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PEOPLE'S REPUBLIC OF BANGLADESH
MINISTRY OF IRRIGATION, WATER DEVELOPMENT & FLOOD CONTROL
FLOOD PLAN COORDINATION ORGANIZATION

DHAKA INTEGRATED FLOOD PROTECTION
FAP-8B

A.D.B. T.A. NO. 1318-BAN .



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COMBINED
INTERIM REPORT NO. 2
and
DRAFT FINAL REPORT

AUGUST 1991



Submitted by:

LOUIS BERGER INTERNATIONAL, INC.

In Association With:

Associated Consulting Engineers (Bangladesh) Ltd.
Desh Upodesh Ltd.
Technoconsult International Ltd.

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Submitted by:

LOUIS BERGER INTERNATIONAL, INC.

In Association With:

Associated Consulting Engineers (Bangladesh) Ltd.
Desh Upodesh Ltd.
Technoconsult International Ltd.

*Dhaka Integrated Flood Protection
Project*

ADB TA No. 1318-BAN
Ministry of Irrigation, Water
Development and Flood Control



Louis Berger International, Inc.

In association with
Associated Consulting Engineers Ltd.
Desh Upodesh Limited.
Technoconsult International Ltd.

Memo No.: BY399\DIFP\ADB\030991-232

03 September, 1991

Asian Development Bank
P.O. Box 789
Manila, Philippines

Attn. : Mr. P.K. Thomas
Manager, IFSI

Subject: T.A. No. 1318-BAN, Dhaka Integrated Flood Protection Project
Interim Report No. 2 and Draft Final Report, August 1991

Dear Mr. Thomas,

In accordance with Section 4.01 of the Contract for Consultants Services we are pleased to herewith submit five copies of our combined *Interim Report No. 2 and Draft Final Report*, presenting the feasibility details for the flood protection, drainage and environmental improvement components selected for the Project.

The Project which is recommended and analyzed herein conforms to the scope and costs which were discussed and agreed by the Government and the Bank during the Fact Finding Mission. Priorities and scheduling are currently being refined in cooperation with the Implementing Agencies, but based on the analyses contained in this report it is not expected that of the any program adjustments will have a significant effect on the Project feasibility. All final adjustments and comments by the Government and the Bank will be incorporated into the *Final Report*.

With best regards,

Yours truly,

R.D. Berlin, P.Eng.
Project Manager

enc. : As listed
c.c. : Mr. A.M.M. Nurul Huq, Chief Engineer, FPCO (with 50 copies)
Dr. Asad Ali Shah, Sr. Urban Development Specialist, ADB
Mr. K.H. Talukdar, Project Officer, ADB-BRO

ABBREVIATIONS

ADB	-	Asian Development Bank
AEC	-	Atomic Energy Commission
BWDB	-	Bangladesh Water Development Board
CUS	-	Center for Urban Studies
DCC	-	Dhaka City Corporation
DEPC	-	Department of Environment and Pollution Control
DMA	-	Dhaka Metropolitan Area
DOE	-	Department of Environment
DOF	-	Department of Fisheries
DPHE	-	Department of Public Health Engineering
DWASA	-	Dhaka Water Supply and Sewerage Authority
EQS	-	Environment Quality Standards
FAP	-	Flood Action Plan
FPCO	-	Flood Plan Co-ordination Organization
HBFC	-	House-Building Finance Corporation
IDA	-	International Development Association (of the World Bank)
IPH	-	Institute of Public Health
JICA	-	Japan International Corporation Agency
LGD	-	Local Government Division
LGEB	-	Local Government Engineering Bureau
MEF	-	Ministry of Environment and Forest
MIWDFC	-	Ministry of Irrigation, Water Development & Flood Control
MLGRDC	-	Ministry of Local Government, Rural Development and Cooperatives
MOI	-	Ministry of Information
MOW	-	Ministry of Works
NGO	-	Non-Government Organization
PC	-	Planning Commission
PHED	-	Public Health Engineering Department
PIU	-	Project Implementation Unit
PMU	-	Project Management Unit
PWD	-	Public Works Department
RAJUK	-	Rajdhani Unnayan Kattripaka (Capital Development Authority)
SOB	-	Survey of Bangladesh
SPARRSO	-	Bangladesh Space Research and Remote Sensing Organization
UDD	-	Urban Development Directorate
UNCHS	-	United Nations Centre for Human Settlements
UNDP	-	United Nations Development Programme
UNICEF	-	United Nations International Childrens Education Fund
WHO	-	World Health Organization

Physical Units

Cusec	-	Cubic meters per second	m	-	meter
ha	-	hectares	mld	-	million liters per day
kl	-	kilo-liters(thousand liters)	mm	-	millimeter
km	-	kilometer	sq m	-	square meter
l	-	liter	sq km	-	square kilometer

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DRAFT FINAL REPORT
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1.0 INTRODUCTION

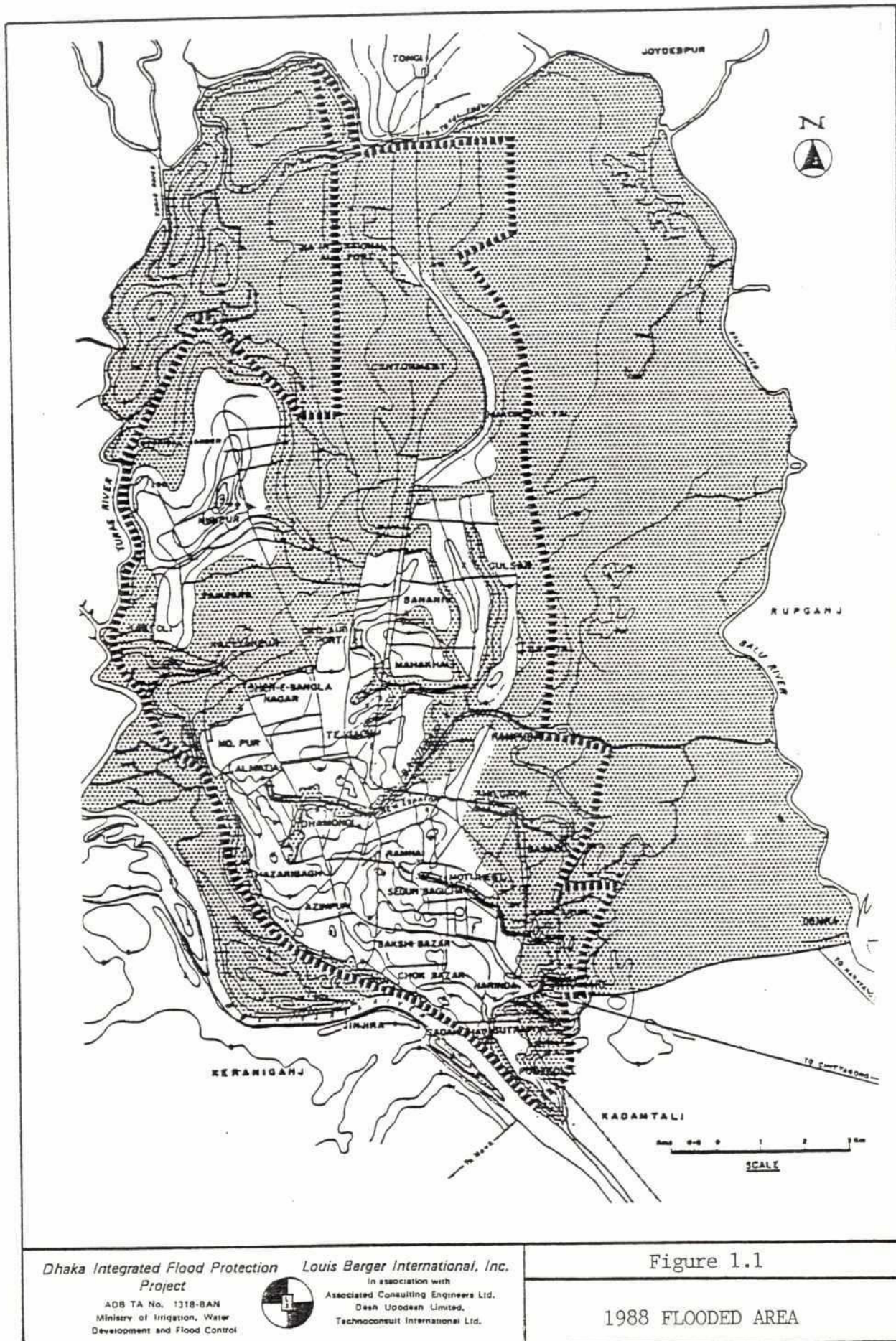
1.1 Background

During the monsoons of 1987 and 1988, Bangladesh suffered two of the most serious floods on record. Vast areas of the country, including the capital city of Dhaka with a population of about 4.8 million people, were flooded to an unprecedented degree with flood levels 1.5 meters higher than normal for periods of up to four weeks. In Dhaka city alone it is estimated that about 200 sq km, or 77% of the total area of 260 sq km, were submerged to depths ranging between 0.3 to over 4.5 meters (see Figure 1.1), and that about 2.5 million people, or 60% of the city population, were directly affected by these floods. City life was totally disrupted during this period. Although there are no comprehensive records of the economic value of losses due to flooding, JICA has estimated that the equivalent 1990 damage of a normal annual flood would be about Taka 1,400 million, and of a 1988 scale flood (70 year recurrence period) would be Taka 10,100 million.

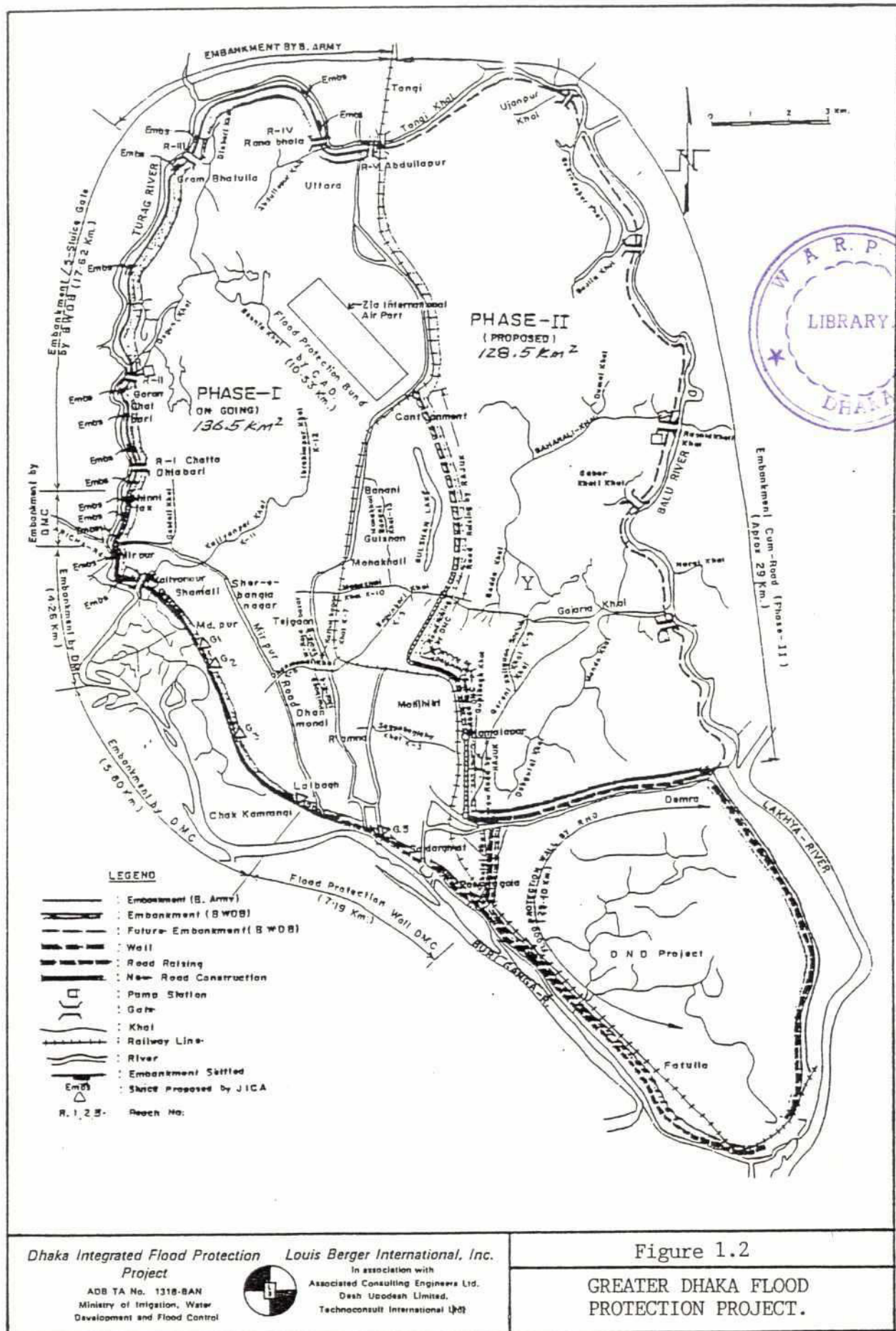
In the wake of these floods, in October 1988 the Government of Bangladesh (GOB) established a Committee for Flood Control and Drainage of Greater Dhaka, with the primary objective of preparing a flood control plan for the Greater Dhaka Metropolitan area, based primarily on the 1987 JICA study on storm drainage system improvements for Dhaka City, and the 1988 "Jansen Report" on causes of the 1988 flood and recommended solutions. In January 1989 the Committee submitted a detailed scheme for phased investments in flood protection and drainage for Dhaka, Tongi, Narayanganj and Savar, which was approved by the Government in March 1989.

Figure 1.2 shows the recommended program for Dhaka. In view of the high priority assigned to the Dhaka protection scheme, the Government immediately initiated Phase I of the recommended works on a crash program basis using their own resources. These works, which were designed to provide protection to about 136.5 sq km in the highly urbanized westerly part of the city, included construction of about 30 km of embankment and 7 km of flood protection wall along the westerly perimeter of the city, complemented by about 2 km of new roads, 8.5 km of road raising to the east, pipe sluices, cleaning and repair of internal drainage khals and sewerage systems. Additional works taken up at the same time included construction of a flood protection bund around Zia International Airport and 30 km of flood protection wall around the Dhaka-Narayanganj-Demra zone to the south of the city.

Implementation of the program was a coordinated effort involving the BWDB, DCC, DWASA, RAJUK, CAAB and the Army, with the BWDB taking the lead role. The crash program was initiated in March 1989, and work taken up under the program is now nearly, but not all, complete. Along the west side of the Phase 1 area all embankments have been constructed and are being maintained, six sluices are being or have been constructed, and 5.2 km out of 8.1 km of flood protection walls have been done. Along the east side, all road-cum-embankment raising has been completed.



Source : JICA Storm Water Updating Study, February 1990



Source : BWDB Synopsis of Flood Protection and Drainage Project, June 1990

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However, the work on flood protection carried out by the Government using its own resources was started without a proper feasibility study and site investigations, and construction was done under extremely tight time constraints without adequate quality control or adequate scheduling and coordination of interlinking activities. As a result, there have been some serious failures and erosion of large sections of the embankment, drainage congestion due to blocking of the natural drainage paths, and objections to the construction from taxpayers in the old Dhaka area where businesses are seen to be affected. The flood control and drainage system is not yet complete nor fully operative. In order to provide a minimum acceptable level of protection for the western part of Dhaka, and for benefits to be realized and the system to be made secure, it is essential that construction deficiencies be corrected, additional flood protection and drainage venting works be completed, and improvements to the internal drainage system be done. This is planned under the proposed Project.

The overall flood protection program for Dhaka involves remedial works and completion of the westerly embankment (30 km), construction of the easterly embankment (29 km), internal embankments and road raising, construction of additional sluices and pump stations, and improvement of storm water drainage. The program of flood protection has been developed in close coordination with the drainage master planning study under JICA and the North-Central Regional Study being assisted by EEC and France, and provides adequate flexibility to incorporate needed modifications at the detailed engineering stages. The close cooperation that has been established with donor-assisted activities that have an impact on the flood protection scheme is planned to be maintained through the FPCO, and the compatibility of proposed investments with master planning and regional studies will be reconfirmed prior to undertaking any investments.

The cost of an integrated flood protection program for all of Dhaka City to protect the city from floods of 100 year frequency is estimated at over \$450 million. In view of the large investment requirements, the flood protection program will need to be phased and implemented over a period of 10 to 15 years. In planning the flood protection program, cost effectiveness of investments is being considered: protecting the existing densely populated residential, industrial and commercial areas is the first priority, followed by increased pumping capacity (as more intensive urban land use of peripheral areas is made) and increased safety (by dividing protected areas into self-contained compartments by building internal embankments). Such an approach will: (i) give more time to the Government to develop appropriate urban land management policies for newly urbanizing areas; (ii) improve economic justification as land value increases take place; and (iii) permit an incremental approach to flood protection in line with affordability of investments.

The first priority components are being covered under the Project, which includes the rehabilitation, protection and completion of the flood protection embankments and walls and drainage scheme components for the

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westerly Phase 1 area, covering over half of the City area and containing about 87% of the population. Construction of additional pumping stations will also be required as a high priority item in the near future order to maximize the benefits of the flood protection and drainage program, and following the completion of feasibility studies by JICA, in early 1992, the Government intends to request for additional donor assistance mainly for pumping stations and for the easterly Phase 2 part of Dhaka.

