as the first of several stages in a long-term flood control program. The FAP, later endorsed by the donors, consists of project-oriented studies in all the country's main regions and supporting activities to promote improved project design and execution and use of non-structural measures.

The GOB seeks an approach which will provide a comprehensive and permanent solution to the recurrent flood problem and so create and environment for sustained economic growth and social improvement. The flood policy that was adopted incorporated a long-term plan of major physical works to control flooding that originates from the main river system and a set of eleven principles to guide future development. The principles include a number of non-structural approaches to flood protection and mitigation (as well as structural measures such as major-embankment and river-training works), including effective land and water management, strengthened flood preparedness and disaster management, floodplain zoning, coordinated planning of roads and related rural infrastructure to ensure unimpeded drainage, and increased local and individual participation in all aspects of flood control and drainage works. Minor local works also are to be considered.

1.4 Land annually flooded to a depth of more than 0.3 m occupying about 6 million hectares or almost 65 percent of the net cultivated area of Bangladesh. At present, about 30 percent of this area is either partly or fully protected against floods. For the remainder, even with full implementation of flood-control projects as outlined in the FAP, about 30 percent will remain unprotected; substantial areas that may eventually be provided with embankments will remain unprotected for 20 years or more during the implementation period; and all protected areas will remain vulnerable to damage during catastrophic failure or overtopping of structures during floods of greater than design recurrence interval.

1.5 Thus, it is important to examine flood-proofing measure that could mitigate flood damage to agriculture and to private and public property in unprotected floodplain areas. Potential measure might include the protection or raising of homestead mounds, refuge areas, roads, water supply and other health related facilities and commercial and industrial premises, as well as the provision of additional bridges, culverts in roads. Non-structural measures include institutional measures to coordinate development activities to control flooding and drainage, the provision of hydrological data to local government engineers so as to improve the design of roads, bridges, culverts, drains and small-scale embankments, the regulation of land-use in flood-hazard areas, and adjustments for the crop calendar to reduce risk. These approaches are a mixture of minor structural and non-structural measures that rely on high public participation, low public participation , low public capital inputs, and private investment. They focus on coordinated government policy to effect change and create incentives for beneficial private action. They require high management and information inputs rather than large public expenditure on physical works.

1.6 USAID will finance this study and Supporting Study 14 : Flood Response. These two studies are complementary and between them encompass a study of non-structural and structural flood response and flood proofing in both rural and urban areas. As conceived in the FAP Report (December, 1989), Supporting Study 14 was to be confined to a study of how people living in small rural communities on the active flood plains respond to floods. To simplify study design and management, USAID in collaboration with FPCO, propose to examine all the agricultural and small rural community flood response under Supporting Study 14, and confine study 23 to an examination of flood response of private industries and local and central government and actions to flood proof municipal and urban areas and public sector infrastructure throughout the country.

2 Region

2.1 Flood proofing pilot study and implementation areas (possibly upazilas) will be selected to represent unprotected flood prone environments in all of the FAP regions.

3. Scope of Work

3.1 The overall objectives of this study are to identify and implement effective measures to avoid or reduce the adverse human, infrastructure and economic effects of flooding, particularly in unprotected areas. The study will be carried out in two phases. During Phase 1 (7 months) a study of how individuals, industrialists, local and central government respond to floods in rural towns/municipal areas, and for national infrastructure (roads, rail, power etc) will be undertaken. The measures these entities have adopted to mitigate flooding, and new approaches that may be formulated will be examine, successful measures categorized, and candidates for pilot flood-proofing identified.

During Phase 2, flood proofing measures will be tested in a series of small pilot activities. It is expected that flood proofing measures successfully tested and demonstrated during Phase 2 will be adopted by individuals, commercial or industrial firms, local governments and other institutions using private, commercial or institutional funds.

3.2 The studies will be carried out in two phases, as follows:

- a preparatory phase (Phase 1), lasting seven months; and
- an implementation period (Phase 2), including pilot activity period lasting 12 to 18 months and project execution of indefinite duration, but likely extending through 1995, with monitoring evaluation and training or education.

