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2004 Floods in Bangladesh
Damage and Needs Assessment
and Proposed Recovery Program

PART I – MAIN REPORT



A Joint Report by
The Asian Development Bank
and
The World Bank

To the Government of Bangladesh
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CURRENCY EQUIVALENTS
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Currency Unit = Taka (Tk)
1 Taka = US Dollar 0.016
1 US Dollar = Taka 59

Acronyms and Abbreviations

ADB	Asian Development Bank
ADP	Annual Development Plan
AusAID	Australian Agency for International Development
BADC	Bangladesh Agriculture Development Corporation
BMDA	Barind Multipurpose Development Authority
BMD	Bangladesh Meteorological Department
BRDB	Bangladesh Rural Development Board
BWDB	Bangladesh Water Development Board
CI	Corrugated Iron
DER	Disaster Emergency Response
DfID	UK Department for International Development
DPHE	Department of Public Health Engineering, Ministry of Local Government, Rural Development and Cooperatives
DWASA	Dhaka Water and Sewerage Authority
ECLAC	UN Economic Commission for Latin America and the Caribbean
EMOP	Emergency Operation
FAO	Food and Agriculture Organization of the United Nations
FAP	Flood Action Plan
FBCCI	Federation of Bangladesh Chamber of Commerce and Industry
FFW	Food for Work
FFWC	Flood Forecasting and Warning Center
FSS	Flood Forecasting System
FY	Fiscal Year
GDP	Gross Domestic Product
GOB	Government of Bangladesh
IDA	International Development Association
ILO	International Labor Organization
IMF	International Monetary Fund
I-PRSP	Interim Poverty Reduction Strategy Paper
LCG	Local Consultative Group
LGED	Local Government Engineering Department, Ministry of Local Government, Rural Development and Cooperatives
MDG	Millennium Development Goals
MFA	Multi-Fiber Arrangement
MFDM	Ministry of Food and Disaster Management
NBR	National Board of Revenue
NCB	Nationalized Commercial Bank
NGO	Non-governmental Organization
NHA	National Housing Authority
OCHA	UN Office for Coordination of Humanitarian Affairs
PEDP II	Primary Education Development Project II
PFDS	Public Food Distribution System

Acronyms and Abbreviations (Cont'd)

PKSF	Palli Karma-Sahayak Foundation
PO	Partner Organizations
PRGF	Poverty Reduction and Growth Facility
PRSP	Poverty Reduction Strategy Paper
PWD	Public Works Department, Ministry of Housing and Public Works
RHD	Roads and Highways Department, Ministry of Communications
SME	Small and Medium Enterprises
SPARRSO	Bangladesh Space Research and Remote Sensing Organization
SWAp	Sector Wide Approach
TA	Technical Assistance
UN	United Nations
UNDP	United Nations Development Programme
UNESCO	United Nations Educational and Scientific Organization
UNICEF	United Nations Children's Fund
USAID	United States Agency for International Development
UZR	Upazila Roads
UR	Union Roads
VGF	Vulnerable Group Feeding
WB	World Bank
WFP	World Food Program

2004 FLOODS IN BANGLADESH
DAMAGE AND NEEDS ASSESSMENT AND PROPOSED RECOVERY PROGRAM

PART I – MAIN REPORT

Preface

This report presents the preliminary assessment of damage and needs resulting from the floods that affected Bangladesh from July through September 2004, and the proposed recovery and long-term mitigation program. Part I constitutes the main report, while Part II (see separate volume) includes annexes with detailed assessments of selected sectors.

The report was prepared by a joint team from the Asian Development Bank and the World Bank, in collaboration with the Government of Bangladesh. Team members from the ADB include: Hans Carlsson (Joint Mission Team Leader), Kamal Ahmad, Faruque Ahmed, Shamsuddin Ahmed, Stefan Ekelund, Ki Hee Rye, Zahid Hossain, Nao Ikemoto, Rafiqul Islam, Rezaul Karim Khan, Jamal Mahmood, S. Motin, Arun Saha, Ferdousi Sultana, and Tomoo Ueeda. Team members from the World Bank include: Mohinder S. Mudahar and Enrique Pantoja (Joint Mission Team Leaders), Nilufar Ahmad, G. M. Khurshid Alam, Mahmudul Alam, Mitch Asada, Rafael Cortez, Subrata Dhar, Paul Dorosh, Raihan Elahi, Nuran Ercan, Fabio Galli, Chandra Godavitarne, Zahid Hussain, Zahed H. Khan, Karin Kemper, Qaiser Khan, Khwaja Minnatullah, Jelena Pantelic, Christoph Pusch, Mohi Uz Zaman Quazi, S.A.M. Rafiquzzaman, and Zoe Elena Trohanis.

To complete the assessment, the joint team worked closely with GOB and consulted widely with non-governmental organizations, other bilateral and international agencies, members of academia, and the private sector. The team also visited several flood affected districts, including Bogra, Comilla, Gaibandha, Manikganj, Maulvibazar, Munshiganj, Mymensingh, Narayanganj, Sirajganj, Sunamganj, and Sylhet to meet with local authorities and communities and collect damage information.

The assessment team is grateful to GOB for its considerable work to produce the preliminary damage assessments for all of the affected sectors, and its valuable comments on the draft Report. The team gratefully acknowledges the comprehensive reports prepared by the Disaster Emergency Response (DER) of the Local Consultative Group (LCG) and other organizations that provided valuable insights, information and data on the impacts of the floods.

The interim conclusions of the assessment were discussed with GOB at the end of September, and the draft report shared in mid November 2004. It is emphasized, however, that this is a preliminary assessment based on the information available at the moment of completion of the report. Understanding of the effects of the floods can be expected to evolve as more information becomes available.

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Bangladesh – Flood Affected Districts, 2004

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2004 FLOODS IN BANGLADESH
DAMAGE AND NEEDS ASSESSMENT AND PROPOSED RECOVERY PROGRAM

EXECUTIVE SUMMARY

1. Bangladesh is one of the world's most vulnerable countries to natural hazards, including in addition to floods, droughts, cyclones, and earthquakes. Eighty percent of the country consists of floodplains created by over 300 rivers and channels, including three major rivers: the Ganges, the Brahmaputra, and the Meghna. At the same time, Bangladesh is only a small part of a large regional system, as less than 10 percent of the watershed area of these rivers falls within the national territory. The floodplains are home to a large population – most of which is rural and poor – whose life is intricately linked to the flooding regime. Annual regular flooding has traditionally been beneficial, while low frequency but high magnitude floods can have adverse impacts on Bangladesh's citizens and economy. Recent major floods occurred in 1988 and 1998.

2. The relative severity of disasters in Bangladesh has decreased substantially since the 1970s as a result of improved macroeconomic management, progress in disaster management, and increased resilience of the poor. Despite several major disasters, Bangladesh remains among a handful of countries that have avoided a single year of negative growth since the 1990s. Importantly, agricultural damage due to flooding has decreased with changes in cropping patterns, particularly the shift from deepwater *aman* rice – highly susceptible to floods – to *boro* rice, which is harvested before the monsoon season starts. On the other hand, rapid and uncontrolled urbanization, weak environmental management, poor maintenance of infrastructure, and increasing investments and population in the floodplains may hinder flood reduction efforts and contribute to additional physical and economic losses after major floods. Moreover, progress on regional cooperation on watershed management, and on global and national efforts on climate change, remain critical to reducing Bangladesh's vulnerability to disasters.

3. **The 2004 Floods.** In April, the *haor* areas in the country's northeast suffered from flash floods that destroyed a substantial portion of the *boro* rice crop. The main wave of monsoon flooding started in early July, eventually affecting 36 million people (almost a quarter of the total population) living in the northwestern, northeastern and central districts, including Dhaka. The inundation caused nearly 800 deaths, affected 2 million acres of agricultural land, and damaged and destroyed infrastructure and social and educational facilities as well as private assets including housing, crops, livestock, and fisheries.

4. In early September, while several areas were still experiencing an emergency situation, a localized monsoon depression swept over Bangladesh, bringing three times the normal rainfall. This resulted in flooding in Dhaka and the southwest and central areas of the country. Several districts that had been spared during the previous flood emergency were affected this time. See attached map showing flood-affected districts.

5. **GOB Response.** The Government did a commendable job in responding to the flood emergency and commenced a number of programs that will continue to help the affected population, particularly the poor, with food assistance, employment, housing reconstruction and livelihood restoration. Over the years, the country's disaster preparedness and response capabilities have improved, and people's coping mechanisms to manage and recover from disaster effects have been strengthened.

6. It is estimated that the Government has allocated Tk 24 billion (about US\$410 million) from the FY05 Revenue Budget to meet the unforeseen expenditures required for immediate

rehabilitation of the affected population, critical facilities and infrastructure, and the agriculture and export sectors. This amount includes Tk 12.45 billion (about US\$210 million) redirected for infrastructure rehabilitation by several ministries from their allocation for regular O&M. UN agencies, bilateral donors, non-governmental agencies and the private sector have assisted GOB with funds and in-kind assistance.

7. **Damage and Losses.** The effects of the disaster include asset losses (direct damage) and output losses (indirect losses). Preliminary estimates show that total assets and output losses due to the floods are approximately Tk 134 billion (about US\$2.3 billion), including both the public and private sectors. Of this total, Tk 79.8 billion (US\$1.35 billion) correspond to lost assets and Tk 54.7 billion (US\$930 million) to lost outputs. Asset losses were substantial in sectors such as housing, transport infrastructure, as well as crops, livestock and fisheries. Output losses have been mostly incurred by the private sector, mainly due to agriculture sector losses (Table A). Macroeconomic impacts (secondary effects) of the floods are discussed below.

Table A: Preliminary Estimates of Asset and Output Loss due to the 2004 Floods
(Tk in million)

	Asset Loss	Output Loss	Total	% of Total
Housing	27,500		27,500	20.4
Transport Infrastructure	20,000	11,500	31,500	23.4
BWDB's FCD/I Schemes	4,000		4,000	3.0
Water Supply and Sanitation	900		900	0.7
Dhaka WASA	1,400		1,400	1.0
Urban Municipalities	3,100		3,100	2.3
Primary Schools	2,400		2,400	1.8
Post-Primary (Sec. Schools and Colleges)	1,800		1,800	1.3
Health	400		400	0.3
Agriculture, Livestock & Fisheries	11,800	26,600	38,400	28.6
Industry	4,000	5,600	9,600	7.1
Wholesale & Retail Trade		11,000	11,000	8.2
Power	1,600		1,600	1.2
Others (small losses from several agencies)	900		900	0.7
Total in Tk Million	79,800	54,700	134,500	100
Total in US\$ Million	1,350	930	2,280	
Percent of (FY04) GDP	2.4	1.6	4.0	

Sources: Based on GOB data & Asian Development Bank / World Bank Staff estimates.

Notes: Table includes public and private sector losses; the nominal exchange rate is Tk 59 per US dollar.

8. **Recovery and Financing Needs.** Grasping the full extent of the country's recovery needs is difficult due to limitations in estimating all the output losses and potential private sector recovery investments. With respect to the public sector, it is estimated that financing needs related to rehabilitation and reconstruction of facilities and physical infrastructure would range

between US\$670 and US\$715 million, depending on the level of improved standards applied during implementation of the post-flood recovery program.

9. Financial resources (i.e., credit and cash grants) are also needed to help the poor and vulnerable recover from the floods, and to ensure speedy recovery of the agriculture sector (crops, livestock and fisheries). Credit needs among flood-affected farmers, fishermen and other rural poor households are substantial. The Government quickly allocated funds to assist in crop and livestock rehabilitation and housing reconstruction, and many households and businesses have already started to use their own limited resources to meet recovery needs. Access to additional resources is still needed, given the scale of the remaining recovery needs, particularly in rural areas. The total financing needs for recovery programs targeted to small farmers and poor families, however, will depend on their design, including available credit facilities, delivery mechanisms, and level of involvement of target communities.