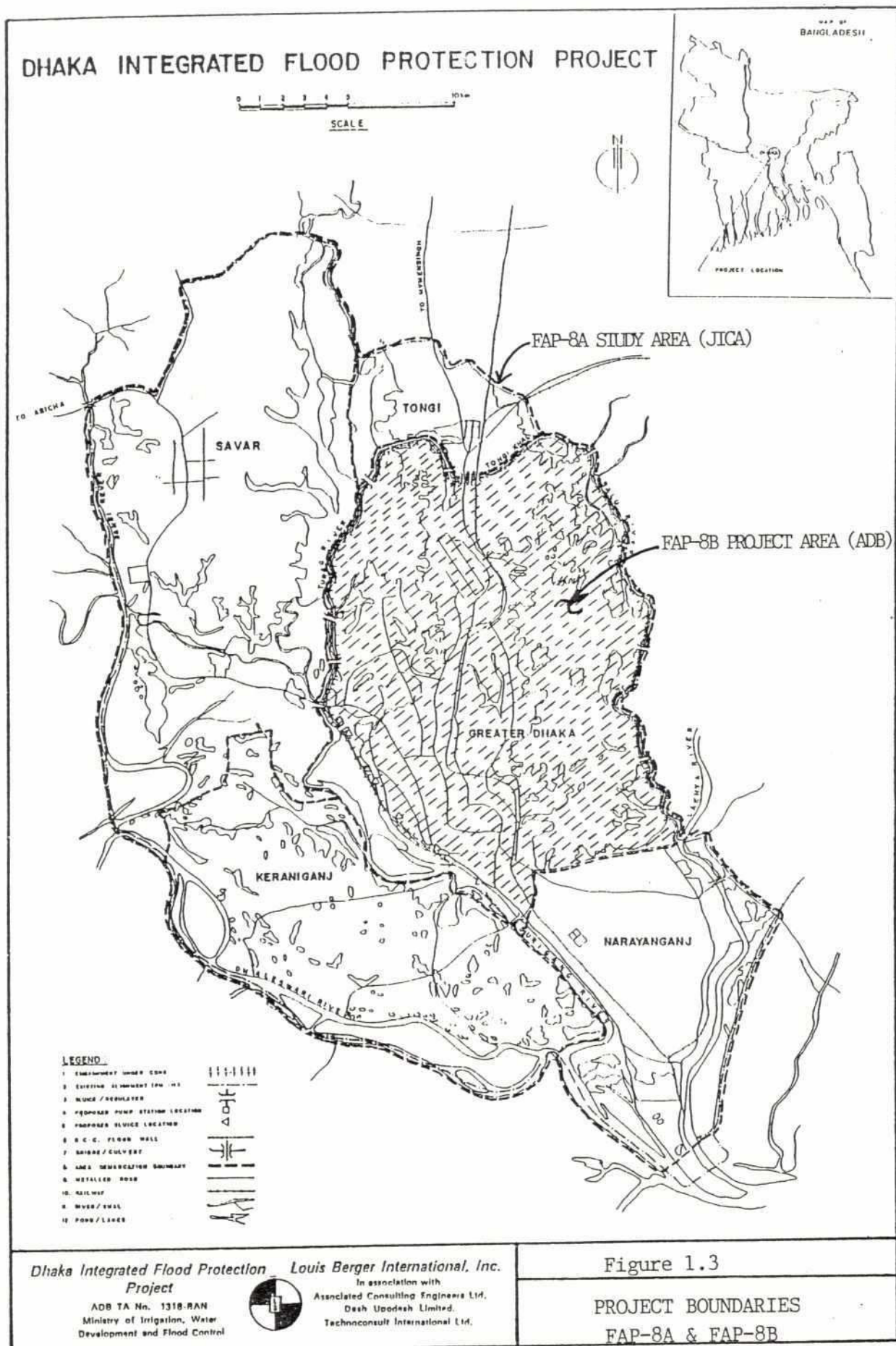
1.2 Flood Action Plan

Several additional studies were carried out in 1988 and 1989 to develop a comprehensive flood policy and program for Bangladesh, including Dhaka city. Based on the results of these studies (all of which agreed on the priority to be given for protective works for the urban areas) a Flood Action Plan (FAP) was formulated under the coordination of the World Bank in November 1989. The FAP identified a total of 11 components and 15 supporting activities to be taken up over a five year period as part of a long term plan of physical works and improved preparedness and management of floods. This was confirmed at the London conference of donors in December 1989 for the purpose of formalizing commitments from various donors for FAP components.

In support of the Government's flood action program, both the Government of Japan and the Asian Development Bank agreed to provide assistance for the Dhaka Town Protection component, FAP-8. This is a two part coordinated action plan specifically focused on the Dhaka Metropolitan Area, and includes:

- i) FAP-8A, JICA Master Plan Study for Greater Dhaka, Tongi, Savar, Keraniganj and Narayanganj, which has the objective of developing Master Drainage and Flood Control Plans for the Dhaka Metropolitan Area of 850 sq. km., identifying priority projects within this area, and preparing feasibility studies for selected components, and
- ii) FAP-8B, ADB Dhaka Integrated Flood Protection Project (DIFPP), which has the objective of identifying drainage, flood protection and complementary environmental improvement projects, and preparing feasibility studies for the immediate investment needs in the Greater Dhaka Area of 260 sq. km. (included in the above larger study area).

Figure 1.3 shows the boundaries of the respective study areas. As a part of their work programs, the JICA and ADB consultants are maintaining close liaison and sharing information and findings to ensure that their actions are complementary and that unnecessary duplication of work is avoided.



1.3 Technical Assistance Objectives

As defined in the Terms of Reference and agreed at subsequent tri-partite meetings, the technical assistance for this Project has two primary objectives:

- (i) to prepare an integrated urban environmental plan for the Dhaka Metropolitan Area (260 sq km) and surrounding urbanized areas to a pre-feasibility level of detail with emphasis on flood protection and drainage. Other aspects to be considered include management of land use, water quality, sewerage/excreta, solid waste, hazardous and toxic wastes, and slum and squatter areas. Also included will be review and comments on the institutional arrangements and legislation related to environmental policy and controls.
- (ii) to prepare a feasibility study (together with selective assistance in detailed design and contract preparation) for priority flood control and drainage components for Dhaka City. Infrastructure works expected to be included include flood protection embankments and walls, roads, internal drainage improvements, sluices and pump stations for the flood protection and drainage components, plus complementary activities in slum area improvement, solid waste management, and sanitation. Recommendations are to be made on the planning and design standards adopted in the works taken up in the Phase I program, on appropriate institutional arrangements for implementation, operation and maintenance of the facilities, and on appropriate cost recovery mechanisms.

In summary, the main objective of the technical assistance is to assist the Government in the implementation of environmental improvements in the DMA, with emphasis on solving the most serious existing problems.

1.4 The Report

This report is a combined Interim Report No. 2 and Draft Final Report, and presents the recommended Integrated Environmental Management Plan for Dhaka City, developed to the feasibility level of detail. It includes: (i) a summary of the Consultants analysis of the current situation in Dhaka in regards to land use management, flood control and drainage activities, water quality and sanitation/excreta management, water supply, solid waste management, slum and squatter area improvement, hazardous and toxic waste management, environmental legislation, and institutional and policy aspects; (ii) the Consultants recommendations for appropriate short and long term actions for flood protection, drainage and complementary environmental improvement components to be taken to improve the Dhaka environment; (iii) recommendations and cost estimates for taking up of selected high priority components for implementation under ADB and NDF assistance in connection with the proposed Dhaka Integrated Flood Protection Project; (iv) recommendations for implementation arrangements and financing plans for the recommended schemes; (v) detailed feasibility

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analyses for the proposed investments; and (vi) an analysis of the major environmental impacts of the proposed flood protection and drainage schemes, and the specific activities which must be taken into consideration in order to mitigate potential adverse impacts of such a program.

The Project components recommended herein, and the associated cost estimates, are based on the preliminary scope of works as identified and agreed during the ADB Fact Finding Mission of 29 June to 16 July 1991. At the time of preparation of this report final refinements to the scope and costs are underway in consultation with the BWDB, DWASA and DCC. It is expected that this report will form the basis for discussions and agreement between the Government of Bangladesh and the ADB in final selection of priority items to be taken up for an ADB assisted Dhaka Integrated Flood Protection Project (Stage 1), and for further detailed design and implementation assistance so that project implementation can commence during the current 1991-1992 financial year.

2.0 BACKGROUND AND PROJECT SCOPE

2.1 General

Bangladesh, with a total area of 144,000 sq km and an estimated population of 116 million, is the most populous of the UN-designated "least developed" countries. Having a per capita income of about \$170, the country is also one of the lowest-income DMCs. Little or no change has occurred in levels of real income over the past decade in the country, mainly due to factors such as a population growth of 2.4 percent a year during the 1980s, a limited resource base, a high degree of underemployment and unemployment, and slow growth in productivity.

While Bangladesh remains primarily rural, its urban population has been growing at the explosive rate of 10.6 percent per year from 1974 to 1981 and 5.4 percent from 1981 to 1990. At 24 million, the urban population is now over 20 percent of the total population. Even though the urban growth rate is expected to decline to around 5.0 percent, the total urban population will be some 37 million, or 26 percent of the total, by the year 2000, and will increase to about one third by 2010.

2.2 Flooding Problems in Bangladesh

2.2.1 General

With major river systems and some 40 per cent of its inland area under waterways, Bangladesh has a history of flooding, exacerbated by heavy rainfalls during the monsoon period of June to September. The first systematic study of the country's flooding problem was carried out with UNDP assistance over thirty years ago. This was followed by a Master Plan in 1964 which proposed a large number of projects for flood control, drainage and irrigation. Subsequently, some major embankments were built along parts of the main rivers, but no national level major flood control measures were taken. The disastrous floods of 1987 and 1988 - which caused damage estimated at \$ 0.5 billion and \$1.3 billion respectively in monetary terms, apart from extensive loss of human life - highlighted the enormity and urgency of the problem and aroused much international concern. Several studies were undertaken in 1988 and 1989 with assistance from UNDP, USAID, Japan and France to develop a comprehensive flood policy and program. At the Government's request, and based upon inputs from the above studies, a Flood Action Plan (FAP) was formulated under coordination of the World Bank and confirmed at the conference of donors held in London in December 1989. At this conference, the ADB expressed its willingness to provide assistance related to mitigating floods in Bangladesh, including urban flooding.

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Following a Government of Bangladesh request, the ADB approved a technical assistance¹ to help prepare an integrated flood protection project for Dhaka, a component included in the FAP.

2.2.2 Flood Action Plan

The FAP has been formulated as an action plan for a period of five years as the first step in the Government's long term flood control program. A set of "Eleven Guiding Principles" provides a broad framework for a plan of physical works together with measures to improve preparedness and management of floods. Prominent among the aspects considered are: (i) the planning and design issues (including location and adjustment of embankments); (ii) social aspects (including closer involvement of the beneficiaries and local authorities in the planning, design and management of projects, and better efforts to educate the public); (iii) environmental issues (including preservation and enhancement of favorable environmental impacts); (iv) matters related to staged development; and (v) implementation issues, particularly those relating to enhancing implementation capability and coordination. The FAP has identified a total of 26 activities, including 11 components - Dhaka Town Protection being one of them - and 15 supporting activities. A national Flood Council and a Flood Plan Coordination Organization (FPCO) were established in September 1989. Implementation of the FAP is the responsibility of a Technical Committee with multiagency representation as well as expert panels (local and foreign), in the fields of engineering, agriculture, economics, social sciences and environmental sciences. Various donors are assisting in the implementation of the FAP. In addition to Dhaka Integrated Flood Protection, the ADB involvement includes the South West Region Water Management Study² and Secondary Towns Integrated Flood Protection³.

While Bangladesh remains primarily a rural country, urban flooding problems have become acute because of high densities and inadequate drainage facilities in towns. Since large investments relating to the housing stock, infrastructure, and industrial/commercial/other buildings are concentrated in the urban areas, flood damages in such areas have been extensive. In recognition of this, all the donor-assisted studies carried out during 1988 and 1989 agreed on the high priority for protective works for urban centers.

¹ TA No. 1318-BAN: Dhaka Integrated Flood Protection; in an amount of \$600,000 in June 1990. Consultants (Louis Berger International, Inc. (USA), in association with local consultants) commenced work in January 1991.

² TA No. 1498-BAN: Southwest Area Water Resources Management Study, approved in March 1991 in an amount of \$3.837 million.

³ TA No. 1396-BAN: Secondary Towns Integrated Flood Protection, approved in October 1990 in an amount of \$600,000.

2.3 Flooding and the Urban Sector

2.3.1 Pattern of Urbanization

The four largest cities (Dhaka, Chittagong, Khulna and Rajshahi) are the first order of urban centers with current estimated populations of 4.8 million (6 million for the Greater Dhaka Metropolitan Area which includes adjacent urban centers), 2.1 million, 930,000 and ----- respectively. These have the status of City Corporations and together have the urban population share of 43 percent. Although all urban areas have been growing rapidly, these have had the highest growth rates over the past 10 years. The next order of centers are the traditional secondary towns such as Comilla, Sylhet, Mymensingh, Barisal, Jessore, Bogra, Pabna, Rajshahi, Sirajganj and Saidpur. These towns have populations ranging from 160,000 to 350,000 and have experienced absolute growths of from 50 to 100 percent during the past ten years. The third order of urban centers consisting of minor towns with a population of between 50,000 to 160,000 is also experiencing a high rate of growth, with some centers growing as much as 100 percent or more between 1981 and 1990. Lower order towns are also growing fast and their number will be increased as villages are upgraded to urban status. With the designation of all sub-district (upazilla) centers as urban in 1981, the total number of urban centers increased from 108 in 1971 to 550 at present⁴. There are some 89 Municipalities (Pourashavas) which contain about 25 percent of the total urban population and another 460 towns, designated as other centers, with approximately 32 percent of the urban population.

Three factors have caused the rapid increase in urban population, i.e., the natural increase of the urban population, the reclassification of urban centers, and rural to urban migration. The last is recognized as a major component of urban growth. Approximately 70 percent of the increase in the population of Dhaka over the last decade has been attributed to such migration. High rural population densities, rural landlessness, natural disasters and other problems for which there are no easy solutions have been major push factors for driving the rural population to urban areas. Another reason for the rural-urban migration has been the relatively more attractive opportunities that the urban areas have offered both for employment and increased earnings. Between 1975 and 1986 employment in the agricultural sector had expanded only 25 percent compared with 175 percent for the non-agricultural sector. Between 1975 and 1988, GDP from the agricultural sector had increased 35 percent compared with 119 percent for the non-agricultural sector. Although the country is still primarily agricultural, in 1988 the non-agricultural sector accounted for 58 percent of the GDP. Per capita GDP gap between the urban and rural areas remain

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According to the Municipal Administration Ordinance, 1960, an urban area should have a population of 15,000 or more, three quarters of the adult males engaged in non-agricultural activities, and a population density of at least 2,000 per square mile. The 1981 population census classified all upazilla headquarters as "urban" irrespective of the above criteria.

significant. Considering the above, rural-urban migration is likely to continue, and the importance of the urban economy will become increasingly pronounced.

There will be a growing need to rapidly increase employment opportunities in the future. Due to the changing age structure and the increasing participation of women in the labor force (estimated to have increased at 15 percent per year from 1974 to 1983), the national labor force is expected to grow considerably faster than the overall population. In the urban areas alone it is estimated that by the year 2000 there will be some 8.6 million new entrants into the labor force. According to a UNDP study⁵ the crop production sector will be able to absorb only 30 percent of the labor force increase between 1989 and 1995, and consequently pressures will increase in the urban areas. The most noticeable shift in urban employment has been in the trade, finance and business sectors which increased their share from some 4 percent to nearly 13 percent in the period 1974-1984. Approximately two thirds of the current employment in the two largest cities of Dhaka and Chittagong is in the informal sector. In Dhaka in particular, with its 36 percent share of the national large-scale manufacturing activity, the informal sector, which provides the bulk of employment to the urban poor, will continue to be critical to future labor absorption.

2.3.2 Urban Conditions

The fast pace of urbanization in Bangladesh is affecting the efficiency of the cities which generate a large proportion of non-agricultural employment. A rapid growth of slum and squatter settlements has followed, and in the Dhaka City Corporation (DCC) area alone 25 percent of the population - some 1.2 million - is living in such conditions. Severe strains on water supply, sanitation, roads, solid waste collection, electricity, transportation, and serviced land for shelter have also resulted. According to the 1981 census, 26 percent of the urban population was served by piped water while only 11 percent had access to adequate excreta disposal facilities. These problems are particularly severe in Dhaka, where the growth rate is comparatively high and where about 66 percent of households are estimated to have incomes below the poverty line⁶. Housing production is grossly inadequate to meet the growing needs of the rapidly increasing population. The environmental conditions throughout most of the urban centers are poor, with discharges of industrial pollutants into river systems, contamination of groundwater from lack of proper sanitation and sewerage, and inadequate management of solid waste disposal.

⁵ Bangladesh Agricultural Sector Review: Performance and Policy, February 1989.

⁶ The urban poverty line income is estimated by costing the FAO minimum food consumption bundle (2,112 calories) per person per day for Bangladesh using urban retail prices and adjusting upwards by 25 percent to accommodate the purchase of non-food essentials.

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Drainage conditions, in particular, are poor. In a recent study¹ it was identified that over 90 percent of the urban population in 10 study towns identified poor drainage as being the worst problem and the highest priority for improvement. In Dhaka City, local flooding due to poor drainage conditions is a regular occurrence during the monsoon period. Poor drainage affects 65 percent of the slum and squatter dwellers (800,000 people), and 22 percent (265,000 people) are regularly flooded during minor rainfalls. For external flooding, the central parts of the city are high enough to remain generally free from flooding, but fringe areas are extensively inundated by 2-4 meters for several months each year by overflows of the surrounding rivers. Major floods, however, such as those in 1987 and 1988, affect even the central parts of the city. Heavy rainfall, high surrounding water levels and an inadequate and unsatisfactorily maintained drainage system all contribute to flooding in the city. Heavy rainfall particularly aggravates flooding when it is late in the monsoon period and adds to the overflow of the rivers. Damage to city infrastructure is usually severe. During the floods of 1988, about 400 km of roads in Dhaka were damaged and about 60 per cent of the 1900 km internal road system was submerged. The flood damage in Dhaka was estimated at between \$ 15 million and \$ 30 million.

2.3.3 Urban Poverty

There is widespread poverty in Bangladesh as a whole, in both the rural and urban areas. In 1987, the World Bank estimated urban "hardcore" poverty at 31 percent of the urban population (rural, 52 percent) and "minimum nutritional" poverty at 66 percent (rural, 74 percent). The urban poverty situation is also compounded by the fact that a dominant proportion of migration to urban areas occurs from the poorest rural groups. The most deprived urban groups (slum dwellers, squatters and pavement sleepers) live in conditions considerably worse than those of the rural poor. With high population growth rates in the urban areas, and assuming no increase in the incidence of urban poverty, the number of urban poor could more than double by 2000, to 30 million.

2.3.4 Development Programs

The government has been aware that increasing urbanization and insufficient employment opportunities are contributing to growing urban poverty and has been taking measures to alleviate the problem. Allocations were made to improve water supply and sanitation services in large urban centers and district headquarters in the Second Five-Year Plan (SFYP), FY1981-FY1985, but the amounts were modest and sector deficiencies increased. In the Third Five-Year Plan (TFYP), FY1986-FY1990, the emphasis continued to be on urban water supply and sanitation, both in large urban centers and Upazilla areas, development expenditures by city development authorities, and housing. The TFYP also included specific allocations for low-income housing and environmental improvement at Mirpur in Dhaka, squatter resettlement programs at Mirpur, Tongi and Demra, and a large sites and

¹ TA No. 1105-BAN, Secondary Towns Infrastructure Development Project.

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services scheme in Chittagong. Following the devastating flood of 1988, the Dhaka City Flood Control Project was undertaken on an emergency basis to construct embankments, protection walls, sluices, pumping stations, and drainage schemes. In addition, the Government has undertaken a large number of land-use plans involving 356 Upazillas and 53 Zillas.

