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## Bangladesh Country Water Resources Assistance Strategy



# **Bangladesh Country Water Resources Assistance Strategy**

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## Abbreviations and Acronyms

<b>ADB</b>	Asian Development Bank	<b>JICA</b>	Japan International Cooperation Agency
<b>APSU</b>	Arsenic Policy Support Unit	<b>KfW</b>	German Development Bank (Kreditanstalt für Wiederaufbau)
<b>BGS</b>	British Geological Survey	<b>km</b>	kilometer
<b>BNWPP</b>	Bank Netherlands Water Partnership Program	<b>L</b>	liter
<b>BOOT</b>	bu ild-own-operate-transfer	<b>LGED</b>	Local Government Engineering Department
<b>BOT</b>	build-operate-transfer	<b>MDG</b>	Millennium Development Goal
<b>BUET</b>	Bangladesh University of Engineering and Technology	<b>MIGA</b>	Multilateral Investment Guarantee Agency
<b>BWDB</b>	Bangladesh Water Development Board	<b>µg</b>	microgram
<b>CAS</b>	Country Assistance Strategy	<b>NGO</b>	nongovernmental organization
<b>CIDA</b>	Canadian International Development Agency	<b>PPTA</b>	Project Preparation Technical Assistance (Team)
<b>CWRAS</b>	Country Water Resources Assistance Strategy	<b>PRSP</b>	Poverty Reduction Strategy Paper
<b>DALY</b>	disability-adjusted life year	<b>UNDP</b>	United Nations Development Programme
<b>Danida</b>	Danish Agency for International Development	<b>UNICEF</b>	United Nations Children’s Fund
<b>DFID</b>	Department for International Development	<b>USAID</b>	United States Agency for International Development
<b>DPHE</b>	Department of Public Health Engineering	<b>WARPO</b>	Water Resources Planning Organization
<b>EGIS</b>	Environment and Geographical Information Systems	<b>WASA</b>	Water Supply and Sewerage Authority
<b>EPWAPDA</b>	East Pakistan Water and Power Development Authority	<b>WHO</b>	World Health Organization
<b>FCD</b>	flood control and drainage	<b>WMCA</b>	water management cooperative association
<b>FCDI</b>	flood control, drainage, and irrigation	<b>WSP</b>	Water Supply and Sanitation Program
<b>FY</b>	financial year	<b>WSP-SA</b>	Water Supply and Sanitation Program for South Asia
<b>GDP</b>	gross domestic product	<b>WSS</b>	water supply and sanitation
<b>GEF</b>	Global Environment Facility		
<b>GWh</b>	gigawatt-hours		
<b>ha</b>	hectare(s)		
<b>IFC</b>	International Finance Corporation		

### Exchange Rate

1US dollar = 60 Bangladesh taka (BDT) (December 2004)



# Contents

## Abbreviations and Acronyms

Acknowledgments .....	i
Foreword.....	ii
Executive Summary .....	iii
1. Development Context and Introduction.....	1
2. Objectives of this Country Water Resources Assistance Strategy.....	7
3. Water and Sustainable Poverty Reduction in Bangladesh.....	9
4. The Water Resources Sector .....	22
5. The Service Sectors .....	29
6. Priorities for World Bank Engagement .....	43
Annex 1. Types of Activities for World Bank Engagement: Long Term.....	A-1
Annex 2. Relationship between Bank Portfolio and National Water Management Plan.....	A-2
Annex 3. World Bank Operational Policy (OP 7.50) on International Waterways .....	A-5
References	

## Tables

<b>Table A.</b> Medium- to Long-Term Programmatic Areas for Support to Water-Related Activities.....	x
<b>Table 1.</b> People’s Own Perception of Status in Three Ulipur Villages before and after 1998 Floods .....	16
<b>Table 2.</b> Development Partners Assistance to the Bangladesh Water (for Agriculture) Sector .....	27
<b>Table 3.</b> Summary of Major Fish Subsector Scenarios .....	40
<b>Table 4.</b> Medium- to Long-Term Programmatic Areas for Support to Water-Related Activities .....	53

## Figures

<b>Figure 1.</b> Linkages between Poverty and Water and Sanitation.....	3
<b>Figure 2.</b> Relationship of Water Resources to Water Service Sectors .....	4
<b>Figure 3.</b> Water Resources Interventions and Effects on Poverty .....	6
<b>Figure 4.</b> The Ganges, Brahmaputra and Meghna Basins .....	10
<b>Figure 5.</b> Impacts of Large-Scale Disasters in Bangladesh.....	13
<b>Figure 6.</b> Bangladesh Flood Damage .....	16
<b>Figure 7.</b> Investment in Water for Agriculture.....	26
<b>Figure 8.</b> Profile of Arsenic Occurrence in Groundwater .....	33

## Boxes

<b>Box 1.</b> Main Messages of the World Bank’s Water Resources Sector Strategy (2003) .....	5
<b>Box 2.</b> Instability and Erosion in the Brahmaputra-Jamuna River System.....	14

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## Foreword

As outlined in the Poverty Reduction Strategy Paper (PRSP) of the Government of Bangladesh, there is a clear linkage between water and poverty in the country. In recognition of this fact and the importance of appropriate water management for the development and sustainable growth of Bangladesh, the World Bank and Government agreed to produce this Country Water Resources Assistance Strategy (CWRAS).

It was developed over a time frame of almost two years, in parallel with and tying into the PRSP – published in October 2005 - and the Country Assistance Strategy (CAS), to be finalized in late 2005. During the process, many different stakeholders have contributed to this document, which outlines the achievements over the past decades and the remaining and growing challenges in Bangladesh's water sector for the coming years.

The CWRAS takes a comprehensive look at water, ranging from rural and urban water supply and sanitation, irrigation, flood and erosion management, to inland water transport. It addresses the synergies between these issues and the challenges that Bangladesh faces in furthering the management of its water resources, in the face of much needed economic development - but which is associated with increasing demands on water quantity and quality -, of population growth in urban and rural areas, climate change, and the country's downstream position.

The objective of the CWRAS has been twofold. First, in its reengagement with the water sector in Bangladesh, the Bank wanted to solicit from the various stakeholders – government representatives, experts, water users, development partners, civil society organizations - their views on Bangladesh's priorities in the water sector. Second, based on the consultative process and the background papers prepared by knowledgeable experts, to delineate how it could support the country's poverty reduction effort within the water-related sectors over the coming years. Thus, the process has been just as important as the final document.

An immediate outcome to the process of the preparation of the CWRAS has been the increased emphasis on the water resources in and around Dhaka, an issue strongly highlighted in the stakeholder consultations. Other priorities that emerged included a stronger engagement by the Bank in erosion management and support to improvement of irrigation management in the existing large irrigation schemes. The Bank's support to urban and rural water supply and the reengagement in inland water transport have been reconfirmed.

Governance, the lead theme of the PRSP and the CAS, also runs throughout the CWRAS. For investments in the water sector to effectively deliver safe drinking water to people, provide reliable irrigation water to farmers, lead to functioning flood and erosion management structures and ensure fisheries benefits for the poorest – appropriate, functioning institutional arrangements, are essential. This includes the involvement of users, strengthened local government structures and, where appropriate, participation by the private sector. In many cases, this will imply institutional change and reforms. In others, it will imply supporting change that is already on-going, such as rural water supply provision.

We are pleased to make this final document available to the many parties interested in this important multidisciplinary issue, which is so important in contributing to Bangladesh's poverty reduction agenda.

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## Executive Summary

### Development Context and Introduction

1. The population of Bangladesh is forecast to increase from about 133 million to over 220 million by 2050. Urban centers are expected to absorb most of the incremental population, growing from the present 30 million to about 130 million. This population growth combined with economic growth will increasingly stress water resources and this has the potential to be the dominant environmental and possibly the most important development issue facing Bangladesh in the coming half century.
2. Significant investments in infrastructure will be required to provide potable water to the expanding urban centers. Currently, delivery systems provide about 10,000 million liters per day; future demand is expected to be something over 35,000 million liters per day. The problem of meeting such a demand is complicated by arsenic contamination, to which almost half of the population is presently exposed at levels exceeding World Health Organization (WHO) guideline values. Urban and industrial pollution around urban centers is currently affecting fresh water quality and with expansion of the urban centers, the human excreta load will increase from the present 1,500 metric tons per day to a projected 6,000 metric tons per day, while solid wastes will increase from 4,500 to 19,000 metric tons per day.
3. To maintain food security, increases in grain production of about 20 million metric tons will be required by 2050; among other technological improvements, this will require increases in irrigated cropped area. However, increased pesticide use associated with more intensive production will continue to degrade the fresh water resources, since about 15% of these pesticides are washed from the farmland.
4. The demand for fish is expected to increase from the present 2.2 million metric tons to something between 5.5 and 8 million metric tons by 2025. The incremental production will need to be derived from inland aquaculture through some combination of increasing production per unit area, increasing area under production, and increasing imports. Fish currently provide 65% of the country's animal protein consumption and are a critical source of essential minerals, vitamins, and fatty acids. The poorest people in Bangladesh depend on fisheries both for their livelihoods and their source of protein, and reduced per capita fish supplies translate into higher prices and reduced access.
5. Water is instrumental in the performance of a number of economic sectors in Bangladesh, including agriculture, fisheries, industry and commerce, navigation, and health. Agriculture, which accounts for about 19% of the gross domestic product (GDP), has expanded between 2% and 2.5% over the past two decades and employs about 63% of the labor force. The fisheries sector, which accounts for roughly 4% of GDP and provides 9% of the country's employment, is the second most important earner of foreign exchange, and provides 65% of the country's animal protein. Inland capture fisheries have been declining, in part because of a lack of dry season water resulting from the loss of perennial wetlands, irrigation abstractions, encroachment, and pollution. Inland and brackish water aquaculture are not so affected, with annual growth rates exceeding 10% over the past decade. Transport accounts for about 8% of GDP and water transport accounts for about 15% of total transport GDP. Inland water transport is very competitive but has been adversely affected by siltation, declining flows, and deteriorating water management infrastructure and has not received financial allocations commensurate with its potential. Given the dominant role that water plays in the performance of key economic sectors in Bangladesh, and allowing that economic growth is the single most important factor influencing poverty, it follows that water and poverty are closely related. Water, as a basic resource, is instrumental in creating and sustaining employment opportunities and, as a corollary, water-related interventions that

increase the use of labor are pro-poor. Inadequate water and sanitation services have a particularly adverse effect on the poor, on their health, and accordingly on their ability to contribute to economic development.

### **Objective of this Country Water Resources Assistance Strategy**

6. The mission of the World Bank is poverty reduction. Water is a key issue in achieving this objective in Bangladesh, and the Bank has long been involved in the country's water sector. This Country Water Resources Assistance Strategy (CWRAS) describes what the Bank can and will do to help improve country-level water management, and, thereby, assist the Government of Bangladesh in choosing water sector activities that the Bank can engage in strategically: activities that are expected to have the most impact on long-term systemic challenges; that fit with the Bank's comparative advantages; and that support Bangladesh's Poverty Reduction Strategy implementation and complement the Bank's Country Assistance Strategy.

### **Water and Sustainable Poverty Reduction in Bangladesh**

7. Bangladesh has a total area of about 14.7 million hectares (ha) and a net cultivable area of about 8 million ha. The two primary sources of water are local rainfall amounting to about 250 cubic kilometers (km<sup>3</sup>) annually and falling mainly between July and October; and transboundary inflows amounting to about 1,000 km<sup>3</sup> annually derived mainly from the Brahmaputra, Meghna, and Ganges Rivers, with greatest flow also occurring between July and October. Bangladesh occupies only 8% of the total area of these three basins but is the point of concentration of their catchments. The result is excess of surface water during the summer months and water shortfalls in the winter months.
8. The National Water Policy acknowledges that Bangladesh, as the lower riparian, has limited control over rivers entering its borders and that it is affected by the significant upstream diversions and abstractions that reduce water availability during the dry winter months; by the absence of upstream hydrometric data that inhibits responses in periods of both flood and drought; and by the general poor quality of water entering the country from upstream in some of the basins. It further recognizes that the situation is progressively becoming worse as population densities are increasing, economic activity is increasing, and water quality is deteriorating. The net result is that per capita supply of renewable water is declining throughout the basins that Bangladesh shares with India. Reduced water availability in the Ganges-dependent area has affected the southwest region of Bangladesh in a number of ways, including increased saline intrusion, changes to river morphology, and increased environmental hazards, threatening the security of the natural aquatic resources, including the Sundarbans World Heritage Site. The Ganges Treaty has, nevertheless, been better for Bangladesh than the no-Treaty alternative and highlights the importance of Bangladesh redoubling its efforts to engage constructively with India in finding mutually acceptable water- and benefit-sharing agreements on the major rivers they share. The importance of such agreements is highlighted by the Indian explorations of transfer of water from surplus to deficit basins (the so-called "linking of rivers"). It should be noted that India is, for the time being, concentrating on the peninsular rivers. A suggested starting point for Bangladesh is to undertake an objective assessment of where there might be commonalities of interest with India and to build on these to create outcomes that might be mutually advantageous.
9. Bangladesh is generally considered to be vulnerable to potential changes in climate because it has a high population density, is located on a low-lying delta, and is subject to heavy rainfall and inflows of large volumes of transboundary surface water confined to a relatively short monsoon season. Adapting to climate change needs to be considered a requirement for sustainable development in Bangladesh because of the broad range of likely impacts. Because of the extent to which climate change would affect the land and water use systems, a better understanding of its impacts should be promoted and more specific plans should be prepared and implemented. Much

of the existing water resources infrastructure in Bangladesh has exceeded its design life and requires rehabilitation. This provides an opportunity to plan and design for climate change in a proactive manner.

10. Bangladesh is subject to water-related hazards such as cyclones, storm surges, droughts, floods, and river erosion. In practice the poor are most affected because they live in greater density in the most poorly constructed housing in settlements located on lands prone to hazards. Between 1970 and 1998, 171 large-scale disasters were recorded in Bangladesh. This translates into an annual frequency of 6.11, making Bangladesh the most disaster prone of all countries. Over the 28 years of record, these disasters have killed an estimated half million people and affected each person an average of four times. Bangladesh has successfully reduced the impact of disasters through community involvement in planning and risk management; however, response efforts still primarily focus on emergency relief rather than seeking ways to reduce vulnerability to natural hazards. There is a need to strengthen the awareness that risk reduction and disaster prevention make better humanitarian and economic sense than emergency relief, which only responds to the consequences of a natural hazard.
11. It has generally been accepted that for water management investments to be effective, local stakeholders and professionals would need to work side by side as partners at all stages of project planning and implementation. The various categories of water resources interventions generally require a diverse range of unique institutional structures to support participatory management. Based on conventional wisdom and experience from past practice, a few institutional models are being tested that have the potential to achieve the dual objective of establishing an acceptable and sustainable institutional framework, and successful and sustainable cost recovery. Nevertheless, more effort needs to be directed towards refining these and regardless of how attractive a proposed investment might be from a technical standpoint, the institutional aspects continue to be cause for concern.
12. Success has been elusive in the many attempts to achieve effective long-term operation and maintenance of flood control and drainage interventions. To facilitate financing and more effective operation and maintenance of water management infrastructure, consideration needs to be given to classifying infrastructure into two main categories: that which serves the national common good, and that which is local infrastructure. Infrastructure designated as serving the national common good would remain under the control of the government-designated agency with rehabilitation, operation, and maintenance financed entirely by government. Rehabilitation of infrastructure designated as local would require a significant prior financial commitment from local stakeholders for long-term operation and maintenance, and, to the extent practicable, would be implemented through or by local government.

### **The Water Resources Sector**

13. Efforts to systematically develop Bangladesh's water resources started in the 18<sup>th</sup> century and were expanded under the Zamindar system, extending to the present. During this time the water resources information base has improved, analytical processes have been strengthened, and the institutional and policy framework has evolved. In addition, a significant amount of infrastructure has been put in place to manage water for more economically productive purposes.
14. Following the establishment of a Water and Power Development Authority, an outcome of a 1954 United Nations Technical Mission, a Water Master Plan was completed in 1964. This plan emphasized large-scale publicly financed surface water development, overestimated public sector capability, and overlooked the country's groundwater resources. In 1972, the World Bank supported preparation of a Land and Water Resources Sector Study, which promoted a radical shift in strategy to minor development using low-lift pumps to irrigate with surface water and tubewells to irrigate with groundwater. The first framework National Water Plan, sponsored by

- the United Nations Development Programme (UNDP) and executed by the World Bank, was produced in 1987 and was followed by a second phase that was to operationalize its main strategic thrusts and produce an investment plan for 1992; however, the advent of devastating floods in 1987 and 1988 refocused attention on this hazard and gave rise to the internationally sponsored Flood Action Plan (1989–1994). The 1995 Water and Flood Management Strategy synergized the earlier National Water Plan with the outputs of the Flood Action Plan, promoted a broader technical approach to water resources planning, promoted a reduced public sector role in water management, identified the need for a National Water Policy, and recommended preparation of a broad-based National Water Management Plan, which would be guided by the policy. In 1999 the government declared the first National Water Policy. The policy has spawned a number of related initiatives including the preparation of a National Water Code, completion of the National Water Management Plan, and finalization of the Guidelines for Participatory Water Management. The policy fed directly into the Government’s Poverty Reduction Strategy Paper, entitled *Unlocking the Potential – National Strategy for Accelerated Poverty Reduction* which was finalized in October 2005.
15. An extensive policy framework exists, developed mostly over the last 10 years, to govern water resources development and management. Key among these are the declaration of a National Water Policy (1999); the National Water Management Plan (2004); progress towards declaring a National Water Code; and preparation of a Coastal Zone Policy (2005). In addition, a number of related policies of importance to the water sector have been set in place. These include the National Environment Policy (1992); the National Forestry Policy (1994); the National Energy Policy (1996); the National Policy for Safe Water Supply and Sanitation (1998); the National Fisheries Policy (1998); and the National Agriculture Policy (1999). The National Water Management Plan identified two gaps in the policy framework. The first related to the need for land use planning to address such issues as urban expansion, and plans and developments in sectors including industry, energy, education, and health, as well as water. The second related to the need for an integrated transport policy that would lead to more rational investment and upgrading of the various modes of transport.
  16. There are both national and local government institutions that are relevant to the water sector. The national institutions comprise some 35 central government organizations affiliated with 13 different ministries. The local government institutions include 4 city corporations, 206 municipalities, and the local government administrations at the levels of district (64), thana (464), union (4,451), and village (86,500). Nongovernmental organizations (NGOs) and the private sector have also played an important role in the development of water resources. The National Water Management Plan envisages some fundamental changes in the institutional framework in the future. The sector is likely to be managed through national and regional framework plans that reflect the government’s policies, as well as stakeholders’ demands. The plan foresees a sector that is regulated under law with new independent regulatory bodies formed to ensure quality and cost-effective water service delivery. The Bangladesh Water Development Board (BWDB) will be encouraged to operate on a regional basis and the present District-Level Inter-Agency Project Evaluation Committee coordination system will be replaced by district committees under local government. The plan also foresees a strengthened local government that increasingly takes on the task of managing local water resources for agriculture, water supply, sanitation, urban and peri-urban services, and cyclone protection shelters. The principal departments supporting this effort will be the Local Government Engineering Department (LGED) and the Department of Public Health Engineering (DPHE).
  17. Since the 1950s, more than 600 water resources schemes have been completed. The majority of these were intended to increase crop production and varied in size from small single structure schemes with an impacted area of less than 1,000 ha to large multipurpose schemes potentially

- impacting on as much as 100,000 ha. Most were designed to provide flood control, drainage, irrigation, or some combination of these. Others provide riverbank protection or river dredging. At the same time, there was massive private sector growth of minor irrigation from around 1986 to the present, which is now bigger than public programs.
18. Since 1971, public investments in water for agriculture have exceeded US\$5 billion (in real terms) and this has translated to between US\$165 million and US\$260 million annually. Government financing for the sector averaged about US\$110 million annually and this has been consistent for the past two decades. Project-related donor assistance declined from an annual average of about US\$150 million during the first half of the 1990s to an annual average of about US\$55 million during the past few years. Between 1999 to the present, the World Bank undertook no new investments in the water resources sector, which contributed substantially to the overall decline in the level of donor assistance. Since many of the donors build on the experience and expertise of the Bank in determining their own funding allocations and in developing their own programs, the impact of the Bank's decision to withdraw support from the sector was magnified as others followed suit.
  19. The decline in multilateral and bilateral support to the sector was the outcome of a general perception that investments needed to be more effective and this required improving all aspects of service delivery. The precipitous decline in Bank support during the latter half of the 1990s was partly a result of worldwide reductions in Bank lending for water-related infrastructure, and partly specific to Bangladesh, where there were concerns about misprocurement and a failure to reform key water institutions. In part stimulated by such concerns (which were not limited to the Bank or the donor community), the government, with strong Bank support, initiated a series of reforms aimed at restructuring and rejuvenating key agencies, promoting a process of participatory water management, rationalizing the national water management planning process, and developing improved systems for service delivery, including more robust procurement systems.
  20. In reviewing past donor investments, a number of common elements recur that appear to contribute to some projects performing better than others. Key among these for the public sector-financed schemes is the stronger (than in the past) involvement of end users. For minor irrigation, end users are and have always been the driving force. In many interventions, end user involvement is confirmed by their willingness to commit to financial contributions in advance of receiving services. This has been facilitated by a recent change in legislation that permits financial resources collected for operation and maintenance of publicly financed water management systems, including small-scale flood control and drainage schemes, to be retained for local operation and maintenance use. There is little consistency in terms of the local institutional structure put in place to manage the interventions: some use an informal structure while others, in accordance with the Guidelines for Participatory Water Management, use a formal structure with legally registered organizations.

## The Service Sectors

21. **Irrigation and drainage.** The National Water Management Plan suggests that government has a role to play in the development of surface water irrigation systems. Large-scale surface water irrigation projects require considerable lead time to move from a concept to the point where they are delivering water to farmers' fields. Assuming that this lead time is in the order of 10 years, and that private sector irrigation expansion using groundwater will provide sufficient production increases to meet the needs of the expanding population for the next 15 years, there is a 5-year window during which concrete efforts should be made to improve the performance of existing schemes. This would include not only physical rehabilitation but, most importantly, concrete changes in irrigation management approaches and the existing institutional frameworks. The current approach of the government is to mandate that work on two major irrigation projects



should be initiated every year from this point forward. To achieve the desired sustainable food production increases, this would need to go hand in hand with a concerted attempt to improve the performance of existing systems.

22. **Water and sanitation.** Bangladesh has made good progress in improving access to safe water and moving towards the Millennium Development Goals (MDG). The water supply coverage has increased both in the urban and the rural areas. Nearly 97% of the rural population is served by over 10 million hand tubewells; however, arsenic contamination of groundwater above the permissible limit of 50 µg/L (micrograms per liter) in Bangladesh has affected an estimated 25% of the shallow tubewells, reducing safe water coverage in rural areas to around 76%. Current challenges relate to the following: (a) increasing urban demand due to population growth and migration; (b) institutional inefficiency due to lack of clarity as to roles and responsibilities of policymakers and service providers; (c) inequitable service distribution, to which programs have responded by including social awareness to increase the impact of delivered hardware; (d) arsenic contamination, to which the response is shifting towards community-based water delivery systems; (e) financing and cost recovery, which is being addressed by improved service management; and (f) sector coordination, in response to which a National Forum for Water and Sanitation has been established and a new policy support unit is under discussion.
23. **Inland water transport.** In promoting development and more efficient utilization of the sector, a number of challenges need to be addressed. The navigability of many of the rivers is declining as a result of a combination of reduced dry season discharges and siltation in the channels. These problems are exacerbated by the difficulties associated with predicting morphological behavior of many of the rivers. The response has been less than effective because of a number of related difficulties. Poor planning, programming, and management have resulted in inadequate capital funding for necessary interventions to improve navigability. Inadequate recurrent budget allocations have fostered weak management and poor monitoring and control systems leading to little or no maintenance of associated physical facilities such as mooring and storage facilities, theft of navigation aids, lack of and slow modernization of country boats, and little expansion of rural launch facilities. The current approach is one that promotes an agenda for increasing public-private partnership in the sector, improving facilities in the areas of communication, navigation aids, and smaller landing facilities, as well as strengthening service delivery through human resource development.
24. **Fisheries and environment.** Aquaculture, in both fresh and brackish water, has shown annual growth rates exceeding 10% over the past decade. Much of that production is a result of utilization of existing ponds and technologies. But capture fisheries, both inland and marine, are declining and this trend is likely to continue without an infusion of political will, changes in current policies, improved institutional arrangements, and additional investments. Poor landless sectors of rural society depend substantially on the open water capture fisheries and key issues for the sustainable use and preservation of capture fisheries include maintenance of dry season flows, protection of key aquatic habitats, creation and maintenance of fish sanctuaries, limitation to further disruption of migratory pathways, and avoidance of further pollution and chemical degradation.