10. **Macroeconomic Impacts.** The floods will affect Bangladesh's near-term economic prospects, adding to concerns related to the phasing out of the Multi Fiber Arrangement (MFA) and higher oil prices. However, the country's economy appears to be more resilient to disaster impacts, which tend to be temporary and are expected to be overcome in view of Bangladesh's good fiscal and macroeconomic performance. Preliminary analysis shows that FY05 GDP growth will be about 5.2 percent, lower than the 5.5 percent projected before the floods and the Government's target of 6.0 percent. Agriculture, particularly the crop, livestock, and poultry sub-sectors, and small and medium scale industries, are likely to be the most adversely affected in the short run. After being on the rise for three consecutive years, inflation appeared to have stabilized before the floods. However, delayed transplanting of the *aman* rice crop and flood-induced setbacks in other food crops (particularly vegetables) have contributed to higher inflation, which reached a six-year high of 7.9 percent in October 2004.¹

11. The balance of payments position may marginally deteriorate, but Bangladesh will be able to absorb related pressure on reserves. The external current account balance, which had a surplus equivalent to 0.1 percent of GDP in FY04, was projected to have a deficit equivalent to 0.9 percent of GDP in FY05 before the floods, due primarily to a slowdown in export growth resulting from the MFA phase-out. Additional reduction in export growth due to the floods, combined with additional flood-induced imports, is likely to increase the current account deficit to 1.1 percent of GDP, even after taking into account increases in remittances. This could create pressure on reserves. Fortunately, unlike the situation following the 1998 floods, Bangladesh's reserve position is much stronger, in addition to having in place a floating exchange rate regime that will help absorb the pressure on reserves. At the end of June in 1998, the country's gross reserves were US\$1.8 billion (equivalent to 2.8 months of imports), whereas now gross reserves are US\$3.1 billion (equivalent to 3.7 months of imports).

12. **Fiscal Implications.** The relief effort, expansion in food-assisted safety nets, repairs to public property, and the economic impact of the floods are likely to put pressure on both the revenue and expenditure sides of the budget. The budget deficit may reach 4.7 percent of GDP in FY05, which is substantially higher than FY04 (3.2 percent) but close to the original FY05 target (4.3 percent). The pro-agriculture, pro-poor stance of the FY05 budget will help promote the post-flood recovery process provided the allocated funds are fully and effectively utilized. The floods, at the same time, have increased the challenge of meeting the ambitious FY05 budget revenue targets.

¹ The rise in inflation was driven mainly by the increase in food inflation to 10.5 percent, up from 7.1 percent a year before. The projected FY05 post-flood inflation figure is 7.5 percent, compared to a pre-flood forecast of 5.5 percent.

13. **Social Impacts.** Despite remarkable social and economic progress, Bangladesh's floodplains are still populated by mainly poor and rural households. In 2004, as in other recent major floods, the poor were generally least able to withstand the negative impacts of the disaster on their income, health, and personal security. Women, children, the disabled, and the elderly proved to be particularly vulnerable to the floods. Households living near major rivers in northeast rural Bangladesh suffered from the longest and generally most severe flooding. Within these areas, landless laborers and small farmers who lost crops were the most harshly impacted. Many people were rendered homeless across all affected areas; almost 900,000 families lost their homes and about 3 million experienced damages to their housing. Due to severe erosion, in some areas people not only lost their homes, but also their land.

14. While national average agricultural crop and livestock losses for the year have been moderate, the impact of these losses at the individual farmer level will be relatively much larger. Incomes of flood-affected rural families are likely to decline unless bumper *boro* rice and other crops materialize. Flood waters also reduced employment opportunities and incomes, which will particularly affect people living in the northwest and may exacerbate the *monga*² problem. In urban areas, slum dwellers who typically live in poorly drained areas suffered from long periods of water logging, which increased the risk of diarrhea and other waterborne diseases.

15. In the short term, many poor households experienced reduced consumption and increased illness, while in the medium term they are likely to suffer from increased debt and lingering nutritional consequences. Overall, however, incidences of diarrhea and other waterborne diseases were rather low. Health issues were managed relatively well during the floods, and no major epidemics developed. On the other hand, even with the benefits of Government, NGO, and international relief programs, many rural and urban households resorted to informal sector loans with high interest rates as one of their main coping strategies. Although these loans can be instrumental in preventing serious reductions in food consumption and health status, the burden of debt repayment is likely to remain long after the visible effects of the floods are gone.

16. **Environmental Impacts.** The recent floods have caused four main environmental impacts: riverbank erosion, soil erosion, water logging, and water contamination and health risks. Riverbank and soil erosion were exacerbated, especially along embankment areas close to major rivers. Water logging is reported to have caused health risks in urbanized flood-prone areas. Unhygienic conditions resulted from, or were made worse by persistent blockages in drainage systems, poor solid waste management, and inadequate water and wastewater treatment facilities.

17. **Lessons from Recovery Efforts.** While recovery programs have specific features related to a country's context and disaster's characteristics, there are key lessons that should inform rapid and sustained recovery. Some of these lessons have emerged from the experience of the ADB, World Bank, and other international agencies that have extensive experience in assisting many vulnerable countries, including Bangladesh, in the design and implementation of disaster recovery strategies and programs. These lessons include:

- (a) Recovery programs have been more successful when approached as a development issue, paying special attention to household and community recovery in addition to infrastructure reconstruction.

² October and November are called the "monga," referring to the period when food stocks run low and job opportunities are scarce until the December rice harvest.

- (b) Transparency and equity in allocation of recovery funding and implementation of activities have proved essential to achieving sustainable results through the recovery process. The most challenging issues have been keeping politicization of the recovery program in check and involving affected communities through consultation and direct participation.
- (c) Ensuring risk reduction through reconstruction requires applying disaster prevention and mitigation principles to all reconstruction works, and defining sustainable operation and maintenance (O&M) arrangements early in the recovery process for both undamaged and rehabilitated assets.
- (d) As corroborated after the 1998 floods in Bangladesh, donor coordination and flexibility are essential to facilitating rapid recovery. Flexibility has been ensured, for example, through the provision of fast disbursing funds for budget and balance-of-payments support, coupled with fast-tracked reallocation of funds from existing operations and timely preparation of emergency operations, if deemed necessary. At the same time, reallocation of funds has been carefully decided in order to avoid hindering ongoing successful programs, particularly those critical to achieving the Millennium Development Goals (MDGs). Finally, effective and simple implementation arrangements have been established by unbundling the financing of short term rehabilitation from longer term risk mitigation efforts, and by avoiding complex multi-sectoral operations requiring major central oversight and protracted decision-making processes.

18. **Proposed Recovery Approach and Program.** Managing disaster risk is a dynamic process that involves preparedness and response, mitigation and prevention, and recovery activities. Good practice indicates that emergency response is critical not only to deal effectively with the immediate relief needs, but also to minimize health, nutritional, and social risks. At the same time, the need for both speedy recovery of the affected population and the country in general, and for long-term disaster management requires developing a sound recovery program that should consider short-term rehabilitation, medium-term recovery, and long-term hazard management.

19. **Short term rehabilitation** activities usually cover a period of up to 24 months after the disaster. These activities address urgent needs to restore the livelihoods of the affected population, particularly the poor and vulnerable, and to rehabilitate sectors critical to bringing social and economic activity back to a regular pace.

20. **Medium-term reconstruction and recovery** efforts (usually up to 5 years), focus on social and physical infrastructure, which should be repaired or rebuilt to improved hazard-resistant standards. Simultaneously, preparatory activities for disaster risk management should be identified and initiated.

21. Development and implementation of a **long-term, multi-hazard risk management program**, which by definition takes time to be internalized by the public and private sectors. Based on cross-country experience, the importance for a vulnerable country like Bangladesh of having a long-term strategy cannot be overemphasized. To produce sustainable results, this strategy needs to incorporate appropriate policies to reduce hazard risks and continued technical and institution capacity building, complemented with risk identification, improved regulation and enforcement, long-term mitigation measures, risk transfer (insurance) options, and policies and programs that empower communities to develop and take ownership of hazard reduction activities.

**2004 FLOODS IN BANGLADESH
DAMAGE AND NEEDS ASSESSMENT AND PROPOSED RECOVERY PROGRAM**

PART I

SECTION 1: BACKGROUND

A. OVERVIEW OF THE 2004 FLOODS

1.1 Bangladesh is one of the world's most vulnerable countries to natural hazards, including floods, drought, cyclones, and earthquakes. In late June 2004, heavy monsoon rains swelled the waters of the Meghna River, which reached its peak level in early July. The Jamuna and Padma Rivers also burst their banks in early July, due to heavy rains in Bangladesh and in catchment areas outside the country, causing flash floods in the northeast and the west-central districts. The floods spread, eventually impacting Dhaka and other central districts.

1.2 The July-August floods resulted in almost 800 deaths and affected 36 million people (about 25 percent of the population) across 39 districts. The flood water persisted for almost 55 days in certain areas, compared with 65-70 days in 1998. Approximately 38 percent of Bangladesh was inundated by the time the waters began to recede in early August, including 2 million acres of agricultural land. During the emergency, access to potable water and sanitation facilities was diminished, as thousands of tubewells and latrines were affected. The floods also caused heavy damage to housing and major infrastructure (roads, bridges, embankments and irrigation systems), as well as output losses to the agriculture sector and the ready-made garment and other export industries.

1.3 Between September 10 and 16, while an emergency situation still prevailed in certain places, a localized monsoon depression swept over Bangladesh, bringing three times the normal rainfall and causing flooding in Dhaka and in the southwest and central areas of the country. Several districts that had been spared during the previous flood emergency were affected this time.

1.4 **GOB Preparedness and Response.** Over the years, GOB has developed its preparedness and response capabilities to manage natural hazards and reduce loss of life and property. At the same time, the country's population has developed strong coping mechanisms to manage and recover from disasters. The relatively low death toll and low incidence of waterborne diseases after the 2004 floods testify to the success of existing disaster preparedness and response mechanisms.

1.5 The Government did a commendable job in responding to the flood emergency and assisting the affected population. On July 7, the Ministry of Food and Disaster Management (MFD) activated emergency response committees at the District, *Upazila* and Union levels, and established an operations center in Dhaka to coordinate relief activities. About 5,500 emergency shelters were opened to house about 1.7 million homeless, over 3,400 medical teams were mobilized, and 800 temporary health centers were established. Military personnel were deployed to assist with rescue operations and the distribution of food and relief services. To assist the flood-affected households, the Government started the Vulnerable Group Feeding (VGF) program two months earlier than usual. By the end of August, 48,000 metric tons of rice had been distributed through the Gratuitous Relief program. In addition, the Government planned to

distribute 170,000 metric tons of rice, together with the World Food Program (WFP), starting in the six worst impacted districts and gradually expanding to cover the rest. The Government has also distributed clothing and 10,800 bundles of corrugated iron (CI) sheets, along with cash grants totaling Tk 5.4 million, to assist with initial housing reconstruction and related expenses.

1.6 It is estimated that the Government has reallocated Tk 24 billion (about US\$410 million) from the FY05 Revenue Budget to attend to the unforeseen expenditures required for immediate rehabilitation of the affected population, facilities, infrastructure, and the agriculture and export sectors. This amount, which constitutes about 7 percent of the budgeted revenue expenditure for the fiscal year, includes (i) Tk 12.45 billion (US\$210 million) redirected for infrastructure rehabilitation by nine ministries from their FY05 allocation for regular O&M; (ii) Tk 5 billion (US\$85 million) whose release was expedited to provide targeted poverty reduction, employment generation and microcredit programs to flood-affected families;³ and (iii) Tk 3 billion (US\$51 million) spent in agricultural subsidy to give urea and vegetable seeds to farmers. In addition, the Government (iv) speeded up the payment of Tk 3.75 billion (US\$63.5 million) export subsidy owed to exporters in flood affected areas, and (v) increased the size of the Revenue Budget by Tk 360 million (US\$6 million) to meet additional revenue expenditure demands from four ministries. The need to divert O&M funds could result in the deterioration of infrastructure due to inadequate maintenance, and affect the overall sustainability of the recovery effort. GOB recognizes the impact of this action, and is exploring ways to ensure that adequate O&M levels are reached.

1.7 **Non-Governmental Organization (NGO) Response.** During the floods, many NGOs provided food, health supplies and services, water, and other basic necessities to thousands of families throughout the country. Several NGOs are providing support to recovery programs. The Bangladesh Rural Advancement Committee (BRAC), one of the largest national NGOs, has created two loan programs (one specifically for housing) with low interest rates and flexible terms. The Bangladesh Red Crescent Society planned to help reconstruct 1,000 homes and to provide seeds and other agricultural inputs to 30,000 families.