In order to begin to resolve the problems of poverty in both urban and rural areas, the Fourth Five-Year Plan (FFYP), FY1991-FY1995, makes the alleviation of poverty through generation of employment opportunities one of the three major objectives of the Plan, along with accelerated economic growth and increased self-reliance. Another major feature of the FFYP, which sets it apart from previous plans, is the proposed integration of sector based planning with socio-economic group based planning. Because it is felt that the poor and disadvantaged have not been reached through the sector approach, the Plan divides the population of the country into ten socio-economic groups with poor urban informal households, engaged in non-agricultural activities, as one of the main target groups. In order to achieve the dual objectives of poverty alleviation and self-reliance, each sectoral plan will contain programs and policies to assist low income groups to participate in project formulation and implementation. The Physical Planning, Housing and Water Supply sector would be allocated a total of 11 percent of FFYP resources as against 3.4 percent in the TFYP. However, reflecting the emphasis on self-reliance, fully 83 percent of the resources for the sector are to come from the private sector. This indicative allocation to the private sector is meant to reflect the present trends and future response to policies with respect to private sector participation during the Fourth Plan.

The FFYP indicates that the past thrust for urban water supply and sanitation, slum-upgrading, sites-and-services, and land-use planning programs will be continued. An integrated approach to urban infrastructure development and flood protection works will be expanded to secondary towns. A core house program in addition to sites and services may be introduced. More emphasis will be placed on the decentralization of administration, private sector participation, environmental improvement and NGO participation.

2.4 Flood Control Planning for Dhaka City

For the flood protection and drainage of Dhaka city and its surrounding areas, several studies were undertaken in the past, but not thoroughly enough, due to resource constraints. The first full-scale study was prepared by UNDP in 1968. It proposed a master plan covering an area of about 75 sq km area and involving construction of an embankment around the city, pump stations and other drainage facilities. In 1970, another study followed, which was revised and updated after Bangladesh became independent in 1971, involving polders covering about 250 sq km, together with infrastructure improvements. In January 1989, a Government-appointed committee prepared a flood control and drainage plan for Greater Dhaka and its surrounding areas which was officially approved in March 1989. The proposed plan involves: (i) construction of embankments and flood protection walls along the Tongi Khal, Turag and Buriganga rivers,

Dhaka-Demra roads and Balu river to protect the Greater Dhaka area of around 260 sq km; (ii) installation of five pumping stations to drain internal water; and (iii) re-excavation and restoration of 12 canals. In view of the urgency of the flood protection works, and pending assistance from donors, the Government has undertaken some emergency works from its own resources⁸. These works were undertaken by several agencies such as the Bangladesh Water Development Board (BWDB), the Dhaka City Corporation (DCC), the Dhaka Water Supply and Sewerage Authority (DWASA), the Bangladesh Army and RAJUK, the capital development authority. The environmental impact of these investments was studied by the Department of Environment (DOE) of the Ministry of Environment and Forests, assisted by consultants financed under a ADB technical assistance project⁹.

The various studies related to flood protection that were carried out in the past remained largely at master planning, or at project identification/pre-feasibility level of detail. Where elements were carried out, they were done by the various agencies, generally on an ad hoc basis without proper coordination. These piecemeal efforts have been generally ineffective and, in fact, have in some cases, inadvertently compounded environmental and health hazards. Inadequate drainage has resulted in polluted waters remaining stagnant in low-lying lands (and often densely populated slum areas) for long periods of time. Uncoordinated collection and disposal of solid waste has contributed to localized flooding through clogging of drains. Similarly, inadequate and ineffective excreta management has led to high levels of exposure to water borne pathogens during floods. A clear, urgent need has thus emerged to integrate flood protection works for the Dhaka metropolitan area, encompassing about 260 sq km, with other infrastructure and environment improvement measures to maximize impact.

2.5 Institutional Setting

2.5.1 National Institutions

Overall responsibility for coordination of development projects in Bangladesh, including flood control, urban development and housing programs, is the responsibility of the Planning Commission. Specific responsibility for coordination, review and approval of the consultant studies taken up under the FAP lies with the Flood Plan Coordination Organization (FPCO) of the Ministry of Irrigation, Water Development and Flood Control (MIWDFC).

⁸ These include embankments (30 km), flood-walls (34 km), pipe sluices (5), road-raising (9 km), flood protection of the international airport and repair and restoration of sewerage works in the city.

⁹ TA No. 1104-BAN: National Environmental Monitoring and Pollution Control, for \$750,000 financed by JSF, approved on 12 January 1989.

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The Ministry of Irrigation, Water Development and Flood Control (MIWDFC) is responsible for major water resource projects nationwide, including flood control, drainage, irrigation and town protection schemes. The Bangladesh Water Development Board (BWDB) is the implementing agency for the Ministry and has primary responsibility for coordinating works programs and implementing programs directly related to flood protection for both urban and rural areas. The BWDB has a long history and wide experience in poldering works throughout Bangladesh. With a total staff of over 18,000 people (see organogram, Figure 2.1), the BWDB has adequate engineering staff and capabilities to perform the work. Their responsibility includes the planning, design and construction of embankments and outlet structures, and operation and maintenance of the completed facilities. The BWDB is a centrally funded Government body, and has no significant revenue generating capability or authority. It relies on central Government allocations in the annual development plan for financing of its' work programs. The greatest strength of the BWDB is its' strong engineering organization and implementation capabilities; the greatest weakness is its' poor operation and maintenance capabilities which tend to be subordinate to the implementation works, and to traditionally suffer from inadequate attention and funding.

Responsibility for urban development in Bangladesh is fragmented. Key functions are shared among two ministries and a wide range of central departments, utility agencies, development authorities, city corporations, and municipalities. Urban utilities, infrastructure, and urban administration are the responsibility of the Local Government Division (LGD) of the Ministry of Local Government, Rural Development and Cooperatives (MLGRDC), while physical planning, development control, and housing functions are under the Ministry of Works (MOW). Experience and capabilities in integrated urban development are limited, especially at the local level. There is a particularly widespread lack of expertise in programming and budgeting, in financial and property management, and in social work and community-based activities.

Two types of local governments operate in the urban areas of Bangladesh: city corporations, and pourashavas (or municipalities), both under the overall jurisdiction of MLGRDC. The Local Government Engineering Bureau (LGEB), the technical arm of LGD, provides technical support to pourashavas¹⁰. City corporations and special purpose Development Authorities¹¹ have been created in the larger towns of Dhaka, Chittagong, Khulna and Rajshahi, while pourashavas operate in some 89 towns.

¹⁰ Pourashavas are governed by an elected chairman and council members, whereas in city corporations, the Mayor is appointed by the Government. Other than the size of the population served, there is little difference in the responsibility and revenue sources assigned to the two types of urban local governments.

¹¹ The Development Authorities (under the jurisdiction of MOW) prepare master plans, oversee control development of areas, and prepare implement capital investment projects.

BANGLADESH WATER DEVELOPMENT BOARD **ORGANIZATION CHART**

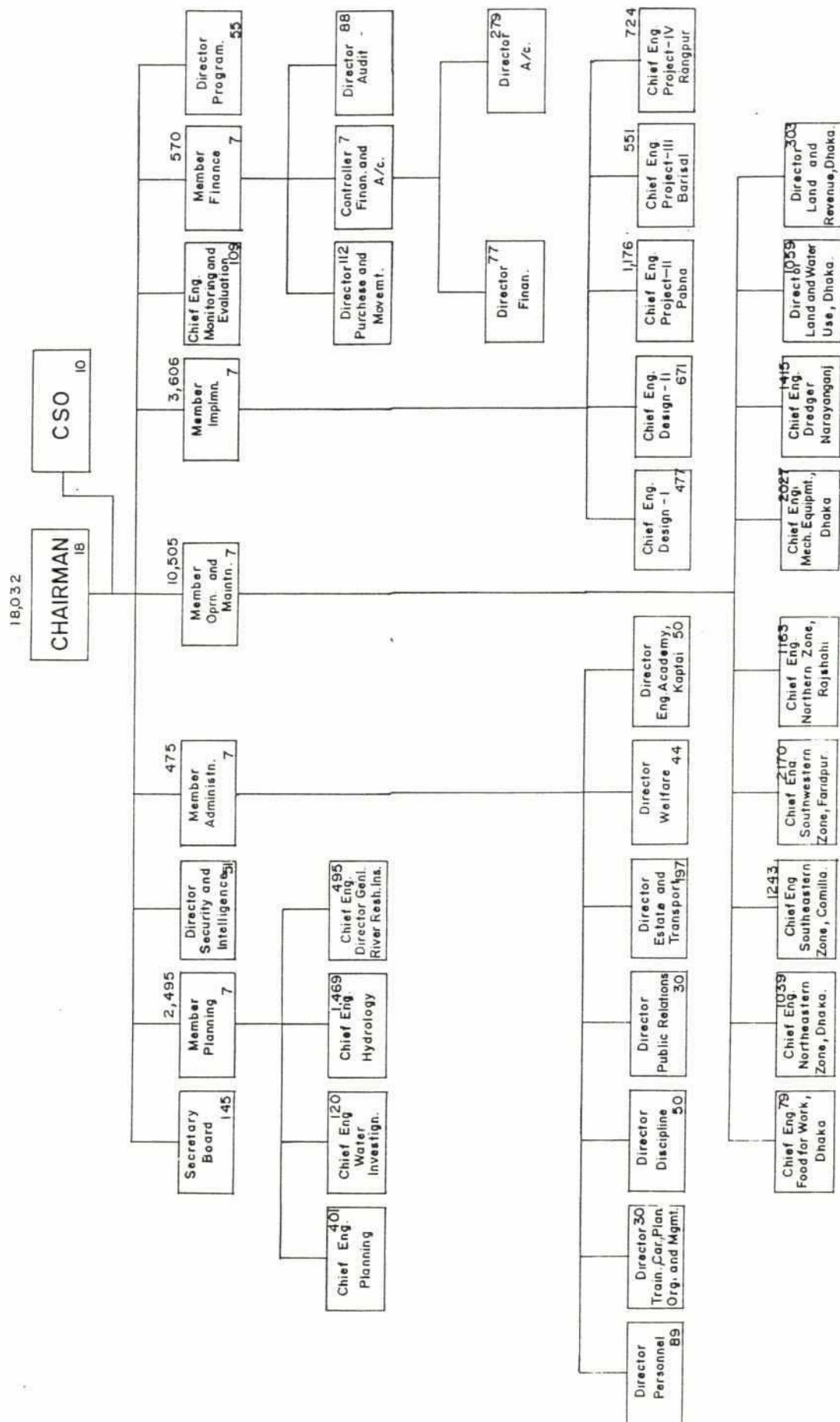


Figure 2.1

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The design and construction of water supply and sanitation systems is generally the responsibility of the Department of Public Health Engineering (DPHE), except in Dhaka and Chittagong where autonomous Water and Sewerage Authorities (WASAs) have been created. These Authorities are independent of the local municipal governments, and their chairmen report directly to the Secretary of LGD. Maintenance responsibility for most of the physical infrastructure built by the development authorities is passed on to the local governments. The Government, through MLGRDC, has complete control over the activities of the local governments.

Local government activity, as measured by spending levels, is not large especially when compared with urban service needs. Own funding sources of the municipalities include taxes, rates and fees. The primary local tax is the house or holdings tax levied on all buildings and the land on which the buildings are located. Revenues from these sources are normally applied towards meeting the establishment costs, conservancy services and routine maintenance of existing infrastructure. Development assistance is provided to the municipalities, generally in the form of grants-in-aid by the Government.

National urban programs of the MOW are implemented through the Public works Department (PWD), the Urban Development Directorate (UDD), the Housing and Settlement Directorate (HSD), and the Office of the Deputy Commissioner of Settlements (DCS). PWD is responsible for construction and maintenance of government buildings and staff housing. UDD, as a planning agency, advises the Government on matters of policy relating to urbanization, land use and land development, socioeconomic research, physical planning for human settlements, and regional development. HSD is charged with providing low-cost housing to the general public. DCS is responsible for allocation of plots and houses, execution and registration of leases, and collection of rents and other charges.

Responsibility for environmental planning, management and monitoring, on a national level, lies with the Department of Environment (DOE) of the Ministry of Environment and Forests (MEF). DOE programs include monitoring of the pollution levels of rivers and groundwater used for human consumption, monitoring and analysis of surface water for pesticide residue and heavy metals (in collaboration with Bangladesh Atomic Energy Commission and Bangladesh Center for Advanced Studies), and analysis on request of water and waste water samples which are brought to DOE laboratories by others. DOE has four divisional offices, one of which is located in Dhaka. Although they have a sanctioned staff of 388 people, currently only 70 are recruited, of which approximately 25 have scientific or technical training/education. DOE has undertaken some surface water monitoring in and around Dhaka, but with the severe constraints on staff and budget this has been limited to only occasional periodic testing up until now.

2.5.2 Dhaka's Institutional Framework

Dhaka's urban institutional framework comprises Dhaka City Corporation (DCC), the Dhaka Water Supply and Sewerage Authority (DWASA), and the Capital Development Authority (RAJUK). DCC and DWASA are under the LGD,

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which regulates their activities, reviews their project proposals and monitors their project implementation, while RAJUK is within the purview of MOW. Physical planning for government shelter-related projects for Dhaka, like other areas, are provided by UDD and HSD, while other urban services and inputs such as industrial estates, airport facilities, schools and hospitals are provided by the relevant Government agencies. Cantonment areas are regulated by the military authorities.

(a) Dhaka City Corporation

Responsible administratively to the LGD, Dhaka City Corporation is empowered to undertake a wide range of urban functions, including road construction and maintenance, surface water drainage, the construction and management of parks and markets, solid waste collection and disposal, public health and sanitation, street lighting and traffic management, and slum improvement projects. In practice, however, much of DCC's work is involved in operating and maintaining existing infrastructure and services. Capital improvement projects are undertaken primarily by RAJUK for new developments, and by DWASA for water supply, sewage and drainage sector works.

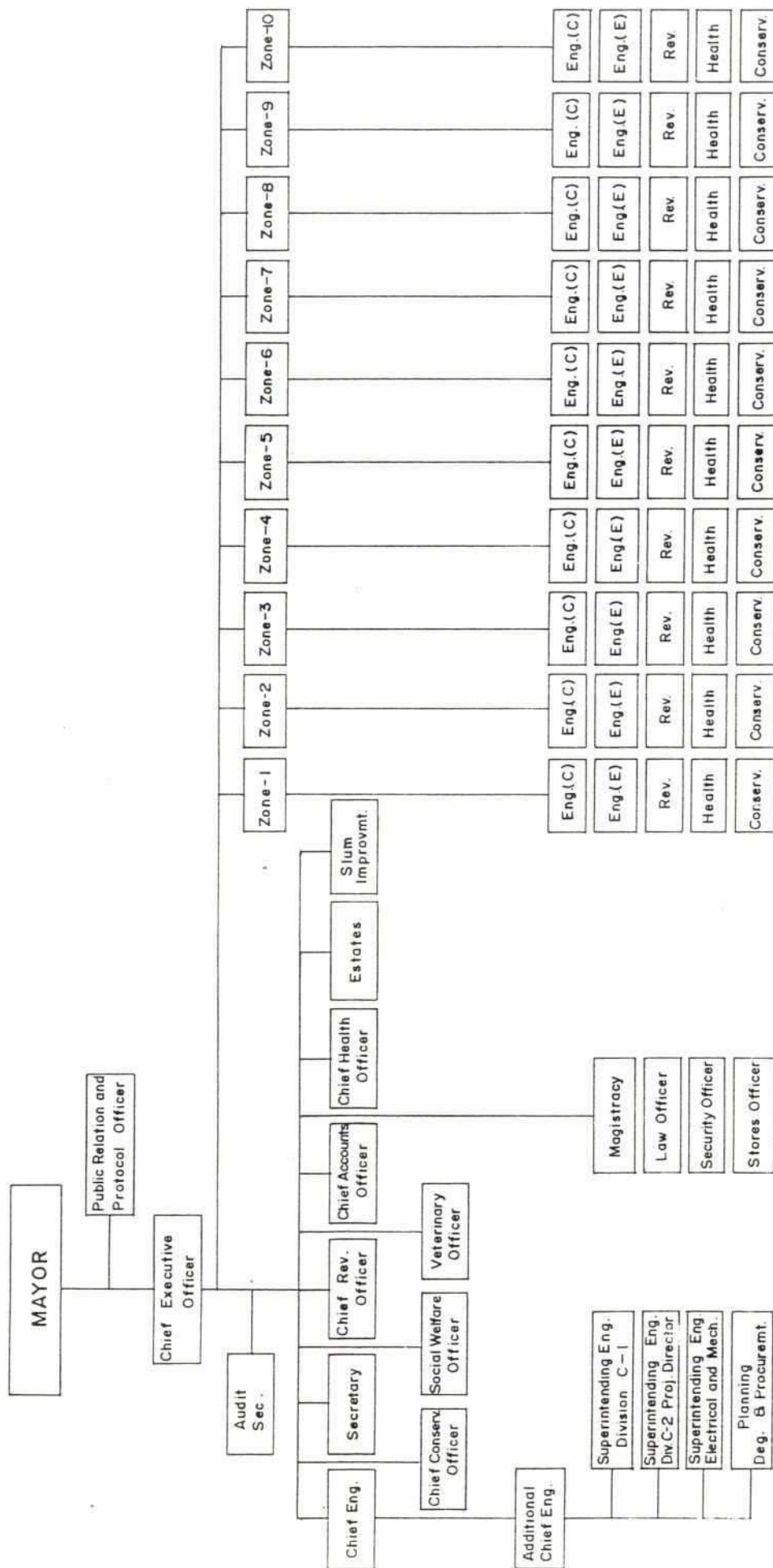
DCC is headed by a Mayor/Administrator, and is organized into five principal areas of responsibility (engineering, conservancy, revenues, accounts and health) under the Chief Executive Officer (see organogram, Figure 2.2). The technical wing is headed by a Chief Engineer, with one Additional Chief Engineer, three Superintending Engineers and Executive Engineers and a Terminal Manager. DCC has recently created a low-cost sanitation unit to implement a pilot latrine program financed by IDA, and has plans to develop a slum improvement cell to implement slum improvement programs. Responsibility for overall financial management is a shared function between the Chief Revenue Officer, the Chief Accounts Officer, and the Audits Sections.

DCC has a sanctioned strength of 4,678 people, but is presently severely under strength with a total staff of 3,800, supplemented by 6,222 muster roll employees (temporary part time laborers). The largest number is in the Conservancy Department (about 4,000, mostly part time laborers for street sweeping and garbage collection), followed by about 1,700 in the Engineering Department. DCC is the executing agency for the Old Dhaka component of IDA's urban development project, including the Dholai Khal pumping station, and has established a project office for administration of the works. The slum improvement cell within DCC has a sanctioned staff of 87 people, but has never been staffed to its approved levels and has been unable to provide any significant improvements to the slum and squatter areas up until now.