### **Priorities for World Bank Engagement**

25. Managing water resources is a continuing challenge and opportunity in Bangladesh. Over the past four decades, government and the private sector have responded to the changing social, economic, and technical environment and these adaptations have contributed to major achievements: increases in cereal production from about 7.5 million metric tons to more than 25 million metric tons annually; inland aquaculture producing an estimated 850,000 metric tons annually, though capture fisheries have declined; provision of safe drinking water to more than

- 75% of the rural population and more than 50% of the urban population; and rural sanitation coverage exceeding 30% in rural areas and 50% in urban areas. Nevertheless, despite the evolution of policies, programs, and plans that promote increasingly efficient utilization of scarce financial resources, remnants of past approaches focusing on capital investments and large-scale infrastructure persist. However, just as past actions were not a guide to the future in 1971 (when the Bank undertook the Land and Water Sector Resources Study), so it is to be hoped that future development can separate itself from the shortcomings of the past 30 years.
26. What follows are medium- to long-term programmatic priorities for World Bank engagement, outlining programs rather than specific projects. While the Bank would engage in these issues, they constitute major investment areas and would require joint efforts with other development partners. The portfolio, summarized in the following table, aims to address:
- **The institutional framework**, including the responsibilities of different actors; and standards for water quality and service provision (especially for the poor), for the environment, for land use management, and for construction and management of infrastructure, which affects the quantity and quality of water resources at various levels.
  - **The management instruments**, including regulatory arrangements; financial instruments; standards and plans; mechanisms for effective participation of stakeholders; and knowledge and information systems that increase transparency, motivate effective water allocation, use, and conservation, and secure maintenance and physical sustainability of the water resources system.
  - **The development and management of infrastructure**, for irrigation, floods, and droughts, and for water quality and source protection.
  - **The political economy of water management and reform**, in which there is particular emphasis on the distribution of benefits and costs, and on the incentives that encourage or constrain more productive and sustainable resource use and in which there is a pragmatic, sequenced and prioritized reform path.
27. **Dhaka water supply and sanitation program and bulk water system.** Dhaka is expected to become one of the world's mega cities, with the population increasing fivefold in the next 50 years from nearly 9 million in 2000 to 30 million in 2025 and 50 million by 2050. This growth will put immense pressure on all public services and infrastructure, but particularly on the infrastructure needed for a safe and reliable water supply system for all inhabitants and for industrial and commercial establishments. The program for Dhaka will require substantial investment in rehabilitation, replacement, improvement, and extension of the city's water supply systems to substantially raise service coverage levels by 2010 and sustain them at that level in the future. This will be accomplished through a combination of public-private sector initiatives to develop major new surface water sources for bulk water supplies, coupled with improvement and expansion of the main water distribution system based on existing deep tubewells and new surface water sources. Peri-urban and poor communities will be encouraged and supported to develop and install safe handpumps and small deep tubewell-based systems. A project to start addressing water supply, sanitation and drainage in Dhaka is under preparation.
28. **Integrated water management of greater Dhaka region.** The rivers in and around Dhaka are heavily polluted. The major source of this pollution is domestic and industrial wastewater discharges. Water pollution exacerbates the problem of water scarcity and inadequate drainage further increases the exposure of urban populations to the effects of polluted water. Health surveys show that over 10% of all morbidity in urban areas is attributable to environmental conditions. The program would build on the work undertaken as part of the Dhaka Environment Project carried out under the Bangladesh Environmental Management Project supported by the Canadian International Development Agency (CIDA) and would address a number of cross-

cutting themes, including urban, environment, pollution, water supply and sanitation, drainage, and flood control issues, and would provide financing to deal with these in an integrated framework, linking water resources with environmental and water and sanitation service interventions. The program would also support the development of a policy on urbanization that addresses the uncontrolled growth of urban centers. There are other major urban centers in Bangladesh that require a similar program and the experience with Dhaka would facilitate an extension to other centers.

**Table A. Medium- to Long-Term Programmatic Areas for Support to Water-Related Activities**

	<b>Broad interventions with overall poverty reduction impacts</b>	<b>Poverty-targeted interventions</b>
<b>Interventions affecting water resources, development and management</b>	<p><i>Type 1:</i>  <b>Broad regionwide water resources interventions</b></p> <ul style="list-style-type: none"> <li>Integrated water management of greater Dhaka region</li> <li>Rehabilitation and rationalization of existing flood control/drainage</li> <li>Major river studies</li> <li>River erosion management</li> <li>Gorai River restoration</li> <li>Inland waterways</li> </ul>	<p><i>Type 2:</i>  <b>Targeted water resources interventions</b></p> <ul style="list-style-type: none"> <li>Wetland and beel rehabilitation and management</li> </ul>
<b>Interventions affecting service sector delivery (e.g. water and sanitation, irrigation, inland water transport)</b>	<p><i>Type 3:</i>  <b>Broad service delivery reforms</b></p> <ul style="list-style-type: none"> <li>Dhaka and Chittagong water supply, sanitation and drainage program</li> </ul>	<p><i>Type 4:</i>  <b>Targeted services</b></p> <ul style="list-style-type: none"> <li>Improved rural, urban, peri-urban service delivery (including continued support to address arsenic contamination)</li> <li>Expansion of minor irrigation</li> <li>Support to improve management of existing surface water irrigation schemes</li> <li>Community-based fisheries</li> </ul>

29. **Chittagong water supply and sanitation.** The government has expressed a willingness to see the Bank involved in supporting improvement of the water supply and sanitation (WSS) service of Chittagong. A project combining the objectives of integrated water resources management, improvement of the overall performance of the WSS utility and expansion of the WSS service, in particular to low-income communities, is under preparation as a component of the Dhaka-Chittagong Water Supply and Sewerage Authorities (WASA) project.
30. **Urban and rural water supply and arsenic mitigation.** Arsenic contamination is threatening to undo past achievements in safe water coverage. Almost without exception, it is the poor that suffer most since they have limited resources with which to respond. The arsenic contamination

presents an opportunity to rethink the institutions that define the drinking water sector and, in particular, to reexamine the role of local governments and communities in the delivery of rural services. In other words arsenic mitigation projects, when integrated within an overall water supply vision, can provide a vehicle for institutional reforms that transform government agencies from providers of services to facilitators assisting local governments to help themselves. World Bank involvement in arsenic would continue with emphasis on the following:

- Establishing innovative institutional arrangements and service delivery systems that clearly define new roles and responsibilities for user communities and local government institutions, bringing them to the forefront of activities related to planning, implementation, and management of water services, thereby mainstreaming arsenic considerations into water supply investments and contributing to sustainable investments.
- Identifying alternative arsenic-safe sources of, and technologies for, water used for drinking and cooking.
- Protecting the right of the poor to access to water supply systems.
- Building capacity at the local level to plan, implement, finance, and manage water supply services.
- Supporting the integration of groundwater management activities with water supply activities.

31. **Wetland and beel rehabilitation and management.** The availability of dry season water will be the most critical issue facing inland capture fisheries in Bangladesh. It is estimated that 50% or more of the perennial wetlands of Bangladesh have been drained, encroached upon, filled, or otherwise lost in the past 30 to 40 years. This has negatively impacted the poor, fish production, and plant and animal biodiversity, as well as a variety of environmental services that wetlands provide. Programs that focus on rehabilitation of formerly perennial wetlands could include reexcavation of *beels* (seasonally flooded wetlands) or other water bodies, coupled with reconnection of those water bodies with rivers and streams and the addition, if required, of small water control structures. Revegetating riparian corridors and reestablishing wetland forests could be a part of the program in suitable areas. Excavated areas would preserve fish and fisheries and provide fishing opportunities to the poor. Those areas immediately adjacent to the wetlands could also provide surface irrigation to farmers in the immediate area and would help in preventing further losses of *khas* (publicly owned) and other public water bodies to encroachment. Excavation and engineering would more logically be the responsibility of local government and those national government agencies concerned with this type of work. The Department of Fisheries, operating through NGOs and local government, could be responsible for overseeing the fisheries management aspects, which would include the maintenance of minimum water levels, development of community management organizations, development of fish sanctuaries, closed fishing seasons, and other aspects of community fisheries management, such as alternative income generation.

32. **Long-term commitment to rehabilitating and rationalizing existing flood control and drainage infrastructure.** Rehabilitation and the associated challenge of sustainability are high on government's water sector agenda and are reflected in key policy documents, including the Poverty Reduction Strategy Paper and the National Water Policy. The Bank has supported government in constructing a significant proportion of the flood control and drainage infrastructure that exists throughout Bangladesh. In some cases, existing infrastructure will need to be abandoned or even destroyed to achieve a rational outcome. Infrastructure interventions also need to be coupled with early warning systems and other soft measures to support communities and the ever-burgeoning population to better cope with floods. The World Bank is a logical

partner for the Government of Bangladesh, since this is a complex area where Bangladesh could profit from international experience, and where the Bank's ability to link across sectors would be an asset. While the rehabilitation and rationalization will adopt sound planning and design principles to ensure that technical, social, and environmental considerations are respected, it will also have an overriding focus on developing sustainable systems for operating and maintaining infrastructure, including strengthening the involvement of local stakeholders and local government institutions in all stages of the implementation process. In addition, the rehabilitation design needs to accommodate potential future climate change.

33. **Provide support to policies and programs that expand minor irrigation.** The present area irrigated by minor irrigation technologies could be expanded from 4.3 million ha to as much as 6.7 million ha. The World Bank's historical involvement with minor irrigation provides it with a strong advantage in dealing with the challenges associated with supporting the sector. The Bank is also strongly positioned to address the unknowns associated with arsenic entering the food chain because of the Bank's ongoing involvement as a key agency in the response to groundwater arsenic in rural domestic water supplies. To promote policies and programs that expand minor irrigation, simultaneous engagement on a variety of issues is required such as subsidies, arsenic, resource availability, conjunctive use, and monitoring, and these need to be woven into an approach that promotes broader economic development; for this the Bank is uniquely positioned. As defined by the National Water Management Plan, the program would support minor irrigation through improvement of shallow tubewell and deep tubewell diesel engine fuel efficiencies, introduction of lower-cost pump sets for force-mode tubewells, and improvement of irrigation distribution to reduce losses in water-short areas.
34. **Assist with studies to better understand the major rivers.** Management of the main rivers, namely the Ganges, Brahmaputra, and Meghna, requires major investments, and studies are proposed that would contribute to a better understanding of long-term and cost-effective development prospects. This would include establishing a scientific basis for determining environmental flows, reviewing and updating the Brahmaputra River Training Study Master Plan in light of recent experience, improving the exchange of information between riparian countries, as well as reviewing the potential for, and feasibility of, developing major infrastructure on these rivers within Bangladesh. In light of the limited water available in the Ganges River, these studies would also serve to broaden the country's development perspective to include both the Ganges, Brahmaputra and Meghna basins. There is a need to continue to facilitate cooperation on these international rivers, to promote exchanges of information, to convene donors associated with these issues, and to maintain a focus on the sharing of benefits, which are all key elements of the studies.
35. **Support efforts to manage river erosion.** Riverbank erosion and channel instability hampers development since the permanent risk of erosion prevents long-term planning. Riverbank erosion destroys about 10,000 ha of land on an annual basis and this has significant economic and social implications. To address this problem, the National Water Policy requires that government undertake surveys and investigations to develop and implement master plans for river training and erosion control works for the preservation of scarce land and the prevention of landlessness and pauperization. The Bank has a history of involvement with erosion protection work along the Brahmaputra River, including Sirajgonj town protection, Chandpur town protection, and river bank protection for the Jamuna multipurpose bridge. In addition to a strong knowledge base, the Bank brings with it the financial resources to address this difficult issue.
36. **Gorai River Restoration Project.** The southwest region is being affected by a shortage of fresh water; increase in salinity of the surface water, groundwater, and soils; deterioration of the Sundarban ecosystems; sedimentation of the rivers; reduced crop and fish production; and reduced navigability. Increasing the dry season discharge of the Gorai River would increase the

volume of fresh water entering the southwest region and mitigate some of the adverse impacts. The Government of the Netherlands and the Bank provided assistance to the Government of Bangladesh in the late 1990s to determine the feasibility of dredging the Gorai River from its offtake at the Ganges to the railway bridge, situated about 16 kilometers (km) downstream. This first stage consisted of dredging a pilot channel followed by two consecutive years of maintenance dredging. Subsequently, this pilot channel largely infilled with sediment (because the associated river training works, which were to be financed by the Bank, were suspended because of misprocurement issues.) The feasibility study based on the pilot dredging concluded that restoration of the Gorai River offtake was feasible through a combination of continuous dredging and structures, including a flow divider, to divert Ganges flows into the Gorai River. The study considered five infrastructure options ranging in cost from an estimated US\$110 million to US\$198 million.

37. **Inland water transport.** Inland waterways are of importance as a part of Bangladesh's integrated transport network. A Policy Note is currently being prepared for analysis of how the Bank could reengage in this sector.
38. Table A summarizes these programmatic areas of support to the water sector by the Bank from the perspective of the poverty impact of these interventions. The strategic priorities for World Bank engagement outlined in the table reflect a long-term vision within a broad intersectoral perspective. They provide a balanced approach to underpinning growth through providing vital broad-based infrastructure and reform, as well as targeting the poor at the local level, as also outlined in the PRSP.



# 1. Development Context and Introduction

## Outlook

- 1.1 The population of Bangladesh is forecast to increase from about 133 million to over 220 million by 2050. Urban centers are expected to absorb most of the incremental population, growing from the present 30 million to about 130 million. This population growth combined with economic growth will increasingly stress water resources and this has the potential to be the dominant environmental and possibly the most important development issue facing Bangladesh in the coming half century.
- 1.2 Significant investments in infrastructure will be required to provide potable water to expanding urban centers. Currently, delivery systems provide about 10,000 million liters per day; future demand is expected to be something over 35,000 million liters per day. The problem of meeting such a demand is complicated by arsenic contamination, to which almost half of the population is presently exposed at levels exceeding World Health Organization (WHO) guideline values. Urban and industrial pollution around urban centers is currently affecting fresh water quality and with expansion of urban centers, the human excreta load will increase from the present 1,500 metric tons per day to a projected 6,000 metric tons per day, while solid wastes will increase from 4,500 to 19,000 metric tons per day.
- 1.3 To maintain food security, increases in food production of about 20 million metric tons will be required by 2050; among other technological improvements, this would require increases in irrigated cropped area. However, increased pesticide use associated with more intensive production will continue to degrade fresh water resources since about 15% of these pesticides are washed from the farmland.
- 1.4 The demand for fish is expected to increase from the present 2.2 million metric tons to something between 5.5 and 8 million metric tons by 2025. The incremental production will need to be derived from inland aquaculture through some combination of increasing production per unit area, increasing area under production, and increasing imports. Fish currently provide 65% of the country's animal protein needs and are a critical source of essential minerals, vitamins, and fatty acids. The poorest people in Bangladesh depend on fisheries for their livelihoods and their source of protein, and reduced per capita fish supplies translate into higher prices and reduced access.

## The Role of Water

- 1.5 Water is instrumental in the performance of a number of economic sectors in Bangladesh, including agriculture, fisheries, industry and commerce, navigation, and health. Agriculture, which accounts for about 19% of the gross domestic product (GDP), has expanded between 2% and 2.5% per year over the past two decades. This growth has been spurred by the elimination of nontariff barriers on pumps and power tillers and by lower tariffs on inputs. These factors have combined to increase the irrigated area, increase fertilizer use, and promote shifts to modern varieties. The fisheries sector, which accounts for roughly 4% of GDP, is the second most important earner of foreign exchange. Inland capture fisheries have been declining, in part because dry season aquatic habitat has been reducing in area and degrading in quality, a result of increasing irrigation abstractions, encroachment, and pollution. Inland and brackish water aquaculture emerged in response to the diminishing supply from capture fisheries. Annual growth of inland aquaculture is forecast at 5.6% and brackish water aquaculture at 3.2%. Transport accounts for about 8% of GDP and water transport accounts for about 15% of total transport GDP. Inland water transport is generally competitive with other forms of transport but has been adversely affected by siltation, declining flows, and deteriorating water management infrastructure and has not received financial allocations commensurate with its potential.



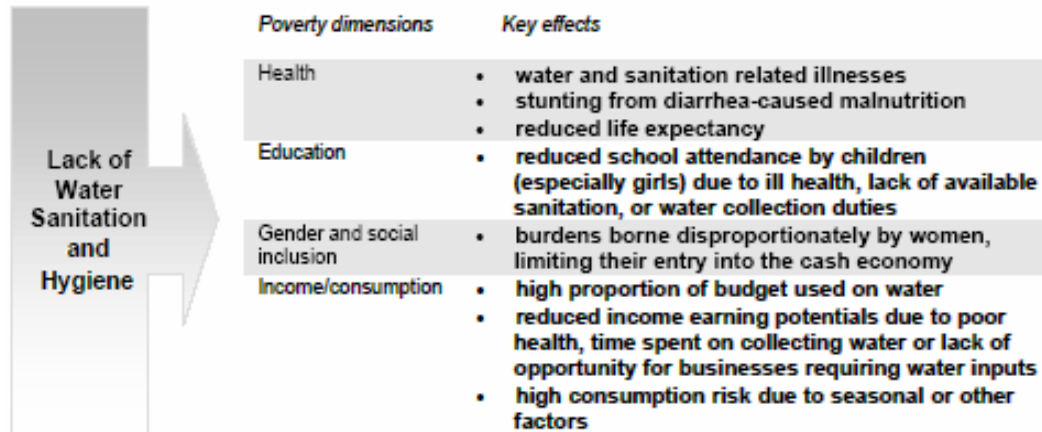
- 1.6 Given the dominant role that water plays in the performance of key economic sectors in Bangladesh, and allowing that economic growth is the single most important factor influencing poverty, it follows that water and poverty are closely related.<sup>1</sup> Water, as a basic resource, is instrumental in creating and sustaining employment opportunities; as a corollary, water-related interventions that increase the use of labor are pro-poor.
- 1.7 Agricultural production, which is dominated by crops, employs about 63% of the labor force. Water management infrastructure that reduces risk, and stabilizes or increases agriculture production promotes a willingness to invest, increases economic expectations, and thereby provides opportunities for farmers at all levels of production. The resulting impacts are increased employment and lower food prices, both important tools for poverty reduction since, like the urban poor, many of the rural poor generate their income from employment, and all are net food purchasers.<sup>2</sup>
- 1.8 Fisheries provide 9% of the country's employment. Government estimates that over 1 million people fish full time and another 11 million fish professionally on a part-time basis. It is estimated that four out of five rural Bangladeshis depend to some extent on aquatic resources. Poorer landless sectors of rural society rely on inland capture fisheries and marine capture fisheries for income and for food and are increasingly vulnerable to growing conflicts over control of these resources. Maintaining present levels of production and preserving current biodiversity in these habitats should be considered priority objectives if the livelihoods of the poorest rural residents of Bangladesh are to be sustained. The measures include maintenance of dry season flows, protection of key aquatic habitats, limitation to further disruption of migratory pathways, and avoidance of pollution and chemical degradation.
- 1.9 Inadequate water and sanitation services have a particularly adverse effect on the poor, on their health, and accordingly on their ability to contribute to economic development (figure 1). Despite relative improvements in coverage over the past two decades, the absolute number of people without water and sanitation coverage (generally referred to as the unserved) has increased. Squatters and people in slums have limited access to piped water supply (30%) and sanitary latrines (20%). This lack of access has significant negative impacts on the urban and rural poor. The urban unserved pay high prices to water vendors for minimal amounts of water of dubious quality. Adults and children in both urban and rural areas expend significant amounts of time and energy – which are thereby not available for work, study, and other beneficial and productive activities – collecting and carrying water, suffering themselves and caring for other family members with water-related, mostly diarrheal, diseases. Death and the burden of water-related disease have led to the loss of an estimated 5.75 million disability-adjusted life years (DALYs).<sup>3</sup> Applying a cost of US\$360 per DALY as a low boundary estimate, the annual cost of inadequate

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<sup>1</sup> Studies have demonstrated a strong association between national per capita income and national poverty indicators such as infant mortality rates, the ratio of female to male literacy, and average consumption and the incidence of income poverty (see discussion in World Bank 2000b). This notwithstanding, the evidence suggests that water and sanitation must be available if significant economic growth is to occur, but their presence does not assure such growth (Vaux 2004).

<sup>2</sup> Recent figures show that over 50% of all rural households are officially landless and 70% have been identified as “resource poor”.

<sup>3</sup> The disability-adjusted life year is a measure of effective loss of life through death and incapacity.

**Figure 1.** Linkages between Poverty and Water and Sanitation

Source: World Bank 2004.

water and sanitation services is more than US\$2 billion.<sup>4</sup> The effects of arsenic contamination add to these estimates.<sup>5</sup>

## The World Bank

### *The Country Assistance Strategy and this Country Water Resources Assistance Strategy*

1.10 The previous Country Assistance Strategy (CAS) operated during World Bank financial years 2001–2003 (FY01–03). To help Bangladesh pursue its poverty reduction goals during this period, the Bank supported efforts to accelerate private sector-led growth, promote integrated rural development, and consolidate human development gains while emphasizing improvements in governance. The poverty focus was maintained through selected interventions in health, education, rural development, and through improving governance. During much of this period, CAS lending remained low (annual average of US\$300 million) but, simultaneously, nonlending services (analytical work, intensified engagement with civil society, communication campaign) helped the government to prepare the Interim Poverty Reduction Strategy. The CAS addressed the role of water through health interventions in water supply and sanitation, and through rural development interventions that operationalized the water policy through a National Water Management Plan, restructuring the key water management agency (the Bangladesh Water Development Board; BWDB), decentralizing management of smaller water schemes, and protecting the rural population, especially the poor, from natural disasters.

1.11 The new World Bank strategy is presented in the forthcoming 2006-2009 CAS which draws on the 2005 Bangladesh Poverty Reduction Strategy Paper (PRSP). The CAS is being elaborated jointly between the Government of Bangladesh, the Asian Development Bank (ADB), the United Kingdom Department for International Development (DFID), the Government of Japan, and the Bank. It will be linked to the PRSP goals and reform program. During FY06-09 it is envisaged

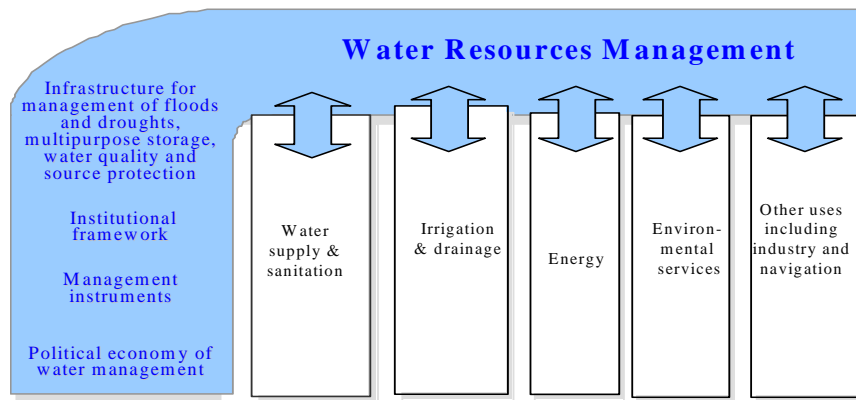
<sup>4</sup> The per capita income of Bangladesh at US\$360 is used. Other estimates for the value of a DALY could be used, such as the annual per capita gross national income, which extends the concept of income more widely than cash receipts. Most other values would increase the cost of a DALY.

<sup>5</sup> About 320,000 children die annually in Bangladesh. Diarrhea accounts for between 50,000 and 100,000 of these deaths. However, the still unpublished 2003 Bangladesh Health and Injury Survey showed that drowning was the leading cause of death for children in all age categories over 1 year.

that the country program will start shifting toward a mix of programmatic lending, including poverty reduction support credits to be considered in the context of the PRSP and the next CAS, technical assistance, analytical and advisory services, and selective investment projects. In addition, the Bank will support government efforts to maintain its dialogue with civil society and to disseminate the reform program to create and sustain public support. It will be important that the poverty reduction support credits be used as a springboard for real engagement with the sectors, including water. This will also have to take into account the effects of the 2004 floods.

- 1.12 The mission of the World Bank is poverty reduction. Water is a key issue in achieving this

**Figure 2.** Relationship of Water Resources to Water Service Sectors



Source: World Bank 2003. Adapted from Global Water Partnership.

objective in Bangladesh, and the Bank has long been involved in the country's water sector. This Country Water Resources Assistance Strategy (CWRAS) describes what the Bank can do and will do to help improve country-level water resources management, and thereby assist the Government of Bangladesh in choosing water sector activities that the Bank can engage in strategically: activities that are expected to have the most impact on long-term systemic challenges; that fit with the Bank's comparative advantages compared to other development partners; and that complement the Bank's Country Assistance Strategies and Poverty Reduction Strategy. While the CWRAS focuses primarily on water resources development and management issues, it also defines what water services (water and sanitation, irrigation and drainage, inland water transportation) the Bank supports (see figure 2).