1.8 **International Community Response.** In mid-July, the UN activated a Disaster Management Team (DMT) to coordinate UN agency activities. The DMT was assisted by the UN Disaster Assessment and Coordination Team (UNDAC) deployed by the UN Office for the Coordination of Humanitarian Affairs (OCHA). The World Health Organization (WHO), United Nations Children's Fund (UNICEF), the Food and Agriculture Organization (FAO), and the WFP provided critical emergency supplies to support the Government ministries involved in emergency response. On August 12, the UN launched a Flash Appeal for US\$210 million, and raised about US\$76 million.⁴ To assist in the recovery effort, UNDP also deployed a team from its Bureau of Crisis Prevention and Recovery (BCPR). The Local Consultative Group (LCG) of Bangladesh established a Disaster and Emergency Response (DER) sub-group, which worked closely with the UN Country Team and met regularly to coordinate the emergency response of donors and international agencies. The DER, in coordination with several of its partner organizations, conducted its own damage and needs assessment and released its final report in October 2004.

1.9 Several bilateral donors have contributed resources for post-flood relief programs, which have been channeled mainly through NGOs. These donors include the United States Agency for

³ This amount would have been spent during the fiscal year, but the beneficiaries would not have been necessarily the same and the expenditure rate would have been slower.

⁴ This amount includes contributions from governments, NGOs, international agencies and private sector. According to OCHA, contributions to the 2004 floods in Bangladesh totaled US\$101 million, including the Flash Appeal.

International Development (USAID), the Australian Agency for International Development (AusAID), the Government of Norway, the Canadian International Development Agency (CIDA), the Swedish International Development Cooperation Agency (SIDA), the Japan International Cooperation Agency (JICA), the European Union, and the United Kingdom's Department for International Development (DFID). Some donors also pledged funds towards the rehabilitation of infrastructure during the recovery phase.

1.10 **Private Sector Response.** Although limited information is available regarding the private sector's response to the floods, several international organizations noted that many national and multinational companies provided contributions to support the relief program. National newspapers reported that local companies also assisted their workers by providing medicine and other health-related services immediately following the floods.

B. COMPARISON OF 1988/1998/2004 FLOOD IMPACTS

1.11 Flooding is a recurrent event in Bangladesh; most of its territory consists of floodplains, and up to 30 percent of the country experiences annual flooding during the monsoon season, while extreme flood events tend to spread over 60 percent of the national territory. Significantly, about 93 percent of the combined basin area of the main rivers lies outside of Bangladesh's borders, and almost 80 percent of the annual rainfall occurs during the monsoon period (between June and September) across the river basins. As a result, the country's water regime is critically affected by upstream interventions that occur outside its national territory. According to the EM-DAT International Disasters Database, Bangladesh has experienced at least thirty major flood events since 1980, with the most severe damage occurring during the 1988, 1998, and 2004 floods (Table 1.1).

Table 1.1: Comparison of Losses Resulting from the 1988, 1998 and 2004 Floods

Loss	1988	1998	2004
No. Livestock killed	172,000	26,564	8,318
Crops damaged (m. ha.)	2.12	1.74	1.30
Deaths	2,300	1,100	747
Rice production losses (million metric tones)	1.65	2.06	1.00
No. of people affected	45 million	31 million	36 million
Roads damaged (km)	13,000	15,927	27,970
Percent of land inundated	60	68	38
No. of homes damaged/destroyed	7.2 million	980,000	4 million
Total losses	Tk 82.6 billion (US\$1.4 billion)	Tk 118 billion (US\$2 billion)	Tk 134 billion (US\$2.3 billion)

Sources: Ministry of Fisheries and Livestock; Papers from the *National Workshop on Options for Flood Risk and Damage Reduction in Bangladesh*, September 7-9, 2004; ADB and World Bank Staff estimates.

1.12 There is no doubt that all three of these flood events caused extensive damage in terms of the number of people affected, agricultural losses, and damage to housing and infrastructure systems. However, an important trend to note between each of the three floods is the continued decline in the number of deaths attributed to the disaster. For example, in 1988, the number of deaths reached over 2,200, while in 2004, the number of deaths to date is under 800. The fact that about 600 of the 2004 fatalities are attributed to drowning, and that only about 100 succumbed to diseases, testifies to the effectiveness of the overall emergency response and preparedness initiatives carried out by the Government, international organizations, NGOs, and others. The

number of livestock deaths has also decreased over the past 15 years, as communities have established more effective coping strategies and become better prepared to deal with flooding.

1.13 A major difference between the 1998 floods and other severe flood events was that water levels rose at a slow, steady rate, and flood water persisted in some areas for almost 70 days before receding. The 2004 floods were the result of continuous, heavy downpours in the catchments during July and August with quickly rising water levels, which persisted for a few weeks.

1.14 It is relevant to note that although the amount of land affected by floods was larger in 1998 than in 2004, the number of people affected and the amount of losses to infrastructure and agriculture assets were larger in 2004. This trend is likely related to population growth and increased density, as well as to loss of land due to river erosion. Most importantly, it may also be attributed to investments in infrastructure without adequate planning for drainage and attention to maintenance, which ultimately leads to systemic failure during times of severe flooding. In addition, small and medium enterprises have been increasingly established in floodplains over the past ten years, which also leads to greater asset losses during flooding.

Are Floods Getting Worse in Bangladesh?

1.15 Bangladesh's vulnerability to floods is changing, although the nature of this change is not fully understood. Flood damage in Bangladesh seems to have increased in recent years, and the increase has been attributed to worsening flood events. It has been noted that intervals between severe floods are getting shorter, and that flood onsets are increasingly more rapid. However, there is no conclusive evidence that peak discharges or flooded areas in the country have changed dramatically over time.⁵ In fact, there is no statistically significant evidence available to establish that major floods are increasing in frequency or intensity in Bangladesh, or that rainfall amounts or distribution have changed. Analysis of any emerging trend is also made difficult by the fact that flood patterns in Bangladesh are complex. For example, the 1998 floods were a '100 year event' on the Jamuna and a '20 year event' on the Ganges and Meghna, while the 1988 floods (incidentally a 1 in 50 year event) took place right after a major flood in 1987. Interestingly, the floods of 1988 (and 1991) coincided with earthquake activity in northern Bangladesh.

1.16 There is some indication that flood hazard risks are changing due to natural and human-induced factors. Relevant physical processes include tectonic plate movement, which is causing some parts of the country to sink and others to rise; the subsidence and compaction process intrinsic to such an active delta; and fast riverbed aggradation that reduces the carrying capacity of major rivers. Process related to human interventions include rapid urbanization and unplanned development of the floodplains, soil erosion due to tilling, and certain flood management efforts. There are also upper riparian interventions such as flood embankments, damming of rivers, and deforestation that are affecting river flows. In addition, global climatic change could be affecting the hydrology and water resources of Bangladesh's river network; 60 percent of the country's surface is lower than 6 meters above sea level, which may ultimately result in more serious flooding.

⁵ Trends in Bangladesh parallel the recent global increase in the number of disasters. This worldwide trend seems to be the result of vulnerability increase due to population growth, economic growth, rapid and often uncontrolled urbanization, and concentration of investment and people on coastlines and other exposed areas.

C. GENERAL ISSUES

1.17 Bangladesh's success in water and flood management depends significantly on an appropriate level of collaboration among neighboring countries sharing the major watersheds. In addition to technological and economic issues, political and diplomatic matters affect regional collaboration. In 1996, India and Bangladesh signed an agreement to share Ganges waters at Farakka, which is a positive step toward this objective.

1.18 Despite the substantial amount of knowledge on Bangladesh's hazards, an especially flooding, further analysis is needed to assess possible changes in the hazard risk and vulnerability profile of the country. It is essential to understand the evolving flood patterns, and the possible causes for change and their implications, particularly if improved standards and specifications are to be applied to housing, critical facilities and infrastructure. As part of the process, it will be relevant to assess the possible secondary impacts of flood control structures, some of which seem to have contributed to the drainage problem being experienced in certain areas of the country.

1.19 Structural transformation of the economy has contributed to vulnerability reduction: agriculture is more resilient, and industry and services, which now account for a large share of the economy, have proved to be less sensitive to disasters. Susceptibility of agriculture to floods has diminished with the parallel decline in area planted to deepwater *aman* rice that is grown on flood-prone land during the monsoon season, and the increase in the amount of rice produced within five to six months of a damaged rice harvest associated with the expansion of the *boro* crop. Improved infrastructure and enhanced capacity of the Government and farmers to undertake effective rehabilitation activities may also have reduced the magnitude of production shortfalls caused by natural disasters.

1.20 Nevertheless, with further development and concentration of investments in Bangladesh's floodplains, the damage caused by floods has increased. As economic losses increase, higher standards of protection, which are economically justifiable, may be needed. Consequently, the cost of flood risk mitigation, which is already considerable, may become even higher. Although the envisaged shift in rural flood mitigation will allow for less costly, more localized solutions, the costs of urban flood protection, including drainage and continuous protection against erosion, will continue to rise. Protection of coastal areas will also require continuous investments to deal with changes in land and water uses.

1.21 Expansion in risk mitigation infrastructure will create additional demands on operation and maintenance (O&M) and funding of recurrent expenditures. As the 2004 floods show, effectiveness of river flood protection, and overall resilience of infrastructure to flooding and possibly to other disasters, has been weakened by inadequate O&M. This is an issue that needs to be addressed directly if future disaster vulnerability efforts are to be successful.

SECTION 2: ASSESSMENT OF DAMAGE

2.1 This section presents the methodology used to conduct the damage and needs assessment and gives an overview of the social, environmental and economic impacts of the 2004 floods, including the macroeconomic impact on economic growth, fiscal deficits and balance of payments. The damage assessment covers the following sectors: housing, transport, water supply and sanitation, education, health, water resources management, municipal infrastructure, trade and industry, agriculture, fisheries and livestock, power, and GOB-Rajuk⁶ infrastructure. Analyses and assessments included in this section are based on GOB data, field visits, and knowledge of the sector.

A. DAMAGE ASSESSMENT METHODOLOGY

2.2 A sound estimate of damage and needs following a natural disaster is critical to forming both a well-designed national recovery plan and to procuring international support. The joint team based its damage and needs assessment on the methodology developed by the UN Economic Commission for Latin America and the Caribbean (ECLAC). This methodology, which has been applied in previous assessments by the ADB and World Bank, provides a satisfactory framework for identifying and quantifying the social, economic, and environmental impacts of natural disasters.

2.3 In accordance with this methodology, the assessment considered asset losses, output losses, and macroeconomic (secondary) effects. Asset losses refer to impacts on assets, such as damage to physical infrastructure, capital, and stocks immediately following the disaster. Output losses⁷ comprise the change of flows in goods and services, as well as other economic flows such as increased expenses, reduced production, diminished revenues, and the cost of emergency relief efforts following the disaster. By adding these estimates for asset and output losses, the report indicates the magnitude of overall damage due to the disaster. Secondary effects illustrate ways in which the disaster alters the performance of the country's main economic variables, including impacts on balance of payments, inflation, foreign exchange reserves, and overall economic growth. This approach helps develop a comprehensive perspective of the damage in order to provide policymakers with a good understanding of the ways in which critical sectors and the national economy as a whole have been affected by the disaster.

2.4 Based on the above methodology, this report presents a preliminary assessment of damage and needs that relied on available data provided by the Government, information and analysis from other assessments, including reports prepared by DER and others, and field visits to a sample of flood-affected districts. The assessment process and analysis was limited by the logistics of gathering data quickly, the widespread nature of damage, and the difficulty in obtaining data related to the September floods, as it was unfeasible to visit areas that were still under water.

B. SITE VISITS AND CONSULTATIONS

2.5 The mission held discussions with concerned GOB sector agencies and line ministries, UN agencies, development partners, NGOs, public and private institutions, the private sector, and members of academia. The mission also visited several flood-affected districts, including Bogra,

⁶ Rajuk (*Rajdhani Unnayan Kartripakkha*) is a public body responsible for creating and implementing urban development plans.

⁷ In general, output losses are more difficult to estimate than damage to assets.

Comilla, Gaibandha, Manikganj, Maulvibazar, Munshiganj, Mymensingh, Narayanganj, Sirajganj, Sunamganj, and Sylhet, and met with local authorities and communities to collect damage information.

C. MACROECONOMIC AND FISCAL IMPACTS OF THE 2004 FLOODS

2.6 Estimates indicate that damage to assets and output losses equal about Tk 134 billion (US\$2.3 billion), constituting 4 percent of GDP. Of this total, Tk 79.8 billion (US\$1.35 billion) correspond to lost assets and Tk 54.7 billion (US\$930 million) to lost outputs. Housing, transport infrastructure, crops, fisheries, and livestock suffered the most damage. The public sector accounts for about 43 percent of asset losses. Output losses, which account for about 40 percent of the total loss, have been almost entirely incurred by the private sector, mainly through losses in the agriculture sector. (Additional information is provided in Annex 1).