(b) Dhaka Water Supply and Sewerage Authority

DWASA, which also comes under LGD, was set up in 1963 as a semi-autonomous agency with the responsibility for planning, construction, operation and maintenance of water supply and sewerage facilities. Recently (1989) the

ORGANIZATION CHART OF DHAKA CITY CORPORATION (DCC)



Sanctioned Strength : 4678

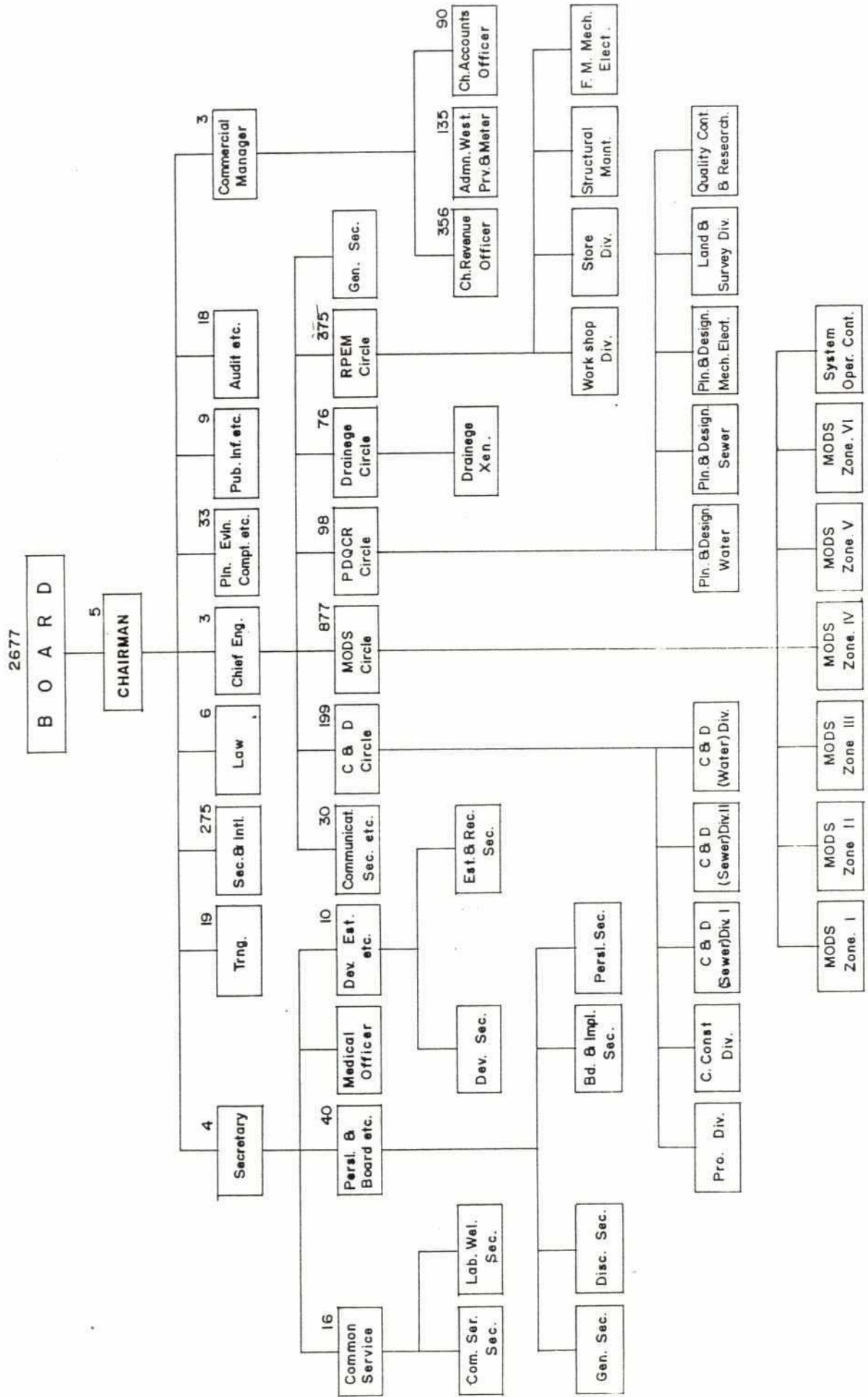
Existing Strength : 3800

Master Roll : 6222

Figure 2.2

Case

THE ORGANIZATION CHART OF DHAKA WASA



Government increased DWASA's responsibilities with the transferal from DPHE of responsibility for the operation and maintenance of all major drainage khals and pipe drains within the city. The Authority is governed by a Board of Governors appointed by the Government, with the Chairman also serving as the Chief Executive Officer (see organogram, Figure 2.3). DWASA is divided into Engineering, Commercial and Administration Departments, and six Central Service Divisions, all of which report directly to the Chairman. Engineering operations are divided into five divisions: Planning, Design and Quality Control, Construction and Development, Maintenance and Distribution, and the newly formed Drainage Circle. For administrative purposes, Dhaka is divided into six zones.

DWASA's total staff has grown from 1,800 in 1979 to a sanctioned staff of 2,677 at present. DWASA's present major program is being implemented as a part of IDA's DWASA III project for water supply and sewer system expansions, expected to be nearing completion in 1992. In view of the high staffing levels in relation to the scale of the operations, IDA's ongoing DWASA III project includes a staff productivity study to review the operation of the administration and all major departments to recommend ways to improve productivity through organizational changes, and to determine appropriate norms for different job functions. Other programs taken up under DWASA III include a leak detection study to devise ways for reducing unaccounted water losses; establishing a waste prevention unit to survey the system for connections and water/sewer use; introducing inventory management for ensuring adequate spare parts supplies for maintenance; and design of a computerized MIS system to facilitate operations and capital planning, financial controls and monitoring.

IDA is presently in the process of formulating their fourth project (DWASA IV), tentatively estimated to cost \$540 million, through an ongoing consultancy that includes studies on the availability of both surface and groundwater in the greater Dhaka area. Potential major components include surface water supply (Phase I water treatment plant), ground water supply (tubewells, trunk supply mains and a long term development plan), sewerage and sanitation, water resources regulation and assistance for further development of DWASA and sector institutional capabilities. In parallel with the IDA program, the Government of France is also studying the possibility of financing package surface water treatment plants for supplementing the supply of potable water to Dhaka.

(c) RAJUK

Radjahani Unnayan Kattripaka (RAJUK - the Capital Development Authority) has the primary responsibility for land use planning and control in Dhaka and the surrounding areas. RAJUK is a semi-autonomous Government body under the MOW which is responsible for most of the public development activities within Greater Dhaka and the surrounding urban areas, and for regulation and control of the development activities of others within the same area. Primary activities of Rajuk include: (i) capital development works in Dhaka and its' suburbs, (ii) planning and development of residential and commercial areas, including planning and construction of feeder roads, (iii) allotment of land to public for housing and commercial



C. A

centers, and (iv) registration and control of development plans of private agencies and other public bodies.

RAJUK is responsible for maintaining and updating City Master Plans, and has the legal authority for controlling development within the context of any approved Master Plan zoning regulations. Specific functions include master planning, preparation of zonal or project plans, development of new areas and disposal of serviced plots and market facilities under its own self-financing development schemes, approval of other public and private development plans, construction of major roads, control of all non-DCC areas and provision of water in non-DWASA areas. RAJUK serves as a control agency for all formal developments within Dhaka, but in practice has little coordination with either DCC, DWASA or DOE during the approval process, and has little involvement in development activities focussed on the urban poor sector.

(d) Other Agencies

Other agencies which have an important, though not necessarily a lead, role in urban management in Dhaka include: (i) the Urban Development Directorate (UDD) of the Ministry of Works for developing overall urban development policies, planning strategies and control legislation; (ii) HSD for providing sites and service projects focused specifically on the urban poor; (iii) the Roads and Highways Department (RHD) of the Ministry of Communications for planning and implementation of major communication networks and bypass roads; and (iv) all other public organizations and private utility companies for providing essential urban services and infrastructure. Agencies which occasionally assist in testing and environmental monitoring include: (i) the Institute of Public Health (IPH) which is responsible for the testing of food products, and provides a supplementary service to the public by providing water quality testing upon request; (ii) the Atomic Energy Commission (AEC) which has more sophisticated laboratory equipment than either DOE or DWASA and has the capability to periodically test for heavy metals and other contaminants upon request; and (iii) the Department of Fisheries (DOF) which has its own laboratory facilities and programs for testing the water quality in the larger water bodies in Dhaka, and is in a position to provide expert advice on topics directly related to impacts of pollution on the fisheries. All these agencies can provide a supporting service in programs for water quality monitoring for Dhaka.

(e) NGOs and Service Organizations:

There are a large number of NGO and service organizations in Dhaka who are providing support and assistance, particularly to selected slum and squatter areas. Typically, much of this support is modeled on providing education opportunities, community and health care services, income generating opportunities, and family planning services with an emphasis on promoting the welfare of the mother and child groups. There is a large opportunity to utilize the resources of this body of committed people who are concerned with the welfare of the poor in future development of urban slum improvement programs.

2.6 Donor Involvement in the Sector

While direct flood protection programs for Dhaka have been undertaken in the past by the Government from its own resources, several international agencies have been assisting the Government in programs relating to environmental improvements. The ADB has assisted in the preparation of an integrated metropolitan development plan for Dhaka during 1979-1981¹² and an ongoing urban infrastructure improvement project in 1989¹³, involving improvement of municipal facilities in the Mirpur suburb of Dhaka. The World Bank has assisted in three projects for water supply and an urban project, having components in Dhaka involving improvement of slums, solid waste and drainage improvements in the inner city area. The Japanese International Cooperation Agency (JICA) prepared a drainage plan for the western half of the Dhaka metropolitan area in October 1987. This was updated in February 1990, and priority drainage investments (\$15 million) in two of the ten drainage zones are being implemented during 1990-1992. Since November 1990, as part of FAP, JICA is preparing a master plan for drainage and flood protection for the larger regional metropolitan area of 850 sq km, which includes about six towns in the vicinity of Dhaka. UNDP, besides collaborating with the ADB in the 1981 planning study, has also financed feasibility studies that led to urban investments in Dhaka by the World Bank and the ADB. Two further studies are being developed: one with the Planning Commission for the study of traffic and transportation problems of Dhaka and the second with the Capital Development Authority (RAJUK) for updating of the master planning study.

2.7 Project Area and Need for the Project

The Project relates to Dhaka, the national capital, which is estimated to have a population of about 6 million in the metropolitan area (DMA). The area under the responsibility of the Dhaka City Corporation (DCC), covering an area of 260 sq. km., contains an estimated population of 4.8 million. Most of the population of the city is concentrated in the western part; the eastern part of the city is less dense, with considerable areas still under agricultural and non-urban uses. The Project covers the most densely populated western part of the Dhaka city comprising about 136 sq km, which accommodates a population of 4.2 million or some 87 percent of the city population. The population of Dhaka has been growing at a high rate of 5.5 percent per annum.

While the contribution of Dhaka in the national economy is substantial, the living conditions in Dhaka have progressively deteriorated. About 60 percent of the households in Dhaka are estimated to have incomes below the poverty level. Some 25 percent of the population is living in slums. As

¹² TA No. 282-BAN: Study of Integrated Urban Development of Dhaka Metropolitan Area, for \$288,870 financed jointly with UNDP, approved on 6 March 1979.

¹³ Loan No. 942-BAN: Dhaka Urban Infrastructure Improvement Project, for \$24.2 million, approved on 12 January 1989.

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the population has increased, severe strains on municipal facilities such as water supply, sanitation, drainage and solid waste management have emerged. During the 1988 floods, one of the most severe on record, some 60 percent of the DMA population and 80 percent of the area remained submerged in water for periods up to four weeks. Even during normal years, drainage congestion and periodic flooding is a chronic problem in Dhaka, particularly for the low income and slum dwellers of whom 22 percent are regularly flooded during even minor rainfalls.

2.8 Project Rationale and Objectives

The proposed Project is being designed in an integrated framework of flood protection, environmental improvements and poverty alleviation. The underlying rationale for the Project is to provide a flood free and secure living environment, and to improve the urban efficiencies and environmental conditions (particularly for the urban poor) in Dhaka City for promotion of sustainable long term economic development. The Project aims at an integrated urban development program consisting of: (i) flood control and drainage works; (ii) complementary environmental improvement programs in low cost water supply and sanitation programs for the low income residents, solid waste management and slum and squatter area development; and (iii) implementation assistance. The Integrated Environmental Management Plan (IEMP) that has been formulated (see Chapter 3) provides a framework for the Project within a long term integrated development strategy for Dhaka, requiring close coordination and integration of parallel programs for optimal results.

The Project scope has been formulated based on the following considerations:

- (i) the Project should provide an adequate and realistic beginning (within the limits of affordability) for the implementation of a longer term program for the flood protection of Dhaka in a period of 10-15 years;
- (ii) the proposed investments should be cost effective, and should include only the high priority immediately needed flood protection and drainage investments to provide security to those areas of the city where population densities are high, thereby covering a large proportion of the city population;
- (iii) in view of the design and construction inadequacies in the newly constructed westerly embankment, which have increased the danger of flooding damage in the city in case of a catastrophic failure, remedial works on this embankment, together with an intensive O&M program should be given the highest priority;
- (iv) the Project should enhance the environmental health conditions in Dhaka, and contribute to poverty alleviation through complementary environmental improvement measures for the low-income groups, to reinforce the impact of the Project.

2.9 Scope and Coverage of the Project Components

The Project has the following four Parts:

Part A:	Flood Protection
Part B:	Drainage
Part C:	Environmental Improvement
Part D:	Implementation Assistance

Major components covered under each Part of the Project are described below. A more detailed description of each Part is given in Chapter 4 and the scope and terms of reference for the proposed consulting services covered under Part D are given in Appendix 6.

The scope of Part A (Flood Protection) covers mainly the completion and augmentation of the westerly flood protection embankment and flood walls, work on which was initiated by the Government following the 1988 floods. This includes intensive remedial works using wick drains for foundation stabilization in critical sections of the existing embankment, erosion rehabilitation and protection, other remedial works, reprofiling and recompaction, stabilization of parts of existing concrete flood wall and construction of new flood wall, slope protection, construction of additional sluices, and the establishment of a maintenance program.

A comprehensive drainage program is envisaged under Part B to alleviate periodic flooding in the city. This includes rehabilitation of priority existing major drainage canals (Khals) throughout the City, construction of new piped drainage facilities, improvement of secondary and tertiary drainage facilities, and the initiation of an intensive O&M program.

The environmental improvement program under Part C includes (i) slum and squatter area improvement, with intensive community and beneficiary participation, to benefit over 8,750 families; (ii) solid waste management program, linked to the low-income area being improved under Part B, involving provision of collection trucks, handcarts, and bins; and (iii) sanitation, water supply, and local drainage, involving provision of public toilets, pit latrines, public water supply standpipes, and cleaning of local drains.

Part D covers Project implementation support, including incremental administration and consulting services support for detailed engineering design, construction supervision, and project management. The consulting services requirements are based on an assessment of the institutional capabilities of the involved agencies and the previous implementation experience of the flood protection scheme. For Project management, 408 mm of consulting services (102 mm international, 306 mm domestic) are estimated to be required as detailed in Appendix 6.

3.0 INTEGRATED ENVIRONMENTAL MANAGEMENT PLAN FOR DHAKA

3.1. Introduction

In the complex urban environment, proper management of inter-sectoral activities are essential if benefits from improvement programs in any one sector are to be fully realized. Therefore, the Dhaka Integrated Flood Protection Project has been formulated in the context of an Integrated Environmental Management Plan (IEMP) for Dhaka city to provide an integrated framework wherein selected investment components are complementary to the proposed drainage and flood control program, and will mutually reinforce their impacts on an area-wide basis.

In Interim Report No. 1 the existing situation, problems and needs were identified by sector for: (i) land use management, (ii) water quality, sewerage and excreta management, (iii) water supply, (iv) solid waste management, (v) slum and squatter area improvement, and (vi) industrial, hazardous and toxic materials and waste management. Strategies have been identified to address the problems, covering policy and legislation which are solely a Government responsibility, short term remedial actions which could be suitable for inclusion in the project, and medium to long term actions which will require planned and phased actions to be taken by the responsible agencies. Actions recommended, as summarized in the following sections, are complementary to each other, and are suitable for incremental implementation.

3.2 Land Use Management

There is a lack of effective land use management in Dhaka which has resulted in, on the one hand, uncontrolled and unregulated urban growth with consequent environmental degradation and blocking of natural drainage channels, and, on the other hand, a lack of adequately serviced land to meet the increasing demands for new housing. Some of the key problems which have contributed to this in Dhaka include the lack/absence of: (i) a cohesive urban development policy to provide clear directions for the basic issues of urban development; (ii) up-to-date Master Plan and Structure Plans for long term planning; (iii) effective legislation to guide/control land use and establish appropriate development standards; (iv) coordination amongst sectoral development agencies; (v) a clear Government policy regarding effective use of vacant and under-utilized public lands; and (vi) any mechanism for applying or collecting development surcharges to assist in financing the essential public infrastructure and services which must be provided to sustain development.

Some of the more acute problems which affect Dhaka which are, at least in part, attributable to poor land use management include: (i) an extreme shortage of serviced land for meeting the ongoing growth demands, particularly for the low income and poor groups; (ii) rapid and uncontrolled growth of slum and squatter communities, particularly in the low-lying urban fringe areas which are most susceptible to flooding; (iii) inadequate access to basic sanitation services, particularly for the poor; (iv) sustained environmental degradation due to uncontrolled discharges

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of wastes; (v) deteriorating public health conditions; (vi) inadequate protection of drainage facilities, leading to increased frequency and severity of local flooding; (vii) indiscriminate and uncontrolled infilling of low lands, which would potentially form an essential part of a planned flood control scheme for the city; (viii) excessive demands on inadequate public infrastructure, utilities and services due to growth and increasing densification; (ix) increasing traffic congestion due to inadequate provision of roads and appropriate traffic controls; (x) failure to provide appropriate park lands and open spaces; and (xi) inadequate financial resources for public bodies to provide essential services.

Actions identified as being necessary to address these problems include the need to: (i) prepare and adopt a national policy for providing clear direction on urban development policies and strategies, and alleviation of urban poverty; (ii) review, approve and adopt physical planning and land use control legislation; (iii) prepare up-to-date Master Plan and Structure Plans for long term guidance and strategic planning; (iv) develop land use standards, development standards, and control mechanisms¹; (v) review Government land ownership and needs and recommend appropriate Government policies and strategies for rationalizing the use of vacant and under-utilized lands considering the potentials for disinvesting the lands, converting the lands for public use, for use for low income residential use, or transferring/leasing/selling to squatters/ settlers to provide long term security of tenure; (vi) establish a formal development review committee with representatives from RAJUK, DWASA, DCC, DOE and all utility agencies; and (vii) develop a strategic long term plan for land acquisition for public use and for low income housing needs.