3.3 Emphasis has been given to the preparatory phase that is funded and will determine the detailed terms of reference (TORs) for later activities in Phase 2, for which finance is still pending.

3.4 Phase 1 will include a review of reports and empirical data and experience, evaluation of individual and local government initiatives and presentations of findings in a review workshop and report. Preparation activities will include efforts to obtain commitments for funding later phase.

4. Terms of Reference

4.1 These TORs are intended to provide a framework for the study. They outline specific tasks, staffing requirements, schedules and products. More detailed work plans will be developed during study preparation to identify data requirements, data collection methods and report contents.

4.2 Phase 1

Task 1. Review existing studies and data (national and international) relevant for identifying appropriate flood-proofing measures which could br tested or implemented during Phase 2. This review will be supplemented by brief field visits to selected flood-prone areas.

Task 2. Based on the findings of Task 1, a systematic survey will be designed and carried out to obtain data on relevant aspects of rural housing and public health; agricultural livestock- and fisheries- production systems; (input from study 14) road, rail and waterway communications; and institutional, commercial and industrial infrastructure and enterprises in rural towns/municipalities. Particular attention should be paid to damage during the 1987 and 1988 floods;

Compile and analyze data on flood-affected households (inputs from FAP 14) and commercial / industrial activity. Determine hydrological parameters needed to forecast costs and benefits, estimate effectiveness of selected measures (including social, economic and cultural acceptability) and identify practises for which further studies are justified;

Prepare a mid-term issues report to summarize findings, further data needs and prospective recommendations; and

Organize a workshop of Bangladeshi and expatriate specialists, including members of FAP panel of experts, to exchange and record experience and ideas on flood-proofing of rural property, infrastructure and economic production systems. One purpose will be to develop concepts and strategies for flood-proofing studies and activities to be carried out in Phase 2.

Task 3. From preceding activities, identify one or more representative flood-prone areas (total about 8) in which to carry out pilot studies of flood-proofing in Phase 2. Prepare geographical profiles of each selected area and plan phase 2 operations.

Formulate and adopt concepts for present or potential measures to reduce flood vulnerability:

- Establish and use quantitative and qualitative standards to evaluate prospective interventions for adjustment, where justified, of perceptions and responses to risk of flooding; seek to

  * establish consistent and thorough bases for measuring costs for damage and loss attributable to flooding

  * establish consistent and thorough bases for measuring benefits of interventions in terms of improved sustainability of agriculture, public health and economic output; and

  * identify actions needed to achieve reasonable equity in distribution of costs and benefits.

  Identify resources and roles of public and private sector organizations for implementation of measures found to be effective; and

Prepare an interim report giving detailed TOR's for the pilot activities. The report also should include arrangements for monitoring, evaluation and training activities. It will include definition of scope for selected flood-proofing measures to be carried out as pilot projects in the second phase and of practices shown to be effective and deserving of immediate implementation.

4.3 Phase 2

The TORs for these latter activities will be prepared during Phase 1.

4.4 Relationship with other Action Plan Studies

The study team will receive technical support from the team conducting the Flood Response Study (Activity No. 14) and will work in close consultation with the FPCO and with consultants or other institutions engaged on other FAP activities, especially Flood Forecasting and early Warning (Activity 10) and Disaster Preparedness (11) studies. Other include Regional Studies (2-6); Environmental Study (16); Fisheries Study (17); and Compartmentalization Pilot Project (20).

Coordination between this and other FAP studies to provide mutual support and avoid duplication of activities will be achieved through regular progress reviews arranged by the FPCO.