2.7 **Impact on the Economy.** Preliminary analysis indicates that FY05 GDP growth would be about 5.2 percent, lower than the 5.5 percent projected before the floods and the 6.0 percent government target (Table 2.1). These macroeconomic effects are temporary and are expected to be overcome in view of Bangladesh's good fiscal and macroeconomic performance. The crop and animal farming sub-sectors, and small and medium scale industries are likely to be most affected in the short run. The worst-affected were the rural poor – farmers, day laborers, rickshaw pullers, small traders, and fishermen who work on the inland lakes and ponds. Factory workers and day laborers suffered income losses due to disruption of industrial activities in many districts. About 2 million workers lost work for an average of 40 days, according to an International Labor Organization (ILO) assessment. A significant portion of the urban population in Dhaka and Sylhet in particular also had their homes damaged and livelihoods affected.

Table 2.1: Impact of the 2004 Floods on Key Economic Indicators

	FY02	FY03	FY04	FY05	
				Pre-Flood	Post Flood
GDP Growth (%)	4.4	5.3	5.5	5.5	5.2
Agriculture (%)	.01	3.1	2.7	3.3	3.0
Manufacturing (%)	5.5	6.8	7.4	6.2	5.3
CPI Inflation	2.8	4.4	5.8	5.5	7.5
Balance of Payments	<i>US\$ in billions</i>				
Exports	5.9	6.5	7.6	7.9	8.4
(Annual % change)	-7.6	9.5	16.1	5.1	12.0
Imports	7.7	9.7	10.9	11.1	11.3
(Annual % change)	-8.7	13.0	12.5	10.0	15.0
Gross official reserves	1.6	2.5	2.7	3.0	3.2
Reserves in months of imports (GNFS)	2.1	2.9	2.7	3.0	2.9
Central government operations	<i>Percent of GDP</i>				
Total Revenue	10.2	10.3	10.1	11.1	10.7
Total Expenditure	14.9	13.7	13.3	15.5	15.4
Overall budget deficit	4.7	3.4	3.2	4.3	4.7
Domestic financing	2.6	1.3	2.1	1.9	2.4
Money and credit	<i>End of year, % change</i>				
Broad money	13.1	15.6	13.4	12.6	14.0
Private sector credit	13.9	12.6	12.0	13.3	13.8

Source: GOB; Asian Development Bank / World Bank staff estimates.

2.8 Inflation Impact. Past floods have tended to be inflationary.⁸ In this case, delayed *aman* rice transplanting and flood-induced setbacks in other food crops have contributed to higher inflation. In October 2004, inflation reached a six-year high of 7.9 percent driven mainly by the increase in food inflation to 10.5 percent, up from 7.1 percent a year before.⁹ In contrast, nonfood inflation has remained stable at 4.2 percent. The projected FY05 post-flood inflation figure is 7.5 percent, compared to a pre-flood forecast of 5.5 percent. It is positive that the inflation rate, after rising during the last three years, appeared to have stabilized around 5.6 percent during the last quarter of FY04.¹⁰ However, food price inflation was already high at 6.9 percent before the onset of the floods, although it declined slightly to 6.5 percent in July 2004.

2.9 Pressure on External Balances. The balance of payment position may marginally deteriorate due to the floods, but the country should be able to absorb the related pressure on reserves. Before the floods, the external current account balance was projected to have a deficit equivalent to 0.9 percent of GDP in FY05, assuming slower export growth as a result of the MFA phase-out. The additional reduction in export growth due to the flood and additional flood-induced imports are likely to increase the current account deficit to 1.1 percent of GDP despite increases in remittances. Fortunately, unlike the situation after the 1998 floods, Bangladesh's strong reserve position and floating exchange rate regime will help absorb the resulting pressure on reserves. At the end of June in 1998, the country's gross reserves were US\$1.8 billion (equivalent to 2.8 months of imports), whereas at the time of this year's floods, gross reserves stood at US\$3.1 billion (equivalent to about 3.7 months of imports).

2.10 Export growth was projected to decline from the 16.1 percent achieved in FY04 to 5.1 percent in FY05 because of the MFA phase out. Despite the floods, recent trends have been more positive than expected, and overall export growth could reach at least 12.0 percent this fiscal year.¹¹ Production in many of the ready-made garment (RMG) factories in Dhaka and Narayanganj were disrupted for 3 to 4 weeks in July, but the floods did not significantly affect July exports. However, fisheries and shrimp sectors suffered. Moreover, a number of export-oriented units suffered indirectly because their workers were unable to come to work and/or because the supply of raw materials was disrupted. At the same time, post-flood relief and rehabilitation activities are likely to induce increases in the import of selected products such as construction materials, food, and medicines.

2.11 Budget Deficit. The budget deficit in FY05 is likely to expand significantly. The relief effort, expansion in food-assisted safety nets, rehabilitation of damaged public property, and the impact of floods on economic growth are likely to put pressure on both public expenditure and tax revenues. The overall budget deficit can be expected to rise from 3.2 percent of GDP in FY04 to 4.7 percent in FY05. The experience of both the 1988 and 1998 floods show that current expenditures tend to rise significantly in the flood year and decline in the succeeding year. However, the FY05 budget includes increased budgetary allocations to support agriculture and rural development and to expand the targeted poverty alleviation programs. Full and effective utilization of these funds can go a long way towards restoring the livelihoods of the poor.

⁸ Annual inflation was about 3 percentage points higher than its 5-year moving average during the 1988 and 1998 floods.

⁹ The last time inflation was so high was in the aftermath of the 1998 floods, when it reached over 8 percent.

¹⁰ The official fiscal year begins July 1 and ends June 30. FY05 began with the year-on-year inflation rate (July 2004 over July 2003) at 5.6 percent, the same as in May and June 2004, although higher than the 5.1 percent year-on-year inflation in July 2003.

¹¹ Historically, export growth tends to decline in the flood year and bounce back the year after, while import growth in dollar terms tends to increase in the aftermath of floods.

2.12 Revenue expenditures may still overshoot the overall target, as the floods have created additional demands. The Government has implemented several programs to support the revival of agriculture, animal husbandry, and livelihoods, and increased the budget for a comprehensive agriculture rehabilitation program to assist farmers with recovery of losses through the provision of free seed and fertilizer, a Tk 1.6 billion budget enhancement to help farmers cultivate 12 crops; and a possible upward revision of the FY05 target of 1.3 billion metric tons for food distribution through the Public Food Distribution System (PFDS). Other possible increases in current expenditures include cash grants to affected people, infrastructure rehabilitation, and O&M. Importantly, ADP implementation is usually below the budgeted ADP size, but floods have tended to reduce the shortfall by augmenting demand for fast disbursing expenditures.

2.13 The flood could also have an adverse impact on revenue collections. The FY05 budget projects a 20 percent growth in revenue relative to the FY04 revenue outturn. In both 1988 and 1998, growth in revenue collections declined in both the flood year and the following year. Thus, achieving the FY05 budget revenue target has become all the more challenging with the reduced tax base resulting from lower economic growth. In the absence of new measures to broaden the tax base, strengthen compliance incentives, and plug leakages, it will be difficult to come close to achieving the revenue targets. National Board of Revenue (NBR) tax revenue collection during July-August 2004 had 15.7 percent growth relative to the corresponding period of the previous year. While this is higher than the 7.8 percent growth achieved in July-August 2003, it remains below the budgetary FY05 NBR tax revenue growth target of 18.7 percent.

2.14 **Impact of Flood-Induced Spending.** Some monetary accommodation may be required to meet flood-induced spending. Monetary growth declined from 15.6 percent in FY03 to 13.4 percent in FY04. This was targeted to decline further to 12.6 percent in FY05 under the monetary program agreed as part of the Fund's Poverty Reduction and Growth Facility (PRGF). This projection has been reassessed to accommodate the rise in private sector credit. GOB has already taken action to increase credit disbursements for agricultural rehabilitation; and, the Finance Ministry has issued guidelines on disbursement of new credit and suspension for one year of farm loans for recovery in the flood-affected areas, including rescheduling all outstanding loans and relaxing the rules for down-payment by defaulters. Nationalized commercial banks, specialized bank and public non-bank financial institutions have increased their FY05 agricultural loan disbursement target by 25 percent. Expansion in microcredit will play a role in helping the poor rebuild their livelihoods. A moderate expansionary stance in monetary management may thus be desirable if the increased disbursements meet the genuine short-run working capital needs and if the credit is not defaulted.

D. SOCIAL AND ENVIRONMENTAL IMPACTS OF THE 2004 FLOODS

Social Impact (*Additional details in Annex 2*)

2.15 Eighty-five percent of Bangladesh's poor live in rural areas, where 53 percent of households are poor (compared to a poverty rate of 37 percent for urban households). Despite increased resilience of the Bangladeshi population, poor households are generally least able to withstand the impacts of floods on household income, individual health, and nutritional outcomes.

2.16 Households living in areas of northeast Bangladesh near major rivers suffered from the longest and generally the most severe floods. Although average agricultural crop and livestock losses for the year are likely to have been small, individual losses in rice production are expected to be much larger. Given that the onset of floods in 2004 was reportedly more rapid than in 1998,

loss of assets per flood-affected household may have been greater, though the number of flood-affected households may be lower.

2.17 Urban slum dwellers living in poorly drained areas suffered from long periods of standing water that led to increased prevalence of diarrheal disease with particularly adverse effects on children. Flood waters also reduced employment opportunities and incomes of these households. Moreover, though the value of their housing is not large, loss of housing assets causes severe hardships for the poor.¹²

2.18 Notwithstanding the benefits of Government and private transfers, existing microcredit programs, and stable food prices, many households that suffered from lost labor earnings, illness, crop losses, and damage to productive assets and housing resorted to informal sector loans with high interest rates as a major thrust of their coping strategies. While these loans can be instrumental in preventing serious reductions in food consumption and health status, the burden of debt is likely to remain long after the visible effects of the floods are gone. Following the 1998 floods, borrowing was also a major coping strategy, with households borrowing the equivalent of about one month of consumption. This debt remained essentially intact one year later, however, suggesting the need for additional mechanisms to provide credit or retire loans of poor flood-affected households.

2.19 Women and children are especially vulnerable to flooding and associated problems. Emergency relief food does not always provide essential nutrition for infant and children. Lactating women may not produce milk due to flood-related stress and lack of nutritious food – thus, infants and children under two years old may become malnourished quickly. Lack of sanitation facilities also caused severe problems for women. Though physical security within rural shelters was generally good, people living along roads and embankments were much more vulnerable. Social capital is lacking in urban slums, where there is little community cohesion between people from different regions. As a result, the security of women, adolescent girls, and children was reportedly a problem in urban shelters.

Environmental Impacts (*Additional details in Annex 3*)

2.20 The recent floods have caused four main environmental impacts: riverbank erosion, soil erosion, water logging, and water contamination and health risks. The flat topography of the delta and the country in general impedes the evacuation of flood flow to the sea, thus inundating low-lying lands for relatively long durations. In addition, most of the rivers are morphologically very active. Major rivers such as the Meghna, Brahmaputra, and Ganges carry large sediment loads from the large catchments outside of Bangladesh. The shifting of river courses is an endemic problem in Bangladesh, which contributes to riverbank erosion and siltation. The Bangladesh Water Development Board (BWDB) estimates that about 1,200 km of riverbanks are actively eroding, and more than 500 km face severe erosion. Thus, flooding has exacerbated riverbank erosion and the siltation, causing closure of the off takes of the tributary channels and thousands of people to become homeless each year.

2.21 Floods also increased the erosion of road and railway embankments, with the most severe impacts occurring in areas close to major rivers. The overflow of flood water, together with strong currents, contributed to the physical damage of embankments and to sedimentation in adjoining rice paddy fields. Soil erosion is aggravated due to the continued use of degraded roads

¹² NGOs estimate that the cost of rebuilding a simple house made of corrugated iron and bamboo panel walls using new materials is about Tk 11,800 (US\$200)

and encroachment of land. Erosion also increases the concentration of suspended sediment in the water, which could affect aquatic ecology in the rivers and streams.

2.22 The increased sedimentation load and encroachment that has occurred over the years have contributed to the aggravation of flood damage. Lakes, wetlands, and natural drainage have been encroached upon and reclaimed, agricultural land has been converted for other uses, and solid and building wastes have been deposited on flood storage lands. As a result, natural water retaining ponds have disappeared, and many of the drainage channels have lost their original conveyance capacity, causing the stagnation of flood flows.