Additionally, in connection with the preparation of long term flood control and drainage plans for Dhaka City, appropriate provisions should be made to: (i) prepare/adopt a drainage and flood control master plan for provision of facilities; (ii) develop a surface water management system and enact legislation to protect the drainage, detention pond and flood plain reserves; (iii) establish non-structural measures for flood management and mitigation, including standards on minimum road crest elevations, lot development elevations and plinth levels; (iv) develop integrated drainage/on-site storage standards for new developments; (v) integrate the development of drainage networks and detention pond reserves with provisions for park lands and public open spaces; and (vi) adopt and

¹ Such standards and controls would: (a) include standards for maximum development densities, minimum park and open space provisions, and provision of land for low income housing areas; (b) identify long term needs for drainage, flood plain reserves, transportation, solid waste disposal, park land and open space areas, and include appropriate controls to restrict/control development in these areas; (c) give consideration to development charges for all new developments or changes in land use to assist in financing the essential public infra-structure, services and amenities.

implement an operations and maintenance program which is complementary to the land uses in the affected area and assists in maintaining an appropriate ecological balance.

3.3 Flood Control and Drainage

Effective FC&D programs are one of the highest priority items for improving the security and health of Dhaka residents. This is especially true for the low income groups and slum dwellers who live in areas of highest risk, and of whom 66% are reported to be regularly affected by floods. In order for these programs to be effective, they must be well integrated; flood control works alone without accompanying drainage improvements, sluices and pump stations are ineffective, and possibly detrimental. For the current situation in Dhaka City, the highest priority zone for a phased protection scheme is the westerly "Phase 1" area of 136 sq km, with 87% of the population. The rehabilitation and completion of the westerly embankment/flood wall scheme has been identified as having top priority over extending improvements to the easterly zone. At present, about 37% of the existing embankment is unstable and potentially subject to failure, and over 16% is potentially subject to catastrophic failure. This could be a life threatening situation for thousands of people in lowlying areas who may have a false sense of security, and for whom failure would mean sudden inundation rather than the past slow and predictable rise of flood waters.

The design and construction of the flood control, erosion protection, and drainage works in the Greater Dhaka area requires planning, coordination between the responsible parties, and experienced design and construction. Innovative, cost-effective, and stable construction methods and materials are needed to rehabilitate and complete the Phase I embankments and floodwalls, and to design and construct the future east embankments.

The development of a unified strategy to deal with the immediate, short-term, and medium to long-term flood control, erosion protection, and drainage problems is an essential component of the DIFPP. The immediate and short-term activities are required to minimize the risk of catastrophic failure of the Phase I embankment and to reduce the risk for failure of the embankment in the future, while the medium and long-term activities will complete the flood protection and drainage schemes for, respectively, the first priority westerly half of the city, and the remaining easterly half. Immediate needs include: (i) preparing a conceptual design for remediation of the Phase I embankments; (ii) initiating a remedial action plan focused on sections which could fail catastrophically; (iii) assessing the integrity of the existing R/C wall and preparing amended designs; (iv) preparing QA and QC plans; (v) reconstructing critical sections of the failed Phase I embankment to Stage I elevations (8.0 m PWD); (vi) undertaking a crash drain clearing program to relieve acute drainage congestion; and (vii) initiating land acquisition proceedings for additional needed lands. Short term needs include: (i) establishing a project office to coordinate and administer the proposed project; (ii) developing a strategic development plan for the flood control, erosion protection, and drainage works in the Greater Dhaka area; (iii) completing

the remedial action plan for the Phase I embankment and reconstructing the remaining damaged or unstable sections of the Phase I embankment to the Stage I elevation (8.0 m PWD); (iv) constructing remaining embankments, flood walls and drainage sluices; (v) constructing internal drainage improvements; (vi) raising the spine road to the 50 year flood level and constructing associated drainage sluices; (vii) providing temporary pumping facilities; and (viii) developing an Operation and Maintenance Plan and training an effective, well organized inspection, operation, and maintenance staff. The medium-term components include: (i) implementing the operation and maintenance program; (ii) completing construction of the westerly embankments to the design level for the 100 year recurrence with 1.2 m freeboard; (iii) improving design of breaches in the R/C wall and constructing the R/C wall redesign at the breach points; (iv) constructing permanent pump stations and retention ponds for the priority westerly area; (v) developing flood plain regulations and initiating development controls; and (vi) developing and initiating emergency flood response programs. Long term components include: (i) designing and constructing the easterly embankments and structures; and (ii) designing and constructing the easterly pumping stations and retention ponds.

3.4 Solid Waste Management

Approximately 50% (about 1,250 tons per day) of the solid waste generated within Dhaka is never collected. Some is deposited in adjacent vacant lots, low lying areas, ponds or rivers, but a large percentage is deposited into the local drainage ditches, storm sewers and khals. This includes household refuse, tannery scraps, refuse from restaurants and hotels, residues from numerous cottage industries, scraps of cloth and dyes from textile shops, sludge and refuse from industries, animal wastes from over 100 uncontrolled slaughter areas, and refuse from street sweeping by municipal employees. From field observations, it appears that about 10% to 15% of the dry season volume in downtown drainage khals is comprised of solid waste. The resulting adverse impacts include clogging of the drainage system, accumulation of noxious decaying material on the water surface, degradation of water quality, attraction of disease carry insects and rodents, and an overall degradation of the environment. Collection practices are inefficient and unsanitary, and garbage collectors are in constant contact with the wastes they collect. Waste dumps are unregulated and unsanitary. Factors which contribute to this include: (i) inefficient and irregular municipal collection; (ii) a lack of municipal solid waste collection in many parts of the City, including all slum and squatter areas; (iii) a lack of convenient access to community bins; (iv) the ease of discarding waste rather than transporting it to a community bin; (v) a lack of public awareness of the adverse environmental and health impacts; and (vi) a lack of social pressure to promote sanitary solid waste management practices.

In order to address these problems, a combination of actions is required, including development of appropriate policies and strategies, and implementation measures. Recommended short term actions include: (i) identifying priorities and developing a formal policy for collection and disposal of solid waste; (ii) establishing national policies, strategies

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and administrative guidelines for solid waste management, including standards for "sanitary" collection and disposal of solid waste, the types of waste that may be placed in a solid waste landfill, disposal options for hazardous waste materials, guidelines for construction and operation of solid waste and hazardous waste landfills, and the minimum staffing requirements and qualifications for management personnel; (iii) legislating and enforcing regulations regarding the collection, transport and disposal of solid and hazardous waste; (iv) improving efficiencies for waste collection and disposal; (v) extending solid waste collection services to include all slum and squatter areas, and other portions of the city which are presently not served or are under-served; (vi) rehabilitating local community collection/storage bins; (vii) developing operation and maintenance manuals for sanitary landfills; (viii) developing a training program for management and technical personnel; (ix) providing municipal sanitation workers with gloves, clothing, protective shoes, nose masks and access to medical facilities; and (x) developing public education programs regarding the health hazards related to solid waste. Longer term measures include developing a long term strategy for solid waste management, including zoning of solid waste landfills, developing strategies for reducing the organic waste stream through recycling, selecting sites for construction of future sanitary landfills, developing improved financial planning for conservancy services, and monitoring leachate movement from landfills.

3.4 Sanitation and Water Quality

There is no comprehensive sanitation policy in place at either the national or local levels. The Dhaka sewer and treatment facilities are operating at or near their full capacity, and on completion of ongoing upgrading programs will be capable of servicing not more than 20% of the total population, or about 1 million people. Of the remaining 80%, about half (40%, or 1.9 million people) are serviced by private on-site "sanitary" systems, while the remaining half (1.9 million), primarily from the low income groups, are serviced by unsanitary systems or have no facilities. Population growth is presently estimated to average about 5.5% per year, or equivalent to about an additional 260,000 persons per year. Based on current trends, roughly half of these (25,000 households) will establish residence without adequate sanitary facilities. Sanitary, commercial and industrial waste discharges are virtually uncontrolled, and storm drains and open drainage channels convey highly polluted waste water, equivalent in effect in most areas to that of raw sewage. The greatest impact of flooding from these systems is felt by the low income groups who most commonly live in lower lying areas. The proposed drainage improvement project under consideration in this Dhaka Integrated Flood Protection Project will benefit the urban dwellers in the short term by reducing the frequency and severity of flooding. It will not, however, have any effect on the longer term effects of pollution and water quality. Environmental legislation is inadequate to control pollution.

In order to address this situation the government must recognize the growing seriousness of the problems, adopt a comprehensive sanitation policy and allocate adequate resources to meet the needs. For Dhaka,

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multi-agency cooperation is needed to develop a priority program to protect the population (in the short term) by containing and diverting the wastes away from the immediate living environment, stop the accelerating degradation of the environment by exercising strict controls over all new developments, and reverse the degradation by a combination of actions including land use control legislation, eliminating or reducing all point and non-point sources of pollution, extending sewer collection and treatment systems and/or exercising pollution control options on offenders, and promoting an intensive low-cost sanitation program.

Specific recommendations to meet the needs include, in the short term: (i) preparing and adopting a clear national policy for providing sanitation services, with time-bound goals to be achieved; (ii) adopting revised pollution control legislation and standards to provide the essential legal foundation for guidance, control and regulation of environmental issues; (iii) rehabilitating and upgrading the storm drainage system within Dhaka to contain and vacate the wastes away from the immediate living environment; (iv) completing ongoing sewer and treatment plant rehabilitation and expansion works; (v) ensuring adequate resources for continued routine maintenance and repairs; (vi) establishing a formal development review committee to ensure that all new developments have satisfactory provisions for utility services and waste disposal prior to approval; (viii) initiating a comprehensive, and long term, low cost sanitation program for Dhaka city with the primary objective of reducing or eliminating the disposal of human wastes in the urban environment; (ix) initiating a long term municipal program for desludging of septic tanks, and introducing effective regulations to prevent the unauthorized dumping of septic wastes into the drains and low-lying areas; (x) initiating a public information campaign for promotion of sanitation and environmental awareness; (xi) sealing off abandoned and active landfill sites; (xii) undertaking a detailed sanitary and storm sewer condition survey; (xiii) undertaking a consumer survey of all households, industries and commercial establishments to determine source and conditions of water supply service, water usage and consumption rates, type and conditions of solid and liquid waste disposal system(s), characteristics of wastes disposed, and water and sewer invoicing and payment records; (xiv) undertaking a short term pollution study; (xv) initiating a long term water quality monitoring program; and (xvi) providing assistance to DWASA to upgrade the laboratory facilities, staffing and training. In the medium and long term it is recommended that: (i) a new Master Plan for sewerage and drainage be developed; and (ii) legislation be reviewed to develop a system of discharge controls and requirements for discharge permits for all industrial and commercial waste discharges into the municipal collection systems (sewers and drains).

3.5 Water Supply

In Dhaka City, 3.6 million (75%) of the 4.8 million residents have direct connections to, or access to, the water supply system. The majority of people who are not directly connected are the slum and squatter dwellers, who obtain water through a secondary connection or from an alternative source. Despite the past and on-going improvement programs related to the

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municipal water supply system, the existing need for potable water still far exceeds the capability of the existing facilities. This is exacerbated by losses estimated at 56% of water production due to leakage (30%) and unaccounted losses (26%). Contamination of water in the transmission system occurs due to low pressure, cracked pipes, poor quality joints, and illegal connections. An increase in system pressure would reduce the inflow of contaminants but may result in an increase in line losses. Substantial exploitable groundwater reserves remain despite current high rates of groundwater abstraction. There is an urgent need for a comprehensive program to provide potable water to the approximately 36% of the residents of slums and squatter settlements who currently rely upon unsanitary sources for their daily needs, and for further expansion of the municipal water supply system to address existing shortages in production as well as anticipated future demand. The transmission system must be expanded to accommodate new development, with special emphasis upon the existing and future need for low income housing, and identifying leaks and improving pressure in the existing municipal system to eliminate the incidence of contamination during transmission and to reduce line losses.

In order to meet these needs, it is recommended that, in the short term: (i) a clear national policy be prepared for providing potable water to the public, with specific attention to ensuring access to supplies for the urban poor as a priority; (ii) a comprehensive water supply plan for Dhaka City be initiated, with the priority attention on providing access to potable water to all residents of slum and squatter settlements (regardless of their legal residence status) through extended public standpipes; (iii) all building permit issuances be formally reviewed and approved by an inter-agency committee before issuance to ensure adequate availability of water and other utility supplies; (iv) a comprehensive consumer survey be initiated for use in developing a Master Plan for Water Supply; (v) legal proceedings be taken against parties who illegally connect to the water supply system; (vi) a study be done to determine how increased revenue could be generated by DWASA to finance urgently needed maintenance and expansion programs; (vii) essential facilities operated by DWASA be protected against the adverse impact of flood inundation; (viii) system chlorination stations be introduced to ensure positive chlorine residuals in the delivered water for elimination of sanitation related diseases; and (ix) treated water from the Chandnightat Water Works be tested for an expanded range of contaminants to determine whether the existing treatment system is removing contaminants from industries located up-stream from the in-take pipe. For the medium and long term, it is recommended that a new Water Supply Master Plan be developed for Dhaka City, which updates the Long Term Plan prepared in 1981.

3.6 Slum and Squatter Area Improvement

Approximately 25% of the Dhaka population, or about 1.2 million people, reside in slum and squatter settlements. At the estimated present growth rate, the slum and squatter population is increasing by at least 60,000 people, or 10,000 households, each year. Slum settlements range in size from 10 households to over 500 households, and are scattered throughout the city, generally in relatively small pockets. Although there are areas

where over 5,000 people are clustered into larger slums, notably within the Mirpur area and in the Old City areas around Islambagh, Shaheed Nagar and Rasulpur, on average about 80% of the clusters are less than 1 acre in size, with average population densities of about 655 persons per acre (110 households). 29% (30,000 households) of the settlements are located on government or semi-government land (mainly squatters), 67% are on private land, and the remaining 3% on disputed land. 41% of the dwellers own their own house, 49% are renters, and 10% are rent free.

The sanitation and environmental conditions within most of the slums are extremely poor. The best service is for water supply, where about 50% have access to municipal standpipes or their own connection, and 14% have access to community tubewells; the remaining 36% however rely on neighbors supplies, or on nearby ponds and streams. Sanitation services are extremely poor; 87% of the population use community facilities, most of which are unsanitary kutcha latrines, and the remaining 13% either use others facilities or defecate in open spaces. 65% of the slums have poor drainage (affecting about 0.8 million people), of which 22% are regularly flooded during even minor rainfalls. 50% were totally inundated during the 1987 floods while 15% were partially flooded, and the situation was worse in the following year. 51% have no internal pathways, and 31% have very narrow paths. Only 9% of the slum dwellers have any form of regular solid waste collection service; the remaining 91% (over 1.0 million people, generating about 100 tons of garbage per day) dispose of their garbage onto nearby low lands, vacant lots, roadside drains or khals. As an inevitable result of these conditions, the living environment and general health of the slum and squatter residences is measurably worse than that of the urban population as a whole. The high rate of disposal of garbage and faeces into the immediate local environment of the slum areas, combined with the poor drainage conditions, lack of access to clean water supplies, and lack of access to proper health care services for a large portion of the population, renders the slum and squatter populations highly susceptible to disease. The infant mortality rate, at 152 to 180 per thousand, is double that of the non-slum urban areas, and the highest crude death rate, at 44 per thousand, is six times that of the non-slum areas. At any given time 30% to 46% of the slum and squatter population is suffering from disease.

The extreme poverty, poor environmental conditions, and poor health conditions are not only a sociological problem, which must be addressed and resolved, but could also ultimately become an explosive political problem. The effects of this are not restricted to the slum areas alone. The predominance of environmental pollution and of disease which affects 25% of the total city population poses a hazard to the entire city, not just the poor. To meet these urgent needs it is recommended that, in the short term, the Government: (i) prepare and adopt a national policy for providing clear direction on urban development policies and strategies, and alleviation of urban poverty; (ii) issue clear directions to executing agencies identifying poverty alleviation programs as a high priority item; (iii) set up and staff the DCC Slum Improvement Cell without delay; (iv) initiate and extend the LGEB/UNDP SIP program for slum and squatter areas within Dhaka where the dwellers meet the basic requirements for security

of tenure and willingness to participate; (v) extend, on an urgent and priority basis, the basic water supply and sanitation services into those areas which do not meet the criteria for inclusion in the SIP program; (vi) extend solid waste collection services into all areas covered under both the SIP program, and the urgent water and sanitation program area; (vii) alternatively, provide community motivation and technical direction to assist slum dwellers and squatters in adopting local sanitary methods of solid waste disposal, such as composting or burying; and (viii) ensure adequate allocation of resources to meet the annual poverty alleviation program needs. For the medium and long term it is recommended that: (i) physical planning and land use control legislation be adopted for effective control of land use and development; (ii) a strategic long term plan be developed for land acquisition for provision of land for public use and for low income housing needs; (iii) policies and strategies be developed, including consideration of incentives, disincentives and regulatory methods, for promoting active private sector participation in providing serviced lands and/or affordable shelter for the low income segment of the population.

3.7 Industrial, Hazardous and Toxic Materials and Waste Management

The present state of industrial, hazardous, and toxic waste and material management in Dhaka can be summarized as follows: (i) a clearly defined national policy for management of industrial, hazardous, and toxic wastes and materials does not exist; (ii) enforcement actions against known polluters are non-existent; (iii) impacts of industrial discharges on public health and the environment are unknown; (iv) industrial discharges to the existing sewage systems are unregulated, and could upset treatment processes; (v) most industries discharge directly to surface water and open sewers; (vi) environmental management and enforcement is spread between several agencies; (vii) existing legislation is not extensive enough and must be expanded; (viii) only draft environmental standards exist for discharges; (ix) there are no formal permitting requirements; (x) there are no guidelines for monitoring and inspection; (xi) there are no guidelines for sampling and analysis; (xii) remediation of existing contamination has not yet been initiated at any level; (xiii) cost reimbursement and enforcement of guidelines and rules have not been developed; and (xiv) there exists a concern on the part of existing industry that enforcement actions will be unequally applied, giving certain industries economic advantages over other industries, both within and outside the country.