Table A.1
List of Flood Action Plan Studies

FAP Study Number	TITLE
1	Brahmaputra Right Bank Study
2	North Western Regional Study
3	North Central Regional Study
3.1	Jamalapur Priority Study
4	South West Regional Study
5	South East Regional Study
6	North East regional Study
7	Cyclone Protection
8	Dhaka Town Protection
9	Secondary Town Protection Project
10	Flood Forcasting and Early Warning
11	Disaster Management Plan (Preparedness)
12	FCD/I Agriculture Review
13	O & M Study
14	Flood Response Study
15	Land Acquisition and Resettlement
16	Environmental Study
17	Fisheries Study
18	Topographic Mapping
19	GIS
20	Compartmentilization Pilot Project
21	Bank Protecion and AFPM Project
22	as 21
23	Flood Proofing
24	River Survey Programme
25	Flood Modelling/Management Project
26	Institutions Development Programme

Appendix B

OUTLINE Terms of Reference for Flood Proofing Pilot Project

1. Scope of Work

1.1 Objectives

The objective of the Flood Proofing Pilot Project is to identify and implement appropriate flood proofing measures which would:

a) save human lives and reduce suffering;
b) reduce disruption to incomes and livelihoods; and
c) reduce damage to infrastructure, government services and public utilities.

and to develop a methodology for planning and implementing flood proofing measures nationwide.

1.2 Outputs

The outputs from the Pilot Project will be:

- detailed plans for flood proofing the selected areas;
- completed flood proofing measures in the selected areas; and
- a methodology for applying flood proofing principles nationwide.

1.3 Coordination with other FAP Studies

The activities of the Pilot Projects should be coordinated with the activities of other Flood Action Plan Studies, including the FAP Regional Studies and the related feasibility studies.

2. Terms of Reference

The Pilot Projects have the following two distinct parts :

Part 1: **Pilot Studies** in which the flood proofing measures for specific locations are identified and a program for their implementation is developed; and

Part 2: **Pilot Implementation** in which the flood proofing measures identified under Part 1 are implemented on a pilot basis.

The main activities to be undertaken during Part 1 are given below.

2.1 Mapping and Data Collection

Task 1 Prepare data and maps showing topography, population distribution, economic activities and land use.

Task 2 Prepare depth of flooding maps based on an appropriate flood. The map should be prepared from topographical maps and interviews with local people to determine flood levels during the selected flood. The variation in flood levels during recent significant floods (for example 1987, 1988 and 1991) and other significant hydrological features should also be determined

Task 3 Prepare an inventory and map local resources including homesteads, industrial and commercial facilities, infrastructure (markets, roads, railways, ferry ghats etc), public buildings, water supplies, public utilities (electric, telephone etc). The inventory should indicate the extent of the resource, type of construction (permanent, semi-permanent etc), present condition and effect of recent floods.

Task 4 Determine the objectives, programme and funding of other government and non-government programmes being implemented in the locality.

Task 5 Identify and quantify the affects (including physical damages) of recent flood on local communities, economic activities etc.

2.2 Preparation of a flood proofing program

Task 1 Determine flood proofing measures already taken by local people including householders, women, farmers, fishermen, entrepreneurs, communities and government and non-government institutions.

Task 2 Identify and prioritize flood proofing measures from the information collected and from discussion with local people about:

a. the affects of flood on property and communities;

b. the main income generating activities and production systems;

c. the effect of floods on infrastructure, government services and public utilities ; and

d. disincentives for flood proofing (for example financial constraints such as lack of adequate funds, or physical constraints such as erosion hazard).

Task 3 Determine the social and economic viability of the flood proofing measures identified in Task 3 and develop a flood proofing program for the selected area.

Task 4 Evaluate the need for non-structural measures (for example, planning controls, floodway clearance) and assess the potential impact and likely success of such measures.

Task 5 Determine the environmental impact of the measures proposed.

Task 6 Identify sources for funding and prepare a funding plan and implementation schedule the flood proofing measures proposed.

3. Duration and Staffing

Part 1 of the Pilot Project should take about 3 months to complete and would involve staff with the following disciplines: Rural Planning, Water Resources/Civil Engineering, Rural Sociology, Rural Economics. The professional staff would be supported by a Rapid Appraisal Team.

Appendix C

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