2.23 Water logging in irrigated land creates environmental hazards such as the concentration of salts drawn from the deeper soil profile, and the build-up of alkalization and sodium in soils, which will hamper plant growth. Water logging is reported to have caused health risks in the urbanized low-lying and flood-prone areas. Urban environmental facilities including production wells, tubewells, pit latrines, and ground level water reservoirs in flooded areas were submerged. Drinking water was contaminated by flood water containing sewage and industrial and agricultural storm runoff. The extremely poor, clogged drainage systems, ineffective solid waste management, and inadequate wastewater treatment all contributed to the creation of unhygienic conditions.

E. OVERVIEW OF SECTORAL DAMAGE

Table 2.2: Preliminary Estimates of Asset and Output Loss due to the 2004 Floods
(Tk in million)

	Asset Loss	Output Loss	Total	% of Total
Housing	27,500		27,500	20.4
Transport Infrastructure	20,000	11,500	31,500	23.4
BWDB's FCD/I Schemes	4,000		4,000	3.0
Water Supply and Sanitation	900		900	0.7
Dhaka WASA	1,400		1,400	1.0
Urban Municipalities	3,100		3,100	2.3
Primary Schools	2,400		2,400	1.8
Post-Primary (Sec. Schools and Colleges)	1,800		1,800	1.3
Health	400		400	0.3
Agriculture, Livestock & Fisheries	11,800	26,600	38,400	28.6
Industry	4,000	5,600	9,600	7.1
Wholesale & Retail Trade		11,000	11,000	8.2
Power	1,600		1,600	1.2
Others (small losses from several agencies)	900		900	0.7
Total in Tk Million	79,800	54,700	134,500	100
Total in US\$ Million	1,350	930	2,280	
Percent of (FY04) GDP	2.4	1.6	4.0	

Sources: Based on GOB data & Asian Development Bank / World Bank Staff estimates.

Notes: Table includes public and private sector losses; the nominal exchange rate is Tk 59 per US dollar.

2.24 Preliminary assessments of damage to assets and recovery needs are summarized below. Rehabilitation costs are based on asset replacement to higher design standards and specifications that will make them less vulnerable to future flood damage. Detailed descriptions of each sector are found in individual sector annexes at the end of this document. Table 2.2 highlights the output and asset losses by sector, while the public sector damage and recovery needs are summarized in Table 2.3. See the accompanying volume (Part II) for detailed annexes of selected sectors.

Table 2.3: Preliminary Estimates of Rehabilitation and Reconstruction Needs for Public Sector Facilities and Infrastructure

Taka in Million			
Selected Sectors	Asset (Damage) Loss	Total Financing Need	GOB Funding (Sept 2004)
Transport Infrastructure	20,000	20,000 to 22,000	
Agriculture, Fisheries and Livestock	300	400	
Primary Education	2,400	2,400 to 2,600	
Post-Primary Education	1,800	1,800 to 1,900	
Health	400	400	400
Water Resource Management	4,000	4,300 to 4,500	250
Urban Municipalities	3,100	3,100	
GOB Housing & Infrastructure	385	400	400
Water Supply & Sanitation	900	950	500
Water, Sewerage & Drainage (Dhaka)	1,350	4,200	
Power	1,600	1,600 to 1,750	
Total in Tk million		39,550 to 42,200	1,550
Total in US\$ million		670 to 715	26

Sources: Based on GOB data & Asian Development Bank / World Bank Staff estimates.

Notes: Damage figures refer only to physical infrastructure and facilities. They do not include resources required to mitigate the direct impact of the disaster on poor and vulnerable groups in rural and urban areas, or for the rehabilitation of critical sectors such as crops, livestock, and fisheries. Final figures will depend on the level of improved standards applied.

Housing (Additional Details in Annex 4)

2.25 In the 39 flood-affected districts, about 900,000 housing units were fully damaged and 3.4 million were partially damaged. Asset losses are estimated to be between Tk 21.8 billion (US\$370 million) and Tk 28.3 billion (US\$480 million). The flood washed away homes, particularly at the riverbanks; in certain cases not only the home disappeared, but also the land was washed away due to severe erosion. At the time of the joint mission field visits, a number of flood victims still occupied temporary shelters on the flood protection embankments. In rural areas, villagers who did not leave their homes built bamboo platforms at higher levels, or raised the height of their beds by tightening them with bamboo and wooden poles.

2.26 The predominant housing type in the affected rural areas comprises mud or masonry plinths with walls made of CI sheeting or woven bamboo wall panels, and CI sheet roofs. While development control regulations apply in municipal areas, rural housing is not subject to land use or building code requirements.

Transport Infrastructure (Additional Details in Annex 5)

2.28 The assessment covers road, bridge, rail, and inland water transport infrastructure. The floods caused extensive localized damage to transport sector infrastructure systems in all 39

flood-affected districts. Road infrastructure was the worst affected infrastructure sub-sector by the flooding. Railway infrastructure also suffered some localized damage on part of the network, while inland water transport infrastructure suffered limited damage. Most of the transport infrastructure damage was caused by a combination of inundation, flash flooding, and long, heavy spells of rainfall. Inadequate maintenance, and in some cases low design standards, accentuated the flood damage to the road sub-sector. This in some cases contributed to the complete failure of road stretches, resulting in the disruption of transport services in rural areas that rely heavily on road infrastructure for mobility.

2.29 The preliminary assessment prepared by the GOB shows that the overall damage to transport infrastructure in the flood-affected districts totals about Tk 15.3 billion (US\$260 million). This can be broken down by sub-sector in the following manner: (a) damage to primary road network¹³ – about Tk 6.5 billion (US\$111 million); (b) damage to secondary road network¹⁴ – about Tk 6.4 billion (US\$109 million); (c) damage to municipal roads in Dhaka City – about Tk 944 million (US\$16 million); (d) damage to railway network – about Tk 944 million (US\$16 million); and (e) damage to inland water transport infrastructure – about Tk 177 million (US\$3 million).¹⁵

Water Supply and Sanitation (*Additional Details in Annex 6*)

Rural Areas

2.30 For rural areas and secondary towns, the Department of Public Health Engineering (DPHE) estimated that 240 *Upazilas* (sub-districts) were affected by the floods and that 200,000 public hand pumps were damaged. Taking private hand-pumps into account, the team estimates that this number would reach about 700,000. Ringwells were damaged mostly due to collapse of the platforms/aprons, soil erosion, and siltation. There is no assessment of the number of damaged toilets; however, based on coverage data and extrapolation, it is likely that about 1,852,000 of unlined pit latrines in the affected areas were damaged to some degree. The DPHE has calculated that losses to assets reached Tk 900 million (US\$15 million).

Urban Areas

2.31 Urban flooding, specifically in Dhaka City, poses major health risks and causes severe economic losses. The lack of a proper drainage network and poor maintenance cause regular water logging of parts of Dhaka and damage to Dhaka Water Supply and Sewerage Authority (DWASA) facilities. Obstructions to drainage channels, mixing of sewage with flood water, and infiltration of contaminants into the water supply networks and ground water tanks pose serious health risks to the citizens of Dhaka. Additionally, nearly 40 percent of city dwellers live in low-income slums and shanties that do not have adequate water and sanitation services and are subject to frequent inundation, which causes health problems and economic losses.

2.32 The flood waters inundated a number of DWASA facilities in Dhaka City and Narayanganj, causing damage to 3 deep tubewells, 42 pump houses, 2 water treatment plants (Saidabad and Narayanganj), 180 km of sewerage lines, and 26 sewer lift stations. In addition, the flooding caused some damage to the Pagla sewage treatment plant, 600 manhole covers, most of the water distribution network, and drainage infrastructures. DWASA resorted to continuous pumping in eastern and western sections of the city to remove the flood water. The problem

¹³ The primary road network consists of National Highways (NHs), Regional Highways (RHs) and District Roads (DRs) under the management of the Roads and Highways Department (RHD).

¹⁴ The secondary road network consists of *Upazila* Roads (UZRs) and Union Roads (URs) under the management of the Local Government Engineering Department (LGED).

¹⁵ Damage estimates for inland waterways do not include additional dredging costs.

appears to have been aggravated by the lack of regulators in the western embankment, which required pumping even when the water level in the river was lower than flood levels within the city. The total damage to assets under DWASA is estimated at about Tk 1.4 billion (US\$23 million).

Education (*Additional Details in Annex 7*)

2.33 The education sector suffered damage due to a combination of factors – direct flood damage, the use of educational facilities as emergency shelters, and river erosion, which intensified during the flood. The damage was also partially due to deferred maintenance. Furniture was damaged particularly in those schools which served as shelters. Toilets in schools used for shelter were damaged beyond repair. Generally, except in river eroded areas, the damage appears to be light and can be fixed relatively easily. However, there is a need to consider new design standards for future construction and additions, not only to reduce future damage, but also to be more effective as shelters. Although classes were resumed as quickly as possible, they were interrupted for an average of twenty days.

Primary Schools

2.34 Damage estimates are significantly less than the replacement costs. Vulnerability to flood damage increased where maintenance was poor. Except for substantial damage to buildings that occurred due to river erosion, other damage has been generally assessed as low. Almost 70 percent of the damage was to Government primary schools, 28 percent to non-Government primary schools, and the rest to community schools. Damage to non-Government schools has also been assessed because these schools receive a significant amount of government support. In primary schools, very few text books were lost, and the Government replenished those that went missing from its existing stocks. Damage (asset loss) to primary schools is assessed at about Tk 2.4 billion (US\$41 million).

Post-Primary Schools

2.35 The damage levels are more difficult to validate for post-primary schools because of the large variation between various private and public institutions, which use different standards for construction and maintenance. Damage to post-primary schools comprised water damage, damage due to erosion, and vandalism to structures and furniture, in the cases where the schools were used as emergency shelters. The damage (asset loss) to post-primary schools is estimated to be about Tk 1.8 billion (US\$31 million), comprising 78 percent for buildings and 22 percent for furniture and equipment.

Health and Nutrition (*Additional Details in Annex 8*)

2.36 Physical damage to health centers was generally light, even though the health impacts on the population were substantial as more than 400,000 people were affected by waterborne diseases following the floods. Water supply and sewerage systems have been seriously damaged in some areas, which have had immediate consequences on health status. Scarcity of food supply and unhealthy cooking practices aggravated the deterioration of people's health, especially that of children, pregnant women, lactating mothers, and elderly and sick persons. People who received treatment at health centers had generally been injured due to flood-related accidents (head trauma, snake bites), water and food-related diseases, respiratory infections, skin diseases, eye infections, malnutrition, and stomach diseases. The negative effects of malnutrition cannot be estimated accurately at this time, but malnutrition is likely to increase, as happened after the 1998 floods. It may take at least a year to recover the nutrition status registered before the flood. Damage (asset loss) is estimated at about Tk 400 million (US\$7 million).

Water Resources Management (*Additional Details in Annex 9*)

2.37 According to the Bangladesh Water Development Board (BWDB), damage occurred to several flood control and irrigation (FCD/I) structures in 331 schemes across 39 districts, comprising 2,537 km of embankments (147 km fully damaged), 555 km of irrigation-drainage systems (219 km fully damaged), 45 km of riverbank protection works (10 km fully damaged), and 435 water control structures (35 fully damaged). Embankment and riverbank protection works account for 88 percent of the damage; the remaining 12 percent comprise water control structures and irrigation-drainage systems. Small-scale water resources management schemes under the Local Government Engineering Department (LGED) suffered relatively minor damage. In these schemes, damage occurred to 112 small-scale water resources management schemes in 24 flood-affected districts, comprising damage to 242 km of flood protection embankments, 154 km of drainage canals, and 153 water management structures. The estimated loss of annual agricultural production of the affected area (about 38,000 ha) is about 125,000 tons. The immediate impact of the flood damage will be reduced agricultural production from these subprojects, which will in turn reduce incomes for some 44,000 households. The total damage to water resources management facilities is estimated to be about Tk 4.0 billion (US\$66 million).

Urban and Municipal Infrastructure (*Additional Details in Annex 10*)

2.38 The urban municipal infrastructure damage assessment and cost estimate covers municipal roads, drainage systems, bridges and culverts, local markets, and other municipal centers and/or buildings, including infrastructure in slum areas. Overall, there has been damage to 2,277 kilometers of roads, 80 kilometers of drainage channels, and 1,559 meters of bridges or culverts as well as other structures. In addition to damage to the physical infrastructure, housing and business establishments in some towns such as Habiganj, Sunamganj and Sylhet also had extensive damage due to flooding and water logging, with consequent losses to the households and firms. According to the estimates prepared by the LGED, the costs for repair and rehabilitation of the damages to urban infrastructure from the recent floods in 159 municipal areas would amount to about Tk 3.1 billion (US\$52.5 million).