Future strategies for the management of industrial, hazardous, and toxic wastes and materials must be developed in concert with other waste management considerations. This includes both the assessment and analysis of impacts of existing industries on public health and the environment, and the development of permitting requirements for future industrial development. In order to address the situation, the government must recognize the seriousness of the situation and adopt a comprehensive national environmental policy. This policy must be consistent with the national environmental goals, and should promote economic development, protect human health and the environment, and preserve the cultural

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heritage through protection of human and natural resources. It is therefore recommended that, in the short term: (i) a clear national policy be prepared and adopted to deal with environmental issues, including industrial, hazardous, and toxic waste management; (ii) a single department (DOE) be designated as the manager of the environmental programs of the country, with formal requirements for delegation of responsibilities to other government departments and agencies; (iii) the draft environmental regulations and standards be adopted as constituted; (iv) modification of existing and draft legislation be started, to be consistent with the national environmental policy; (v) a comprehensive monitoring and inspection program be established for existing industry; (vi) guidelines for monitoring, inspection, testing, and analysis be developed; (vii) a national permitting program for both existing and proposed facilities be established; (viii) siting issues be addressed through the DOE; (ix) permitting fees be established which cover the cost of government review of permit applications; (x) environmental impact assessments be required as a part of the permitting process; (xi) existing industry be required to submit permit applications for all points of discharge from their facilities; and (xii) the impacts of existing industry on public health and the environment be evaluated. For the longer term, it is recommended that: (i) an effective public education and awareness program be established with regard to industrial, hazardous, and toxic wastes; (ii) waste reduction and toxicity reduction methods be implemented on a national basis; (iii) long-term monitoring and inspection programs be continued and a statistical database be implemented; (iv) regular monitoring and reporting requirements to be undertaken by industry be implemented; (v) discharge standards for air, surface water, ground water, soil, and sewage be developed which are consistent with the national environmental policy; (vi) national guidelines for laboratory analysis, sampling, remediation, and preparation of environmental impact assessments be established; (vii) the qualifications and education of the staff of DOE be upgraded through a comprehensive long range plan of hiring, short-courses, on-the-job training, and education release programs.

3.8 Priorities and Programs

Based on an evaluation of the needs, it has been concluded that the scale of the needs to solve today's problems is so great that the amount of work actually taken up for implementation will initially be determined more by resource availability than by the identified needs. Therefore, priority consideration has been given to those elements which are suitable for incremental upgrading and which: (i) in the short term, will provide the greatest benefit to the low income and poor groups at the least cost; (ii) are complementary to each other, and serve to reinforce their impacts; (iii) are not reliant upon major institutional changes or Government actions for successful implementation; (iv) do not duplicate ongoing programs; and (v) provide a foundation for promoting lasting environmental improvements for Dhaka in the long term.

Consideration has been taken of the present ongoing and proposed programs in Dhaka which address some of the problems in Dhaka noted in the preceding. Included in these are: (i) the LGEB/UNDP Slum Improvement

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Project (SIP) which includes modest infrastructural improvements to slum areas, plus intensive public motivation and community participation; (ii) the ADB financed Dhaka Urban Infrastructure Improvement Project for an area based urban service rehabilitation and upgrading for about 520 ha within the existing development area in Mirpur, and including strengthening of DOE's environmental monitoring capabilities; (iii) the World Bank/UNDP financed Environmental Improvement Project for an integrated urban development project within the Old City area covering Islambagh, Shaheed Nagar and Rasulpur, and including construction of the Dholai Khal pump station and drainage improvements; (iv) the JICA financed Greater Dhaka Protection Project, FAP-8A, for preparation of a flood control Master Plan for Dhaka and the surrounding areas; (v) the upcoming UNDP/UNCHS assisted project for Preparation of Structure Plan, Master Plan and Detailed Area Plan for Dhaka and Chittagong, including strengthening of the planning and management capabilities of RAJUK and CDA; (vi) the upcoming UNDP assisted Greater Dhaka Metropolitan Integrated Transportation Study; (vii) the ongoing UNDP technical assistance support for financial management and solid waste management strengthening of DCC; (viii) the proposed UNDP assisted urban land policy project; (ix) the ongoing IDA financed DWASA-III Urgent Expansion Project (and possible DWASA-IV Project) for expansion and rehabilitation of portions of the DWASA sewer and water network, including consumer surveys, pilot leak detection programs and strengthening of the DWASA financial management capabilities; (x) the JICA assisted Urgent Sewerage Construction and Expansion Project for the rehabilitation and up-grading of the Pagla treatment plant, and existing sewers, pump stations and outfall; (xi) the JICA financed Kallyanpur Khal improvement and pump station construction program; (xii) the ADB assisted National Environmental Monitoring and Pollution Control Project for strengthening of DOE's capabilities in national environmental planning, assessment and monitoring; (xiii) the Government of France assisted surface water supply feasibility study program; and (xiv) the Government sponsored own programs for urgent water supply expansion, drain cleaning and flood protection programs.

Accordingly, priority for implementation under the Project has been given to providing complimentary environmental improvements to those areas where drainage and flood control works will be taken up, with a focus on improving environmental conditions for the low income groups in particular. Works recommended to be taken up include: (i) extending access to clean water supplies to all residents in Dhaka, irrespective of their status or whether they have legal tenure; (ii) developing a comprehensive low cost sanitation program to reduce/eliminate disposal of human wastes in the environment; (iii) developing a comprehensive slum improvement program for slum areas where there is security of tenure, modeled on the ongoing LGEB/UNICEF programs; (iv) promoting improved collection, disposal and local storage of solid wastes to reduce the intrusion of wastes into the local environment, the drainage systems and the surface water bodies. The programs have also been developed to be complimentary to other ongoing projects within Dhaka, and are suitable for expansion or extension.

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Table 3.1 following shows the inter-relationship between the various components selected for review and for implementation under the Project. Components will be taken up on an area basis focused on improving mainly low income regions in lowlying areas to complement and enhance the benefits from the proposed drainage and flood control works.

Descriptions of the selected Project components are described in the following Chapter 4.

table/cct

LINKAGES BETWEEN INTEGRATED ENVIRONMENTAL MANAGEMENT PLAN COMPONENTS

IMPACT OF ON	LAND USE MANAGEMENT	FLOOD CONTROL AND DRAINAGE	SOLID WASTE MANAGEMENT	SANITATION AND WATER SUPPLY	SLUM IMPROVEMENT	ENVIRONMENTAL MONITORING AND ENFORCEMENT
LAND USE MANAGEMENT		Increased land values leading to potential for cost recovery. Reduces costs of land development to flood-free elevations.	Reclamation of low lying areas by landfill for ultimate use as recreation areas, parks, low income housing, bus terminals.	New areas for housing development opened up by extension of sanitation and water supply.	Must be preceded by assurance of security of tenure for slum residents, otherwise cost contribution is impossible.	Enforcement of environmental standards & pollution control may force some polluters to relocate, possibly to city outskirts/industrial estates.
FLOOD CONTROL AND DRAINAGE	Zoning of flood detention areas. Reservation of drainage routes & embankments. Compensation of land holders.		Reduced blockage of drain by solid waste. Landfill of reclaimed areas above flood level.	Reduced contamination of flood detention & drainage waters due to improved sanitation.	Regularizing slum areas may make it more difficult to remove such areas if necessary to implement flood control and drainage works. Improved waste disposal practices will reduce drain blockages.	Enforcement of solid waste disposal and collection will help avoid blocking of drains, thus contributing to flood control.
SOLID WASTE MANAGEMENT	Reservation of suitable landfill areas & ultimate use of filled areas. Buffer zones around landfills.	Reduced capacity to remove solid wastes in flood & drainage waters. Increased need for proper disposal.		Improved water supply will enable area surrounding solid waste receptacles to be cleaned.	Improved tenure, community education and cost contribution will induce slum communities to upgrade solid waste disposal practices.	Enforcement against illegal solid waste dumping will increase collection volumes and landfill area requirements. Monitoring may result in some landfills requiring sealing.
SANITATION AND WATER SUPPLY	Zoning for industrial uses. Permit system for new developments based on availability of services.	Improved performance of low cost sanitation systems. Possible lowering of groundwater table from reduce recharge.	Reduced contamination of drainage waters from better collection. Possible contamination of shallow groundwater aquifers by landfill leachate, reducing suitability for water supply.		Need to extend water supply mains into slum areas & establish standpipes. Shared latrines and improved waste disposal will improve sanitation.	Monitoring quality of tap water will help detect cross contamination and leakages. Monitoring well water is necessary to ensure safety of groundwater. Monitoring surface water will help detect pollution zones for determining corrective measures and warning public.
SLUM IMPROVEMENT	Security of tenure for existing slums. Prevention of new slum areas. Assurance of basic services for new low income areas.	Reduced frequency and intensity of flooding. Increased tendency to locate slums in flood protected areas. Slum areas located on embankments.	Improved solid waste collection will help improve living conditions in slums, reduce vermin populations and smells and spread of disease.	Improved sanitation and water supply are major components of slum improvement plan, leading to improved living conditions and reduced disease incidence.		Monitoring will provide data on progressive improvement in slum living conditions and reduction in disease incidence. Enforcement may be necessary to consolidate environmental improvements.
ENVIRONMENTAL MONITORING AND ENVIRONMENT	Coordination of planning and environmental enforcement agencies.	Need to monitor water held in detention ponds which are used for fishing, bathing etc. Need for rigorous monitoring of maintenance procedures for flood security.	Need to monitor possible contamination of groundwater by landfill leachate.	Need to design monitoring program to detect improvements due to sanitation & water supply. Enforcement to prevent illegal connections & cross contamination.	Increased community awareness will increase pressure on reducing sources of pollution and help enforcement agencies.	

4.0 PROPOSED INFRASTRUCTURE INVESTMENT PROGRAM

4.1 Component Selection Criteria

Within the framework of available financing, the selection of individual components recommended for incorporation into the Project is based upon a blending of technical, social and economic considerations. Included among these are the key factors of :

- a) Needs: Each component considered has to have a clearly identifiable need based upon the present degree of deficiency of the service, the general community's perception of their own priority needs, the resulting demand for improved service, the expected growth rate in Dhaka, and the long range projections for development.
- b) Benefits: Each component must provide an immediately identifiable benefit to the urban population (particularly the urban poor), must improve the urban services to the broader community, and should complement and support the long range development plans for the City as a whole (including the residential, commercial and industrial sector expansion).
- c) Implementability: Components selected must be capable of being taken up, operated and maintained by the implementing agencies, and where required include strengthening measures to enable the agencies to do so.
- d) Affordability: All components selected must be affordable at all levels - not only to GOB, but also to the implementing agencies and to the individual beneficiaries, and be supported by a complementary financing plan to ensure that affordability can be realistically achieved.
- e) Security: Flood protection components, in particular, must be designed and constructed to appropriate technical standards to minimize risks and to ensure security for the Dhaka residents living within the flood protection area.
- f) Feasibility: All components selected must be clearly feasible, based upon rigorous environmental, financial and economic analyses, and an evaluation of the social benefits.

Based upon an evaluation of these criteria it was concluded that the priority needs for the Dhaka Integrated Flood Protection Project should be focused towards providing a flood free and secure living environment, supported by complementary environmental improvement programs targeted towards further improving the living conditions for the urban poor. In planning the flood protection program, the cost effectiveness of investments has been considered: protecting the existing densely populated residential, industrial and commercial areas is the first priority, followed by increased pumping capacity (as more intensive urban land use of peripheral areas is made), increased flood security (by dividing

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protected areas into self-contained compartments by building internal embankments), and expansions to the protected areas. While the immediate planning period is to the year 2000, the longer term planning considers the urban development needs to year 2010.

The components recommended further in this section for inclusion within the five year Project period have all been identified as being necessary, affordable and feasible for immediate implementation and inclusion under the proposed Project, and to be suitable for incremental expansion over the longer term. Those further field investigations which are essential for detailed design have been included as a part of the Project works. In addition, complementary works have also been preliminarily identified as being desirable for the long term success of the operation and management of the Project works - particularly in the urban land development and building control sectors - but as requiring further study before final recommendations can be made, and proposals have been made for implementing additional studies under technical assistance grant.

4.2 Design Criteria and Technical Levels

All works proposed for inclusion in the Project have been selected on the basis of identifying the priority flood control and drainage needs for the residents of Dhaka City, plus complementary environmental improvement programs to meet the basic needs for the low income residents in particular, and to developing low cost, technically appropriate solutions within the financial constraints of the project.

The key criteria utilized in evaluating appropriate design alternatives focused on the aspects of risk minimization, functional utility, economy of construction, durability and maintainability of the facilities. The highest priority for selection of program elements was directed towards remedying flood control and drainage defects by upgrading, rehabilitation and betterment programs, and towards optimizing the benefits by incremental extensions of complementary environmental services into areas of greatest need. Support for strengthening operations and maintenance capabilities has been integrated into the management plan for the infrastructure program, and has been complemented by specific provision within the Project budget to ensure that operation and maintenance service is up to an acceptable standard by the end of the five year implementation program.

Based upon these factors, the Consultant and the implementing agencies (BWDB, DWASA and DCC) have agreed on technical approaches and appropriate design standards for infrastructural improvements in the flood protection, drainage, water supply, sanitation, solid waste, and slum improvement components of the Project. They promote, to the greatest extent possible, maximum use of local materials, technologies and resources. However, they also incorporate the introduction of new cost effective technologies and training for the use of geosynthetic materials for construction of flood protection embankments appropriate to the special needs of the Project, and suitable for applications on similar projects throughout Bangladesh in the future.

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Typical design sections agreed for works included in the Project, plus the agreed technical approach for further field investigations and detailed engineering designs for remedial works on the western embankment, are presented in Appendix 3.

4.3 Cost Estimates

In order to develop the cost estimates for the Project, the Consultant worked in close cooperation with the engineering personnel in the BWDB, DWASA and DCC to develop appropriate unit rates for the proposed program elements, based on current 1991/92 prices. Such factors as the local cost and availability of construction materials, the accessibility of the proposed work elements, the distance from the nearest supply sources for major equipment and materials, and contractor availability were also evaluated.

The base costs developed for the project elements were computed either as a product of the applicable unit cost times the estimated quantity of work, or as a lump sum item to cover a grouping of works within a particular element, as applicable.

The total Project costs are derived from these 1991/92 base costs, with adjustment factors added to cover all related costs including physical contingencies, O&M during construction, site investigations and detailed engineering design, incremental administration, public information programs, and price escalations (inflation) related to the proposed year of implementation.

Appendix 5 provides a summary of the costs of the infrastructure investment program by sector, including the base costs for land acquisition, civil works, equipment supply and operation and maintenance during the Project period, plus allowances for physical and price contingencies. Additional costs for management support, detailed engineering design and supervision, incremental administration, and interest during construction have been calculated separately for the Project as a whole, and are presented in cost summary Tables 4.1 and 6.1.

4.4 Determination of Project Scope and Preparation of Outline Designs

In order to determine the scope of works required for each element of the program, the Consultants firstly: (i) undertook a comprehensive review of available reports, studies and mapping to identify data gaps and investigation needs; (ii) undertook reconnaissance field surveys of the existing and proposed embankments, flood walls and main drainage channels to preliminarily determine conditions, problems and needs; (iii) established a close working liaison with the major implementing agencies (BWDB, DWASA and DCC) to identify problems and priorities as identified by the local authorities; and (iv) established a close liaison with the parallel JICA FAP-8A program to share information and coordinate supplemental data gathering programs.

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Based on this, it was determined that additional field investigation programs and analyses would be required in order to accurately determine the magnitude of observed problems, particularly for failed sections observed in the existing embankment, and to develop technically appropriate solutions. Accordingly, the following supplemental field investigation programs were taken up:

- i) a comprehensive condition survey for the existing westerly embankment and floodwalls to determine the extent and magnitude of readily observable deficiencies,
- ii) supplemental subsoil investigations along the existing westerly embankment through both failed and apparently stable sections to determine the likely causes of past failures, the probability of further future failures, and to determine remediation techniques for repair and stabilization of the existing embankment,
- iii) supplemental subsoil investigations along critical sections of the proposed easterly embankment, and along proposed access routes to the embankment, to determine appropriate subsoil treatment and construction methods for future embankment construction,
- iv) supplemental crest survey and typical cross sections along the existing westerly embankment, coupled with establishing a series of settlement gauges and piezometers for monitoring, in both failing and apparently stable sections: (i) the rate of settlement of the embankment foundation, (ii) the rate of consolidation of the embankment, and (iii) the changes in pore water pressure in the subsoil,
- v) preliminary condition survey of the existing reinforced concrete floodwall to determine it's effectiveness and remedial works required;
- vi) supplemental topographic survey along the central spine road to determine the existing elevation and the need for raising to serve as a temporary flood protection embankment as part of a phased program of flood protection for Dhaka City, and
- vii) preliminary survey of drainage crossings of the central spine road to determine floodproofing needs as part of a phased program for flood protection for Dhaka City;
- viii) geotechnical evaluation of the subsoil investigation programs to recommend technically appropriate alternatives for embankment repair and stabilization in order to increase the security of the flood protection scheme for Dhaka.



(C)

The readers attention is directed to the summary of the major results and recommendations arising from the above programs which have been presented the separate report entitled "Preliminary Analysis and Design, Phase 1 Embankment, June 1991". Extracts of the executive summary and conclusions and recommendations of this report are included in Appendix 4.

Based upon this information and intensive coordination meetings with the engineering staff of the BWDB, DWASA and DCC, an unconstrained program of improvements was initially prepared focused on meeting the critical deficiencies for the flood control and drainage schemes for Dhaka, and on developing appropriate environmental improvement programs which would complement the FC&D schemes, with specific emphasis on alleviating critical deficiencies for the urban poor. Cost estimates were prepared and compared against the expected availability of program financing. Benefits of each element were analyzed and preliminary estimates of affordability and feasibility prepared.

Following the first approximations, the scope of the works program was progressively refined to bring the total project costs down to within the level of the funding expected to be made available. Those program elements which provided the greatest level of benefits, which had the highest cost effectiveness, which had the best levels of affordability and which were judged most feasible were retained for the Project, while other components were progressively eliminated. The final works program presented in this report is the end result of an iterative process of progressive reduction in the number of elements originally proposed, supported by an increasingly refined analysis of benefits, affordability and financial and economic viability.

The work program has been developed to the feasibility stage of analysis, with the location, scope, costs and phasing of each element proposed to be included in the Project clearly identified. The recommended components for all sectors are described in the following sections, and detailed in the cost estimates presented in Appendix 5.

Further refinements to the proposed program are currently being finalized in coordination with the implementing agencies, but are not available for incorporation in this Draft Final Report. All agreed modifications will be presented in the Final Report, following Appraisal.

4.5 Engineering Design and Construction Supervision

It will be necessary to prepare detailed engineering designs for all proposed annual works programs before proceeding to tendering and construction. Work to be included under this will include, to the extent required for each component, additional field surveys and subsoil investigations, preparation of final engineering design drawings, bills of quantities, specifications and tender documents. The cost of Project Management assistance, detailed engineering designs and construction supervision has been included in the Project estimates, averaging approximately 4.7% of the base cost.