- 1.13 In its Water Resources Sector Strategy, approved in February 2003 (box 1), the Bank committed itself to developing CWRASs in selected countries. The Water Resources Sector Strategy complements the Bank's 1993 Water Resources Management Policy, and incorporates the Bank's renewed commitment to poverty reduction. The Water Resources Sector Strategy recognizes the importance of water management to all aspects of economic growth and thus to poverty reduction.

***The Filters the Bank Will Apply in this CWRAS***

- 1.14 To determine which interventions the Bank can meaningfully support, this CWRAS reviews critical issues and subjects potential interventions associated with those issues to a simple framework that:

- a. Takes into account the relevance of selected interventions in terms of the National Water Management Plan and the priorities identified in the plan. The plan presents 84 programs grouped into eight clusters. It places a high priority, and thus recommends an early start on, programs for developing institutions, creating an enabling environment, rationalizing existing flood control drainage schemes and irrigation schemes, and safeguarding the natural environment and aquatic resources. Recognizing that water is an important vector in influencing human health, the plan also assigns priority to providing water and sanitation for domestic purposes (including arsenic mitigation).
  - b. Analyzes the expected impacts of any Bank engagement in terms of poverty reduction, as shown in figure 3. It is expected that, as in other contexts, a combination of all four categories of intervention will be appropriate and, a priori, that the Bank might provide support to projects in all four quadrants.
  - c. Focuses on systemic challenges in the country’s water development and management.
  - d. Seeks to identify initiatives that result in making things happen on the ground, recognizing that it is important to focus on doing a few things right to demonstrate new approaches that work; therefore, while it is necessary to be comprehensive, it is not necessary to be complex.
  - e. Focuses on sequencing of interventions, recognizing that such a large task cannot be accomplished everywhere at once – or quickly.
  - f. Takes into account the comparative advantage of the Bank.
  - g. Ensures consistency with ongoing activities in the country, which already define the Bank’s engagement in some areas of the water sector (such as the National Water Management Improvement Project, the Bangladesh Water Supply Program Project, and so on)
- 1.15 The CWRAS is not a substitute for in-depth analytical work on the water-using sectors, nor is it intended to dismiss the goal of integrated water management; its purpose, rather, is to define practical, implementable, sequenced, and prioritized actions that provide an entry point for further analytical work and investments.

**Box 1. Main Messages of the World Bank’s Water Resources Sector Strategy (2003)**

- Water resources management and development is central to sustainable growth and poverty reduction and therefore central to the mission of the Bank.
- Most developing countries need to be active in both management and development of water resources infrastructure.
- The main management challenge is establishing a “pragmatic but principled” approach that respects principles of efficiency, equity, and sustainability, but recognizes that water management is intensely political.
- Since most developing countries have inadequate stocks of hydraulic infrastructure, the Bank needs to assist in developing and maintaining hydraulic infrastructure and in mobilizing public and private financing, while meeting environmental and social standards.
- The Bank will reengage with high-reward/high-risk hydraulic infrastructure, using a business model that puts development impact first.
- The Bank is perceived by many to have a major competitive advantage in the water sector and there is accordingly a strong demand for the Bank to engage.
- The Bank’s water assistance must be tailored to country circumstances and be consistent with the overarching Country Assistance Strategy and the Poverty Reduction Strategy Paper.

**Figure 3.** Water Resources Interventions and Effects on Poverty

		Nature of intervention:	
		broad	poverty targeted
affecting water...	resource development & management	<b>Type 1:</b> Broad region-wide water resource interventions	<b>Type 2:</b> Targeted water resource interventions
	service delivery	<b>Type 3:</b> Broad impacts through water service delivery reforms	<b>Type 4:</b> Targeted improved water services

Source: World Bank 2003.

### *The Comparative Advantage of the World Bank*

- 1.16 In selecting issues with which the World Bank could best support government, it is necessary to reflect on those characteristics of the Bank that set it apart from others supporting the sector. This does not necessarily imply that the Bank will only engage in those issues in which it has a unique advantage but that these will receive priority. The comparative advantage of the World Bank extends to the following areas:
- a. The magnitude of the World Bank's lending, which extends across various sectors, provides the Bank with the ability to link water issues with issues in other sectors through economy wide engagement. This size also permits the Bank to engage simultaneously at various scales and promote integration across these.
  - b. The World Bank is able to convene donors working in the water sector and provide leadership as they work together with government to address common and intractable constraints. The Bank provides a multidisciplinary perspective and a broad range of experience and knowledge.
  - c. The World Bank, both directly and through its role in the Global Environment Facility (GEF), can, when requested to by *all* riparian parties, facilitate cooperation on international waters and help finance priority investments resulting from cooperative management.
  - d. Finally, the World Bank Group can assist borrowers in the area of private sector participation in infrastructure, through involvement of both the International Finance Corporation (IFC) and the Multilateral Investment Guarantee Agency (MIGA).

## 2. Objectives of this Country Water Resources Assistance Strategy

- 2.1 Bangladesh is a country of contradictions. At independence in 1971, Bangladesh was greeted with predictions of dire and total societal failure (Kissinger's memorable "the basket case of the world"). Yet since independence Bangladesh has made astonishing welfare advancements. This includes major strides in developing export-related industries, achievement of food self-sufficiency, and an underpinning by sound macroeconomic policies. Average GDP growth rate in recent years remains at around 5% and reached 5.3% in FY04 - in spite of the 2004 floods. The poverty reduction trend, which accelerated in the 1990s, has continued and the government is setting ambitious goals for poverty reduction in its PRSP process.
- 2.2 Achievements in human development results, such as reductions in child malnutrition and maternal mortality and an increase in net primary school enrollment, have been greater than income poverty reduction, and impressive in relation to countries of similar income level. In fact, Bangladesh has already made good progress towards the Millennium Development Goal (MDG) of providing universal education.
- 2.3 All of this has been achieved in the face of assessments by donors and international finance institutions that Bangladesh suffers from a lack of absorptive capacity, that government frequently lacks ownership of development programs, and especially that line agencies suffer from weak (project) implementation capacity. The latter assessment has conditioned the Bank's declining involvement in the infrastructure sector, including water, in recent years. A further challenge is related to overall weak governance and corruption.
- 2.4 Thus, by reengaging in the water sector, the Bank recognizes that while framework conditions could ideally be better, progress has been made in past decades and the Bank is willing to develop options to support further progress. This operationalizes an approach of "principled pragmatism", which seeks to promote good practice in areas where best practice might not always be possible; in other words, not making the best the enemy of the good. In this context, a number of the major – water-related – drivers for growth and economic development in past decades in Bangladesh need to be highlighted. They include:
- Substantial increases in dry season productivity, largely through tubewell irrigation.
  - Successful reduction in the impact of disasters through community involvement in planning and risk management.
  - Some successes (and some failures) in large irrigation and flood control projects.
  - Great resilience in dealing with recurring floods.
  - Greatly improved access to bacteriologically safe drinking water in the rural areas over past decades due to major private household investments in shallow tubewells, though this has been compromised by the arsenic issue.
- 2.5 For most of Bangladesh's independence, the Bank has been a – even *the* – central partner to the government in the water business. It is thus regrettable that for a number of years following the late 1990s governance issues caused the Bank to withdraw support from the water sector in Bangladesh. The Bangladesh Water Supply Program Project was approved in June 2004, and two projects, related to water, sanitation and drainage in Dhaka, and to the water resource-environment nexus around Dhaka, respectively, are under preparation.. In addition, further activities towards flood management, responding to the severe flooding events of 2004, are under way. No other water-related projects have been approved since 1999. The Bank is now committed to reengage as an active partner in the water sector in Bangladesh. In developing this

reengagement further, the Bank is building on the enormous stock of excellent prior analytic work, and on the lessons learned (both of success, and of failure).

2.6 The CWRAS is an attempt – in a quick and nimble manner – to summarize the lessons, to assess the comparative advantage of the Bank, and to formulate a set of rules of engagement so that water development and management continues as a driver of social welfare in Bangladesh. Its objective is thus to contribute to a strategic reengagement of the Bank in supporting the Government of Bangladesh in its activities in the water sector.

2.7 The aim of the CWRAS is to underpin such a strategic approach by:

- Engaging with a variety of stakeholders (including pertinent government ministries, NGOs, other development partners, the private sector, and research institutes); specifically, soliciting input from all, forging consensus to the extent possible, but with no illusion that consensus on all issues is either possible or desirable.
- Building on, and not replicating, the large amount of analytic work that has been carried out in the country, going back to the land and water studies of the 1970s through the Flood Action Plan and most recently the National Water Management Plan.
- Making use of local expertise.
- Ensuring that discussions reflected the content of and contributed to the development of the PRSP and the new CAS.

### **3. Water and Sustainable Poverty Reduction in Bangladesh**

#### **The Water System**

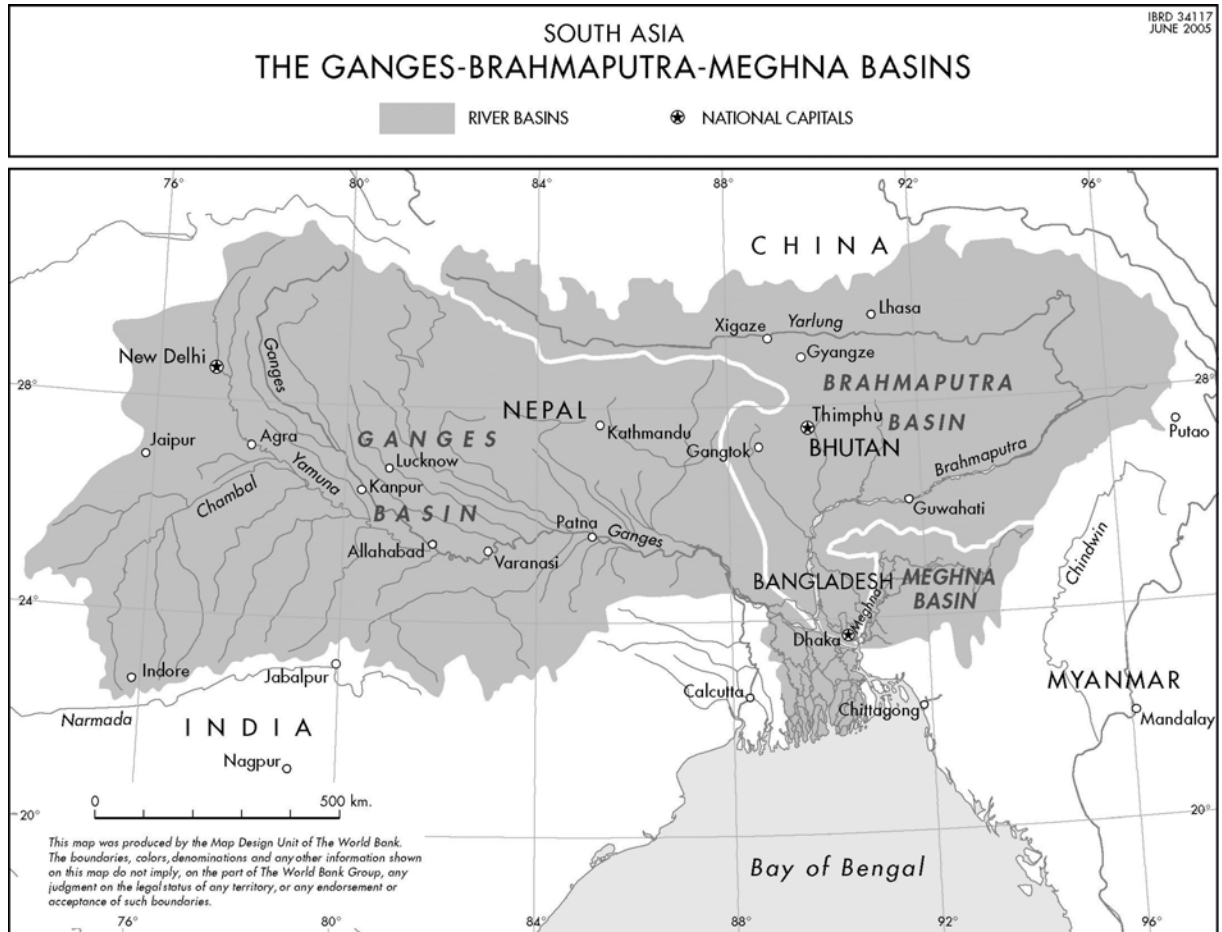
##### *The Land and Water Resource Base*

- 3.1 Bangladesh has a total area of about 14.7 million hectares (ha) and a net cultivable area of about 8 million ha. The two primary sources of water are local rainfall amounting to about 250 cubic kilometers (km<sup>3</sup>) annually, falling mainly between July and October; and transboundary inflows amounting to about 1,000 km<sup>3</sup> annually, derived mainly from the Brahmaputra, Meghna, and Ganges Rivers, with greatest flow occurring also between July and October. Bangladesh occupies only 8% of the total area of these rivers' three basins but is the point of concentration of their catchments. The result is a huge excess of surface water during the summer months and water shortfalls in the winter months. Consequently, the minimum flows required to meet total demands are less than what is available from surface and groundwater in the southwest and north-central regions of the country. (This analysis assumes that arsenic contamination does not significantly compromise the suitability of groundwater for irrigation.)

##### *Location Matters*

- 3.2 Bangladesh is the lower riparian of the Ganges, Brahmaputra, and Meghna Rivers, occupying only 8% of the total area of the three basins, and is the point of concentration of the runoff generated in the upper catchments in the Himalayas (figure 4). Continuing changes in the upper catchment, which include deforestation in the Himalayas, land degradation, and landslides, and development in the middle catchment in the form of flood control infrastructure, combine to increase the flood peaks and sediment loads within Bangladesh and exacerbate the disadvantages of being the lower riparian. While some developments in the upper catchment tend to aggravate flood problems, water shortages in Bangladesh during the dry season, between January and March, are worsened by other developments such as upstream water diversions and withdrawals.
- 3.3 The National Water Policy acknowledges that Bangladesh, as the lower riparian, has limited control over the rivers entering its borders. In particular, Bangladesh is affected by the significant upstream diversions and abstractions that reduce water availability during the dry winter months, by the absence of upstream hydrometric data that inhibits responses in periods of both flood and drought, and by the general poor quality of water entering the country from upstream in some of the basins. The National Water Policy further recognizes that the situation is progressively becoming worse as population densities and economic activity are increasing, and water quality is deteriorating. The net result is that per capita supply of renewable water is declining throughout the basins that Bangladesh shares with India. Reduced water availability in the Ganges dependent area has affected the southwest region of Bangladesh in a number of ways, including increased saline intrusion, changes to river morphology, and increased environmental hazards, threatening the security of the natural aquatic resources.



**Figure 4.** The Ganges, Brahmaputra and Meghna Basins

- 3.4 The riparian countries have been working towards a more stable and equitable sharing of the water resource. The Treaty between the Government of the Republic of India and the Government of the People's Republic of Bangladesh on Sharing of the Ganga/Ganges Water at Farakka (1996), generally known as the Ganges Water Treaty, is an outcome of this effort and Bangladesh has reportedly received the flows stipulated in the treaty on a consistent basis.<sup>6</sup> The National Water Policy specifies, and the National Water Management Plan further endorses, working cooperatively and constructively with co-riparian countries in jointly developing and managing the basins so that their potential contribution to the welfare of all can be achieved. This strategy includes improving the exchange of information, reducing pollution, and strengthening education, research, and training in water management. The principal benefit to this approach, which fosters cooperation, is overall regional and area development.
- 3.5 The approach presented in the Bangladesh policy and planning documents notwithstanding, India is exploring the idea of transferring water from surplus to deficit basins (the so-called "linking of rivers"). It should be noted that India is, for the time being, concentrating on the peninsular rivers. While an understandable response would be for Bangladesh to object strenuously to the Indian proposal, international experiences have shown that cooperation among riparians on international rivers can result in mutually beneficial outcomes. A suggested starting point for Bangladesh is to

<sup>6</sup> A former member of the Joint Rivers Commission notes that since the 1977 agreement there has been no decline in discharges at Farakka, and Bangladesh has received at least the flows stipulated in that agreement.

undertake an objective assessment of where there might be commonality of interest with India. This could include dry season augmentation in the Ganges, and controlled flooding and enhanced dry season water availability in a variety of other shared rivers. Bangladesh then also needs to bring proposals to the table that identify areas to which it can contribute. While the World Bank's role as an impartial international arbiter is negligible unless all riparians ask it to act, the Bank can assist in identifying common interests and help to build on these.

### *Climate Change and Adaptation Needs*

- 3.6 Bangladesh is generally considered to be vulnerable to changes in climate because it has a high population density, is located on a low-lying delta, and is subject to heavy rainfall and inflows of large volumes of transboundary surface water confined to a relatively short monsoon season. A possible scenario for climate change would have temperatures rising by up to one degree Celsius, monsoon precipitation increasing by as much as 10%, dry season precipitation reduced, and sea level rising by 30 centimeters or more. These changes would have several critical impacts:
- a. The combination of reduced winter season precipitation and increased temperatures, resulting in higher evapotranspiration rates, will reduce winter river flows. In addition to reducing the fresh water available for an expanding population, this could result in saline water intruding further inland along coastal areas, affecting natural ecosystems (mangrove forests) as well as food production systems. A further likely impact is that the sediment transport characteristics of the river systems would be altered.
  - b. Increased precipitation during the monsoon season will increase river discharges and probably increase flooding in some areas of the country. This may well result in restoring some of the seasonally flooded wetlands areas (*beels*) that were lost to drainage, and yield some benefits to fisheries and winter season agriculture. However, adverse impacts could include increased river erosion and poor drainage of agricultural lands.
  - c. A sea level rise will exacerbate drainage problems in the coastal zone, which has been largely protected from flooding by embankments. This will occur in two ways. Firstly, existing infrastructure (embankments and drainage regulators) was designed for historical water levels and tidal fluctuations. A sea level increase would reduce the tidal range within which outflow occurs, decreasing the total discharge during each cycle. Secondly, tidal meeting points will migrate further inland. These locations, where sediment deposition occurs, will impede upstream drainage and change drainage characteristics of the region.
- 3.7 Adaptation requirements were defined in some detail in an earlier World Bank study in terms of the most vulnerable impact categories for climate change, namely coastal resources, fresh water resources, agriculture, human health, ecosystems, and biodiversity (World Bank 2000a). An adaptation measure identified as common to all was the need to incorporate climate change in long-term planning. Importantly, it was noted that learning to better deal with existing climatic variations constitutes one of the best preparations for dealing with climate change. Specifically, this comprises improving construction quality, and strengthening operation and maintenance of existing systems.
- 3.8 Climate change is expected to have a broad range of impacts, and sustaining development over the long term in Bangladesh will require adapting to them. Climate change is expected to have extensive impacts on the land-water system, and a better understanding of these impacts should be promoted and plans for addressing them should be prepared and implemented. There is an opportunity for expected climate change impacts to be taken into account proactively in the planning and design of existing water resources infrastructure rehabilitation, given that much of this infrastructure has already exceeded its design life span.
- 3.9 Bangladesh will be further impacted by climate change that occurs in the upper basins in India. Under a changed climatic regime for any given region, the combined effect of lower rainfall and

more evaporation would lead to less runoff, substantially changing the availability of fresh water in the watersheds. An assessment of the implications of climate change for hydrological regimes and water resources using scenarios developed from Hadley Centre Model Simulations indicates that, by the year 2050, the average annual runoff in the River Brahmaputra will decline by 14%. Studies have indicated that the impact of snow melting in the high Himalayas will lead to flood disasters in Himalayan catchments. Impacts will be observed more in the western Himalayas, as the contribution of snow to the runoff of major rivers on the western side is about 60% compared to 10% on the eastern side (IPCC 2001). Singh (1998) suggests that an increase in surface temperatures will lead to a rise in the snowline, increasing the risk of floods in north India during the wet season.<sup>7</sup>

## **Water Development and Management and Poverty**

### *The Land and Water Strategy of 1972: Setting a New Course*

- 3.10 The 1964 Water Master Plan, prepared by the East Pakistan Water and Power Development Authority (EPWAPDA) with assistance from the United States Agency for International Development (USAID), focused on increasing agriculture production mainly through extensive flood control embankments combined with structures to facilitate drainage in the short run and public-financed medium- to large-scale irrigation in the longer run. This plan was prepared for a nation of fewer than 60 million people of whom more than 90% lived in rural areas producing mainly rain-fed rice with relatively rudimentary technologies. The plan did not reflect input from local stakeholders, since sustainability and related operation and maintenance issues were not addressed, nor did it consider intersectoral problems since the flood plain was extensive, fish were abundant, the road network was limited, and there were virtually no water-polluting industries. Also, the priority was to increase rice production. The plan was therefore highly prescriptive and focused on restricting flood waters to prescribed avenues through a clearly defined system of embankments designed to prevent flooding of agriculture lands and ignored the effects of drought on the production system. This approach was firmly embraced by most engineers within EPWAPDA and by its successor, the Bangladesh Water Development Board (BWDB).
- 3.11 The 1972 Land and Water Resources Sector Study identified the inherent problem of limited cultivable land, subjected annually to drought as well as to severe flooding and to periodic cyclone damage, and noted that these problems were being exacerbated by population pressures of mounting intensity. To increase food production rapidly enough to avoid unmanageable imports and to provide useful employment in rural areas, the study proposed a series of quick-yielding, low-cost, labor-intensive projects, while at the same time planning for long-run programs. The following key inputs were emphasized: (a) high-yielding seed production and distribution; (b) input packages comprising seeds, fertilizer, plant protection, and improved draft power; (c) low-lift pump irrigation and small drainage improvements; (d) minor to medium-size drainage works; (e) tubewell irrigation; and (f) early investigation of increasingly more difficult and major drainage works, including polders in deeply flooded areas for flood protection and irrigated agriculture. Implementation capacity was highlighted as an area of concern. The study further recommended that since the delta lends itself to scattered developments not requiring large indivisible investments, the rural works type of approach could be applied if backed up with adequate engineering, but regional master plans needed to be prepared without delay (World Bank 1972).
- 3.12 The 1972 study resulted in a shift to financing of small- and medium-scale flood control, drainage, and irrigation projects by most donors, including the Government of the Netherlands,

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<sup>7</sup> <http://www.teriin.org/climate/impacts.htm>.

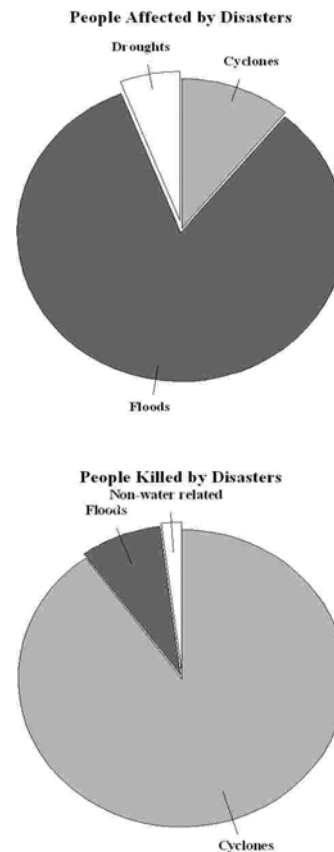
which led the way with its Early Implementation Projects; the World Bank in partnership with the Canadian Government, which modeled a series of small-scale water resources development projects on the Early Implementation Project experience; and the Asian Development Bank (ADB), which invested in small- to medium-scale projects. At the same time, a series of changes were made to improve the availability of agriculture inputs, and agriculture extension services were restructured and improved. Possibly the most important change in terms of increasing food production was that the government and the donors agreed on policies promoting the expansion of irrigation from groundwater using tubewells provided by the private sector. As a result, groundwater irrigates about 90% of the 4.5 million ha currently under irrigation.

- 3.13 The 1972 study also identified the urgent need for regional master plans to ensure that water management infrastructure was planned and constructed in a rational manner. These plans were not prepared as part of the 1987 National Water Policy and detailed in the regional studies sponsored by the Flood Action Plan. Nevertheless, the 1964 Water Master Plan provided de facto guidance to the BWDB in identifying and planning small and medium flood control interventions. Recently the ADB, in accordance with the mandate provided by the National Water Policy, has been supporting preparation of district-level water resources assessments through two projects.<sup>8</sup> The preparation of these district-level studies is being coordinated through the Water Resources Planning Organization (WARPO) and includes representation from several agencies, including the BWDB.

#### *Natural Hazards, Vulnerability, and the Poor*

- 3.14 Bangladesh is subjected to water-related hazards such as cyclones, storm surges, droughts, floods, and river erosion. In theory these hazards affect everyone, but in practice the poor are most affected. The poor outnumber the rich (53% of the rural population are classified as poor with 37% classified as very poor), they live in greater density (at least 900 persons/km<sup>2</sup>), they occupy the most poorly constructed housing on settlements located on lands prone to hazards, and they do not have the resources to endure natural hazards without assistance.<sup>9</sup>
- 3.15 Between 1970 and 1998, 171 large-scale disasters were recorded in Bangladesh. This translates into an annual disaster frequency of 6.11, making Bangladesh the most disaster prone of all countries.<sup>10</sup> These disasters killed an estimated half million people and affected more than 400 million (UNDP 2001). Tropical

**Figure 5. Impacts of Large-Scale Disasters in Bangladesh**



<sup>8</sup> The second Small-Scale Water Resources Development Sector Project (2002–2009), under the LGED, is to prepare water resource assessments for 56 districts, and the Project Preparation Technical Assistance (PPTA) Team for the Southwest Regional Project (2003–2004) is to prepare plans for 5 districts. Water resource assessment plans for the 3 hill districts have not been assigned.