2.39 Flood damage assessments were rapidly prepared by each municipality, and reported through the LGED after a preliminary verification by a group of consultants working under LGED-executed projects. Further assessment was needed since some of the damage assessments and estimated replacement costs appeared to have been overestimated.

Trade and Industry (*Additional Details in Annex 11*)

2.40 According to GOB data, the trade and industry sectors were worst hit by the floods in the greater Dhaka and Narayanganj districts, which account for a substantial part of the manufacturing and knit-wear sectors. Preliminary estimates by the Federation of Bangladesh Chamber of Commerce and Industry (FBCCI) suggest that over 700,000 of the 6 million micro and SME units were affected. The direct losses that industries suffered include damage to machinery due to rusting, deposit of mud, chemicals, and other pollutants; damage to physical infrastructure and inventories; losses to non-fulfillment of contracts; and damage to goods in transit. Damage to industry reached Tk 4.0 billion (US\$66 million) in asset losses and Tk 5.6 billion (US\$93 million) in output losses. Trade (wholesale and retail) suffered output losses of about Tk 11 billion, or US\$186 million.

Agriculture, Fisheries, and Livestock (*Additional Details in Annex 12*)

2.41 GOB reports indicate that about 4.9 million families (or 42 percent of all farm families) were affected in the crops, livestock, and fisheries sub-sectors. The overall preliminary damage and loss for these sub-sectors is assessed at Tk 38.4 billion (US\$650 million), comprising Tk 29 billion (US\$495 million) for crops, Tk 4.4 billion (US\$75 million) for livestock, Tk 4.7 billion (US\$80 million) for fisheries, and relatively minor damage to physical infrastructure facilities.¹⁶

2.42 **Crops.** Damage to crops is primarily on account of potential production loss of the *aus* and *aman* rice crops, jute, summer vegetables, papaya, bananas and sugarcane. It was reported that the flash floods of April 2004 also resulted in the loss of the *boro* crop valued at about US\$151 million. Rice production in 2004/05 is expected to be lower by about one million metric tons (about 4 percent), but the price of cereals is unlikely to be affected because adequate stocks are available in the country. However, household incomes will be seriously affected unless there is a bumper *boro* crop to compensate losses from the *aus* and *aman* crops. In addition, there were substantial losses to fruits and vegetables.

2.43 **Livestock.** Both the subsistence and commercial farmers were affected, and suffered losses to livestock and poultry – almost all in the private sector. Animal deaths are estimated to be about 8,300 cattle, buffalos, goats and sheep; 366,000 chickens; and 81,000 ducks. Other losses were in the production of milk, eggs and meat; damage to animal and poultry sheds; and, loss of feed, fodder and pasture. GOB estimates that the consequent reduction in animal weight, which will affect productivity in the short run, will reach Tk 13.5 billion (US\$230 million).

2.44 **Fisheries.** Damage, losses, and potential production losses have occurred to farms, ponds, hatcheries, and nurseries due to loss of fries, fingerlings and fish – almost all in the private sector. On the other hand, the open water capture fisheries are likely to gain from the 2004 floods, since lost fries and fish remain in Bangladesh waters. However, these losses are expected to be relatively small in fresh water farms due to loss of fries and to the brackish water shrimp farms, particularly for those farms that raise shrimp throughout the year. Production losses to shrimp farms are not included in the estimate.

GOB and Rajuk-Administered Facilities and Infrastructure

2.45 The damage to facilities owned by respective Government or semi-Government agencies are as follows: (a) Government-owned housing complexes: flood damage occurred to floors, wall plaster, external electrical, and water and sanitation facilities, and roads and footpaths; (b) National Housing Authority (NHA): damage reported are in housing estates, and comprise subsidence and water damage to buildings, and external infrastructure of roads, drains, and culverts, and electrical facilities; (c) Rajuk (*Rajdhani Unnayan Kartripakkha*): major damage has occurred to road infrastructure under the management of Rajuk, such as the main road in Narayanganj (Bangabandu Road), and road infrastructure in Motijeel Commercial Area, Uttara, Gulshan, Banani and Badda Rehabilitation Area. Damage to road infrastructure was most probably exacerbated due to weak construction and poor maintenance.

2.46 Total damage suffered by the three agencies is estimated to be about Tk 400 million (US\$7 million), as follows: Government office buildings and infrastructure – Tk 112 million

¹⁶ According to Government estimates, damage to agriculture infrastructure was large, but the team has adjusted the figures since most of the damage cannot be directly attributed to floods

(US\$2 million); National Housing Authority (NHA) housing estates – Tk 210 million (US\$4 million); road infrastructure under Rajuk - Tk 58 million (US\$1 million).

Power

2.47 Damage to the power sector has been estimated by GOB at Tk 1.6 billion (US\$27 million). The extent of damage caused by the floods to the power sector is minimal relative to the sector's annual investment program and annual maintenance budget. One of the main sources of loss due to the flood is the lost benefit to consumers when flood-affected areas are disconnected from the power supply. (The power supply was interrupted or stopped in several parts of the country for safety reasons as the rising water level came very close to high voltage power lines). The physical damage identified by the utilities are mainly tilted poles, submerged substations, submerged meters, submerged utility offices, and affected transformers. Upon review of the damage estimate from the Power Division and participation in field visits, the team concluded that the initial damage estimate seemed high.

F. ISSUES

2.48 Provision of a reliable post-disaster damage assessment is central to determine recovery needs and develop a sound recovery strategy. Given the frequency of disasters in Bangladesh, a concerted effort should have been made to develop national capacity to assess damage and needs. Assessments cannot continue to be undertaken by individual ministries without applying a methodology and consistent guidelines. Due to this limitation, controversy surrounding the estimated losses – which occur in many countries – tends to distract from real issues such as priorities and needs for recovery.

2.49 While international agencies can assist in post-disaster damage assessments, the task should be fully carried out eventually by the Government and supported by qualified national experts. In addition, a reassessment of the economic and financial losses should be undertaken 18 to 24 months after the event to review the short-term economic performance adequately and adjust, if necessary, the country's poverty reduction strategy. Lessons learned from previous disasters need to be understood better and mainstreamed into sector strategies and plans.

2.50 As the preliminary assessment shows, recovery efforts in Bangladesh need to take into account changing circumstances related to the economy and disaster vulnerability of the country and its population. It appears that Bangladesh's economy is becoming more resilient to the impact of disasters. In this respect, the 1998 floods seemed to have been an important transition point. The macroeconomic impact of this event was less than initially expected and much less severe than previous major floods. Nevertheless, as the 2004 floods also helped to corroborate, extensive damage to rural and urban assets and crop and livestock losses took place, affecting the poor in particular ways.

SECTION 3: RECOVERY NEEDS AND PROPOSED RECOVERY STRATEGY

3.1 The following section discusses the evolution and recent disaster management efforts in Bangladesh, and the Government's current recovery efforts following the 2004 floods. This part of the report also describes the recovery needs by sector, and discusses the key elements of a sustainable strategy for long-term hazard risk reduction.

A. RECOVERY AND LONG-TERM HAZARD RISK REDUCTION

3.2 The recent floods have underscored the reality of Bangladesh's precarious environment. The regularity of excessive floods that take lives and destroy property, crops, and livestock are starkly opposed to the annual flooding that contributes to the country's overall prosperity. Aware of the country's exposure to natural hazard risks and the need to minimize disaster losses, the Government has increasingly focused on medium and long-term disaster management planning. The many hazard reduction activities completed or initiated in the past have yielded a handsome dividend through drastically reduced life loss through the enhancement of the country's emergency response capacity.

3.3 **Flood Management Experience.** Management of riverine hazards in Bangladesh has evolved over time. After severe floods in the 1950s, the Government started to implement a major flood protection plan. During the early 1970s, the Government's efforts were directed at post-disaster relief and recovery while continuing to build large-scale flood prevention and irrigation schemes. The main objective of the Government's strategy at the time was to achieve self-sufficiency in food supply, and the primary purpose of most of the embankments was to protect agricultural production. Coastal embankments were designed to keep saline water out during high tides, while river embankments were built to protect cropland from floods.

3.4 The severe flood of 1974 and the famine that followed immediately afterwards engendered a shift toward the intensification of crop production during the dry season. This new strategy was facilitated by a change in agriculture practices and technologies (e.g., the advent of low-lift pumps, tubewells and the spread of dry-season cropping). Although flood control and drainage projects were still constructed, small scale, low-cost and quick return projects in flood control, drainage, and irrigation development became much more common. Many of these projects were completed under several public works programs, such as the Rural Work and the FFW programs. As a result, small-scale irrigation was expanded, and *boro* rice production increased rapidly. At the time of the 1987 and 1988 floods, about 6,000 kilometers of embankments had already been built, considerably altering aspects of the hydraulic balance of the delta.

3.5 **The Flood Action Plan (FAP).** Immediately after the devastating floods of 1987 and 1988, a series of studies were initiated on flood management, with support from the international community, including a Flood Policy Study and a Flood Preparedness Study; the Pre-feasibility Study of Flood Control; the Eastern Water Study; and a Survey of Flood Control Planning in Bangladesh. It was also agreed in 1989 to prepare a five-year action plan to facilitate long-term flood control as recommended in the Flood Master Plan outlined under the Flood Policy Study. Following consultations with donors, the Government endorsed a proposal to formulate a Flood Action Plan (FAP) comprising short and long-term components and supporting activities, which the World Bank would coordinate.

3.6 When the FAP was launched in 1990 with donor support, it incorporated both flood prevention and control measures. Many critics in Bangladesh and abroad perceived the FAP as a predominantly structural framework.¹⁷ Nevertheless, most of the FAP studies and pilot projects undertaken proved to be useful by many accounts. The studies were generally effective in assessing the negative effects of some past projects, and in identifying potential problems with new proposals under consideration. They also highlighted the need for improved flood preparedness measures, while bringing increased attention and awareness of key stakeholders to environmental aspects.

3.7 **National Water Resource Management.** In 1995, a *Water and Flood Management Strategy* was developed, identifying the need for a *National Water Policy* (actually declared in 1999) and recommending the establishment of a *National Water Management Plan* (approved in 2004). The Plan recommends that new independent regulatory bodies be formed to ensure quality and cost-effective water service delivery. For example, the Bangladesh Water Development Board (BWDB), which monitors water resources management and development and irrigation and flood control, is expected to operate on a regional basis. At the same time, strengthened local government agencies would take on the task of managing local water resources for agriculture, water supply, sanitation, urban and peri-urban services, and cyclone protection shelters.

3.8 **Cyclone and Storm Surge Monitoring and Management.** The Bay of Bengal is highly susceptible to the formations of cyclone and storm surges, due to its concave coastline and shallow continental shelf. Theoretically, the country is prone to at least one major cyclone every year. Government efforts to deal with these hazards intensified after a series of devastating cyclone disasters in the 1960s, during which time a Storm Warning Center was established.

3.9 Cyclone risk management has advanced significantly, resulting in improved cyclone warning capacity using satellite data and monitoring. Cyclone preparedness measures have also progressed. The *Cyclone Preparedness Program* (CPP) was implemented by the Bangladesh Red Crescent Society, with the participation of 20,000 volunteers in the coastal and offshore areas. The number of cyclone shelters has been increased through Government-sponsored shelter construction schemes, and with the assistance of major NGOs such as the Red Crescent Society. Additionally, *killas* (raised mounds) have been built for the protection of livestock, while reinforced-concrete multi-functional school buildings and community centers have been built to be used as shelters in cyclones and floods.

3.10 **Monitoring of Seismic Activity and Earthquake Preparedness.** Bangladesh is located in a tectonically active region and is highly vulnerable to earthquakes. During the last 150 years, several major earthquakes with a magnitude greater than 7 on the Richter scale have affected Bangladesh, and two of them (with their epicenters within the country) caused considerable damage.¹⁸ Recent studies indicate that at least one 8.1 to 8.3 magnitude earthquake is overdue along the plate boundaries within Bangladesh. Such an event would have catastrophic effects in the country's major, densely-populated cities. However, earthquake risks are little known among policymakers and the public, and implementation of earthquake mitigation measures has not yet taken root.

¹⁷ Answering the criticisms that FAP was too focused on an structural solution, its components were expanded from the original 26 to 33 to include environmental and poverty considerations.

¹⁸ For example, the great earthquake of 1897 (Magnitude 8.7 on the Richter scale), with the epicenter only 230 km away from Dhaka, caused extensive damage to masonry structures in the city and surrounding areas.