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Further details of the above services, including broad Terms of Reference for the Project Implementation Consultant Services, are included in Appendix 6. Special preconstruction and preparation activities which are required in order for the Project to get off to a fast and effective start and to meet the schedule for the first years activities are discussed further on in Chapter 10.

4.6 Description of Proposed Works

As described in Chapter 2, the proposed Project is being designed in an integrated framework of flood protection, drainage, environmental improvements and poverty alleviation. The underlying rationale for the Project is to provide a flood free and secure living environment, and to improve the urban efficiencies and environmental conditions, particularly for the urban poor in Dhaka City.

The Project aims at an integrated urban development program consisting of: (i) flood control and drainage works; (ii) complementary environmental improvement programs in low cost water supply and sanitation programs for the low income residents, solid waste management and slum and squatter area development; and (iii) implementation assistance. In conjunction with this, emphasis has been placed on ensuring that adequate O&M capabilities are developed during the Project period.

The Project has the following four Parts as summarized in Chapter 2 and briefly described below; a more detailed description of each Part is given in the text following, while the scope and terms of reference for the proposed consulting services covered under Part D are given in Appendix 6.

Part A: Flood Protection: covers mainly the completion and augmentation of the westerly flood protection embankment and flood walls, work on which was initiated by the Government following the 1988 floods. This includes intensive remedial works and erosion protection on the existing embankment, stabilization of parts of existing concrete flood wall and construction of new flood wall, construction of additional sluices, raising and flood proofing the central spine road, and the establishment of a maintenance program.

Part B: Drainage: a comprehensive drainage program is envisaged to alleviate periodic flooding in the city. This includes rehabilitation of existing major drainage canals (Khals), construction of new piped drainage facilities, improvement of secondary and tertiary drainage facilities, and the initiation of an intensive O&M program.

Part C: Environmental Improvement: includes (i) slum and squatter area improvement, with intensive community and beneficiary participation, to benefit over 8,750 families; (ii) solid waste management program, linked to the low-income areas being benefitted under Part B, involving provision of collection trucks, handcarts, and bins; and (iii) sanitation, water supply, and local drainage, involving provision of public toilets, pit latrines, public water supply standpipes, and cleaning of local drains.

Part D: Implementation Assistance: covers Project implementation support, including incremental administration and consulting services support for detailed engineering design, construction supervision, and project management.

The following sections provide a summary of the focus of attention and the general approach taken for developing the sectoral programs, plus summaries of the scope and cost of major works taken up. Summary descriptions of the overall approach has been previously provided in Chapter 2, a summary of the total costs by category are presented in Chapter 6, and detailed estimates of the costs of the annual works programs and individual work items are included in Appendix 5. Table 4.1 provides a summary of the total costs of the recommended Project by sector.

TABLE - 4.1
Summary of Project Costs by Sector
(\$ million)

	Foreign	Local	Total
1. <u>Base Costs by Sector:</u>			
Part A: Flood Protection	14.46	25.86	40.32
Part B: Drainage	8.56	34.24	42.80
Part C: Environmental Improvement:			
i) Slum Improvement	0.61	1.34	1.95
ii) Solid Waste Mgmt.	1.82	3.38	5.19
iii) San/WS/Local Drain	1.14	3.35	4.49
Part D: Project Implementation Assistance:			
i) Incremental Admin.	0.32	1.47	1.79
ii) Consulting Services	1.59	3.20	4.79
Subtotal	28.50	72.84	101.34
2. <u>Contingencies:</u>			
Physical	2.94	6.76	9.70
Price	2.06	6.10	8.16
Subtotal	5.00	12.86	17.86
3. <u>Interest During Construction:</u>			
Service charge on Bank loan	3.20	-	3.20
IDC on Domestic Borrowing	-	2.30	2.30
Subtotal	3.20	2.30	5.50
TOTAL	36.70	88.00	124.70

4.6.1 Parts A and B: Flood Protection and Drainage Alternatives

In Interim Report No. 1 discussions were presented on the existing conditions, evaluation and status of flood protection works, problems and needs, alternative flood control and drainage strategies, and recommended strategies to meet those needs. The strategies as presented have been further reviewed and discussed in detail with representatives from the various involved agencies and ADB officials, and this Report presents the results and conclusions for proceeding with the planned activities.

Two basic alternatives were selected for further evaluation: (i) the overall plan for providing flood protection and drainage to the entire 265 sq km area comprising the Dhaka City Corporation as presented in Plan A in Interim Report No. 1, and (ii) a staged program for flood protection and drainage which will be suitable for progress expansion as funding becomes available, initially covering the highly urbanized 136 sq km westerly portion of Dhaka City which was evaluated as being the highest priority area for immediate attention.

(a) Flood Protection and Drainage - Overall Plan:

Plan A which was presented in Interim Report No. 1 was prepared to include all work required to provide complete flood protection and drainage improvements in the Dhaka City Corporation area of approximately 265 sq km for the full 100 year recurrence period. The proposed activities required for the overall plan are shown on Table 4.2 and Figure 4.1 and are briefly described as follow:

- i) perform site investigations, rehabilitate and stabilize the existing west flood protection embankment along Turag and Buriganga Rivers,
- ii) repair eroded areas and provide slope protection along the existing west embankment,
- iii) construct remaining drainage sluices on the west embankment between Satmasjid and Kellar Morh area,
- iv) construct remaining embankment/floodwall to complete flood protection in West Dhaka from Kellar Morh to Mitford Hospital,
- v) rehabilitate existing floodwall,
- vi) perform site investigations and construct new east flood protection embankment along Balu River,
- vii) construct sluices along east embankment,
- viii) rehabilitate internal drainage khals and construct storm drainage improvements,
- ix) perform site investigations and construct Pump Station No. 3 for the west area, and Pump Stations Nos. 4, 5, and 6 for the east area,
- x) raise central spine road to provide flood protection during the construction period, and to form a permanent internal partition for future development of compartmentalization programs.

FIGURE 4.1

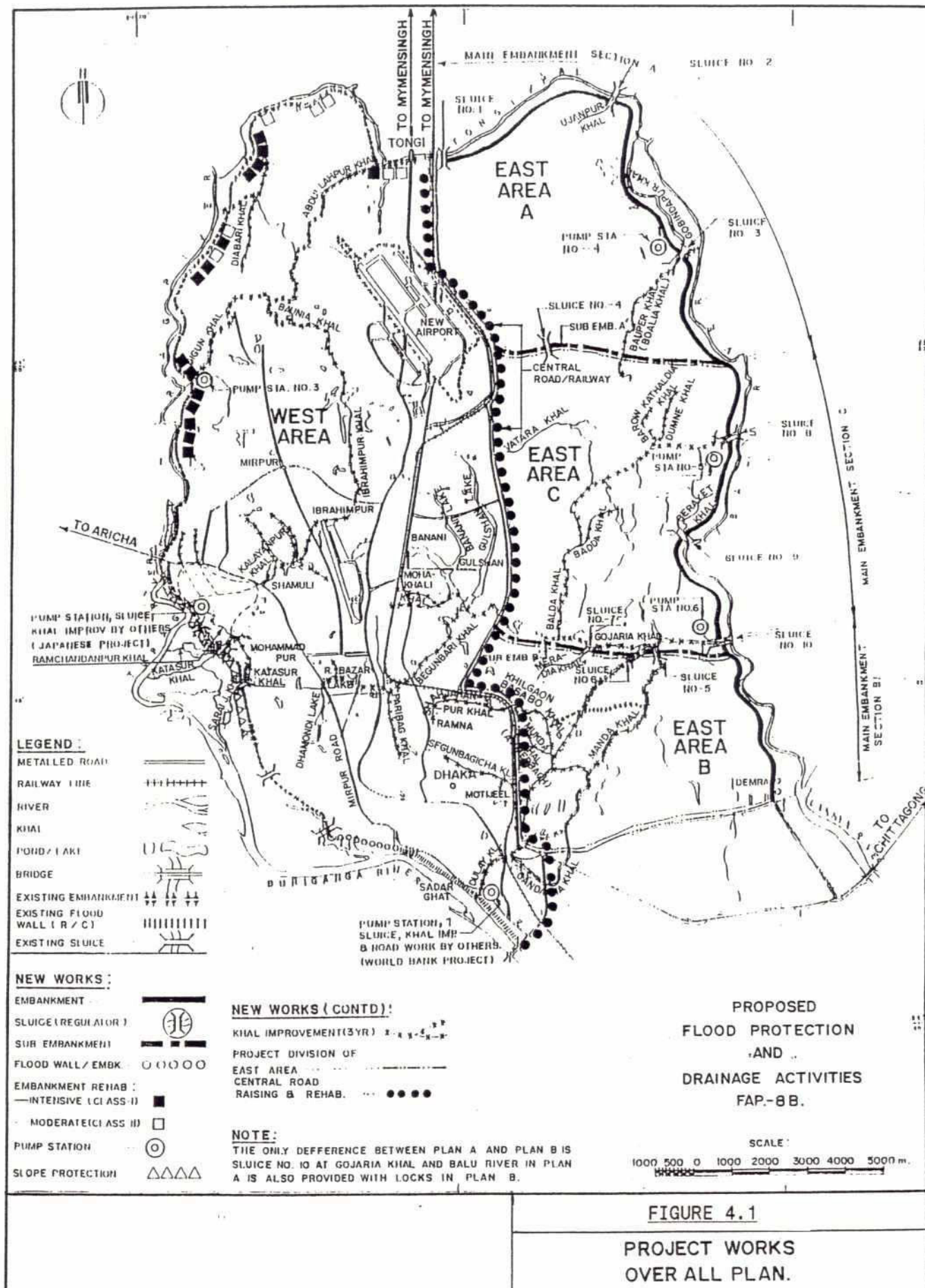


TABLE 4.2

COST ESTIMATE TO PROVIDE 100 YEAR LEVEL OF PROTECTION WHEN ALL WORKS ARE COMPLETED
AND ABOUT 50 YEAR LEVEL OF PROTECTION FOR WEST AREA WITH COMPLETION OF PHASE I WORKS

DESCRIPTION	BASE CONST. COST W/O DUTIES & TAXES	DUTIES & TAXES (MAJOR ITEMS ONLY)	BASE CONST. COST INCL. DUTIES & TAXES	RIGHT OF WAY	BASE CONST. COST INCL. R/W	TOTAL COST INCL. DAT R/W & CONT.	TOTAL COST INCL. DAT R/W & CONT. MILLION \$ US	NOTES
	(1)	(2)	(3) (1)+(2)=(3)	(4)	(5) (3)+(4)=(5)	(6) (5)x1.2=(6)	(7) (6) - 36.5 = (7)	
FLOOD PROTECTION - PHASE I								
1. Rehabilitation of West Embankment	537.88	228.46	766.34	17.85	784.19	941.03	25.78	1. All amounts are expressed in millions of Tk. unless otherwise specified.
2. Slope Protection - West Embankment	34.00	4.45	38.45	0.00	38.45	46.14	1.26	
3. Sloices - West Embankment	24.00	23.08	37.08	0.00	37.08	44.50	1.22	
4. Floodwall/Embankment - West	223.16	153.53	376.69	0.00	376.69	452.03	12.38	
5. Central Road Raising & Rehabilitation	108.00	47.00	155.00	0.00	155.00	186.00	5.10	2. Exchange rate: 1 \$US = 36.5 Tk.
Subtotal	927.04	456.52	1383.56	17.85	1391.41	1669.70	45.74	3. No Right of Way amount has been shown for floodwall Embankment-west, anticipation that all work may be performed within existing Stream boundaries. Detailed survey and design may determine need for additional right-of-way.
DRAINAGE - PHASE I								
1. Khai Rehabilitation and Improvement	784.56	0.00	784.56	237.32	1021.88	1226.25	33.60	4. Right of Way requirements for Pump Stations have been estimated based upon acquiring the lands at pre-inflation rates. Detailed design studies may determine that other combinations of higher pump capacities and lower right of way requirements are more cost effective.
2. New Pipe Drain Construction	361.48	0.00	361.48	0.00	361.48	433.78	11.88	
3. Secondary & Tertiary Drain Improvement	111.94	0.00	111.94	0.00	111.94	134.33	3.68	
Subtotal	1257.98	0.00	1257.98	237.32	1495.30	1794.36	49.16	
PHASE I WORK - BASE CONSTRUCTION COST	2185.02	456.52	2631.54	255.17	2886.71			
+10% physical & 10% Eng. & Admin. Cont.	437.00		526.31		577.34			
TOTAL COST - PHASE I WORK	2622.02		3157.85		3464.05	3464.05	94.90	
PERCENTAGE OF TOTAL COST-PHASE I WORK	75.69		91.16		100.00	100.00		5. The cost estimate does not include any amounts for operation and maintenance during construction nor for any price increases during the construction period. Prices are based upon mid-1991 rates.
FLOOD PROTECTION - REMAINING WORK								
1. East Embankment - Section A	978.99	58.69	1037.68	321.00	1358.68	1630.42	44.67	6. Under Duties and Taxes, only major items are shown separately. Minor items, averaging from 2 to 5%, are included in base construction cost.
2. East Embankment - Section B	311.67	34.25	346.12	103.20	449.32	539.18	14.77	
3. East Embankment - Section C	780.33	75.82	856.15	195.88	1052.03	1262.44	34.59	
4. East Sub-Embankment - Section A'	108.25	5.60	113.85	60.86	174.71	209.65	5.75	
5. East Sub-Embankment - Section B'	277.91	22.34	300.25	69.90	370.15	444.18	12.17	
6. Sloices - East	129.00	71.00	200.00	0.00	200.00	240.00	6.58	
7. Pump Station No. 3 - West	678.60	381.40	1060.00	382.50	2042.50	2451.00	67.15	7. Abbreviations :
8. Pump Station No. 4 - East	470.34	264.66	735.00	330.00	1065.00	1278.00	35.01	W/O : Without
9. Pump Station No. 5 - East	514.80	289.60	804.40	420.87	1225.27	1470.32	40.28	DAT : Duties & Taxes
10. Pump Station No. 6 - East	1057.68	594.92	1652.60	1228.26	2880.86	3457.03	94.71	Incl. : Including
Subtotal	5307.77	1798.28	7106.05	3712.47	10818.52	12982.22	355.68	R/W : Right of Way
DRAINAGE - REMAINING WORK								Cont. : Contingencies
1. Khai Improvements - East	103.00	0.00	103.00	60.25	163.25	195.90	5.37	Eng. : Engineering
REMAINING WORK - BASE CONSTRUCTION COST	5410.77	1798.28	7209.05	3772.72	10981.77			Admin. : Administration
+10% Physical & 10% Eng. & Admin. cont.	1082.15		1441.81		2196.35			Const. : Construction
TOTAL COST - REMAINING WORK	6492.92		8650.86		13178.12	13178.12	361.05	
PERCENTAGE OF TOTAL COST-REMAINING WORK	49.27		65.65		100.00			
TOTAL COST-ALL WORK (100 YEAR PROTECTION)								
	9114.94		11808.71		16642.17		455.95	
PERCENTAGE OF TOTAL COST ALL WORK	54.77		70.96		100.00			

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The base construction cost for the complete flood protection and drainage scheme for Dhaka City, including duties and taxes, physical contingencies, engineering and administration, and right of way acquisition, is estimated at approximately Taka 16,600 million (US \$455 million), of which right-of-way costs amount to about 29%, and duties and taxes amount to about 16%. Operation and maintenance during the implementation period plus price contingencies, together amounting to about 15% of the capital costs, would be additional to the above estimate.

As evaluated in Chapter 7, the concept of providing full flood protection and drainage for all of Dhaka City is economically viable and is feasible. However, it was clear that the total cost of this approach would far exceed the presently available financing. Accordingly, it was agreed that complete flood protection for Dhaka City would be considered in the context of a long-term strategy for development in a staged program over a period of 10 to 15 years, and that no additional evaluation of this option would be done under this Project. It was further agreed that attention would be focused on developing an immediate action plan for protection of the highest priority areas only, which would be suitable for incremental expansion in the future.

(b) Flood Protection and Drainage - Phased Program:

Due to the high costs of providing full protection for all of Dhaka City and the lack of available funding for the overall plan, consideration was given to phasing the Project works to provide maximum early benefits at minimum costs. Accordingly, full consideration was given to optimizing the benefits of past investments, and to incorporating existing roads and embankments into the phasing schemes for maximum efficiency. Based on this, the original Government proposal for developing the westerly half of Dhaka City, which contains over 95% of the commercial and industrial infrastructure and more than 87% of the City population, was evaluated as having the highest priority for completion.