<sup>9</sup> A disaster is the result of a hazard's impact on society. The extent of a disaster is therefore determined by a community's vulnerability to the hazard.

<sup>10</sup> Afghanistan, with an annual frequency of 1.79 large-scale disasters, is the next most disaster prone.

cyclones were responsible for the largest number of deaths, primarily in the coastal areas, while floods affected the greatest number of people (figure 5). Even when the frequency of dramatic natural events does not increase, the increase in population density and in poverty, and the growing scarcity of resources, heighten the magnitude of the impact.

- 3.16 **Erosion and channel instability have caused significant damage to human settlements and infrastructure.** This is because most of the rivers flow through typically unconsolidated sediments of the Ganges-Brahmaputra-Meghna flood plain and delta, which is susceptible to river erosion from channel migration, river widening, and the formation of avulsions (box 2). Expansion is taking place primarily through the destruction of flood plain land and the creation and destruction of short-lived, low-lying *chars* (depositional islands). Riverbank erosion and channel instability hampers development since the permanent risk of erosion prevents long-term planning. Social impacts of erosion include increased impoverishment as thousands of individuals and families lose their land, their income, their security, and finally are completely displaced.
- 3.17 The Brahmaputra-Jamuna River alone has increased in width from an average of 8.3 km in 1973 to 11.8 km in 2000. This represents a total loss of approximately 55,000 ha of flood plain land in Bangladesh.<sup>11</sup>

**Box 2. Instability and Erosion in the Brahmaputra-Jamuna River System**

**The erosion problem will continue and, in places, will become more severe than that currently experienced.** Most recent research indicates that the channel instability and widening observed in the Brahmaputra-Jamuna can be related to the 1953 Assam earthquake, as a result of which a sediment wave is traveling down the Brahmaputra-Jamuna, Padma, and lower Meghna River system. There is increased instability at the wave's peak followed by more moderate conditions in its aftermath. It is predicted that the rate at which the Brahmaputra-Jamuna instability increases will slow down, but that the Padma will experience increased instability and is expected to increase in width during the coming years as the peak of the sediment wave passes through. This will then be followed by increased instability and increasing width in the lower Meghna.

- 3.18 Efforts to control bank erosion and to stabilize flood plain land have been carried out for more than a century in the area of Bangladesh. A major problem is scouring or undermining of protective works caused by constantly shifting angles of river attack, which commonly destroys bank protection facilities soon after construction is complete. The rapidly changing river planform, even during a normal flood, can result in very unfavorable morphological conditions and requires a new design approach. There are only a few examples of structures that have proven sufficiently resistant to major bank erosion. All were constructed during the last decade and include the protection work at the Jamuna Bridge, constructed at a cost of about US\$50 million per km; Sirajganj town protection constructed for about US\$30 million per km; and test revetments constructed at Bahadurabad for about US\$10 million per km. Only the river bank protection at Jamuna Bridge has been without any reports of failure to date. None of these solutions is suitably cost effective for large-scale replication along dominantly rural areas.
- 3.19 In an effort to reduce the unit cost of providing reliable river erosion protection, short heavily reinforced structures separated by long unprotected reaches have been constructed. This "hard point" approach has certain vulnerabilities. Massive bank erosion can occur between the structures, leading to a requirement to acquire land and resettle inhabitants. If any single structure

<sup>11</sup> This is based on a systematic analysis of satellite images for the last 30 years to assess river changes and flood plain erosion/accretion (EGIS 1997; updated in EGIS 2000).

in a series fails, a major part of the protection is at stake. Current bank protection concepts acknowledge the need to protect longer reaches with lower-cost systems.

- 3.20 **Substantial areas of Bangladesh are flooded annually and the rural economy has adapted to normal flooding, but severe flooding causes hardship.** In addition to affecting crop production, it has direct impacts on household food security and thus food consumption, on the labor market, including female rural employment, and on the livability of homestead settlements (del Nino and Roy 1999).
- 3.21 Generally, floods result from high flows in the transboundary rivers, internal rainfall, and the low level of the country. Synchronization of peak flows from the major rivers with spring tides in the Bay of Bengal or with cyclonic surges can combine to worsen the flood situation. Flood impacts are dictated by any of the following: (a) flood timing, since crops can withstand more flooding at some stages than at others; (b) flood duration, since damage to crops and other agriculture-related processes occur after submergence tolerances have been exceeded; and (c) flood depth, which determines the areas impacted by different amounts of flooding.
- 3.22 To reduce flood-related constraints on agricultural production, the BWDB has provided some form of flood control and drainage (FCD) facilities to 5.18 million ha (60% of the country's net cultivable area), in 464 projects. Of this area, 1.16 million ha (22%) comprises the coastal embankments and polders, 0.26 million ha (5%) consists of partial flood protection (submersible embankments), and 0.7 million ha (15%) provides FCD with a significant irrigation component (FCDI). FCD/FCDI projects account for 2.01 million ha (Halcrow and others 2000).
- 3.23 A number of studies on the impacts of FCD investments raised uncertainties as to the net impact on agriculture production during the kharif II season (July to October). A 1998 study by the Bangladesh University of Engineering and Technology (BUET) determined that there was little correlation at the greater district level between the percentage increase in FCD protected areas and the percentage change in kharif II production. Prior to that, the Flood Action Plan 12 evaluation carried out in 1991–92 found that 13 of the 17 projects evaluated had resulted in higher water levels outside the project areas, and a 1990–91 evaluation by the Master Planning Organization of eight projects reported that all eight had increased external flooding intensities. This outcome was corroborated by the modeling work carried out for the Compartmentalization Pilot Project where water levels decreased inside the project but increased outside. It has also become apparent that embankments and regulators prevent fish from migrating to and from spawning and feeding grounds and that this infrastructure has played a significant role in the decline of the open water fishery and in the reduction of biodiversity.
- 3.24 Are floods in the Ganges, Meghna, and Brahmaputra basins getting worse? Available information indicates that in recent years flood damage in Nepal, India, and Bangladesh is increasing and these increases have been attributed to worsening flood events (figure 6).<sup>12</sup> However, analysis of available data by Mirza and others (2001) provides no conclusive evidence that peak discharges or flooded areas in Bangladesh have changed over time. Increasing damage is considered the likely outcome of rising populations on the flood plain combined with associated growing economic activities, including intensification of agriculture and better infrastructure (Mirza and others 2001). The total estimates of asset and output loss due to the recent 2004 floods amount to US\$2.3 billion, or 4% of GDP, though this estimate did not take account of improved post flood season production.
- 3.25 While flooding has had a smaller-than-expected impact on the national economy of Bangladesh, and at a regional level flood impacts have a strong element of uncertainty, flooding impacts

<sup>12</sup> Nepal flood damage is reported in ADB 1991. Between the 1950s and 1980s, flood damage in India increased by a factor of 40 (CSE 1992). Bangladesh damage increases are reported in Mirza 1991.

strongly on the poor.<sup>13</sup> Some better-off households are able to absorb the shock of flooding, but for most it accelerates a downward spiral into poverty, as assets are destroyed by the floods or sold off to support daily needs. In a study of three communities after the 1998 flood, the percentage of people classified as rich declined within all three communities, while the proportion of people in the categories of “helpless” and “destitute” poor increased (table 1).

**Table 1.** People’s Own Perception of Status in Three Ulipur Villages before and after 1998 Floods

Wellbeing category <sup>a</sup>	Hatya		Saluandamar Hat		Aminpara	
	Before flood (%)	1999 (%)	Before flood (%)	1999 (%)	Before flood (%)	1999 (%)
Rich	24	5	2	1	31	25
Social poor	43	27	..	..	10	15
Helpless poor	10	19	98	87	45	35
Destitute poor	21	40	..	10	15	25
Beggars	2	9	..	..	..	..

.. Zero or insignificant.

a. Definitions used:

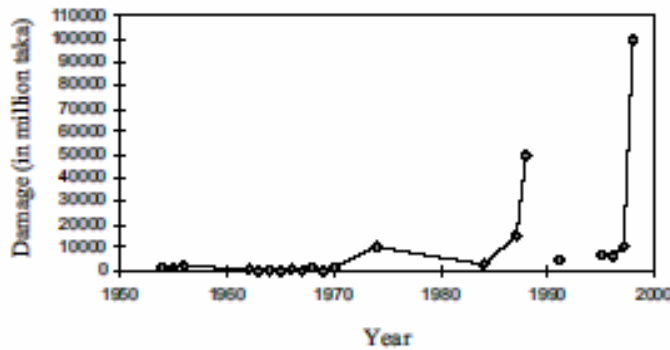
Social poor are defined as those who can turn to the community, including moneylenders, in times of need.

Helpless poor are those who are largely landless, and earn their living from wage labor and sharecropping.

Destitute poor describes households, usually headed by women or elderly men, that have no income-earning members; disabled people are also among this group. Members of destitute poor households often starve.

Source: Naryan and Petesch 2002.

**Figure 6.** Bangladesh Flood Damage



Sources: Mirza 1991; ADRC 2000.

<sup>13</sup> Recurrent flooding has been cited as one of six leading sources of vulnerability for poor people in Bangladesh; flooding drives even middle-income households into destitution (Naryan and Petesch 2002, p. 530).

**Meaningful Stakeholder Participation**

- 3.26 In preparing the Flood Action Plan, partly because of the poor results of project evaluation studies and partly because of pressure from donors and NGOs, the government accepted that for investments in water management infrastructure to be effective, local stakeholders and professionals would need to work side by side as partners at all stages of project planning and implementation. In response, a Guideline for People's Participation was prepared. This guideline fell far short of prescribing meaningful interaction between local stakeholders and professionals and, as the Bank-supported Systems Rehabilitation Project illustrated, methods and relationships needed to be more clearly and explicitly defined and the local stakeholders needed to be identified more broadly than just beneficiary farmers. In response, the Guidelines for Participatory Water Management were prepared in 2000 by an interagency task force comprising membership from the BWDB, LGED, Ministry of Livestock, Ministry of Fisheries, and Department of Agriculture Extension.
- 3.27 While the Guidelines for Participatory Water Management constitute an excellent starting point for promoting local stakeholder involvement in water management infrastructure, they fall short of promoting meaningful participation. Rather than establishing mechanisms to improve agencies' ability to respond to local stakeholders, the guidelines approach the participation issue from the perspective of devising mechanisms and procedures to encourage local stakeholders to participate in achieving the objectives of the executing agency.
- 3.28 There is a strong case for government involvement in the development and management of water resources. A certain amount of water for drinking and domestic purposes is considered a human right, obliging government to ensure its availability to citizens. Investments in major water infrastructure tend to be lumpy and beyond the capacity of private investors. Water development and use can impose significant externalities on other users, through changing flood characteristics, availability, or quality. Surface water resources such as rivers, beels, and *haors* (flooded tectonic depressions) are generally common property resources, accessible to a broad range of users (Rijsberman 2004). The challenge in Bangladesh is to establish planning and management systems appropriate to a decentralized civil administration, including devolution of responsibilities to civil society.
- 3.29 The various categories of water resources interventions generally require a diverse range of unique institutional structures to support participatory management. These categories mainly include large-scale flood control and drainage schemes, large-scale public irrigation (which may include flood control and drainage), medium- and small-scale water management interventions, and water supply and sanitation.<sup>14</sup> Based on conventional wisdom and experience from past practice, a few institutional models are being tested that have the potential to achieve the dual objectives of establishing acceptable and sustainable institutional frameworks, and successful and sustainable cost recovery.
- 3.30 **Large-scale flood control and drainage schemes.** There are no adequate existing institutional models within Bangladesh for managing large-scale flood control and drainage schemes. Several potential models have been identified. These include the reorientation of the BWDB with regard to its structure and staffing in order to better implement the National Water Policy, which is specifically geared towards participatory management by beneficiaries and local government institutions.

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<sup>14</sup> Large-scale interventions are those impacting more than 5,000 ha.



- 3.31 **Large-scale irrigation schemes.** There are several existing institutional models within Bangladesh for large-scale irrigation schemes. The BWDB could retain control of such systems down to the tertiary outlets while working with registered user groups, organized in several tiers under the cooperative system, which collect water charges and participate in overall scheme management and operation and maintenance.<sup>15</sup> Alternatively, schemes could be managed through an authority<sup>16</sup> or control could be transferred to a privatized operator who sells water on a pay-as-you-use system.<sup>17</sup>
- 3.32 **Small- and medium-scale water resources schemes.** Currently the best institutional model for schemes of this type appears to be the ADB-financed Small-Scale Water Resources Development Sector Project. The project reports that the first 74 subprojects completed (with currently six years of record) have, over this period, increased their capital funds (shares and savings) from US\$13,000 in the first year to about US\$130,000 at present (ADB-GoN-GoB 2005). This is a strong indicator of institutional activity since usually shares are sold and savings collected at meetings of the membership. The full contingent of 280 completed subprojects also reported more than US\$1 million disbursed in microcredit, the funds originating with the membership.<sup>18</sup> Finally, actual expenditures in FY04 for operation and maintenance was about US\$38,000 of the memberships' own fund for 258 subprojects.<sup>19</sup> This project relies heavily on local stakeholders' initiative to identify interventions, to ratify engineering designs, to demonstrate commitment to operating and maintaining the infrastructure by contributing a specified amount of funds in advance of physical construction, and to sign postconstruction lease agreements for managing, operating, and maintaining the infrastructure.<sup>20</sup> However, even this approach may not go far enough in terms of empowering local stakeholders in dealing with local water management issues.
- 3.33 Water management investments, particularly those addressing localized problems, need to be local stakeholder driven. To achieve this end requires that financial responsibility, decisionmaking authority, and accountability be devolved to local stakeholders and to their representatives – i.e. the local government. Investments need to be structured such that service agencies are placed in a position that obligates them to respond to the requirements of these groups, the end users of the infrastructure. This implies that new approaches to financing and implementing investments in construction of infrastructure need to be developed. To the extent that this can be accomplished with effect, it will promote better construction quality and increased transparency, an outcome of the latter being reduced corruption.
- 3.34 The case for empowering local government and local stakeholder involvement in managing developing, owning, operating, and maintaining water management infrastructure is strong. Past practice, consisting of limited local government and local stakeholder participation, demonstrated a low level of sustainability and greater participation is advocated by the National Water Policy,

<sup>15</sup> Schemes operating under this model are being supported by the ADB. They include the Meghna-Dhonagoda Project and the Pabna Irrigation Project.

<sup>16</sup> Barind Multipurpose Development Authority.

<sup>17</sup> Thakurgaon Irrigation Project.

<sup>18</sup> The system for disbursing microcredit is highly variable from one group to the next. However, these programs do have a number of common features. In all cases, loan amounts have been modest and thus of interest to only those with few assets. The borrowers are individuals known to the water management cooperative associations (WMCAs), the funds belong to the WMCA, and thus the collection rates are relatively high. Finally, credit is mainly issued for economically productive (income-generating) activities, which further ensures repayment.

<sup>19</sup> The amount per subproject is still relatively low at US\$138, but the trend is upwards.

<sup>20</sup> This project is implemented by the LGED with support from the ADB and the Government of the Netherlands.

mandated by the Local Government Ordinance, and promoted by the Poverty Reduction Strategy Paper. The means are more intractable.

- 3.35 Decentralization and devolution of authority requires local government to be elected at several levels (union, upazila, and zila parishad) and provided with adequate financial and administrative powers to carry out their respective mandates. At present, elected representation exists at the union parishad (which, as of 2004-2005, receives direct ADP Block Grant transfers). With the enactment (February 2003) of the *Gram Sarkar* (village government) Act, government has in place a program to form 40,000 gram sarkars. However, these are not intended to be a separate tier in the local government but rather a component part of the union parishad, which will provide them with their budget. The Upazila Parishad Act remains in place and is the basis for elected representation at this tier of local government. However, no decision has been taken as to whether this Act will be implemented or abandoned. There are strong demands from civil society to establish an elected union parishad.
- 3.36 Whatever the outcome of government's process and decisions regarding the establishment of representative and accountable multitier democratic local government, it is in the interests of achieving more effective water management to shift responsibility to existing local government institutions as far as practicable. Ideally, the end result would be financing arrangements whereby local government institutions would access funding for small- and medium-scale water management infrastructure on the basis of predetermined conditions and criteria. These funds would in turn be used to contract the services required to plan, design, and implement water management interventions from either the public or the private sector. Obviously, the scale of these interventions would need to be consistent with the jurisdiction of the local government institution involved. A shift in this direction will require strengthening local government institutions.
- 3.37 **Water supply and sanitation.** Current thinking is that arrangements will evolve from a heavy reliance on the public sector in the short run to a gradual but steady transition to increased private sector participation. To promote effectiveness of the public sector in the short run, emphasis must be placed on greater autonomy, better management, broader service coverage, and at least operation and maintenance and a part of the replacement costs. To effect these changes will require organizational reform. The evolving role of the private sector is expected to include contract services (operation and maintenance of selected facilities, revenue billing and collection, and so on), build-operate-transfer (BOT) and build-own-operate-transfer (BOOT) schemes to provide bulk water supply and water treatment, and, in partnership with local communities, playing a leading role in the development and operation of peri-urban water supply schemes. To enhance delivery of water supply and sanitation services in peri-urban and disadvantaged areas and to meet the needs of the unserved, NGOs and community-based organizations will be encouraged to participate with the support of investment funds from government.
- 3.38 Because of the significant contribution that water supply and sanitation services make to both quality of life and to productive purposes, government must ensure that the provision of these services is held to a high standard. To do so, the government plans to establish an appropriate, independent regulatory framework to supervise and monitor public as well as private sector performance.

***Sustainability: Operation and Maintenance***

- 3.39 Success has been elusive in the many attempts to achieve effective long-term operation and maintenance of flood control and drainage interventions. Among the many reasons commonly cited are insufficient funding, institutions that are not appropriately equipped to carry out these tasks, low priority, and the absence of local stakeholder involvement. While these reasons are

- valid, they all reflect a project culture that has evolved in implementing water resource interventions.
- 3.40 Most public sector investment in the water sector has been provided through (relatively) short-term projects with donor support provided through centralized executing agencies. Donor support to the sector has at best been sporadic, more often as not responding to priorities of their own constituents rather than providing consistent and long-term commitments to the sector. The government, burdened with the responsibility of providing counterpart financing for the implementation of these projects, under significant time pressure to implement sometimes unrealistic schedules, and unable to predict what priorities the donor community would next assume, has been poorly positioned to manage long-term operation and maintenance of public sector-financed water management interventions. The result has been that operation and maintenance, too, have become financed as a project rather than an indigenous (albeit with donor assistance) program of the government.
- 3.41 The National Water Policy position on financing operation and maintenance of flood control and drainage is subject to interpretation since it appears to contain contradictory statements.<sup>21</sup> The National Water Management Plan interprets the policy to mean that operation and maintenance costs are not to be recovered on existing schemes that remain under BWDB control, whereas when management and/or ownership is transferred, the operation and maintenance costs are also transferred to the recipient entity. This position would seem to be sensible since depending entirely on government budget resources to finance operation and maintenance of the entire spectrum of flood control and drainage infrastructure is not plausible.
- 3.42 To facilitate financing and more effective operation and maintenance of water management infrastructure, consideration needs to be given to classifying infrastructure into two main categories: that which serves the national common good and that which is local infrastructure. Infrastructure designated as serving the common good would remain under the control of the BWDB with rehabilitation, operation, and maintenance financed entirely by government. Rehabilitation of infrastructure designated as local would require a significant prior financial commitment from local stakeholders for long-term operation and maintenance, and to the extent practicable would be implemented through or by local government.
- 3.43 In practice, this approach could mean that even relatively small interventions of say less than 5,000 ha could be delineated in this way with the major infrastructure, for example peripheral embankments and major regulator(s), designated as serving the common good; whereas developments associated with the subbasins, whether channel reexcavation, the provision of flushing facilities, or other, would be initiated by local stakeholders and require strong input from local government and the other stakeholders. This approach constitutes an extension of the system already adopted under the Small-Scale Water Resources Development Sector Project whereby

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<sup>21</sup> With regard to operation and maintenance (O&M), the National Water Policy states that:

“The management of public water schemes, barring municipal schemes, with command area up to 5,000 ha will be gradually made over to local and community organizations and their O&M will be financed through local resources;” (p. 9)

“For the foreseeable future, however, cost recovery for flood control and drainage (FCD) projects is not envisaged in this policy. In case of flood control, drainage, and irrigation (FCDI) projects water rates will be charged for O&M as per Government rules.” (p. 16)

“Water charges realized from beneficiaries for O&M in a project would be retained locally for the provision of services within that project.” (p. 16)

local stakeholders request support to refine the impact that major infrastructure is already providing.<sup>22</sup>

- 3.44 Operation and maintenance of water supply and sanitation systems is adversely affected because local government institutions are only peripherally involved in planning and implementing the systems and because they have limited access to resources. The Water Supply and Sanitation Policy (1998) recognizes these problems and promotes a stronger role for local government institutions and other community-based user groups in the provision of services. Along with much improved operation and maintenance, there is an urgent need for water quality surveillance and monitoring because of the health risks associated with various contaminants, including arsenic, which poses an additional challenge.
- 3.45 The following chapters present the history and challenges of the water resources sector, as well as the service sectors (irrigation, fisheries, water supply and sanitation, and inland water transport), and outline possible engagement by the World Bank in supporting their development.

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<sup>22</sup> For example, several subprojects have been implemented that provide facilities to flush water through the Gorai left bank embankment. Other subprojects are designed to refine water management locally within the larger coastal polders constructed by the BWDB. It should be noted that some of these cases are viewed by the BWDB as interfering with their infrastructure.



## 4. The Water Resources Sector

### Background

- 4.1 Efforts to systematically develop Bangladesh's water resources started in the 18<sup>th</sup> century and were expanded under the Zamindar system, extending to the present. During this time the water resource information base has improved, analytical processes have been strengthened, and the institutional and policy framework has evolved. In addition, a significant amount of infrastructure has been put in place to manage water for more economically productive purposes.
- 4.2 Following the establishment of a Water and Power Development Authority, an outcome of a 1954 United Nations Technical Mission, a Water Master Plan was completed in 1964. This plan emphasized large-scale publicly financed surface water development, overestimated public sector capability, and overlooked the country's groundwater resources. In 1972 the World Bank supported preparation of a Land and Water Resources Sector Study, which promoted a radical shift in strategy to minor development using low-lift pumps to irrigate with surface water and tubewells to irrigate with groundwater. The first framework National Water Plan, sponsored by the United Nations Development Programme (UNDP) and executed by the Bank, was produced in 1987 and was followed by a second phase that was to operationalize its main strategic thrusts and produce an investment plan for 1992. However, the advent of the devastating 1987 and 1988 floods refocused attention on this hazard and the internationally sponsored Flood Action Plan (1989–1994) resulted. In 1995, keying off work undertaken in the Flood Action Plan, a Water and Flood Management Strategy promoted a broader technical approach to water resources planning and a reduced public sector role in water management, identified the need for a National Water Policy, and recommended preparation of a broad-based National Water Management Plan that would be guided by the policy. In the 1999 government declared the first National Water Policy. The policy has spawned a number of related initiatives including the preparation of a National Water Code, completion of a National Water Management Plan (approved in 2004), and finalization of the Guidelines for Participatory Water Management. In March 2003 the government prepared an Interim Poverty Reduction Strategy. The Poverty Reduction Strategy Paper (PRSP) entitled *Unlocking the Potential – National Strategy for Accelerated Poverty Reduction*, was then released in October 2005. The PRSP now forms the core of future Three-Year Rolling Plans and provides the basis for annual budgets, guiding water management investments through its development strategy.
- 4.3 An extensive policy framework exists, developed mostly over the last 10 years, to govern water resources development and management. Key among these are the declaration of the National Water Policy in 1999; the National Water Management Plan; progress towards declaring a National Water Code; and preparation of a Coastal Zone Policy (2005). In addition, several important water-related policies have been established for other sectors, including, the National Environment Policy (1992); the National Forestry Policy (1994); the National Energy Policy (1996); the National Policy for Safe Water Supply and Sanitation (1998); the National Fisheries Policy (1998); the National Agriculture Policy (1999); and the National Arsenic Mitigation Policy (2004). The National Water Management Plan identified two gaps in the policy framework. The first related to the need for land use planning to address issues related to urban expansion, including urban development of industry, energy, education, and health, as well as urban water development. The second related to the need for an integrated transport policy that would support more rational investment decisions and improvements in transport quality across the various modes of transport.
- 4.4 Institutions relevant to the water sector exist at national and local levels. The national institutions comprise some 35 central government organizations affiliated with 13 different ministries. The local government institutions include 4 city corporations, 206 municipalities, and the local

government administrations at the levels of district (64), thana (464), union (4,451), and village (86,500). NGOs and the private sector have also played a key role in the development of water resources. The National Water Management Plan envisages some key changes in the institutional framework of the future. The sector is likely to be managed through national and regional framework plans that reflect government policies as well as stakeholders' demands. The plan foresees a sector that is regulated under law with new independent regulatory bodies formed to ensure quality and cost-effective water service delivery. The BWDB will be encouraged to operate on a regional basis and the present District-Level Inter-Agency Project Evaluation Committee coordination system will be replaced by district committees under local government. The plan also foresees a strengthened local government that increasingly takes on the task of managing local water resources for agriculture, water supply, sanitation, urban and peri-urban services, and cyclone protection shelters. The principal departments supporting this effort will be the LGED and the Department of Public Health Engineering (DPHE).