Current Organizational Set Up

3.11 Over the years, the Government has established a number of policy guidance bodies and agencies to deal specifically with disaster management, including: the National Disaster Management Council, chaired by the Prime Minister, which provides policy and advice on issues related to disaster management in the country; the Inter-ministerial Disaster Management Co-ordination Committee, with the representation from all line ministries and key government departments. The Ministry of Food and Disaster Management has been designated the Government focal point for disaster-related issues. Within this ministry, a Disaster Management Bureau serves as the coordinating body for disaster-related activities. This Bureau promotes disaster mitigation and preparedness within all agencies and levels of government, through training and public education. The Bureau also serves as the Emergency Operations Center during a disaster.

3.12 In terms of forecasting and monitoring hazards, the Bangladesh Meteorological Department (BMD) provides day-to-day weather forecasting and cyclone/storm warnings through its Storm Warning Center. BMD also issues long range forecasts for floods. Using remote sensing facilities and geographic information systems (GIS), the Bangladesh Space Research and Remote Sensing Organization (SPARRSO) monitors and forecasts floods and cyclones. In addition, SPARRSO conducts natural resource surveys and monitors other natural hazards.

3.13 BWDB, under the Ministry of Water Resources, forecasts floods through its Flood Forecasting and Warning Center (FFWC), in addition to being responsible for the construction and maintenance of embankments, drainage structures, and other water management schemes. FFWC was established in 1972 to improve the accuracy of flood forecasting and upgrade the Flood Forecast Model. Progress notwithstanding, further improvement of the flood forecasting system (FFS) under FFWC is urgently needed. This effort would require updating the 50 year old topographic and elevation data through ALS or similar, creating DEM, increasing reliability of FFS, increasing weather forecasting period from 48 hours to 7 and 21 days, linking FFS to major infrastructure and agricultural land to improve its usefulness, as well as overall transfer of technology and capacity building.

Non-Governmental Organizations and Disaster Management

3.14 Non-governmental organizations (NGOs) have had an exceptionally high profile in disaster relief and rehabilitation activities in Bangladesh. NGO involvement is not surprising, given the focus on poverty alleviation, social development and community participation. NGOs also have considerable community outreach capabilities, which have facilitated their disaster response activities. Through their involvement in disaster response many NGOs have increasingly realized that, while disaster relief is intrinsic to their mission, prevention and mitigation programs are equally, if not more, beneficial to vulnerable communities.

B. LESSONS FROM PREVIOUS RECOVERY EFFORTS

3.15 Recovery programs have been more successful when approached as a development issue, through, for example, integrating physical reconstruction with employment generation, ensuring community participation in housing and small infrastructure reconstruction, facilitating access to resources needed for livelihood restoration, and including hazard risk and vulnerability concerns into reconstruction activities and future sector development plans. Moreover, transparency and equity in allocation of assistance to affected households and geographical areas have been

identified among the main factors ensuring achievement of sustainable results from recovery efforts.

3.16 Donor coordination and flexibility have been critical elements in facilitating rapid recovery, as documented after the 1998 floods in Bangladesh. In this case, development partners agreed to provide broad budgetary and import support, complemented with additional new emergency lending that has been generally assessed as highly beneficial. Implementation capacity at the project level, however, has emerged across many vulnerable countries as a major constraint, or rather as a reality check to over-ambitious recovery plans.

3.17 International experience has also shown that in order to ensure effective recovery efforts, it is important to balance the desire to start post-disaster rehabilitation and reconstruction activities and works as soon as possible with the need to prioritize, design, and appraise the selected works adequately. At the same time, the effectiveness of recovery efforts has been hindered when adequate hazard-resistant standards have not been made available or properly applied. Investments in longer term, large-scale risk reduction proposals, such as major flood management works, need careful assessment and formulation of a sound investment plan. There is evidence that this type of project often displaces other high priority activities needed to achieve country development results.

3.18 In general, the Government's success in maintaining relative financial stability after major recent disasters, the surge in remittances, and the wide reach of microfinance have facilitated recovery in Bangladesh. However, the specific focus on speedy recovery of the agriculture sector and sound fiscal management contributed substantially to the recovery after the 1998 floods. Specifically, the comprehensive agricultural rehabilitation program provided timely credit and agricultural inputs. This program, along with good weather conditions, helped boost agricultural production, particularly rice and wheat. With the exception of the 1998 floods, major disasters have tended to reduce the annual growth rate of the agricultural sector.

3.19 Ensuring food security is a high priority in post-flood economic management. Following the 1998 floods, private sector trade stabilized rice prices at levels equal to the cost of imports from India, preventing a decline in calorie consumption that would have occurred had prices been higher. Thus, maintenance of stable rice (and wheat) prices through a continued liberalized trade regime and the absence of domestic market restrictions can have widespread, significant benefits for poor households during the post-flood period.

3.20 To the extent that additional resources provided by food aid (in excess of the amount that donors would be willing to give for cash-based programs) are greater than the extra cost of imported food aid, food aid is a net benefit for the Government. Otherwise, cash-based programs (including cash transfers or cash-for-work public employment schemes) would be a more efficient means of transferring resources.

C. PROPOSED RECOVERY APPROACH AND PROGRAM

3.21 To be successful, post-disaster recovery and reconstruction efforts should be approached as part of a dynamic risk management process that requires dealing with weaknesses in emergency management revealed by the disaster, and incorporating disaster mitigation and prevention to reduce physical, social, and economic vulnerability in the long term. Accordingly, in addition to short term rehabilitation, the proposed recovery program also considers medium-term reconstruction and recovery efforts, and long-term mitigation and vulnerability reduction activities.

3.22 **Short term rehabilitation activities**, which usually cover a period of up to 24 months after the disaster, should address urgent needs to restore the livelihoods of the flood-affected population, particularly the poor and vulnerable, while rehabilitating sectors critical to bringing social and economic life back to a regular pace. In the case of the 2004 floods in Bangladesh, this phase should cover sectors such as roads and railways, water supply and sanitation, education (including rehabilitation of dual-purpose school/flood shelter buildings), water resource management, municipal infrastructure, agriculture, social protection, housing, and urgent risk reduction initiatives.

3.23 In this respect, the Government has formulated a number of assistance programs to help flood-affected households. It created a disaster risk mitigation fund of Tk 750 million (US\$12.7 million) to benefit families earning less than Tk 3,500 (US\$59) per month. The Government also started a food for work (FFW) program in October 2004, with an allocation of Tk 1.7 billion (US\$28.5 million) and 195,000 metric tons of food. This program, targeting the poorest rural households, will last through the end of the fiscal year and will provide employment in small projects costing a minimum of Tk 100,000 (US\$1,695).

3.24 Another initiative is the Government's Test Relief program, modeled after the FFW program. It focuses on repairing and rebuilding schools and basic infrastructure (embankments, bamboo bridges, etc.) to complement medium and large-scale infrastructure reconstruction efforts. For housing repair and reconstruction, GOB, in coordination with UNDP, has distributed 100,000 bundles of corrugated iron (CI) sheets. Municipalities have also distributed 100,000 bundles of CI sheets valued at Tk 209 million (US\$3.5 million). Simultaneously, the Government has allocated rehabilitation funds for priority sectors such as water supply and sanitation, rural roads, and urban drainage. Moreover, it has facilitated credit targeted to agricultural rehabilitation and distributed free seed and fertilizer to flood-affected small and marginal farmers.

3.25 **Medium-term reconstruction and recovery efforts** (usually up to 5 years), focus on social and physical infrastructure while identifying and initiating preparatory activities for disaster risk management. This phase should cover in the case of Bangladesh the following: transport infrastructure, educational facilities, water resource management, water and sanitation, and municipal infrastructure. It is critical that sufficient allocation and adequate use of O&M funds for infrastructure be ensured throughout the implementation of the recovery program and afterwards. In addition, critical preparatory activities for disaster management, such as enhancing the existing early warning system, and specifically the flood forecasting system (FFS) operated at FFWC, should be initiated.

3.26 **Development and implementation of a long-term, multi-hazard risk management program**, which in Bangladesh should be aligned with the Comprehensive Disaster Management Program (CDMP) supported by UNDP and DFID. Based on cross-country experience, the importance of having a long-term hazard management strategy for a vulnerable country like Bangladesh cannot be overemphasized. To produce sustainable results, this strategy needs to incorporate appropriate policies to reduce hazard risks and to support community-based mitigation efforts, complemented by continued technical and institution capacity building. At the program level, key issues that should be addressed include: developing and promoting the application of hazard-resistant standards and specifications for housing, critical facilities and infrastructure; improved specification, regulation and enforcement of building codes; and development of options for risk transfer. Further details on the current country's efforts in this respect, and some of the most critical issues are discussed below.

Towards a Comprehensive Disaster Management Program

3.27 As there are several government agencies charged with disaster management, better coordination and communication is important to facilitate effectiveness. More attention should be devoted to activities such as assessing the potential of people's traditional coping mechanisms related to floods and cyclones, low-cost, non-structural flood-proofing measures, or the benefits of further integrating NGOs and other stakeholders into the disaster management process.

3.28 In order to start addressing the above issues, CDMP aims to provide an integrated framework for disaster-related activities in the country.¹⁹ Specifically, CDMP is expected to help strengthen disaster management at the national, regional and local levels, including governmental and non-governmental disaster management agencies and organizations. Once completed (over the next four years), CDMP should have promoted the integration of disaster management and relief activities into the country's overall development efforts, while broadening support for disaster management among concerned stakeholders, including government agencies, donors, NGOs and community-based organizations (CBOs).

3.29 After the July-August floods, GOB organized on September 7-9, 2004, in Dhaka, a National Workshop on Options for Flood Risk and Damage Reduction in Bangladesh, the key recommendations of which were presented to the Prime Minister on October 31, 2004 and subsequently adopted for implementation by relevant ministries and agencies in a phased approach (6 months, 6-24 months, and greater than 24 months). A separate workshop booklet was issued and distributed to ministries, agencies, and development partners. In addition, it was agreed that an inter-ministerial committee will be formed and chaired by the Principal Secretary.

3.30 Findings from other developing countries indicate that disasters disrupt short and medium term investment plans, and in the long term may hinder growth and poverty reduction efforts. Bangladesh's interim Poverty Reduction Strategy Paper (I-PRSP) recognizes this issue, stressing in particular the link between poverty and disaster vulnerability. Since disasters occur regularly in the country, some resources should be earmarked for post-disaster response as an integral part of the budgetary process, while mitigation and preparedness measures should be properly funded and implemented on a programmatic basis.

3.31 In the medium to long term, Bangladesh needs to establish long-term alternatives to meet disaster-related costs. Financial risk transfer mechanisms are an option, however challenging. Expanding the scope of conventional catastrophe insurance, both by the public and private sectors has been recommended in the past, but not much progress has been made so far. Establishing a flood or weather index-based derivative for loss of output or income is not a viable option yet, given the difficulty in defining the trigger event. As noted above, flooding in Bangladesh is very complex and cannot be measured only in terms of rainfall at particular weather stations, or river flow or depth. Verification and determination of compensation entitlement is also heavily constrained due to lack of land ownership, sharecropping, and high fragmentation.

¹⁹ In addition to developing a comprehensive framework for disaster management, the Government and development partners have been supporting activities that focus on specific issues or sectors in disaster management. For example, a telecommunications disaster action plan is awaiting review and acceptance by the Government. This plan spells out necessary activities to reduce the vulnerability of telecommunications service and to help keep service functional during the emergency response period.

D. RECOVERY NEEDS BY SECTOR

3.32 The Government has already begun to build upon its immediate response efforts to address recovery needs in key sectors. This section gives an overview of the joint team's assessment of recovery needs as discussed during meetings with the Government and other stakeholders. In certain cases, the team has indicated the Government's medium- to long-term plans for recovery, as well as areas that will require assistance from development partners. Part II (see accompanying volume) includes detailed annexes for each of the sectors discussed below.

Housing (*Annex 4*)

3.33 The total cost of reconstructing the housing in flood-affected districts is estimated to be in the range of Tk 25 billion (US\$430 million) to Tk 33 billion (US\$560 million), which includes a 20 percent increase for the improvement of housing design standards. A range is indicated, as the cost depends on the level of improvements incorporated into the reconstructed structures. Except for housing for government staff, housing is the responsibility of private homeowners. As part of the recovery, GOB has distributed bundles of CI sheets and provided some cash grants. Individual homeowners have access to formal credit from microfinance organizations.