- 4.5 Since the 1950s, more than 600 water resources schemes have been completed. The majority of these were intended to increase crop production and varied in size from small single-structure schemes with an impacted area of less than 1,000 ha to large multipurpose schemes potentially impacting on as much as 100,000 ha. Most were designed to provide flood control, drainage, irrigation, or some combination of these. Others provide riverbank protection or river dredging.

### Successes: What Has Worked

- 4.6 In reviewing a range of investments in the Bangladesh water (for agriculture) sector, there are a number of recurring common elements that have contributed to better-than-average performance of initiatives. Key among these for the public sector-financed schemes is the stronger (than in the past) involvement of the end users. In many of the cited interventions, end user involvement is confirmed by their willingness to commit to financial contributions in advance of receiving services. This has been facilitated by a recent change in legislation that permits financial resources collected for operation and maintenance of publicly financed water management systems to be retained for local operation and maintenance use. There is little commonality in terms of the local institutional structure put in place to manage the interventions. Some use an informal structure while others, in accordance with the Guidelines for Participatory Water Management, use a formal structure with legally registered organizations. For minor irrigation, the end users are and always have been the driving force.
- 4.7 The assessment is by no means quantitative, and the identification of an intervention here as successful does not necessarily imply that the intervention in its entirety was or is successful but rather suggests that certain elements set the intervention apart from others.
- 4.8 **Minor irrigation development.** Private sector groundwater development for irrigation has been instrumental in the steady expansion of agricultural output. Rather than government contributing to minor irrigation development, it has been a source of net revenue (diesel tax revenue less electricity subsidies) (WARPO 2000). The ownership of the equipment resides with the end user farmers who cover the entire spectrum of income groups and who generally provide irrigation water to neighboring plots at competitive prices. Infrastructure quality, management and operation, maintenance, and benefits are not issues since the individual owners ensure that their requirements for the equipment and its use are met.
- 4.9 **Muhuri Irrigation Project.** The Muhuri Irrigation Project consists of a large closure on the Feni River that ponds water allowing for pumped offtake from a system of natural and improved waterways. The project was developed at a cost to government of about US\$2,600 per hectare in the early 1980s. The project development process substantially excluded local stakeholders, the closure dam eliminated the tidal habitat in the river mouth with the result that there was a reduction in biodiversity, and there is no functioning organization of the local stakeholders.

Nevertheless, this project has two desirable aspects: it is generally located in an area that is devoid of opportunity for minor irrigation development and thus large-scale surface water management infrastructure was the best viable alternative; and the project infrastructure provides farmers with flood control and access to surface water for irrigation through a network of secondary channels but because the system does not extend to the tertiary level and beyond, development costs are lower. Farmers are responsible for obtaining, operating, and maintaining their own pumps to abstract water from these channels, and for the associated field distribution systems. This they are doing. The major infrastructure that was constructed was of good quality and continues to function effectively and provide the anticipated benefits.

- 4.10 **Thakurgaon Irrigation Project.** The Thakurgaon Irrigation Project consists of a cluster of deep tubewells that were installed in the late 1960s. After a series of failed attempts to manage the deep tubewells on a user pays principle, local stakeholders recently established a private company called Barindro, which took control of system assets. The project is now operating successfully with an approach that demands payment in advance at a specified unit rate. Payments are made to pump operators and, upon receipt of payment, they provide water in accordance with the terms of the payment on a first come, first served basis to any cultivators within the command area. The system as it currently operates provides for long-term management, operation, and maintenance of the equipment. Farmers are reportedly happy with the pay-as-you-use system, the organization of water delivery, and the financial transparency.
- 4.11 **Small-Scale Water Resources Development Sector Project.** The Small-Scale Water Resources Development Sector Project provides flood control, drainage, or irrigation infrastructure to subproject areas less than 1,000 ha. The project approach relies heavily on local stakeholders' initiative to identify interventions, to ratify engineering design, to demonstrate commitment to operating and maintaining infrastructure by contributing a specified amount of funds in advance of physical construction, and to sign a postconstruction lease agreement for managing, operating, and maintaining the infrastructure. This process has been effective in enough cases to confirm its viability. Many of the interventions have also contributed effectively to increased food production, and to poverty reduction; some have demonstrated sustainable operation and maintenance. Where success was not achieved, this was the result of shortcuts that compromised the development process or infrastructure by being of low quality or inconsistent with what was required.
- 4.12 Other interventions provided substantial agriculture benefits to the economy for a time, but the benefits were not sustainable. These include the various interventions in the coastal region, full flood protection projects, as well as partial flood protection provided in the haor areas of the northeast region. The lack of sustainability related to several factors. In some cases, infrastructure was not maintained; in others, institutions to operate them effectively were not in place; and in others, hydrotechnical changes compromised performance. Some of these interventions were also questionable in terms of their impact on biodiversity.

## Addressing the Challenges

### *Disaster Management*

- 4.13 Bangladesh has successfully reduced the impact of disasters through community involvement in planning and risk management. Response efforts have included flood and cyclone warning systems and shelters. However, response efforts still primarily focus on emergency relief rather than on seeking ways to reduce vulnerability to natural hazards. There is a need to strengthen the awareness that risk reduction and disaster prevention make better economic sense than emergency relief, which responds to the consequence of a natural hazard. Providing a higher degree of safety from unpredictable hazards allows people to build more economically secure lives for themselves



and their children. This is of utmost importance for the poor, as natural disasters divert the resources they need to escape poverty.

### ***River Management***

- 4.14 Contemporary river management strategies are oriented towards forecasting future erosion hazards, reducing hazards through nonstructural measures such as strategic retirement of embankments and resettlement of affected habitation, and developing low-cost erosion control. There has been considerable progress in forecasting future hazards over the last decade through a combination of tools including low-water satellite imagery, available in the first months of each year, and verification river surveys during the flood season. This system allows for works to be designed and tendered for the upcoming dry season. The early start is essential to avoid major construction activities at the beginning of the following flood season in May and June, a result of which is low-quality works.
- 4.15 The BWDB is presently executing three projects utilizing elements of this approach: the Jamuna-Meghna River Erosion Mitigation Project, the Flood Action Plan 21, and the Environmental Monitoring Information Network. With the requisite support and commitment, they could establish the capability to plan for erosion hazards on a nationwide basis. In a further development, costs for the protective work on the ADB-supported Jamuna-Meghna River Erosion Mitigation Project, currently under implementation, are expected to be about US\$3 million per km. To the extent that the solution being adopted in this project is effective, it could be economically feasible to protect agricultural land.

### ***Flood Management***

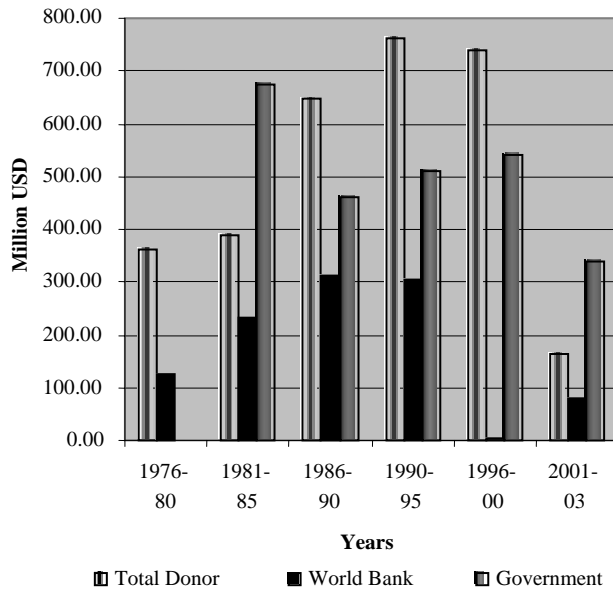
- 4.16 In response to the mixed impacts of flood control infrastructure, the National Water Policy promotes a significant shift away from past practice. Under the policy, agricultural land everywhere is to be adapted to the existing flood regime. The National Water Management Plan has interpreted this to mean that no new flood control is to be introduced in rural areas, and that the emphasis now is on improving the performance and management of existing schemes. That is, within existing flood control schemes, different interventions are to be considered where required on a case-by-case basis and these interventions are to be driven by stakeholder wishes and their willingness to contribute to costs.
- 4.17 The experience of the ADB-supported Small-Scale Water Resources Development Sector Project implemented by the LGED indicates that stakeholders, at a small scale, will contribute to the cost of interventions that protect them from unusual flood events or improve postflood drainage. However, it is also apparent that service delivery must be organized in such a manner that local stakeholders' representatives are able to make decisions in a transparent and open manner free from undue influence of any particular stakeholder or stakeholder group. Effective delivery of local stakeholder-sponsored flood management interventions requires that the executing agencies establish mechanisms and procedures to ensure their ability to respond to local stakeholders and to devolve authority to the lowest practicable level.

### **World Bank Involvement**

- 4.18 Total investments in water for agriculture have exceeded US\$5 billion and this has translated to between US\$165 million and US\$260 million annually (current prices). Annual government financing for the sector has been consistent for the past two decades at an average of about US\$110 million. Annual project-related donor assistance declined from about US\$150 million on average during the first half of the 1990s to about US\$55 million on average during the past three years (figure 7). Between 1999 and the present the Bank undertook no new investments in this sector, which contributed substantially to the overall decline in the level of donor assistance. Since many of the donors build on the experience and expertise of the Bank in determining their

own funding allocations and in developing their own programs, the impact of the Bank's decision to withdraw support from the sector was magnified as others followed suit.

**Figure 7. Investment in Water for Agriculture**



- 4.19 The decline in multilateral and bilateral support to the sector was the outcome of a general perception that investments needed to be more effective and this required improving all aspects of service delivery. The precipitous decline in Bank support during the last half of the 1990s was a direct result of misprocurement. It did lead to the recognition that some fundamental changes in procedures were required. In response, with strong Bank support, the government initiated a series of reforms aimed at restructuring and rejuvenating key agencies, promoting a process of participatory water management, rationalizing the national water management planning process, and developing improved systems for service delivery, including more robust procurement systems.
- 4.20 The Bank, through the proposed Water Management Improvement Project, would contribute to government reforms by (a) contributing to integrated rural development by promoting water resources management and thereby helping to increase agricultural and fisheries production and improve conservation of the ecology by progressively transferring local-level water management functions from the government to water management organizations of local communities; and (b) reforming and strengthening key public sector institutions, for example the BWDB and WARPO, by promoting good governance, accountability, and effective management and delivery of the core public service for improved flood management, drainage, and cyclone mitigation. This project is, however, currently on hold.

### Development Partners Involvement

- 4.21 Since the 1950s, more than 600 water resources schemes have been completed. The majority of these were intended to increase crop production and varied in size from small single-structure schemes with an impacted area of less than 1,000 ha to large multipurpose schemes potentially impacting on as much as 100,000 ha. Most were designed to provide flood control, drainage,

irrigation, or some combination of these. Others provide riverbank protection or river dredging. In total, Bangladesh's development partners have contributed about US\$2.5 billion. A profile of this assistance is provided in table 2.

- 4.22 **Asian Development Bank (ADB).** The assistance that ADB provides to Bangladesh is governed by the Partnership Agreement on Poverty Reduction signed between them in 2000. The five-year operational strategy of ADB in the water sector, which conforms to the agreement, is two-pronged: (a) to support government in effectively institutionalizing key National Water Policy principles and guidelines; and (b) to assist government in implementing the National Water Management Plan, while recognizing the need to continuously upgrade these instruments. Implementation of ADB's strategy is guided by several important principles. First, investments need to support a general move towards decentralization – in terms of the structure of the implementing agency as well as the development of responsive democratic local government. Second, the investment process needs to promote local stakeholder participation and ownership, which needs to translate into significant operation and maintenance efforts and thus sustainability. Third, multisectoral coordination mechanisms need strengthening.

**Table 2.** Development Partners Assistance to the Bangladesh Water (for Agriculture) Sector

Country/donor	% of total donor assistance	Grant (%)	Loan (%)
World Bank	40.5	0	100
Asian Development Bank	24.4	1	99
Netherlands	8.8	100	0
European Economic Community	4.3	100	0
United Kingdom	2.8	10	90
Canada	2.6	100	0
Germany	2.3	100	0
International Fund for Agricultural Development	1.9	0	100
Kuwait	1.8	0	100
India	1.6	11	89
United Nations Development Programme	1.6	100	0
Japan	1.6	95	5
Saudi Arabia	1.6	35	65
France	1.3	90	10
United States of America	1.2	100	0
Denmark	0.8	100	0
Sweden	0.5	100	0
People's Republic of China	0.4	18	82
Pakistan	0.2	0	100

- 4.23 **Government of the Netherlands.** The Government of the Netherlands is assisting the Bangladesh water sector on a number of fronts. They work with and support multilateral donors in promoting local stakeholder involvement in water sector projects, in strengthening the institutional framework by directly assisting existing institutions (the BWDB and the LGED), and in investing in interventions that reverse environmental degradation. The Government of the Netherlands also has programs that are independent of other donors and that tackle such issues as development of capability to promote integrated water management, improved operation and maintenance, support for a center of excellence for environmental analysis, and the orderly and responsible development of natural resources in the coastal area. The latter includes supporting new institutional structures.
- 4.24 **Canadian International Development Agency.** The Canadian International Development Agency (CIDA) is investing in interventions that promote financial management reform in the Ministry of Water Resources and the institutions reporting to this ministry. They are also supporting development of an information network based on satellite radar technology that is accessible to the poor and those living in rural areas, assisting the planning and management of water and land resources on both the national and local levels.
- 4.25 **United Nations Development Programme.** UNDP has developed programs that help the people and Government of Bangladesh to develop their capacity to meet development challenges through initiatives that link advocacy, policy advice, and projects. With respect to the principal issues in water resources management, UNDP is currently focused on initiatives to strengthen local governance and natural hazard preparedness at the national and local levels.
- 4.26 **German Development Bank (Kreditanstalt für Wiederaufbau, KfW).** The German Government, through KfW, finances capacity development for planning, implementing, and maintaining riverbank protection. This program is a direct extension of the earlier Flood Action Plan 21 component that conducted applied research on various bank protection methodologies.
- 4.27 **Government of Japan.** Three areas of priority for Japan's assistance to Bangladesh are (a) agriculture and rural development; (b) improvement of the social sector; and (c) disaster prevention and management. The focus of Japan's assistance to Bangladesh has been shifting to initiatives that aim more directly at mitigating the impacts of the population on the environment, developing human resources, and reducing poverty. In delivering its development assistance, the Government of Japan has also shifted towards a more collaborative working relationship with other development partners.



## 5. The Service Sectors

### Irrigation and Drainage

#### *Overview*

- 5.1 Currently, about 4.5 million ha of the total cultivable land of 8 million ha are irrigated, and the area under irrigation contributes an estimated 13 million metric tons of cereals (mainly rice) annually to Bangladesh. About 90% of this irrigation is provided by the private sector, mainly from groundwater. The studies carried out for the development of the National Water Management Plan suggest that a further 1 million ha could be brought under irrigation by the private sector through groundwater development (Halcrow and others 2000). This translates into a potential annual increase in rice production of as much as 5 million metric tons, enough to feed an additional population of between 25 million and 30 million people at current consumption rates. This increase in population is expected within the next 15 years; by 2050, population is forecast to nearly double to 230 million. While it would be presumptuous to suggest that irrigation alone will be responsible for maintaining the balance between food production and population growth, it is reasonable to assume that irrigation will need to contribute beyond what can be achieved through private investment.
- 5.2 The National Water Management Plan suggests that government has a role to play in the development of surface water irrigation systems, where feasible, and to focus where practical on the conjunctive use of ground and surface water (NWMP, AW 003-1). Additional irrigation with large-scale surface water projects could amount to as much as a further 1 million ha, a major proportion of which would be financed by the public sector. Further gains are also possible by diversification to crops requiring less water, particularly in the southwest and western areas of the country, where rainfall is low and water is relatively scarce. It is generally recognized that the development of groundwater for irrigation has required virtually no public sector financing in contrast to a capital cost to the public sector for surface water systems ranging anywhere from US\$500 to US\$1,800 per hectare.<sup>23</sup> It is further recognized that farmers readily mobilize the financial and technical resources needed to operate and maintain groundwater irrigation infrastructure, in contrast to surface systems where, in most cases, the cost of irrigation user fee collection has exceeded the fees collected. The National Water Management Plan also notes that irrigation intensities are low on the 15 major existing irrigation schemes.<sup>24</sup> On balance, the large-scale surface water irrigation projects have not had a very good performance history in the country. With appropriate institutional changes, their performance could be increased and if they achieved their potential, they would provide incremental production of about 1 million metric tons of unmilled rice during the winter season. Drainage has generally been provided in conjunction with flood control and/or irrigation and as such is not accounted for as an independent entity. For the most part, drainage is effected by gravity, but eight large projects have facilities for pumped drainage.

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<sup>23</sup> These figures are abstracted from the National Water Management Plan, but arguably may be low (Halcrow and others 2000). Capital investment in the Teesta Project was about US\$250 million in 1985 to develop 100,000 ha of irrigation. This translates into a unit cost of US\$2,500 per hectare.

<sup>24</sup> Most of the BWDB's large irrigation schemes are designed for supplementary irrigation during kharif-2 (mid-June to December) and rabi season (November to March). Within the 15 major BWDB schemes that cover 480,000 ha, between 1996 and 1998, an average 36% of the net cultivable area was irrigated during kharif-2, and 46% was irrigated from BWDB sources during the winter (rabi) season. During the premonsoon (kharif-1) season, this figure was 7.

### ***Current Challenges and Approaches***

- 5.3 To develop 1 million ha of surface irrigation over a 15-year period will cost over US\$100 million per year. In addition, operating costs are expected to increase annually by US\$10 million. In more concrete terms, the incremental unmilled rice production associated with this irrigation development would be publicly subsidized at a level exceeding US\$50 per metric ton.<sup>25</sup> There is presently strong impetus within the government to promote support for a number of large-scale surface water irrigation systems, many of which have their origins in the 1964 Water Master Plan. Current support for new surface water irrigation development is driven by at least three considerations. First, concerns about the sustainability of groundwater irrigation persist. Second, there are concerns about arsenic in food crops grown on land irrigated with arsenic-contaminated groundwater. Scientific studies published so far suggest that the contribution from food to total human arsenic exposure is probably not significant generally in Bangladesh, but could be significant in specific cases (for example specific diets or settings); studies of this issue are ongoing (World Bank-WSP 2005). Related concerns are the possibility of arsenic accumulation in groundwater-irrigated soils, which could lead over time to increasing arsenic levels in food crops (or adverse impacts on, for example, yields) (see, for example, Alam, Snow, and Tanaka 2003; Meharg and Rahman 2003; Duxbury and others 2003; Abedin and others 2002; Roychowdhury and others 2002a and 2002b), as well as the local contamination of deep aquifer layers. Third, government policy calls for national food security in the face of an expanding population.<sup>26</sup>
- 5.4 Large-scale surface water irrigation projects require considerable lead time to move from a concept to the point where they are delivering water to farmers' fields. *If* one assumes that (a) this lead time is in the order of 10 years; and (b) for the next 15 years, private sector irrigation expansion will increase production sufficiently to meet the needs of the expanding population, *then* there is a five-year window (2005–2009) during which concrete efforts should be made to improve the performance of existing schemes. This would include not only physical rehabilitation but, most importantly, concrete changes in irrigation management approaches and the existing institutional frameworks. The current approach of the government is to mandate that work on two new major irrigation projects should be initiated every year from this point forward. To achieve the desired sustainable food production increases, this would need to go hand in hand with a concerted attempt to improving the performance of existing systems.
- 5.5 The Ganges and Brahmaputra Rivers have strongly influenced the development of Bangladesh, and they continue to have enormous importance as strategic natural resources. Historically, these rivers have supplied food, provided transport, generated employment, supported a wealth of biodiversity, and contributed to the overall quality of life for the inhabitants of these basins. They continue to do so; however, fresh water quality and availability in these systems is deteriorating, particularly in the dry season. In particular, the southwest region is being affected by a shortage of fresh water; increased salinity of surface water, groundwater, and soils; deterioration of the Sundarban ecosystems; river sedimentation; reduced crop and fish production; and reduced navigability.
- 5.6 The options to address these changes are limited, and difficulties associated with reaching consensus on how best to harness, develop, and share the waters of these international rivers has so far hampered progress. The lives and aspirations of a large and rapidly growing population, both within Bangladesh and within the basins as a whole, are being affected. To persist in past

<sup>25</sup> Based on a 25-year project life, operation and maintenance costs equivalent to 10% of capital costs, yields of 5 metric tons per ha, and interest rates of 10%. The cost of 1 metric ton of unmilled rice is about US\$165.

<sup>26</sup> The government considers that for food production to keep pace with population increases, the irrigated area needs to increase annually by 2% (Division Chief Planning Commission, Dhaka, pers. comm., 2003).

approaches denies the grim reality that these resource-rich basins are home to a large and increasing concentration of some of the world's most impoverished people.

- 5.7 Over the past century, the mouth of the Ganges River has been migrating eastward. This has contributed to the evolution of the river systems in the southwest and has resulted in many of the smaller distributaries being separated from the Ganges main channel. Two distributaries of significance remain in Bangladesh – the Gorai and the Arial Khan.<sup>27</sup> The Government of the Netherlands provided assistance to the Government of Bangladesh in the late 1990s to determine the feasibility of dredging the Gorai River from its offtake at the Ganges to the railway bridge, about 16 km downstream. This first stage consisted of dredging a pilot channel followed by two consecutive years of maintenance dredging. Subsequently, this pilot channel largely infilled with sediment. The feasibility study based on the pilot dredging concluded that restoration of the Gorai River offtake was feasible through a combination of continuous dredging and structures, including a flow divider, to divert Ganges flows into the Gorai River. The study considered five infrastructure options ranging in cost from an estimated US\$110 million to US\$198 million. There has been no action to follow up on this study, in part because of the Bank's reluctance to engage in the sector and in part because government considers the possibility that investment in the Gorai River would compromise its ability to obtain support for a barrage on the Ganges River.

### ***Will It Work?***

- 5.8 The expansion of private sector irrigation through groundwater development requires that more appropriate pricing policies be put in place. Diesel is used to power about 90% of pump sets and irrigates about 70% of the area. Electricity powers the rest. Present pricing policies subsidize irrigators using electrically powered pump sets and, through taxes, penalize those irrigators using diesel fuel.<sup>28</sup> It is estimated that reducing the taxes on diesel fuel by US\$0.02 per liter, while reducing tax revenues by US\$3.7 million, would result in an increase in the area irrigated by 170,000 ha and increase production by 500,000 metric tons. Because of production costs and limited supply, electricity may not be a suitable source of power for irrigation and, notwithstanding operation and maintenance advantages, the expansion of electrically powered pump sets should not be promoted by inappropriate pricing policies.
- 5.9 Development of selected major irrigation systems in areas where groundwater is unavailable can work. However, Bangladesh will require support from the development partners. A starting point needs to be the identification of how improvements can be made to the operation of existing surface water irrigation facilities with a view to establishing effective and sustainable implementation methodologies. At the same time, work is required to determine environmental flow requirements as a preliminary step to undertaking feasibility assessments on any proposed schemes. To date, the government has declared four sites within the coastal zone as Ecologically Critical Areas and preservation of these will require that sufficient freshwater from the major river systems flow through the coastal areas to prevent further salinization, drought, and the corresponding destruction of biodiversity and habitat.<sup>29</sup>

<sup>27</sup> The Arial Khan is in fact a distributary of the lower Ganges or Padma River.

<sup>28</sup> In 1996, the National Minor Irrigation Project reported that the economic price of electricity (including generation and transmission) was 230% of the financial price while the economic price of diesel was 56% of the financial price. As a result the financial cost of irrigating with diesel was about US\$70/ha while the financial cost of irrigating with electricity was US\$40/ha. The effect of this is that more than 35% of the total economic cost of power is used to irrigate less than 30% of the irrigated area.

<sup>29</sup> The Ecologically Critical Areas are: Tekhaf Bay at Cox's Bazaar, Saint Martin's Island, Sonadia Island, and areas around the Sundarban Reserve Forest.



- 5.10 The Ganges Water Treaty represents good progress in establishing a stable framework within which Bangladesh can begin to plan for the development of the main rivers for multipurpose uses in accordance with the National Water Policy. Specifically, it provides some assurance of upstream discharges so that the Gorai River augmentation project could be implemented with some promise. There are risks. The Gorai augmentation study did not adequately deal with the issue that the Ganges discharge at the Gorai offtake may be too low and this reduces the volume of water available for redirection into the Gorai. A second area of concern is that the operation of the gates at Farakka has led to a steeper recession limb of the hydrograph. As a result, there are more residual bars and pools that restrict free channel flow.
- 5.11 The Ganges River represents only about 15% of the total dry season flow of all the rivers in Bangladesh while the largely uncontrolled Brahmaputra represents more than 65%. Bangladesh could benefit from a water-sharing agreement for the Brahmaputra River, which would help to achieve the predictability necessary to plan for development and utilization of water in much of the country.

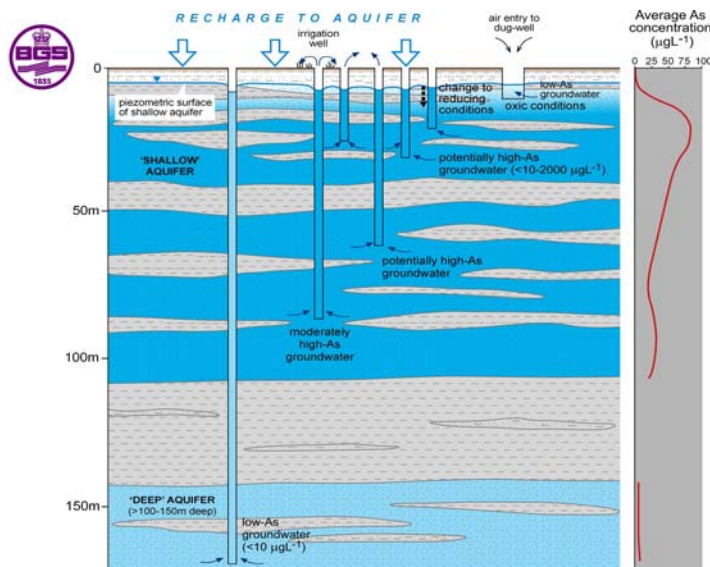
### *Development Partner Support*

- 5.12 In general, development partners in Bangladesh promote and support the continued expansion of private sector-driven groundwater irrigation. Because of the relatively poor performance of major surface water irrigation systems in the past, the development partners now provide little support for major surface water irrigation. Major surface water projects need to be part of the water management landscape in Bangladesh. But what is also clear is that the evolving irrigation sector has yet to adequately establish working systems that result in sound operation and maintenance, especially given that new irrigation projects also imply social costs such as resettlement. Nevertheless, development partner support is needed to support the improvement of existing systems and use this as a platform to expand major surface water irrigation.

## **Water and Sanitation**

### *Overview*

- 5.13 Bangladesh has made good progress in improving access to safe water. Water supply coverage has increased in both urban and rural areas. Nearly 97% of the rural population is served by over 10 million hand tubewells. However, arsenic contamination of groundwater above the permissible limit of 50 µg/L (micrograms per liter) has affected an estimated 25% of the shallow tubewells, reducing safe water coverage in rural areas to around 76%. Arsenic in groundwater has affected an estimated 35 million people both in urban and rural water areas. Between 10,000 and 12,000 cases of arsenicosis have been identified so far, and undoubtedly many unidentified cases exist. Figure 8 provides a profile of arsenic occurrence.
- 5.14 On average, more than half the urban population has access to water supply. The four largest cities, Dhaka, Chittagong, Khulna, and Rajshahi, have piped water systems that serve 70%, 33%, 51%, and 40% of the population respectively. An important challenge for these growing cities is that almost 40% of the total population is low income and this group is largely unserved. In addition, only 100 of the over 250 municipal towns have piped water systems, and these primarily serve urban core populations. The urban population in the slums and fringes of medium and small towns rely on hand tubewells. Nevertheless, squatters and those living in urban slums are without easy access to water or sanitation.
- 5.15 The gains in water supply have not been matched in sanitation coverage. Recent surveys place sanitation coverage at 33% in rural areas and slightly over 50% in urban areas. The popular technology in rural areas is the pit latrine, with or without water seal. The sanitation coverage in large towns and cities is between 65% and 76%. Pit latrines and septic tanks are the technology of choice in urban areas. Poor drainage decreases soil permeability, making dense urban areas unfit

**Figure 8.** Profile of Arsenic Occurrence in Groundwater

Source: World Bank. 2005.

for on-site sanitation options. Pits fill too fast and effluent from septic tanks flows into open drains, aggravating environmental pollution. Only Dhaka has a waterborne sewerage system and it serves only about 27% of the population. The slow progress in sanitation coverage, combined with poor hygiene habits, has thwarted expected health gains from improved access to clean water. Morbidity and mortality rates due to excreta-related and waterborne diseases remain high, resulting in malnutrition, increased medical cost, and lost income.

### ***Current Challenges and Approaches***

- 5.16 **Inequitable service distribution.** While average coverage figures confirm the substantial progress over the last two decades, service provisions have been inequitable, with disadvantaged social groups suffering the most. Even in well-served areas there are still pockets of unserved and underserved areas where people access safe water with considerable difficulty. Coastal saline areas have around 250 persons per tubewell, leaving as many as 15 million people without easy access to reliable and safe water supplies. In areas where the water table is low, the average is higher, with 380 persons per tubewell. Safe water and sanitation coverage in the three hill districts of Rangamati, Khagrachari, and Banderban is very poor. The initial approach to resolving this infrastructure deficit was hardware oriented, with a focus on rehabilitation, service coverage, and an extension of existing water and sanitation facilities. Government and donors researched, adapted, and devised appropriate technology options for water supply and sanitation and the result was a range of technology options. The top-down and hardware orientation improved service coverage but the effectiveness and sustainability of service delivery and improved health impacts that were expected from the intervention remained elusive. This led to a realization that provision of physical facilities alone was not a sufficient precondition for improvement of health. The missing pieces included social awareness, sense of ownership of facilities, and behavioral change leading to a demand-responsive approach.
- 5.17 **Arsenic contamination.** In Bangladesh, arsenic was first detected in groundwater in 1993; however, it was not until 1998 that a coordinated effort was made to address this issue through the Bank-supported Bangladesh Arsenic Mitigation Water Supply Project. While there has been considerable work done to date, the knowledge base related to arsenic in terms of occurrence and

mitigation is incomplete. There is a need for further research and development, since the mitigation options for households or point sources are limited. A likely response will be a shift from point source to community-based water supply systems in those villages where this is socially and financially possible. Despite the significant institutional implications associated with community-based systems, the consequences of households switching to bacteriologically contaminated surface water poses an unacceptable threat. Arsenic mitigation will therefore be addressed within the overall context of improving service levels, and mainstreamed into the water and sanitation sector. The Bangladesh Water Supply Program Project, assisted by the Bank and started up in 2005, will provide important lessons in this regard.

- 5.18 **Financing and cost recovery.** Water supply systems are heavily dependent on government subsidies. An analysis of water supply and sanitation in 42 municipalities in 1986 showed that only 57% of expenditure was billed, and only half of that was collected. This resulted in revenue amounting to only 29% of expenditure. Despite efforts to change this situation, a second analysis five years later found similar results (UNDP-World Bank 1991). However, more recent analysis of 61 district towns where service supply is supported by the ADB, the Government of the Netherlands, and the Danish Agency for International Development (Danida) show improvements in both billing and collection efficiency (DPHE 2000), clearly the result of improvements in service management. This was again demonstrated in the 18 District Towns Water Supply and Sanitation Project, wherein 16 of the 18 municipalities generated profits before depreciation and three generated profits after depreciation. The situation is better in the large autonomous Water Supply and Sewerage Authorities (WASAs). In Dhaka, the WASA is able to cover operation and maintenance costs, depreciation and financing costs from user fees, but its collection performance needs improvement; in Chittagong, the WASA also generates a small profit.
- 5.19 **Sector coordination.** Sector planning lacks a holistic approach and mechanisms to facilitate participatory planning at the local level. In consequence, planning is project based and suffers from duplication, misplaced priorities, and uncoordinated development. Agencies are oriented towards meeting physical targets rather than towards establishing and monitoring processes for reaching goals relating to facility operation, management, utilization, and maintenance. To relax this constraint, the Local Government Division has instituted a National Forum for Water and Sanitation with representation from sector-related ministries and agencies for intrasectoral and intersectoral coordination. The Unit for Policy Implementation, a Danida-supported initiative, has helped the Local Government Division to formulate a vetting guideline to screen all new project proposals for compliance with the national policy principles. The Unit for Policy Implementation is also working on a Sector Development Framework, which would be a reference for sector coordination and development.
- 5.20 DFID has been supporting the Ministry of Local Government in establishing an Arsenic Policy Support Unit (APSU). It has also become apparent that policy and strategy related to arsenic needs to be integrated within the development framework of the entire sector. The Bank and Water and Sanitation Program carried out a study that confirmed this and calls for a more systematic operational response rather than the current ad hoc interventions (World Bank-WSP 2005). Key sector donors and government are now working on a new technical assistance package to unify policy assistance support to form a national Policy Support Unit. It is too early to determine the extent to which these initiatives may prove successful.

### ***Will It Work?***

- 5.21 **Inequitable service distribution.** Bangladesh's development partners are responsible for nearly 50% of all funding for the sector. However, while these development partners emphasize capacity building and institutional changes, this financing is predominantly project based. Consequently, the changes being promoted are unlikely to be sustained beyond the project period unless the

government formalizes them through institutional reforms and reorientation. A UNDP project on good governance has been piloting innovative institutional arrangements that involve local government institutions in local development. Under this approach the union parishads control and manage funds, which the project gives them directly in the form of annual development block grants. Initial project experience has been encouraging and it should be monitored carefully in the future.

- 5.22 **Arsenic contamination.** The economic status and demographic and sociological conditions are not presently conducive to the installation of large-scale water treatment plants and associated transport and distribution systems. Even urban water supply systems face problems of inefficient management, unskilled technical staff, capital shortage, inferior quality materials, and inadequate power supplies. The lack of people's awareness of the seriousness of the arsenic problem and the need to address it is also impeding mitigation activities. To expedite resolution of the arsenic problem, the role of local government and end users in the management of water resources needs to be reexamined and brought in line with stated government policies.
- 5.23 **Financing and cost recovery.** Except in large cities, where WASAs are supposed to be managed as profitable corporations, cost recovery, specifically through mobilization of local resources, is not accorded a high priority. In addition, water supply and sanitation (WSS) tariffs are eroded by inflation, as there is no mechanism for automatic adjustment; complex tariff structures distort consumption and result in unproductive cross-subsidies. In smaller urban centers, where the WSS service is the responsibility of the local government, property taxes are potentially the most productive form of mobilization of local resources. Yet the revenue base of municipalities is both weak and underutilized. Holding or property taxes do not respond to increases in population or economic activity, due to deficiencies in property assessment practices. Nonrealization of taxes and financing of recurrent revenue expenditure from central government development grants is common practice.
- 5.24 **Service management.** Bangladesh has lagged in the efficient management of services. Even large WASAs are fairly inefficient when it comes to nonrevenue water, metering, billing and collection, or staffing ratios. Central government agencies provide services without paying adequate attention to building local institutional capacity for management. This problem is acknowledged in the Water Supply and Sanitation Policy (1998), which specifies a larger mandate for local government institutions and user communities in planning, implementing, operating, and maintaining services. At present, those who set policy and those who provide services are often the same body, which results in centralized and supply-sided service delivery. The lack of clarity of roles and responsibilities of policymakers and service providers is a major hurdle that must be overcome if the sector institutions are to become more efficient and accountable. As yet, there is no go-forward process.

### *Development Partners Support*

- 5.25 ADB has been supporting the urban water subsector since the early 1980s. It supported the Secondary Towns Infrastructure Development Projects (Phases I and II) and the third Urban Development Project. These integrated, multicomponent infrastructure projects included water and sanitation facilities. ADB also supported the first Five District Towns Water Supply and Sanitation Project in the mid-1980s and the recently concluded second Nine District Towns Water Supply and Sanitation Project (commonly known as 9-DTP). These projects accorded municipalities a greater role in planning, implementing, and managing their resources. The municipalities worked hand in hand with government agencies in implementing the project. Management procedures were established, rules and regulations framed, and key technical, accounting, and management personnel were trained.

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- 5.26 UNDP is implementing a Community-Based Water Supply and Sanitation Project, which in response to changing needs is currently focused mainly on sanitation and has achieved full sanitation coverage in four unions. The project brings together awareness-raising activities with developing community organizations, appropriate technology, and community participation in all stages of service provision and management.
- 5.27 The Government of the Netherlands' involvement in the water supply and sanitation sector started in the 1970s with a focus on water supply in district towns. The most recent Dutch support, for the 18 District Towns Water Supply and Sanitation Project, focused on water supply, sanitation and drainage, hygiene promotion, and institution building to improve municipal capacity in finance, management, operation and maintenance of water systems, and hygiene promotion. The Government of the Netherlands is now analyzing its future role in the water supply and sanitation sector.
- 5.28 Danida has been supporting the water supply and sanitation sector in both rural and urban areas in Bangladesh for almost three decades. Danida recognized that the absence of a sector development framework and a mechanism to coordinate development constrain a holistic approach to development. In 1999, in the absence of a development framework for the sector as a whole, Danida shifted from a project-based to a program-based approach. Currently, Danida's support to the sector is channeled through Sector Program Support. It focuses on facilitating implementation of the National Policy for Safe Water Supply and Sanitation (1998) through six components: urban water supply in coastal areas; rural water supply in coastal areas; arsenic mitigation in coastal areas; water and sanitation in the three hill districts; training network at BUET; and services for the poor through the NGO Forum. Danida also has two new projects in the final planning stages, which will increase water supply, improve sanitation coverage, promote hygiene, and strengthen institutions in the eight coastal districts.
- 5.29 WHO supports a number of ongoing projects that provide assistance with water quality surveillance, promote better sanitation through training and pilot projects, provide capacity building for the DPHE and the sector, and reinforce arsenic mitigation programs through research, training, establishment of protocols, laboratories, and information systems, and through provision of monitoring and advisory support.
- 5.30 For the past several years the Japan International Cooperation Agency (JICA) has focused on the provision of arsenic-free drinking water, mostly in northwestern Bangladesh. Upcoming projects continue to concentrate on improving the quality of drinking water: in one project by establishing three water quality laboratories and in a second project to provide arsenic-free water on a sustainable basis to communities in three upazilas of Jessore District.
- 5.31 WaterAid, with financial support from the DFID, has a substantial ongoing program targeting 2.2 million beneficiaries and aiming to provide sustainable improvements in hygiene behavior and reduce exposure to water and environmental sanitation risks for entire poor rural and urban communities.
- 5.32 The United Nations Children's Fund (UNICEF) is in the process of preparing a new country program. It is anticipated that activities in water supply and sanitation will support community-centered approaches to achieving national goals. The program is planned to be of sufficient scale to produce a reliable evidence base to contribute to sector policies and strategies and, therefore, to be instrumental in designing a sectorwide approach.
- 5.33 A broad group of NGOs and others have been working extensively to support government in dealing with arsenic and its mitigation. These include the Dhaka Community Hospital, Proshika, the Bangladesh Rural Advancement Committee, the Asian Arsenic Network, and the NGO Forum

for Drinking Water Supply and Sanitation. The partnership of these and other NGOs provides an important ally for the government in dealing with this difficult issue.

- 5.34 The Water and Sanitation Program for South Asia (WSP-SA), through its Bangladesh country office and its regional and global units, is supporting government, sector institutions, NGOs, and development partners. This support consists of technical assistance, demonstration projects, upstream project preparation, policy advisory assistance, and improvement of service delivery, sharing research and knowledge that leads to reforms in sector policy and institutions. The WSP-SA has concluded that “it is the institutions that need to be fixed before fixing the pipes delivering water to consumers”. The upstream work of WSP-SA on arsenic mitigation produced a key reform agenda for sector institutions and identified new ways to improve service delivery. These included piped water supply with private sponsors for high-density rural areas, emulating the global success story of small-scale private providers in delivering rural water supply, and a new approach to dealing with sanitation through collective and community behavioral change that results in a totally sanitized community rather than the partial coverage that results from simply providing hardware.

## **Inland Water Transport**

### *Overview*

- 5.35 Transport accounts for about 8% of GDP and water transport accounts for about 15% of total transport GDP (Bureau of Statistics 2000). Inland water transport moves about 30% of total freight and about 14% of total passengers, compared with 7% and 13% respectively for rail and 63% and 73% respectively for road. Water transport depends entirely on adequate water depths and is thus particularly vulnerable to the effects of siltation, declining river flows, and flood management infrastructure constructed across watercourses. Inland water transport is the least expensive form of transport in Bangladesh and in the southwest part of the country the most cost effective. There are presently about 6,000 km of navigable waterways in the summer and 3,800 km in the winter. This is significantly lower than in 1970 when the navigable waterways during the summer were about 13,500 km and the winter waterways were 8,500 km in length. An estimated 3 million people rely on inland water transport for their livelihoods.
- 5.36 By 2015 the actual volume of inland transport freight and number of passengers is forecast to increase by 70% and 50% respectively, even as its share of total freight and passengers are forecast to decrease to about 17% and 8% respectively (notwithstanding its cost advantages and livelihood benefits).
- 5.37 Waterway maintenance will be essential, given the expected rapid increases in actual freight and passengers. However, the volume of dredging that is being undertaken to maintain the waterways has declined from a mid-1980s annual level of 3 million m<sup>3</sup> to about 2.7 million m<sup>3</sup>. This reflects the proportionately lower budget allocation the subsector receives. In FY02 inland water transport accounted for more than 25% of commodities and passenger movement, but was allocated only 6.6% of government investment in the transport sector.

### *Current Challenges and Approaches*

- 5.38 In promoting development and more efficient resource utilization in the sector, a number of challenges need to be addressed. The navigability of many of the rivers is declining due to a combination of reduced dry season discharges and siltation in the channels. These problems are exacerbated by the difficulties associated with predicting morphological behavior of many of the rivers. The response has been less than effective because of a number of related difficulties. Poor planning, programming, and management have resulted in inadequate capital funding for necessary interventions to improve the navigability. Inadequate recurrent budget allocations have fostered weak management and poor monitoring and control systems, leading to little or no

maintenance of associated physical facilities such as mooring and storage facilities, theft of navigation aids, lack of modernization of country boats, and little expansion of rural launch facilities. A further issue is that mooring stations are often not properly integrated into the road network.

- 5.39 The Department of Shipping and the Bangladesh Inland Water Transport Authority are the two main organizations responsible for the development and regulation of the sector. The regulatory framework consists of the Inland Water Transport Authority Ordinance (1958) and the Inland Shipping Ordinance (1976). There is some ambiguity as to the responsibilities of the regulatory bodies and there is a need to redefine the responsibilities of the organizations. These organizations also require strengthening and an early step in this process would be a review of staffing in the context of roles, functions, and required skills.
- 5.40 The current approach is one that promotes an agenda for increasing public-private partnership in the sector, improving facilities in the areas of communication, navigation aids, and smaller landing facilities, as well as strengthening service delivery through human resource development and adopting measures to prevent accidents. This has resulted in the signing of a number of development service agreements including preparation of a private sector port and inland water transport policy, and several infrastructure schemes to be operated on a BOT basis: construction of Khanpur container terminal at Narayanganj, construction of a new river terminal at Paanga opposite Pagla (Dhaka), and establishment of land ports at Teknaf and Banglabandh. To improve operational efficiency, steps have been taken by Bangladesh Inland Water Transport Corporation to lease or charter its loss-generating cargo fleets to the private sector. Procurement of three dredgers and one booster pump is planned to support a long-term dredging program to excavate 8.8 million m<sup>3</sup> of material from 19 river routes.
- 5.41 In addition, government has allocated its own funds for a number of initiatives that are to be under implementation by 2007:
- Establishing river port facilities in the Munshiganj-Mirkadim area.
  - Constructing a bus and truck terminal at Paturia ferry landing.
  - Dredging the canal connecting the Dhaka-Mongla and Chittagong-Mongla waterways.
  - Providing landing facilities in the coastal upazilas Cox's Bazaar, Sandwip, and Monpurar.
  - Undertaking measures to reduce vessel accidents, including ship model testing, weather forecasting, and modernizing old passenger launches.

#### ***Will It Work?***

- 5.42 The National Water Policy and the National Water Management Plan place a high priority on the maintenance of the inland water transport subsector. A Master Plan for Inland Water Transport was prepared in 1989 that takes account of the various challenges facing the sector and suggests appropriate measures. While many of the recommendations of the master plan have not yet been adopted and government support to the subsector is disproportionate to the contribution of the subsector to the economy, an approach that incorporates substantial private sector involvement holds promise. Nevertheless, to effectively implement this approach will require significant changes to the manner in which government agencies undertake their business and this in turn requires further reforms and capacity building.

#### ***Development Partners Support***

- 5.43 Historically, Bangladesh has received support for inland water transport from the Government of the Netherlands, Danida, and the World Bank. However, over the past decade, support from these development partners has dwindled, in part because government itself accorded low priority to

the sector. Danida withdrew its assistance to the sector because of misprocurement related to the rehabilitation of ferries; this work was undertaken by the Bangladesh Inland Water Transport Corporation. The World Bank financed the Inland Water Transport III Project and has been prepared to finance a follow-on Inland Water Transport IV Project. However, the latter has been stalled due to disagreements between the government and the Bank. An outcome of this is that the recommendations of the Inland Water Transport III Project have not been implemented. Currently, a Sector Policy Note is under preparation to address the way forward. Spain is providing financial assistance for the procurement of three dredgers and one booster pump.

## **Fisheries and Environment**

### *Overview*

- 5.44 The fisheries sector of Bangladesh includes inland and brackish water aquaculture, and inland and marine capture fisheries. The sector accounts for 6% of the GDP, provides 9% of the country's employment, and is the second most important source of foreign exchange. According to the Bangladesh Bureau of Statistics fisheries are the only activity in rural Bangladesh showing significant expansion, with an annual growth of 8.4%. Four out of five rural Bangladeshis depend to some extent on aquatic resources. The government estimates that over 1 million people fish full time and another 11 million professionally on a part-time basis. Fish are reported to account for 65% of the country's animal protein consumption.
- 5.45 Aquaculture, both fresh and brackish water, has shown annual growth rates exceeding 10% over the past decade. Much of that production is a result of utilization of existing ponds and technologies. High levels of growth are expected to continue as long as internal prices remain stable and shrimp exports are not reduced, thereby continuing to provide incentives for shrimp farmers to increase production. The Fisheries Sector Review and Future Development Study have elaborated estimates for current and projected sector outputs. The quantity of fish produced is forecast to continue to grow at an average annual rate of 1.5% over the coming decade (table 3), driven by strong growth in aquaculture. At the same time, fish prices are expected to continue to increase at an annual rate of 2.7% from the current value of US\$730 per metric ton, resulting in an annual increase in production value estimated at 4.2% (FSRFD 2003). But capture fisheries, both inland and marine, are declining and this trend is likely to continue without an infusion of political will, changes in current policies and institutional arrangements, and additional investments.
- 5.46 It is unlikely that internal production will keep pace with internal demand. Consequently, it is likely that prices will continue to rise further, making fish protein less accessible to the poor. Imports, mostly from India and Myanmar, are becoming increasingly important to markets across the country. While unlikely to represent more than 5–10% of the overall fish consumed in the country, anecdotal information indicates that imports may be impacting prices, particularly prices of cultured carps and catfish in urban markets. The lack of reliable statistics does not allow an informed answer to this important question.



**Table 3.** Summary of Major Fish Subsector Scenarios

Production sector	2002 (metric tons/year)	2012 (est.) (metric tons/year)	Annual change (percent/year)
Inland aquaculture	850,000	1,465,744	5.6
Coastal aquaculture	94,580	129,597	3.2
Inland capture fisheries	750,419	606,919	-2.1
Coastal/marine capture fisheries	589,500	501,689	-1.6
Totals	2,284,499	2,703,949	1.5

- 5.47 The rivers around all the major cities are heavily polluted. The Buriganga and the Lakhya Rivers around Dhaka absorb about 80% of the city's effluent. In addition, the Department of Environment has identified more than 450 polluting industrial units discharging toxic wastes into these rivers. Revitalization of the rivers around the major cities was not adequately addressed in the National Water Management Plan, but it is badly needed.
- 5.48 Permanent wetland areas in the country have declined by 50% and continue to decline. Wetlands provide essential environmental services to all Bangladeshis in the way of flood protection, water purification, and groundwater recharge, among other services. Apart from these direct services, wetlands serve as nursery and breeding grounds supporting fish production. Development practices need to more aggressively support the maintenance of perennial habitats or minimum stream flows to ensure that sufficient parent stock are available for repopulation of the flood plain fishery, which is the key to the capture fishery in Bangladesh.