3.34 Current housing construction techniques are inadequate to provide resistance to floods. While housing construction is a private activity that is highly dependent on resource availability, a program to inform people on simple and effective design and construction methods to reduce vulnerability of the houses to flooding and other hazards would be invaluable. At a minimum, the buildings may be constructed on elevated plinths that are higher than the likely level of flood waters, as appropriate. Naturally, the cost of reconstruction to improved standards would be higher; but, the additional cost would depend on the extent of improvement introduced.

Transport Infrastructure (*Annex 5*)

3.35 The estimated total cost of reconstructing/rehabilitating the flood damaged transport infrastructure (roads, bridges/culverts, railway and inland water transport infrastructure) is in the range of Tk 20 billion (US\$340 million) to Tk 22 billion (US\$380 million). The actual costs will depend in large part on the engineering reconstruction standards that are adopted for the road sub-sector. This means that, for the road sector, GOB needs to carefully re-examine the design standards that will be followed to reconstruct and/or rehabilitate the roads that were damaged by the flooding to ensure that the life cycle costs of periodic flooding events are adequately taken into account in the proposed design solutions.

Water Supply and Sanitation (*Annex 6*)

3.36 **Rural and Secondary Towns.** The recommended recovery program, estimated to cost Tk 590 million (US\$10 million), includes: short-term rehabilitation needs estimated to cost Tk206 million (\$3.5 million) for repair/rehabilitation of 100 pump houses and 50 pumps; the rehabilitation of 20 km pipelines; and the construction/repair of 1,000 community latrines; in urban areas and rehabilitation of 100 ring wells, construction/repair of 2,000 community latrines, and repair of 20,000 hand-pump platforms in rural areas. GOB has provided funds for implementation of this immediate rehabilitation program; and the installation of at least one hand-pump and two pit latrines in each flood shelter.²⁰ There is a need to install at least 4,700 hand pumps and 9,000 community latrines in the flood shelters, at an estimate cost of Tk 206 million

²⁰ The DPHE report indicates that there are 824 hand pumps and 2,197 latrines in 5,554 flood shelters.

(US\$3.5 million) for the installation of hand pumps, and Tk 177 million (US\$3 million) for latrines. The total recovery needs are estimated to cost about Tk 590 million (US\$10 million).

3.37 Urban Water Supply, Sewerage and Drainage. According to a revised recovery plan from DWASA, the priority recovery needs for urban water supply and sanitation are estimated to cost about Tk 4.2 billion (US\$71 million) and include urgent works to rehabilitate water supply lines, electrical equipment, sewer lines, and sewerage lift pump stations; culverts and storm sewer cleaning; and, urgent flood mitigation works to improve drainage and pumping capacity to dispose of flood waters from the city. DWASA is implementing immediate restoration works valued at Tk 519 million (US\$8.8 million) with GOB assistance supplemented with its own funds. The bulk of the balance of funds needed for post-flood, medium-term recovery work is estimated to cost Tk 3.7 billion (US\$63 million). GOB is expected to provide about Tk 844 million (US\$14 million).

Education (*Annex 7*)

3.38 Primary schools. The estimated cost for rehabilitation of primary schools is Tk 2.4 billion (US\$41 million). Recovery needs include repair or reconstruction of school buildings, comprising about 70 percent government schools, about 28 percent non-government schools, and 2 percent community schools.

3.39 Post-Primary schools. The estimated cost for repair and reconstruction of post-primary school buildings is about Tk 1.8 billion (US\$30 million). Replacement costs for buildings indicated are for replacement to the same standards. These estimates need to be revised upwards (20 – 25 percent), based on the improved design standards.

3.40 Replacement or additions to both primary and post-primary schools would take into account flood and seismic risks, space per student according to UNESCO standards, the need for at least two usable floors, reinforced construction to withstand expected flood levels by district, and the dual use as emergency shelters. Enhanced designs developed under the second phase of the Primary Education Development Project (PEDP-II), should be the basis for replacement of both primary and post-primary schools. These include the space allocation per student, and design options for different areas depending on the degree of vulnerability to floods and other natural hazards. The trade-offs between single and two-story structures, and the dual use of schools as emergency shelters need to be considered in the designs of new structures.²¹

Health and Nutrition (*Annex 8*)

3.41 Recovery needs are estimated to be Tk 413 million (US\$7 million). Minor damage occurred to buildings and equipment. Although electricity was temporarily interrupted in some places, the drug supply was not affected. GOB has already provided funding for rehabilitation of the damaged health centers, and no other needs have been identified by GOB at this time. The Engineering Department of the MOHFW stated that the total number of buildings/structures affected by the flood is around 1,860. In addition, a significant amount of the expanded program on immunization (EPI) and family planning services were lost during the flood, and medical examinations were postponed.

Water Resources Management (*Annex 9*)

²¹ Water supply and sanitation facilities for emergency shelters are indicated under Water Supply and Sanitation sector.

3.42 The total recovery needs are estimated to be about Tk 4.3 billion (US\$72 million). The estimated rehabilitation cost for infrastructure repair and reconstruction includes a 10 percent allowance over the estimate from the BWDB to cover improved design standards, flood proofing, consultancy, and physical contingencies. Some of the immediate works have already been taken up at a cost of Tk 250 million (about US\$4 million) using GOB financing.

Municipal Infrastructure (*Annex 10*)

3.43 The flood damage assessments were prepared by each municipality and reported through the LGED after preliminary verification by a group of consultants working under LGED-executed projects. It is believed however, that the damage assessments and estimated replacement costs may be overestimated, both in terms of quantity and related cost estimates.

3.44 According to LGED, the repair and reconstruction works in the 159 municipalities are estimated to cost about Tk 3 billion (US\$53 million), made up as follows: about Tk 2.8 billion (US\$48 million) for roads, about Tk 176 million (US\$3 million) for drainage facilities, and Tk 100 million (about US\$2 million) for repair of bridges and culverts.

Trade and Industry (*Annex 11*)

3.45 No estimate of recovery needs has been prepared for the trade and industry sector, as lost production will be met through mechanisms such as overtime work and air-shipment of products. However, this will be at individual excess cost to the entrepreneurs, who are facing a cash-flow shortage until they return to a normal production and export cycle over the next few months. The Government has responded to this issue by expediting the payments of Tk 1.5 billion (US\$25 million) of overdue cash incentives.

Agriculture, Fisheries and Livestock (*Annex 12*)

3.46 Agriculture sector losses have been borne by individual farmers, who are mostly poor. Rapid recovery of this sector is critical to facilitate recovery, reduce poverty, and promote economic growth. The overall short- and long-term needs of farmers and fishermen who face severe hardships are assessed at about Tk 21 billion (US\$358 million), comprising: credit facilities to enable revival of livelihoods, recovery grants to promote the livestock sub-sector, and rehabilitation of infrastructure.

3.47 In the long-term, it is necessary to develop and implement a strategy to strengthen disaster preparedness among these farmers, and the rural families in general, which are not only among the poorest in Bangladesh, but are also highly vulnerable to natural disasters.

Microcredit (*Annex 13*)

3.48 As discussed in earlier sections, speedy revival of livelihoods is crucial to the recovery process of the affected people. In addition to the relief, food, and cash grants provided, it is necessary for people to have access to credit facilities. Credit is an important tool that helps people re-establish their livelihoods and improve their economic situation. Credit also promotes the spirit of self reliance and assists people to cope with the hardships they endured. There is a need for credit facilities through microfinance organizations rather than informal borrowing. According to a preliminary survey carried out by the Palli Karma-Sahayak Foundation (PKSF), the recent floods have severely affected about 192 of its Partner Organizations (POs). Based on

the Tk 1,000 credit need of about 20 percent of its 384,256 members that experienced losses, a credit line of approximately Tk1 billion (US\$17 million) would be needed.²²

GOB and Rajuk-Administered Facilities and Infrastructure

3.49 Rehabilitation needs are estimated to cost about Tk 380 million (about US\$6 million). Road rehabilitation should be done to higher standards, and the replacement costs indicated should be revised to reflect these higher standards. In addition, adequate maintenance requirements and funding needs to be provided to reduce the degree of damage incurred during future floods.

Power

3.50 Recovery needs in the power sector are assessed at Tk 1.6 to 1.75 billion (US\$27 to 29 million). Most of the damage requires labor-intensive construction works with some requirement of distribution equipment. Rehabilitation of damaged power plants, distribution, and the Aricha SPC pole plant has been completed. The power utilities will be able to meet this additional cost from their own revenue earnings, or if required, from funds earmarked by GOB for this particular purpose.

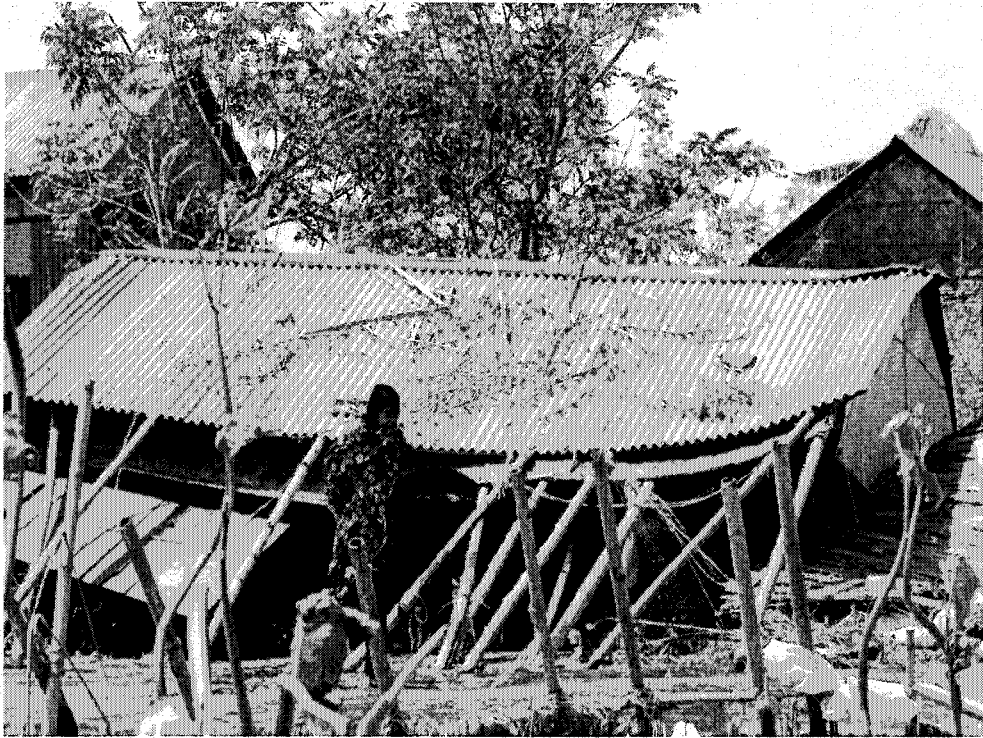
3.51 The power sector utilities, specifically the rural electric cooperatives (PBSs), took precautionary measures during the flood. They identified electrical installations and distribution lines in hazardous areas by putting up red flags and shutting down energized lines; they also removed service drop and energy meters from consumers' premises that were going to be submerged by flood water to a safe height; they also arranged close patrolling by a vigilance team in order to check for possible theft of electrical materials and equipment after shutting down the energized lines. The substations and power distribution lines, which were disconnected as a precautionary step, were quickly brought back to operation once the flood waters receded.

²² This needs assessment does not include the Government's microcredit programs, such as those implemented by the Bangladesh Rural Development Board (BRDB).

Photographs
The 2004 Floods in Bangladesh



Photos by Mufthy Munir



Photos by Jelena Pantelic



Photos by Mufty Munir



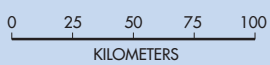
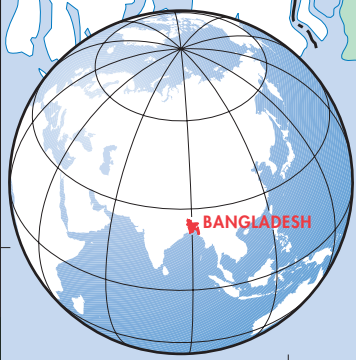
Photos by Mufty Munir



Photos by Mufty Munir

BANGLADESH FLOOD-AFFECTED DISTRICTS, 2004

- DISTRICTS AFFECTED IN JULY-AUGUST 2004
- ADDITIONAL DISTRICTS AFFECTED IN SEPTEMBER 2004
- DISTRICT CAPITALS
- DIVISION CAPITALS
- NATIONAL CAPITAL
- DISTRICT BOUNDARIES
- DIVISION BOUNDARIES
- INTERNATIONAL BOUNDARIES



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