#### *Current Challenges and Approaches*

- 5.49 **Inland aquaculture**, which produces an estimated 850,000 metric tons with over 80% from smallholder pond polyculture, is the largest single source of fish amongst the various fisheries subsectors. This should be viewed as a major success of the government and its fisheries agencies. Other areas of importance include seed production, pen and cage culture, and commercial aquaculture. Small pond carp polyculture will continue to offer the greatest potential for expansion and increased production within the fisheries sector. New ponds continue to grow at a rate of 2% or more per year.
- 5.50 Key issues in the subsector, particularly for poorer farmers, are (a) availability of information; (b) extension support; and (c) quality of available fish seed and access of the poor to production units. Landless and marginal farmers and the fish seed industry will require additional investment and technical support. Government-NGO partnerships have proven to be the most effective means for promoting and improving smallholder aquaculture. Smallholder aquaculture does, and will continue to, offer opportunities for rural poverty reduction and investment.
- 5.51 **Brackish water aquaculture** produces almost 95,000 metric tons of shrimp, prawn, and fish and this amount is expected to double over the next decade. Shrimp exports are now the second most important source of foreign exchange in the country. Most of the current investment is and will continue to be undertaken by the private sector. Increase in total shrimp production could be achieved by improving culture systems without expanding the total pond area, although the latter is unlikely to happen. Improved approaches will require better operational management with the support of extension services, improved pond construction, better hatchery and water management, reduced postlarvae mortality, improved stocking ratios, and, most importantly, improvements in postharvest handling.

- 5.52 Shrimp and prawn aquaculture are profitable and practitioners are, for the most part, able to finance their own activities. Strategies addressing the key issues of this subsector would mainly involve government and private sector coordination and cooperation. For organizations with a poverty reduction focus, direct investment opportunities are limited. Apart from supporting poor fishermen involved in the capture of wild postlarvae, it is difficult to identify areas within this subsector where poverty-focused investment would be justified.
- 5.53 **Open water capture fisheries (inland and marine).** Poorer landless sectors of rural society depend substantially on the open water capture fisheries. The yearly output of inland capture fisheries is progressively declining. This is primarily due to habitat loss, reduced dry season flows, and unregulated overfishing as wetlands and other aquatic resources are lost to infrastructure, agriculture, urbanization, and increasing pollution. The primary emphasis in both the marine and inland capture fisheries must remain on maintaining current levels of output within the increasing constraints of land and water use, urban and agricultural intensification, and social pressures on poor communities. Individual species of high-value fish and their fisheries are disappearing. The consequence of these declines will most impact the rural poor in terms of income and access to food. Maintaining present levels of production, preserving current biodiversity, and sustaining existing livelihoods should be considered as priority objectives.
- 5.54 Interventions and investments are required if these resources are to continue to supply income, food, and essential environmental services to the poorest members of society. Results from a number of ongoing Department of Fisheries investments have given rise to general agreement that the most effective means of addressing these issues are through integrated approaches that address policy, strategies, and interventions in a coordinated manner; that is, participatory approaches integrating social, technical, and political concerns.
- 5.55 Key issues for the sustainable use and preservation of these capture fisheries include maintenance of dry season flows, protection of key aquatic habitats, creation and maintenance of fish sanctuaries, limitation to further disruption of migratory pathways, and avoidance of further pollution and chemical degradation. In addition, the future of the subsector will require a reduction of fishing effort. Recent small-scale efforts have shown that communities working with local government (district, upazila, and union) are capable, with technical and other support, of sustainably managing local resources. Accomplishing this will probably require integrating alternative income-generating activities with wetland and fishery management. There is a need for the government, NGOs, and donors to continue to cooperate and coordinate efforts to establish these approaches at the policy and institutional levels.
- 5.56 **Wetlands management and poverty.** Wetlands seasonally cover 60% or more of the country. Infrastructure, both for water management and transport, has been a major contributor to the ongoing decline in wetlands. Recent wetlands economic studies in Bangladesh (Colavito and others 2000) indicate that wetlands have annual economic outputs exceeding US\$515 per hectare.<sup>30</sup> These studies have shown that the main economic benefits from these common property resources go to poor people in rural communities. In addition, the nation as a whole benefits from the environmental services provided by wetlands in the way of flood control, groundwater recharge, and pollution abatement. They also produce food and other raw materials. A similar situation exists in the marine and coastal fisheries where the poor depend on aquatic resources. Any strategy that addresses poverty alleviation in rural Bangladesh must take these fisheries and aquatic resources into account. Boro rice cultivation requires an inordinate amount of water, which creates problems in a season of water scarcity, when competing users include urban and village communities and other lower-use agriculture crops, fisheries, and wetlands.

<sup>30</sup> According to the Bureau of Statistics, 1 hectare of boro rice is valued at US\$310.

***Will It Work?***

- 5.57 **Fisheries and poverty.** Price is an important factor in maintaining access to fish by the poor. Current and projected annual price increases of about 2.8% over the next 10 years will translate into lower consumption, particularly for the poor (FSRFD 2003). Action that results in sustainable increases in fish supplies and stable or lower fish prices will benefit the poor. One straightforward way to do that is to encourage imports. Current policies do not support this approach.
- 5.58 **Wetlands and fisheries.** Wetlands provide essential environmental services to all Bangladeshis in the way of flood protection, water purification, and groundwater recharge, among other services. Apart from these direct services, wetlands serve as nursery and breeding grounds supporting fish production in other areas. In Bangladesh these wetlands are the critical element in the production of 650,000 metric tons of marine and coastal fish and 750,000 metric tons of inland fish. Current development practices do not aggressively support the maintenance of perennial habitats or minimum stream flows to ensure that sufficient parent stock are available for repopulation of the flood plain fishery, which is the key to the capture fishery in Bangladesh. Despite indication that economic outputs of wetlands exceed that of agriculture production, permanent wetland areas in the country continue to decline, mainly due to the construction of infrastructure related to development of water resources for agriculture. Agriculture benefits are easily defined and are concentrated in a relatively small population, while outputs from a natural (common property) wetland are shared among a much larger and diverse group of stakeholders.
- 5.59 **Institutional.** It is unclear which government organization is responsible for the wetlands of the country. The Ministry of Environment and Forests is responsible through its departments for the most important wetland areas in the country (Sundarban and Tanguar Haor) and has overall responsibility for protection of biodiversity. The Ministry of Environment and Forests is the only organization tasked with the management of protected areas in the country. The Ministry of Fisheries and Livestock, on the other hand, has the technical understanding, the experience in community initiatives, and the personnel at the upazila level with the ability to work with local government and local communities to implement those tasks. Establishing and implementing a coordinated cross-sectoral approach to fisheries sector development should be considered as a long-term goal, requiring first of all policy reform leading to development of (a) the National Fisheries Policy to address broad development goals within a cross-sectoral forum and in the context of the PRSP; (b) an implementation strategy; and (c) modalities for policy implementation and monitoring.

***Development Partners Support***

- 5.60 For the past three decades, development partners, including the World Bank, have assisted the government in the development of inland and shrimp aquaculture and management of inland open water capture fisheries. Almost US\$350 million has been invested by the multilateral and bilateral donors over the past 25 years. Overall financial assistance has been reported to have been allocated, in decreasing order of importance, to (a) aquaculture (49.6%); (b) inland open water fisheries (39.4%); and (c) coastal and marine capture fisheries (3.7%). At present, inland aquaculture continues to be strongly supported by other development partners. Brackish water (shrimp) aquaculture is rightfully led by the private sector with some support from Government of Bangladesh agencies. The inland capture fishery subsector is receiving consistent support from international donors, while the coastal and marine capture fisheries have not benefited from the long-term support that has been granted to aquaculture and the inland capture fisheries. In the past two decades, only 3% of the total government and external support has been directed to the marine capture subsector.

## 6. Priorities for World Bank Engagement

### Preamble

- 6.1 Managing water resources is a continuing challenge and opportunity in Bangladesh. Over the past four decades, the government and the private sector have responded to the changing social, economic, and technical environment. These adaptations have contributed to substantial changes. Cereal production has increased from about 7.5 million metric tons to more than 25 million metric tons annually. Inland aquaculture is producing an estimated 850,000 metric tons annually, though capture fisheries have declined. Safe drinking water has been provided to more than 75% of the rural population and more than 50% of the urban population. Sanitation coverage exceeds 30% in rural areas and 50% in urban areas. Nevertheless, despite the evolution of policies, programs, and plans, remnants of past approaches persist. Just as actions prior to 1971 were not a guide to the next three decades, so too the past 30 years may not be a guide to the next 30 years.
- 6.2 What follows are priorities for World Bank engagement. These cut across all of the water-related sectors and are intended to provide a portfolio that will assist the Government of Bangladesh in achieving its development goals in a balanced and rational manner.<sup>31</sup> The portfolio aims to address:
- **The institutional framework**, including the responsibilities of different actors; and standards for water quality and service provision (especially for the poor), for the environment, for land use management, and for construction and management of infrastructure, which affects the quantity and quality of water resources at various levels
  - **The management instruments**, including regulatory arrangements; financial instruments; standards and plans; mechanisms for effective participation of stakeholders; and knowledge and information systems that increase transparency, motivate effective water allocation, use, and conservation, and secure maintenance and physical sustainability of the water resources system
  - **The development and management of infrastructure**, for irrigation, floods, and droughts, and for water quality and source protection.
  - **The political economy of water management and reform**, in which there is particular emphasis on the distribution of benefits and costs, and on the incentives that encourage or constrain more productive and sustainable resource use and in which there is a pragmatic, sequenced and prioritized reform path.

### Towards an Effective Investment Portfolio

- 6.3 The Poverty Reduction Strategy Paper endorses the vision of the National Water Management Plan in the development of water resources and proposes policies that (a) promote rational management and optimal use of the country's water resources; (b) ensure equitable, safe, and reliable access to water for production, health, and hygiene; and (c) ensure availability of clean water in sufficient quantities for multipurpose use and preservation of the aquatic and water-dependent ecosystems. Also, in accordance with the National Water Management Plan, the strategy specifies priorities that include controlling river erosion, monsoon flooding, and saline water intrusion; improving irrigation and

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<sup>31</sup> Annex 1 summarizes the types of activities appropriate to World Bank engagement.

- drainage congestion; and mitigating drought through reexcavation of *khals* (canals) and channels. These activities would be carried out in the context of enhancing investment impacts by rationalizing existing flood control and drainage projects, promoting stakeholder participation, and multipurpose use of flood embankments.
- 6.4 The PRSP also proposes policies and institutional measures to broaden participatory governance. The strategy states unequivocally that decentralization and devolution of power will be regarded as an essential precondition for good governance and further notes that the consensus view emerging from consultations support the concept of a local government that is elected and that has financial and administrative power.
- 6.5 The proposed activities to be supported by the Bank would support the PRSP. What follows are long-term programmatic priorities for World Bank engagement, outlining programs rather than specific projects. While the Bank would engage in these issues, they constitute major investment areas and would require joint and coordinated efforts with other development partners to be effectively and adequately addressed.

***Dhaka Water Supply and Sanitation Program and Bulk Water System***

- 6.6 Dhaka is expected to become one of the world's mega cities, with the population increasing fivefold in the next 50 years from nearly 9 million in 2000 to 30 million in 2025 and 50 million by 2050. This growth will put immense pressure on all public services and infrastructure, but particularly on infrastructure needed for a safe and reliable water supply system for all inhabitants. At present, about 70% of Dhaka's population is served by the main public water supply system (around 370 deep tubewells in addition to three small surface water sources). There are also about 400 private deep tubewells serving mainly commercial users. The rest of the population, mainly the poor and disadvantaged, are dependent on local sources, many of which are unreliable and increasingly polluted.
- 6.7 A program for Dhaka will require substantial investment in rehabilitation, replacement, improvement, and extension of the city's water supply systems to substantially raise and sustain service coverage levels by 2010. This would be accomplished through a combination of public-private sector initiatives to develop major new surface water sources for bulk water supplies, coupled with improvement and expansion of the main water distribution system based on existing deep tubewells and new surface water sources. Peri-urban and poor communities will be encouraged and supported to develop and install safe handpumps and small deep tubewell-based systems. A project in Dhaka to start addressing water supply, sanitation and drainage issues is under preparation.
- 6.8 Addressing this issue affects poverty as a targeted improved water service. More than 30% of the city's inhabitants live in slums and up to 70% of the total consists of low-income households. As stated earlier, they do not have ready access to water and costs are high relative to users with formal water connections.
- 6.9 There are two main risks. The first risk is that to improve service delivery will require reforms to the organization and management of the city's water services and this will require political commitment. Among other things, the reforms should result in improved efficiency, greater involvement of the private sector, and effective consumer participation. The second risk leads from the first in that the failure to reform the organization and management of the city's water services will result in financial resources becoming increasingly constrained, on the one hand because development partners are unwilling to invest in inefficient sectors, and on the other hand because local budgets will become increasingly constrained if cost recovery is not achievable.

***Integrated Water Management of Greater Dhaka Region***

- 6.10 The rivers in and around Dhaka are heavily polluted. The major sources of this pollution are domestic and industrial wastewater discharges. Water pollution exacerbates the problem of water scarcity and inadequate drainage further increases the exposure of urban populations to the effects of polluted water. Health surveys show that over 10% of all morbidity in urban areas is attributable to environmental conditions. The population is forecast to continue to grow at a rapid rate and, as population increases, problems will become more acute.
- 6.11 The program would build on the work undertaken as part of the Dhaka Environment Project carried out under the Bangladesh Environmental Management Project supported by CIDA and would address a number of cross-cutting themes that would include urban, environment, pollution, water supply and sanitation, drainage, and flood control issues, and would provide financing to deal with these in an integrated framework, linking water resources with environmental and water and sanitation service interventions. This would include an assessment of the Eastern Bypass Project. The program would also support the development of a policy on urbanization that addresses the uncontrolled growth of the urban centers. Other major urban centers require similar programming, and the Dhaka experience would facilitate extension to these other centers.
- 6.12 The World Bank has a comparative advantage in dealing with the broad range of urban water-related problems associated with urban development. In addition to technical and financial resources, the Bank can bring to bear experience from various countries in addressing the kinds of problems encountered here.
- 6.13 Urban water management is a broad-based water resources intervention that provides regional economic benefits extending to all, including the poor. In 1996 more than 45% of the urban population was living below the poverty line and more than 25% was living in extreme poverty. The urban poor are most likely to be subject to the effects of pollution and to be living in unsanitary conditions. Female-headed households are more likely to be in severe poverty than those headed by males.
- 6.14 Implementation of this program will require strong coordination and cooperation among the government bodies responsible for the various water-related aspects of urban improvement, and there is a risk that this coordination may not reach the desired levels. The program will also require capacity building of many of the associated institutions; without effective institutional development, gains may not be sustainable.

***Chittagong Water Supply and Sanitation***

- 6.15 The government has expressed a willingness to see the Bank involved in supporting improvement of the WSS service of Chittagong. A project combining the objectives of integrated water resource management, improvement of the overall performance of the WSS utility, and expansion of the WSS service, in particular to low-income communities, is under preparation as a component of the Dhaka-Chittagong WASA project.

***Urban and Rural Water Supply and Arsenic Mitigation***

- 6.16 Arsenic contamination is threatening to undo past achievements in safe water coverage. Almost without exception, the poor suffer most since they have few means to address this issue. Arsenic contamination presents an opportunity to rethink the institutions that define the drinking water sector and, in particular, to reexamine the role of local governments and communities in the delivery of rural services. In other words arsenic mitigation projects, when integrated in an overall water supply vision, can provide a vehicle for

institutional reforms for transforming government agencies from providers of services to facilitators assisting local governments to help themselves. The Bank is now financing the Bangladesh Water Supply Program Project, which aims to broaden the stakeholder base in rural water supply provision by bringing in private sponsors and involving local governments.<sup>32</sup> Lessons learned during implementation of the Bank-financed pilot Water Supply Program Project should be built upon to design a sectorwide approach program to be supported by the Government of Bangladesh and donors. The Bank, which has been associated with arsenic mitigation programs since the late 1990s, has a comparative advantage to continue leading the effort. As with other investments in the water supply and sanitation sector, the main risk is the absence of the political will and commitment to undertake necessary policy and institutional changes.

6.17 World Bank involvement in arsenic should continue with emphasis on the following:

- Establishing innovative institutional arrangements and service delivery systems that clearly define new roles and responsibilities for user communities and local government institutions, bringing them to the forefront of activities related to planning, implementation, and management of water services, thereby mainstreaming arsenic considerations into water supply investments and contributing to sustainable investments.
- Identifying alternative arsenic-safe sources and technologies of water for drinking and cooking.
- Protecting the right of the poor to access to water supply systems.
- Building capacity at the local level to plan, implement, finance, and manage water supply services.
- Supporting the integration of groundwater management activities with water supply activities.

6.18 Arsenic contamination of groundwater constitutes a serious health threat and the poor, with limited options in terms of access to safe water, are the most susceptible. Addressing this issue affects poverty as a targeted improved water service. Not bringing to bear the skill and financial resources at the disposal of the World Bank to address the arsenic challenge would pose difficult ethical questions.

6.19 As with other investments in the water supply and sanitation subsector, the main risk is the absence of the political will and commitment to undertake necessary institutional changes – changes to ensure the devolution of authority and decisionmaking, changes to promote transparency, broadening the stakeholder base for public-private partnerships, and changes to the manner in which services are delivered.

#### ***Wetland and Beel Rehabilitation and Management***

6.20 The availability of dry season water will be the most critical issue facing the inland capture fisheries of Bangladesh. It is estimated that 50% or more of the perennial wetlands of Bangladesh have been drained, encroached upon, filled, or otherwise lost in the past 30–40 years. This has negatively impacted the poor, fish production, plant and animal biodiversity, as well as a variety of environmental services that wetlands provide.

6.21 Programs that focus on rehabilitation of formerly perennial wetlands could include reexcavation of beels or other water bodies, coupled with reconnection of those water

<sup>32</sup> For more information, visit the project website at [www.bwspp.org](http://www.bwspp.org).

- bodies with rivers and streams and the addition if required of small water control structures. Revegetating riparian corridors and reestablishing wetland forests could be a part of the program in suitable areas. Excavated areas would preserve fish and fisheries and provide fishing opportunities to the poor. Those areas immediately adjacent to the wetlands could also provide surface irrigation to farmers in the immediate area and would help in preventing further losses of *khas* (publicly owned) water bodies to encroachment. Excavation and engineering would more logically be the responsibility of local government and those government agencies concerned with this type of work. The Department of Fisheries, operating through NGOs and local government, could be responsible for overseeing the fisheries management aspects, which would include the maintenance of minimum water levels, development of community management organizations, development of fish sanctuaries, closed fishing seasons, and other aspects of community fisheries management, including alternative income generation.
- 6.22 Addressing this issue affects poverty as a targeted water resource intervention.<sup>33</sup> Given the direct connection between the poor and the wetlands of Bangladesh, and in keeping with the recommendations of the PRSP, there is a need to preserve dry season water.
- 6.23 There are two main risks to this program. Both are management related. The first is that the poor will be denied access to the fisheries resources created through the program. The second is that operation of any water control structures that are put in place are operated in the interests of a few individuals.

***Rehabilitation and Rationalization of Existing Infrastructure***

- 6.24 While the rehabilitation and rationalization of existing flood control and drainage infrastructure would adopt sound planning and design principles to ensure that technical, social, and environmental considerations are respected, it would have an overriding focus on developing sustainable systems for operating and maintaining infrastructure. Effective operation and maintenance will necessarily require strengthened involvement of local stakeholders and local government institutions in all stages of the implementation process. This is pivotal to the achievement of more effective resource utilization. In addition, the rehabilitation design needs to accommodate potential future climate change.
- 6.25 Rehabilitation and the associated challenge of sustainability are high on government's water sector agenda and are reflected in policy documents, which include the PRSP and the National Water Policy. The Bank has supported government in constructing a significant proportion of the flood control and drainage infrastructure that exists throughout Bangladesh. In some cases existing infrastructure will need to be abandoned or even destroyed to achieve a rational outcome. Infrastructure interventions also need to be coupled with early warning systems and other soft measures to support communities and the ever-burgeoning population to better cope with floods. The Bank provides a multidisciplinary perspective and a broad range of experience and, with its ability to link water issues with issues in other sectors, it can help work towards sensible outcomes. The Bank has also worked closely with government over the past decade to put in place a National Water Management Plan that advocates, as high priorities, the rehabilitation and rationalization of existing infrastructure; the introduction of institutional reforms designed to facilitate better management of all aspects of water resources; and implementation of the Systems Rehabilitation Project.

<sup>33</sup> This is a Type 2 intervention as defined in the World Bank's Water Resources Sector Strategy. Type 2 interventions are characterized as interventions that simultaneously improve resource management and improve the lives of the poor.



- 6.26 Addressing this issue affects poverty as a targeted water resource intervention. Studies have shown that incidence of poverty extends throughout all categories of farmers from the landless (less than 50 decimals of land), where poverty is as high as 64%, to large landowners (owning more than 2 ha), where poverty levels are recorded at 16%. The incidence of poverty among marginal farmers is estimated at 44% and among small farmers at 34%. Even in the medium landholding group, about 25% live below the poverty line. According to the 1996 Agricultural Census, an average 41% of the land is operated by farmers classified as small and marginal.
- 6.27 There are two important risks associated with this program. The first is that the construction of capital works will become the dominant objective. This risk is inherent when delivering services through any centralized agency, but is of even greater concern when dealing with the BWDB, as they have yet to internalize the concept of a demand-responsive approach that is people centered and has a livelihood-based emphasis. This concern is further complicated by political involvement in the delivery of services. A second risk is the inability to establish mechanisms to provide sustainable levels of financing for operation and maintenance. It is clear that government is not in a position to provide long-term operation and maintenance support to all levels of infrastructure, and alternative means of financing will include local stakeholder contributions. However, this will require a sound participatory process, with the BWDB responding to local stakeholders in a transparent and equitable manner.

***Provide Support to Policies and Programs That Expand Minor Irrigation***

- 6.28 As defined by the National Water Management Plan, the program would support minor irrigation through improvement of shallow tubewell and deep tubewell diesel engine fuel efficiencies, introduction of lower-cost pump sets for force-mode tubewells, and improved irrigation distribution to reduce losses in water-short areas. It would also support appropriate pricing policies for providing power to operate the pumps.
- 6.29 Minor irrigation based on surface and groundwater pumping will continue to be the main source of irrigation expansion and a key contributor to future agricultural growth. The present area irrigated by minor irrigation technologies could be expanded to as much as 6.7 million ha. This is consistent with the National Water Policy, which promotes this approach to achieving agricultural water use objectives. The World Bank's historical involvement with minor irrigation provides it with a strong advantage in dealing with the challenges associated with supporting the sector. The Bank is also strongly positioned to address the unknowns associated with arsenic entering the food chain because of the Bank's ongoing involvement in managing and coordinating the response to groundwater arsenic in rural domestic water supplies. Promotion of policies and programs that expand minor irrigation requires simultaneous engagement on a variety of issues such as subsidies, arsenic, resource availability, conjunctive use, and monitoring, and these need to be woven into an approach that promotes broader economic development; for this the Bank is uniquely positioned.
- 6.30 Addressing this issue will have a broad, regionwide impact on poverty. As reflected in the PRSP, the government's priority is to develop, through accelerated agriculture growth, rural areas where most of the poor people live. It acknowledges the past contribution of minor irrigation to this end and proposes to expand these achievements.
- 6.31 A risk to this program is that government will need to respond preemptively to fears, based on incomplete science, of arsenic entering the food chain. Other risks are associated with the availability of electricity to power electric pump sets, and the purchase price and associated operating costs of diesel pump sets.

***Assist with Studies to Better Understand the Major Rivers***

- 6.32 The studies would contribute to a better understanding of development prospects set within the context of international water-sharing issues. This would include a full-scale assessment of human and environmental impacts, establishing a scientific basis for determining environmental flows, reviewing and updating the Master Plan for Major River Training in light of recent experience, improving the exchange of information between riparian countries, as well as reviewing the potential for and feasibility of developing major infrastructure on these rivers. In light of the limited water available in the Ganges River, these studies would also serve to broaden the country's development perspective to include both the Ganges, Brahmaputra and Meghna basins.
- 6.33 The studies serve a variety of purposes. They would seek common interests on the riparian rivers as a basis for building on and promoting regional cooperation. Among other things, a scientifically based assessment of environmental flows is necessary to promote understanding between the upper and lower riparian countries in terms of the impact of sharing agreements. The National Water Policy advocates development of the main rivers for multipurpose use. If the development of, or large-scale abstraction from, the main rivers is required to expand and sustain food production and environmental systems beyond what can be achieved through minor irrigation and the development of surface water within Bangladesh, the long gestation period of such major interventions mandate that work to this end be initiated.
- 6.34 The World Bank is well placed to support these studies. The issues are complex and the Bank has at its disposal a range of expertise it can bring to bear. Nevertheless, international water management is intrinsically difficult and controversial and the Bank cannot unilaterally intervene on controversial proposals (see annex 3 which spells out the Bank's operational policy on international waterways). The Bank's investment and influence in India is relatively small and it can only act as an impartial international arbiter when all riparians ask it to act. A risk is also associated with the availability and quality of data. As stated elsewhere, the data necessary to permit rational planning has been classified as confidential and this lack of transparency has hampered investment in the past and may well continue to do so in the future.

***Support Efforts to Manage River Erosion***

- 6.35 Riverbank erosion and channel instability hampers development since the permanent risk of erosion prevents long-term planning. Riverbank erosion destroys about 10,000 ha of land on an annual basis, causing significant economic and social impacts. To address this problem, the National Water Policy requires that government undertakes surveys and investigations to develop and implement master plans for river training, and erosion control works for the preservation of scarce land and the prevention of landlessness and pauperization.
- 6.36 Work of this nature is inherently risky, expensive, and carries a high maintenance requirement. Investments in river erosion management would be based on the updated Master Plan for Major River Training. While the BWDB is developing considerable experience in implementing river erosion protection works, experience with the ADB-financed Jamuna-Meghna River Erosion Management Project suggests that a strong institutional support component will be required to buttress gains that are being made through ADB involvement.
- 6.37 The Bank has long been involved with erosion protection work along the Brahmaputra River, including Sirajgonj town protection, Chandpur town protection, and bank

- protection for the Jamuna multipurpose bridge. In addition to a strong knowledge base, the Bank brings with it the financial resources to address this difficult issue.
- 6.38 This is a poverty-targeted water resource intervention. Social impacts of erosion include increased impoverishment as individuals and families lose their land, their income, their security, and finally are completely displaced. Their social and economic status prior to being subjected to erosion is largely irrelevant, as the erosion destroys any permanent assets.
- 6.39 Where protection is provided only for agricultural land, river erosion protection is costly and uneconomical. Lower-cost erosion measures have not yet been proven successful on rivers of the magnitude of those in Bangladesh. Further attempts to test novel lower-cost measures will be, by definition, somewhat experimental in nature. Quality of construction will be decisive: if poor construction quality leads to failure, technically viable solutions could be erroneously invalidated.

### ***Gorai River Restoration Project***

- 6.40 The southwest region is being affected by a shortage of fresh water; increase in salinity of the surface water, groundwater, and soils; deterioration of the Sundarban ecosystems; sedimentation of the rivers; reduced crop and fish production; and reduced navigability. Increasing the dry season discharge of the Gorai River would increase the volume of fresh water entering the southwest region and mitigate some of the adverse impacts.
- 6.41 The Government of the Netherlands and the Bank provided assistance to the Government of Bangladesh in the late 1990s to determine the feasibility of dredging the Gorai River from its offtake at the Ganges to the railway bridge about 16 km downstream. This first stage consisted of dredging a pilot channel followed by two consecutive years of maintenance dredging. Subsequently, this pilot channel largely infilled with sediment. The feasibility study based on the pilot dredging concluded that restoration of the Gorai River offtake was feasible through a combination of continuous dredging and structures, including a flow divider, to divert Ganges flows into the Gorai River. The study considered five infrastructure options ranging in cost from an estimated US\$110 million to US\$198 million.
- 6.42 The Bank has a comparative advantage with respect to the Gorai River Restoration Project. The Bank has in place a partnership agreement with the Government of the Netherlands and both have had prior involvement in the project by assisting in the preparation of the feasibility study. The project represents a complex mix of technical and institutional issues that require a multidisciplinary approach and the Bank has a strong comparative advantage in terms of performance, knowledge, and financial resources as well as the ability to integrate these.
- 6.43 This broad, regionwide intervention would provide national and regional economic benefits extending to all, including the poor. Within the coastal zone, which forms a significant proportion of the region, the functionally landless comprise more than 53% of the population. This is slightly higher than the national average. An assessment that associates poverty with caloric intake leads to the result that 52% of the coastal population are absolute poor and 25% are extreme poor. Extreme calorie intake poverty is high (above 30%) in Bagerhat District. The rejuvenation of natural common property resources that can occur with the restoration of the Gorai River is expected to reduce the extent of the poverty in the region.
- 6.44 The risks associated with the implementation of the project include: (a) the volume of water available in the Ganges River for diversion into the Gorai River may be

insufficient; and (b) the operation of the gates at Farakka has led to a steeper recession limb of the hydrograph with the result that there are more residual bars and pools that restrict free channel flow, and it may not be possible to prevent the deep water channel of the Ganges from migrating to the northern bank of the river, which would result in no water being discharged down the Gorai.

### ***Inland Water Transport***

- 6.45 Inland waterways are an important part of Bangladesh's integrated transport network. A Policy Note is currently being prepared for analysis of how the Bank could reengage in this sector.

### **Related Interventions**

- 6.46 What follows are interventions that are considered as having a degree of priority, that relate to the initiatives that the Bank could undertake, but in which the Bank does not have a comparative advantage. Nevertheless, in recognition of the necessity of these interventions, the Bank will promote the implementation of these initiatives.

### ***Inventory and Asset Management Plan for Water Supply and Sanitation Sector***

- 6.47 Much of the water supply and sanitation infrastructure in Bangladesh is either poorly maintained due to lack of investment in operation and maintenance or is reaching the end of its useful life. Prior to further investment in these systems, a better understanding of their present condition and performance is required.
- 6.48 An Inventory and Asset Management Plan would comprise a two-year technical assistance project to formulate a 25-year perspective plan for the major towns of Dhaka, Chittagong, Khulna, and Rajshahi. The plan would assess the water resources availability and plan for future needs. Part of the plan could also be financed under the proposed Dhaka Urban and Chittagong Water Supply and Sanitation Project. A practicable investment program could be adopted by the World Bank and other donors based on the plans for the respective cities. The Bank has a strong interest in such plans since their subsequent implementation will require substantial financial and technical resources and it is in this implementation phase that the Bank can bring significant resources to bear. Whilst these may be provided with the cooperation and support of a number of Bangladesh's development partners, the Bank is able to contribute a significant proportion of both and is experienced in organizing a coordinated assault on intractable issues.
- 6.49 Addressing this issue affects poverty as a targeted improved water service intervention.<sup>34</sup> While there has been investment in water and sanitation over the past two decades, services in urban areas have eluded the poor and the very poor with the result that access to water is both difficult and expensive. NGOs, despite targeting services to the very poor, have found them difficult to reach. It is critical that the plan carefully addresses this issue and that subsequent investments are initiated with a poverty focus.
- 6.50 The primary risk associated with undertaking the Inventory and Asset Management Plan is the absence or loss of political willingness and commitment to support potentially significant reforms in both the structure of the institutions and the manner in which they carry out their day-to-day business. However, reforms will be absolutely necessary if

<sup>34</sup> This is a Type 4 intervention as defined in the World Bank's Water Resources Sector Strategy. Type 4 interventions are characterized as interventions that provide targeted services to the poor.

services are to be provided to rapidly growing urban populations and the outcome of a failure to deliver these services is potentially catastrophic.

### ***Strengthen Fisheries Statistical Monitoring***

- 6.51 As in all forms of management, fisheries decision makers require reliable data in order to evaluate the state of the fishery and predict the effects of management controls, particularly given the risk and uncertainty associated with fisheries management compared to other food sectors. Most authorities within and outside the Bangladesh fisheries sector agree that current statistics are not reliable and do not reflect the actual state of the fisheries. In every area of the fishery – water areas, aquaculture production, and inland and marine catches – there is a lack of reliable information.
- 6.52 Improving the fisheries database involves spreading the ownership of the data and involving universities, foreign research institutions, NGOs, the private sector, and others in civil society in the collection and assessment of fisheries information. The long-term objective of a program in this area is not only to improve management decisions but also to contribute to improved policies so that the sustainable use of the country's aquatic resource base is assured. The purpose of the intervention would be to develop and implement a sustainable management information system in support of planning and management of all fisheries-related information.
- 6.53 Addressing this issue will have a broad, regionwide impact on poverty.<sup>35</sup> Many millions of the poorest people in Bangladesh have essential livelihood dependence on fisheries. They are increasingly vulnerable to threats to the resource and the growing conflicts over the control of the resource. More reliable data is expected to yield better decisions leading to sustainable use of the fisheries resource.
- 6.54 The main risks associated with this program are that the data, having been collected, is not properly archived in a universally accessible manner and that the database will not be widely available.

### **Medium- and Long-Term Vision and the FY06–09 CAS Period**

- 6.55 The challenges and priorities outlined above require a long-term vision and many contributors in order to be adequately addressed.
- 6.56 As outlined at the beginning of this document, the World Bank's Water Resources Sector Strategy (World Bank 2003) emphasized how water resources development and management are both critical for achieving growth and poverty reduction in a number of different and complementary ways. An appropriate strategy is a blend of four types of interventions: operating on the resource and on water services, intervening in a broad, systemic manner, and directly targeting the poor. This strategy mirrors the CAS objectives, which simultaneously seek to improve the investment climate and empower the poor, with governance as a core and overarching issue.
- 6.57 Table 4 summarizes programmatic areas of support to the water sector by the Bank from the perspective of the poverty impact of these interventions. The strategic priorities for World Bank engagement outlined in the table reflect a long-term vision within a broad intersectoral perspective, as mapped out in the CWRAS and the Bangladesh National Water Policy. They provide a balanced approach to underpin growth through providing

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<sup>35</sup> This is a Type 1 intervention as defined in the World Bank's Water Resources Sector Strategy. Type 1 interventions are characterized as broad, systematic impacts that make water-related infrastructure an essential building block for regional and national development.

vital broad-based infrastructure and reform, as well as targeting the poor at the local level.

**Table 4.** Medium- to Long-Term Programmatic Areas for Support to Water-Related Activities

	<b>Broad interventions with overall poverty reduction impacts</b>	<b>Poverty-targeted interventions</b>
<b>Interventions affecting water resources, development and management</b>	<p><i>Type 1:</i></p> <p><b>Broad nationwide water resources interventions</b></p> <p>Integrated water management of greater Dhaka region</p> <p>Rehabilitation and rationalization of existing flood control/drainage</p> <p>Major river studies</p> <p>River erosion management</p> <p>Gorai River restoration</p> <p>Inland waterways</p>	<p><i>Type 2:</i></p> <p><b>Targeted water resources interventions</b></p> <p>Wetland and beel rehabilitation and management</p>
<b>Interventions affecting service sector delivery (e.g. water and sanitation, irrigation, inland water transport)</b>	<p><i>Type 3:</i></p> <p><b>Broad service delivery reforms</b></p> <p>Dhaka and Chittagong water supply, sanitation and drainage program</p>	<p><i>Type 4:</i></p> <p><b>Targeted services</b></p> <p>Improved rural, urban, peri-urban service delivery (including continued support to address arsenic contamination)</p> <p>Expansion of minor irrigation</p> <p>Support to improve management of existing surface water irrigation schemes</p> <p>Community-based fisheries</p>

## Conclusion

6.58 Traditionally, the different water-related sectors are treated in isolation, by governments, development partners, academics, and society at large. This approach ignores the linkages between the underlying water resource base and the service sectors. Water availability, be it too much or too little, and water quality set important parameters for domestic, agricultural, and industrial water supply, and therewith have a major impact on the development opportunities of a country. Bangladesh is no exception.

- 6.59 The effort to develop a comprehensive Country Water Resources Assistance Strategy has been an attempt to bring a comprehensive, integrated approach to bear, and it is hoped that it will support a more strategic – and therefore more effective – engagement by the World Bank in water-related sectors in Bangladesh. In addition, the process of arriving at this CWRAS, which involved several stakeholder workshops and consultations, will continue to strengthen the already existing basis for coordinated and joint efforts by the Bank and the development partners in assisting Bangladesh in the further development of its water sector.

## Annex 1. Types of Activities for World Bank Engagement: Long Term

Initiative	Investment lending	Analytical work	Technical assistance	Global Environment Facility
Dhaka and Chittagong water supply and sanitation	√	√	√	
Urban and rural water supply and arsenic mitigation	√		√	
Integrated water management of greater Dhaka region	√		√	
Wetland and beel rehabilitation and management	√			
Long-term commitment to rehabilitate and rationalize existing flood control and drainage infrastructure	√		√	
Provide support to policies and programs that expand minor irrigation			√	
Assist with studies to better understand the major rivers		√	√	√
Support efforts to manage river erosion	√		√	
Gorai River Restoration Project	√		√	
Inland water transport	√	√		



## Annex 2. Relationship between Bank Portfolio and National Water Management Plan

MIS ref	NWMP Program Name	CWRAS Supported
<b>Cluster: Institutional Development</b>		
ID 001	Local Government Needs Assessment for Water Management	<input type="checkbox"/>
ID 002	Independent Regulatory Bodies for Water Supply and Sanitation Service Sector	<input checked="" type="checkbox"/>
ID 003	FCD and FCD/I Management Rationalisation	<input checked="" type="checkbox"/>
ID 004	BWDB Regional and Sub-regional Management Strengthening	<input checked="" type="checkbox"/>
ID 005	Local Government Capacity Building for Water Management	<input type="checkbox"/>
ID 006	WARPO Capacity Building	<input checked="" type="checkbox"/>
ID 007	Department of Environment Capacity Building	<input type="checkbox"/>
ID 008	Disaster Management Bureau Capacity Building	<input type="checkbox"/>
ID 009	Department of Meteorology Capacity Building	<input type="checkbox"/>
ID 010	BWDB Capacity Building	<input checked="" type="checkbox"/>
<b>Cluster: Enabling Environment</b>		
EE 001	Support to the Preparation of New Legislation	<input type="checkbox"/>
EE 002	Field Testing of Participatory Management Models	<input checked="" type="checkbox"/>
EE 003	Water Resources Legislation – Preparation of Supporting Ordinances	<input type="checkbox"/>
EE 004	Project Preparation Procedures – Guidelines and Manuals	<input checked="" type="checkbox"/>
EE 005	Regulatory and Economic Instruments	<input checked="" type="checkbox"/>
EE 006	Field Testing and Finalization of the Guidelines for Participatory Water Management	<input type="checkbox"/>
EE 007	NWRD Improved Data Collection and Processing Facilities	<input type="checkbox"/>
EE 008	Water Resources Management Research and Development Studies	<input type="checkbox"/>
EE 009	Water Resources Management Long Term Research and Development	<input type="checkbox"/>
EE 010	Raising Public Awareness in the Wise Use and Management of Water	<input type="checkbox"/>
EE 011	Private Sector Participation in Water Management	<input checked="" type="checkbox"/>
EE 012	Water and Environment Funds	<input type="checkbox"/>
EE 013	Alternative Financing Methods for Water Management	<input checked="" type="checkbox"/>
<b>Cluster: Main Rivers</b>		
MR 001	Main Rivers Studies and Research Programmes	<input checked="" type="checkbox"/>
MR 002	Main Rivers Abstraction Projects	<input type="checkbox"/>
MR 003	Ganges Barrage and Ancillary Works	<input type="checkbox"/>
MR 004	Meghna Barrage and Ancillary Works	<input type="checkbox"/>
MR 005	Other Barrages and Ancillary Works	<input type="checkbox"/>
MR 006	Regional River Management and Improvement	<input type="checkbox"/>
MR 007	Ganges Dependent Area Regional Surface Water Distribution Networks	<input checked="" type="checkbox"/>
MR 008	North East and South East Regional Surface Water Distribution Networks	<input type="checkbox"/>
MR 009	North Central and North West Regional Surface Water Distribution Networks	<input type="checkbox"/>
MR 010	Main Rivers Erosion Control at Selected Locations	<input checked="" type="checkbox"/>
MR 011	River Dredging for Navigation	<input type="checkbox"/>
MR 012	Hydropower Development and Upgrading	<input type="checkbox"/>

MIS ref	NWMP Program Name	CWRAS Supported
<b>Cluster: Towns and Rural Areas</b>		
TR 001	Urban Arsenic Mitigation	<input checked="" type="checkbox"/>
TR 002	Rural Arsenic Mitigation	<input checked="" type="checkbox"/>
TR 003	Large and Small Town Water Supply and Distribution Systems	<input checked="" type="checkbox"/>
TR 004	Rural Water Supply and Distribution Systems	<input checked="" type="checkbox"/>
TR 005	Large and Small Town Sanitation and Sewerage Systems	<input checked="" type="checkbox"/>
TR 006	Rural Sanitation	<input type="checkbox"/>
TR 007	Large and Small Town Flood Protection	<input type="checkbox"/>
TR 008	Large and Small Town Stormwater Drainage	<input type="checkbox"/>
<b>Cluster: Major Cities</b>		
MC 001	Inventory and Asset Management Plan of the Water Supply and Sanitation Sector	<input checked="" type="checkbox"/>
MC 002	Dhaka Bulk Water Supply and Distribution Systems	<input checked="" type="checkbox"/>
MC 003	Chittagong Bulk Water Supply and Distribution Systems	<input type="checkbox"/>
MC 004	Khulna Bulk Water Supply and Distribution Systems	<input type="checkbox"/>
MC 005	Rajshahi Bulk Water Supply and Distribution Systems	<input type="checkbox"/>
MC 006	Dhaka Sanitation and Sewerage Systems	<input checked="" type="checkbox"/>
MC 007	Chittagong Sanitation and Sewerage Systems	<input checked="" type="checkbox"/>
MC 008	Khulna Sanitation and Sewerage Systems	<input type="checkbox"/>
MC 009	Rajshahi Sanitation and Sewerage Systems	<input type="checkbox"/>
MC 010	Dhaka Flood Protection	<input type="checkbox"/>
MC 011	Dhaka Stormwater Drainage	<input checked="" type="checkbox"/>
MC 012	Chittagong Flood Protection	<input type="checkbox"/>
MC 013	Chittagong Stormwater Drainage	<input checked="" type="checkbox"/>
MC 014	Khulna Flood Protection	<input type="checkbox"/>
MC 015	Khulna Stormwater Drainage	<input type="checkbox"/>
MC 016	Rajshahi Flood Protection	<input type="checkbox"/>
MC 017	Rajshahi Stormwater Drainage	<input type="checkbox"/>
<b>Cluster: Disaster Management</b>		
DM 001	Cyclone Shelters and Killas	<input type="checkbox"/>
DM 002	Bari-level Cyclone Shelters	<input type="checkbox"/>
DM 003	Flood Proofing in the Charlands and Haor Basin	<input type="checkbox"/>
DM 004	National, Regional and Key Feeder Roads - Flood Proofing"	<input type="checkbox"/>
DM 005	Railway Flood Proofing	<input type="checkbox"/>
DM 006	Supplementary Irrigation and Drought Proofing of Rural Water Supplies	<input type="checkbox"/>

<b>MIS ref</b>	<b>NWMP Program Name</b>	<b>CWRAS Supported</b>
<b>Cluster: Agriculture and Rural Management</b>		
AW 001	Promotion of Expanded Minor Irrigation and Improved On-farm Water Management	<input checked="" type="checkbox"/>
AW 002	Improved Performance of Existing Public Surface Water Irrigation Schemes	<input checked="" type="checkbox"/>
AW 003	New Public Surface Water Irrigation Schemes	<input type="checkbox"/>
AW 004	New Public Deep Tubewell Irrigation Schemes	<input type="checkbox"/>
AW 005	Improved Water Management at Local Government Level	<input type="checkbox"/>
AW 006	Improved Water Management at Community Level	<input type="checkbox"/>
AW 007	Rationalization of Existing FCD Infrastructure	<input checked="" type="checkbox"/>
AW 008	Land Reclamation, Coastal Protection and Aforestation"	<input type="checkbox"/>
<b>Cluster: Environment and Aquatic Resources</b>		
EA 001	National Pollution Control Plan	<input type="checkbox"/>
EA 002	National Clean-up of Existing Industrial Pollution	<input checked="" type="checkbox"/>
EA 003	National Water Quality Monitoring	<input checked="" type="checkbox"/>
EA 004	National Fisheries Master Plan	<input type="checkbox"/>
EA 005	National Fish Pass Program	<input type="checkbox"/>
EA 006	Unspecified Regional Programs	<input type="checkbox"/>
EA 007	Improved Water Management in the Haor Basins of the North East Region	<input type="checkbox"/>
EA 008	Environmentally Critical Areas and Integrated Wetland Management	<input checked="" type="checkbox"/>
EA 009	Improved Water Management and Salinity Control in the Sundarbans	<input checked="" type="checkbox"/>
EA 010	Public Awareness Raising and Empowerment in respect of Environmental Issues	<input type="checkbox"/>

## **Annex 3. World Bank Operational Policy (OP 7.50) on International Waterways**

### **Applicability of Policy**

1. This policy applies to the following types of international waterways:
  - (a) any river, canal, lake, or similar body of water that forms a boundary between, or any river or body of surface water that flows through, two or more states, whether Bank [1](#) members or not;
  - (b) any tributary or other body of surface water that is a component of any waterway described in (a) above; and
  - (c) any bay, gulf, strait, or channel bounded by two or more states or, if within one state, recognized as a necessary channel of communication between the open sea and other states--and any river flowing into such waters.
  
2. This policy applies to the following types of projects:
  - (a) hydroelectric, irrigation, flood control, navigation, drainage, water and sewerage, industrial, and similar projects that involve the use or potential pollution of international waterways as described in para. 1 above; and
  - (b) detailed design and engineering studies of projects under para. 2(a) above, including those to be carried out by the Bank as executing agency or in any other capacity.

### **Agreements/Arrangements**

3. Projects on international waterways may affect relations between the Bank and its borrowers and between states (whether members of the Bank or not). The Bank recognizes that the cooperation and goodwill of riparians is essential for the efficient use and protection of the waterway. Therefore, it attaches great importance to riparians' making appropriate agreements or arrangements for these purposes for the entire waterway or any part thereof. The Bank stands ready to assist riparians in achieving this end. In cases where differences remain unresolved between the state proposing the project (beneficiary state) and the other riparians, prior to financing the project the Bank normally urges the beneficiary state to offer to negotiate in good faith with the other riparians to reach appropriate agreements or arrangements.

### **Notification**

4. The Bank ensures that the international aspects of a project on an international waterway are dealt with at the earliest possible opportunity. If such a project is proposed, the Bank requires the beneficiary state, if it has not already done so, formally to notify the other riparians of the pro-posed project and its Project Details (see [BP 7.50, para. 3](#)). If the prospective borrower indicates to the Bank that it does not wish to give notification, normally the Bank itself does so. If the borrower also objects to the Bank's doing so, the Bank discontinues processing of the project. The executive directors concerned are informed of these developments and any further steps taken.

5. The Bank ascertains whether the riparians have entered into agreements or arrangements or have established any institutional framework for the international waterway concerned. In the latter case, the Bank ascertains the scope of the institution's activities and functions and the status of its involvement in the proposed project, bearing in mind the possible need for notifying the institution.

6. Following notification, if the other riparians raise objections to the proposed project, the Bank in appropriate cases may appoint one or more independent experts to examine the issues in accordance with [BP 7.50, paras. 8-12](#). Should the Bank decide to proceed with the project despite the objections of the other riparians, the Bank informs them of its decision.

### **Exceptions to Notification Requirement**

7. The following exceptions are allowed to the Bank's requirement that the other riparian states be notified of the proposed project:

(a) For any ongoing schemes, projects involving additions or alterations that require rehabilitation, construction, or other changes that in the judgment of the Bank (i) will not adversely change the quality or quantity of water flows to the other riparians; and (ii) will not be adversely affected by the other riparians' possible water use. This exception applies only to minor additions or alterations to the ongoing scheme; it does not cover works and activities that would exceed the original scheme, change its nature, or so alter or expand its scope and extent as to make it appear a new or different scheme. In case of doubt regarding the extent to which a project meets the criteria of this exception, the executive directors representing the riparians concerned are informed and given at least two months to reply. Even if projects meet the criteria of this exception, the Bank tries to secure compliance with the requirements of any agreement or arrangement between the riparians.

(b) Water resource surveys and feasibility studies on or involving international waterways. However, the state proposing such activities includes in the terms of reference for the activities an examination of any potential riparian issues.

(c) Any project that relates to a tributary of an international waterway where the tributary runs exclusively in one state and the state is the lowest downstream riparian, unless there is concern that the project could cause appreciable harm to other states.

### **Presentation of Loans to the Executive Directors**

8. The Project Appraisal Document (PAD) for a project on an international waterway deals with the international aspects of the project, and states that Bank staff have considered these aspects and are satisfied that

(a) the issues involved are covered by an appropriate agreement or arrangement between the beneficiary state and the other riparians; or

(b) the other riparians have given a positive response to the beneficiary state or Bank, in the form of consent, no objection, support to the project, or confirmation that the project will not harm their interests; or

(c) in all other cases, in the assessment of Bank staff, the project will not cause appreciable harm to the other riparians, and will not be appreciably harmed by the other riparians' possible water use. The PAD also contains in an annex the salient features of any objection and, where applicable, the report and conclusions of the independent experts.

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1. "Bank" includes IDA; "loans" include credits; and "project" includes all projects financed under Bank loans or IDA credits, but does not include development policy lending programs supported under Bank loans and IDA credits; and "borrower" refers to the member country in whose territory the project is carried out, whether or not the country is the borrower or the guarantor.

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