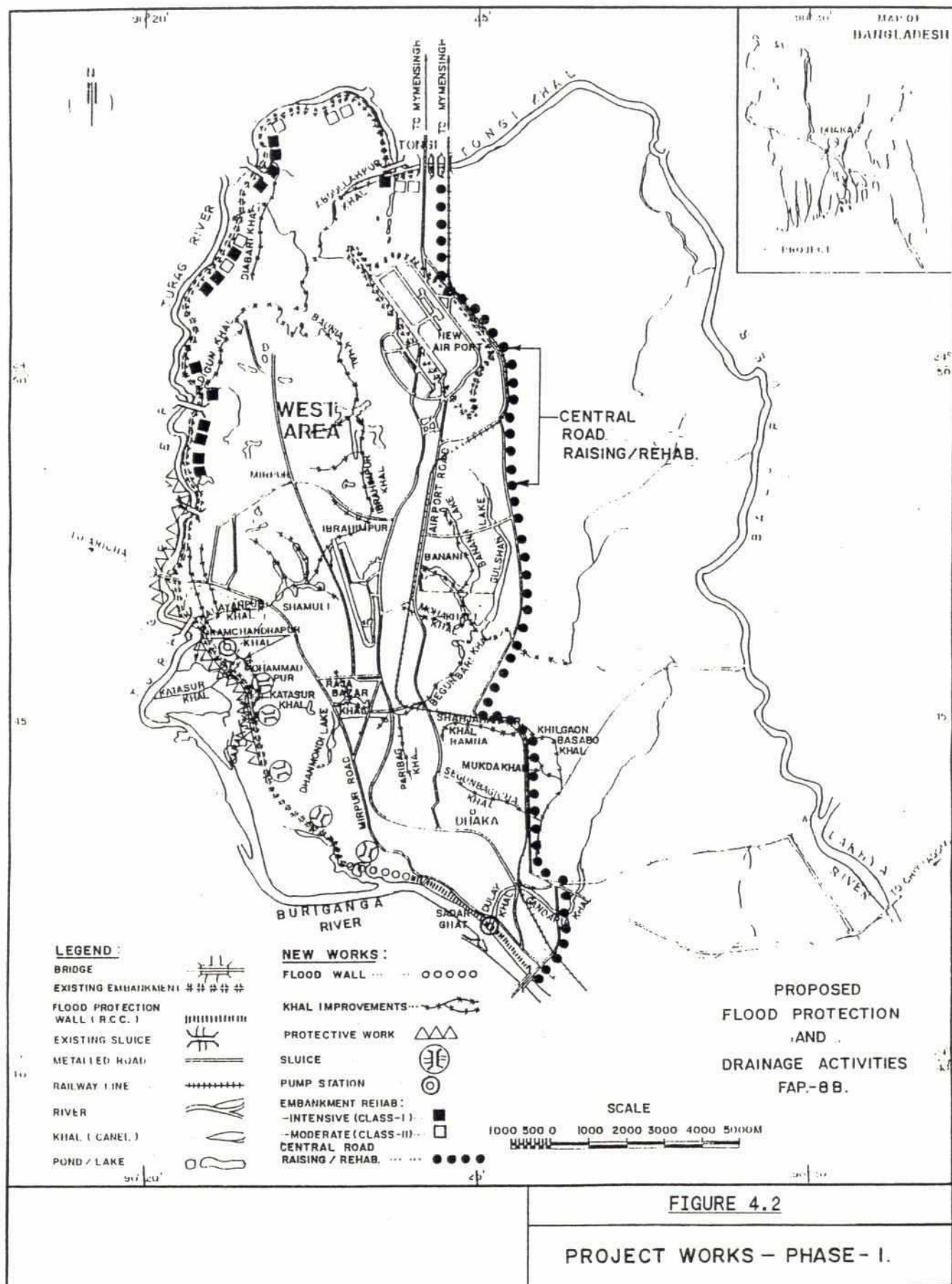
Estimates of costs and feasibility (see Chapter 7) have confirmed this conclusion, and the recommended flood control and drainage components are described in the following:

4.6.2 Part A: Flood Protection

The recommended flood protection works for inclusion in the Project encompass protection of approximately 136 sq km of the westerly portion of Dhaka City as shown in Figure 4.2, and cover those activities necessary to complete the works in this area initiated by GOB following the 1988 floods. The boundary between the western and eastern areas is provided by a sequence of main roads and railway embankments, referred to as the central spine road in this document, which forms the eastern boundary for the Phase 1 Project area.



FIGURE 4.2



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The level of flood protection offered along the westerly side of the protected area, which will consist of a combination of earth embankment and concrete flood wall, will correspond to the maximum water elevation sustained during the 1988 floods, with freeboard added to the elevation of earth structures. The return period of this flood has been estimated at a minimum of 70 years. Following the 1988 flood, GOB also initiated the raising of the central spine road to an elevation corresponding to a 50 year recurrence flood. Preliminary surveys indicate that this elevation has not been reached over the entire length of the Central Road, and the Project includes provision for raising the elevation of the central spine road to match the 50 year flood where this is required.

The scope of recommended work, as shown on Figure 4.2, is as follows:

- i) intensive remedial works over a total 4.7 km length of existing embankment on the western side of the Project area which is unstable and potentially subject to catastrophic failure. These areas are located where the embankment crosses redundant river channels, and the principal reason for the present serious instability of these parts of the embankment is the weakness of the underlying soils. Effective completion of the works will require stabilization of the embankment foundation by installation of extensive foundation drainage works to permit rapid consolidation and consequent strengthening of the foundation soils;
- ii) remedial works on a further 3.1 km of this embankment which is unstable though not subject to catastrophic failure, consisting of foundation drainage measures similar to those for the 4.7 km section described above, but not as extensive;
- iii) minor remedial works on a further 3.2 km of embankment, consisting mainly of reprofiling works, recompaction of soft areas, and filling and compaction of surface cavities and cracks;
- iv) erosion repair and slope protection against wave action on approximately 7.8 km of exposed length of the western embankment. This protection will augment the normal jute mesh and turf protection that will be installed throughout the total length of embankment;
- v) remedial works over approximately 5.3 km of existing reinforced concrete flood wall. The nature of these works will be determined following a detailed inspection and sub-surface investigation of the wall, which is visibly distressed and has been undercut in several locations;
- vi) construction of 1.6 km of new flood wall, which was not constructed by GOB because of local opposition, by use of sheet piles or similar measures which will allow relocation of the wall to a more socially acceptable alignment;
- vii) construction of four remaining drainage sluices at intervals along the embankment alignment;

- viii) raising of the central spine road (eastern boundary of the Project area) as outlined above, mainly by construction of a low flood wall alongside the road or as a median barrier, and provision of sluices and control structures along the central spine road openings; and
- ix) provision of temporary pumping facilities for evacuation of internal drainage during periods of high river stage combined with heavy rainfall (included as a part of the O&M costs for the Project).

The estimated capital cost of the recommended flood protection component of the Project, including base costs for land, civil works, materials and equipment, and O&M during construction, but excluding physical and price contingencies and interest/charges during construction, is Taka 1,471.65 million (\$40.32 million), representing 39.8% of the total base cost of the investments proposed under the Project. Detailed estimates are presented in Appendix 5.

Upon completion of this first phase of the flood protection works, the westerly portion of Dhaka City will be provided with protection against external flooding for an estimated 50 year flood recurrence level. The embankments along the westerly boundary will be completed to the final design level of elevation 10.0 m PWD, suitable for protection against a 100 year recurrence flood with a 1.2 meter freeboard, while the central spine road will be completed to an intermediate overtopping level averaging elevation 7.4 m PWD, suitable for protection against the 50 year recurrence flood. The existing flood walls along the southerly portion of the westerly boundary will similarly provide an intermediate protection level, equivalent to approximately a 70 year recurrence flood with a 0.6 m freeboard.

Upon completion of the Project, protection against internal flooding from extreme rainfall events will remain dependant upon gravity flow discharge and the capability of temporary pumping facilities to evacuate excess water. During normal years performance will be satisfactory, as the maximum rainfall occurs during the June, July and early August period, while the peak flood flows occur in late August and early September. With temporary pumping facilities in operation, it is recommended that operational procedures be established so that internal water levels are maintained below elevation 5.5 m, or about 0.8 m less than the average flood.

However, for the full benefits to be realized from the Project it is important to note that construction of permanent pumping stations to evacuate the internal runoff will be required so that internal water levels can be regulated with a high degree of surety. Construction of Pumping Station No. 3 is recommended to be the highest priority item for the next phase of the program, but the costs exceed the present fund availability under this ADB assisted Project.

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The estimated cost of providing the full design discharge of 65 cms is approximately Taka 1,060 million (\$29 million). Phased construction of Pump Station No. 3 is a viable option, and it is estimated that the cost of providing an initial capacity of 22.5 cms would be Taka 400 million (\$11 million). It is recommended that the Government consider the pump station construction as a high priority item, and initiate at least a first stage construction which would be suitable for future expansion, or seek parallel donor assistance for early completion.

4.6.3 Part B: Drainage

The proposed drainage works are a necessary complement to the flood protection works, and the primary focus of the drainage improvement program is on creating an integrated drainage system within the Dhaka urban area to eliminate/reduce the drainage congestion and regular local flooding which prevails during the monsoon season. The poor drainage is not only a serious health hazard, but also contributes significantly to accelerated road deterioration rates with attendant high maintenance costs. The Project will cover the drainage requirements of the flood protection area, including those drainage facilities which lie outside the area but which are connected to the Project area drainage network.

Included in the infrastructure improvement program are:

- i) cleaning and rehabilitation of major existing open drainage khals totalling 77.9 km in length. The rehabilitation works will consist of dredging and reprofiling to restore the khals to their design capacity, including lining where needed,
- ii) construction of 32.7 km of new piped drains to relieve drainage congestion in the built-up areas of the City
- iii) completion of urgent drainage works started under the GOB crash program designed after the heavy pre-monsoon rains of 1991. This work includes mainly cleaning and unblocking existing covered and open drains in the more densely populated parts of the City, together with a limited program of construction of small capacity new drains, and
- iv) implementation of a rigorous operations and maintenance program for the drainage works over the Project implementation period as the Project construction works are completed.

The estimated capital cost of the recommended drainage component of the Project, including base costs for land, civil works, materials and equipment, and O&M during construction, but excluding physical and price contingencies and interest/charges during construction, is Taka 1,562.09 million (\$42.80 million), representing 42.2% of the total base cost of the investments proposed under the Project. Detailed estimates are presented in Appendix 5.

4.6.4 Part C: Environmental Improvement

The urban infrastructure and services in Dhaka have severe deficiencies, and the slum dwellers/squatters which form more than 25% of the total population do not have access to most of the basic services which are available to other City residents. Local flooding is an annual event in these areas, garbage collection services are generally not available, and sanitation, water supply and access facilities are poor. Health conditions in particular are extremely bad in the slum areas due to the lack of basic services and the consequent pollution within the living environment.

The Environmental Improvement Program will encompass three components which are complementary to the flood control and drainage programs and which will serve to enhance the overall impact of the Project within the Project area: (i) slum and squatter area improvements, (ii) solid waste management, and (iii) sanitation, water supply and local drainage.

The scope of this Part C includes the following components:

(i) Slum and Squatter Area Improvement:

Slum improvement programs modeled on the highly successful LGEB/UNICEF slum improvement project have been included in the proposals. Included in the programs are modest infrastructural improvements to slum areas in water supply (1 hand tube well or standpipe per 10 families), sanitation (1 twin pit latrine per 3 families), footpath access and security lighting, improved drainage facilities and solid waste storage and collection services.

One of the most significant aspects of the program is the high priority placed on motivation and community participation in the improvement works, which will be coordinated through the Slum Improvement Cell to be established by the Dhaka City Corporation. Selection of the slum areas for inclusion in the program is restricted to those areas where security of tenure is guaranteed, either through ownership of the lands by the slum dwellers themselves, secure tenure on government lands, or guaranteed secure tenure on private properties for a minimum period of five years through contract with the property owner. The slum dwellers are involved in the entire development process from the beginning of the project, form their own council and select their own representatives for receiving training. A part of the initial cost of water supply and sanitation services is paid for by the recipients, and this money is returned to supplement a loan fund for income generating activities.

Funding is provided in the program for training, health care and support for income generating activities. Community health workers (CHWs) are selected from within the slum area to receive basic primary health and child care training (1 per 50 households), and primary health care equipment (baby scales, growth charts, etc.) is provided. Groups of ten households each are formed from within the beneficiaries, are trained in operation and maintenance of the infrastructure provided, and operate as a unit to receive further project benefits.

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Training in income generating activities is provided for the female beneficiaries and income generating loans are made available to the women within the groups. Operating on the Grameen Bank model, each group selects their own recipient for financial assistance, and when the initial loans are repaid select other recipients, in rotation, for further aid. NGO assistance is actively solicited to help in providing training for the slum dwellers and to assist in formulating education programs for the children. Guidance for the overall program will be coordinated through the LGEB slum improvement project to draw upon the extensive experiences gained in this national program.

A total of 8,000 families are proposed to be assisted over the five year Project period under this scheme. A further 750 families, presently squatting on public lands and along khals, and contributing to drainage system deterioration, will be resettled under this component.

The estimated capital cost of the slum and squatter area improvement component of the Project, including base costs for land, civil works, materials and equipment, and O&M during construction, but excluding physical and price contingencies and interest/charges during construction, is Taka 71.00 million (\$1.95 million), representing 1.9% of the total base cost of the investments proposed under the Project. Detailed estimates are presented in Appendix 5.

(ii) Solid Waste Management:

Solid waste collection services are, at the present time, at a low level in Dhaka, and are generally limited to the cleaning of major roads and collection of market wastes, with private coverage provided only within the more affluent areas of the City. Accordingly, most of the residents must rely on their own disposal methods, with the result that about half the wastes are uncollected and are disposed of by throwing onto vacant lands or into drains within the locality. This practice is hazardous to the health of the residents, accelerates the clogging of the drainage systems resulting in local flooding and drainage congestion during the rainy periods, and increases the annual cost of drainage system maintenance. There is currently no enforcement of regulations to prevent this practice nor, in the absence of any alternative, is there any scope for the City to begin to do so.

The focus of the proposed project is to provide additional equipment and facilities to enable the City to upgrade their service levels within existing areas and to extend their services into new areas, particularly into the low income areas and those areas adjacent to the drains which are to be taken up under Part B of the Project. Included in the Project are: (a) rehabilitation and new construction of 3,000 dustbins for local short term storage prior to collection, (b) 2,000 hand push carts for collection in congested areas and for transfer of wastes to convenient collection points, (c) 30 garbage trucks for collection and transportation to end disposal sites, and (d) 120 demountable containers.

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Improvement of collection efficiencies is also seen to be a necessary component to complement the Project investments, and technical assistance to achieve this is being provided under the parallel ongoing World Bank financed Dhaka environmental improvement project. Consulting services provided under this Project will further assist in developing appropriate practices to optimize effective utilization of the new equipment.

The estimated capital cost of the solid waste management component of the Project, including base costs for land, civil works, materials and equipment, and O&M during construction, but excluding physical and price contingencies and interest/charges during construction, is Taka 189.53 million (\$5.20 million), representing 5.1% of the total base cost of the investments proposed under the Project. Detailed estimates are presented in Appendix 5 .

(iii) Sanitation, Water Supply and Local Drainage:

Sanitation: The provision of public sanitation facilities and services for the collection and end disposal of human wastes, or the assurance that such services are provided, are a part of the Cities designated responsibility, whereas the provision of private sanitary facilities for personal use is traditionally the homeowners responsibility. However, open defecation and unsanitary human waste facilities constitute one of the major public health hazards in the urban environment, and a strong commitment to extending proven low cost technologies and to increasing the acceptance level for sanitary disposal methods is essential to the health of the community. There is a strong need for intensive municipal support to, and direct involvement in, the promotion and distribution of sanitary facilities.

In line with this the consultants recommend that the elimination of open defecation, replacement of service latrines and upgrading of unsanitary facilities to sanitary facilities form the priority target areas for this program. Included in the proposed project are: (a) 3,000 very low cost sanitary pit latrines which are affordable down to about the 90th percentile of the City residents, (b) 2,500 low cost twin pit latrines which are affordable down to approximately the 70th percentile, (c) 2,500 latrine shelters to promote public interest and acceptance of the program, (d) 30 public toilet/wash houses plus 5 mobile toilets for market areas and public gatherings, and (e) 2 septic tank desludging trucks for collection of sanitary wastes. All private sanitary facilities are proposed to be financed through Project loans on a 100% cost recovery basis, and accordingly the affordability of the facilities to the various income groups is an essential element of this sector of the program, and has been taken into consideration in the development of the proposals.

Under Part D of the Project, adequate funding has been included for the dissemination of public information and education literature to promote the acceptance and use of sanitary disposal methods, and it is envisaged that the City will actively solicit the assistance of local NGOs, community groups and public media services to generate a heightened community awareness of the problems and options available.

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Water Supply: The water supply component is very minor, though socially important, part of the Project focused on providing public water supply facilities to extremely disadvantaged families in slum and squatter areas, irrespective of tenure status, where existing supplies are not available. It includes the provision of 1,000 new standpipes within the existing service zones where supply capacity is adequate to support such moves and/or modest extensions of tubewell service to needy areas.

Local Drainage: The DCC currently maintains about 120 km of local drain pipes plus all roadside surface drains, many of which are damaged, blocked or broken causing localized shallow flooding during even minor rainfalls. Under this component is included: (a) the cleaning and rehabilitation of 120 km of local drains, (b) extension of 71 km of minor drains, (c) cleaning and rehabilitation of 60 km of surface/roadside drains, and (d) the supply of one drain gully sweeper for improved drain maintenance.

The estimated capital cost of the sanitation, water supply and local drainage component of the Project, including base costs for land, civil works, materials and equipment, and O&M during construction, but excluding physical and price contingencies and interest/charges during construction, is Taka 163.97 million (\$4.49 million), representing 4.5% of the total base cost of the investments proposed under the Project. Detailed estimates are presented in Appendix 5.

4.6.5 Part D: Implementation Assistance

As discussed previously in Section 4.5 provision has been made in the Project for incremental administration and consulting services for detailed engineering designs, construction supervision and project management services to assist in the overall coordination and management of the Project. A Project Implementation Office (PIO) will be established under the Project, staffed by representatives of each participating GOB agency and by the Project consultants, to provide:

- i) detailed engineering design and construction supervision;
- ii) coordination and management of the Project activities;
- iii) equipment and logistic support facilities;
- iv) quality assurance and control, including establishment of a materials testing laboratory and program;
- v) development of O&M guidelines and procedures; and
- vi) PBME and community development coordination and services.

Broad Terms of Reference for Project Implementation Consultant Services are described in Appendix 6.

The estimated cost of the implementation support services, excluding physical and price contingencies and interest/charges during construction, is Taka 240.17 million (\$6.58 million), representing 6.5% of the total base cost of the investments proposed under the Project.

4.7 Operations and Maintenance

The cost of operating and maintaining the project facilities during the Project implementation period has been included as a part of the Project costs, based on allowances varying from 1.25% of the capital cost of construction for khals and drains, to 5.0% for embankments and civil works, and to 20% for light equipment such as garbage carts and hand tools. Included in this item is also the estimated cost of operating and maintaining the solid waste collection service during the Project period, based on estimates of actual operating costs including a vehicle replacement allowance. The costs of operation and maintenance of private facilities which do not fall under the Pourashava control are not included.

The total costs of operation and maintenance activities during the Project are estimated at Taka 242.00 million (\$6.63 million), for an average of 6.5% of the base costs. This amount is included in the sectoral totals described previously. Included in this, but not separately enumerated, are the costs of providing essential equipments for operation and maintenance of the facilities, and it is recommended that flexibility be maintained so that essential equipments of a minor nature may be purchased on an "as needed" basis during the Project period. Further discussions on O&M are contained in Chapter 5.

5.0 IMPLEMENTATION ARRANGEMENTS

The implementation arrangements described in this Chapter are primarily relevant to the execution of the recommended Project, or Phase 1 of the overall flood protection plan for Dhaka City. Only some of these arrangements may be applicable for further stages in the future.

5.1 Execution and Coordination

The project implementation structure is shown in Figure 5.1. The overall coordination, monitoring and supervision for the Project will be provided by the Ministry of Irrigation, Water Development and Flood Control (MIWDFC) through the FPCO, under procedures that have been standardized for the FAP. The existing Steering Committee that has provided policy guidance during Project formulation will continue during Project implementation. This committee is chaired by the Minister for MIWDFC and consists of the Chairmen of BWDB, DWASA, and RAJUK, the Secretaries of LGD, MOW, and MOL, the Mayor of DCC, Director General of DOE, Director of UDD, Member (Flood Control and Physical Infrastructure) of PC, and Secretary/Additional Secretary of MIWDFC,

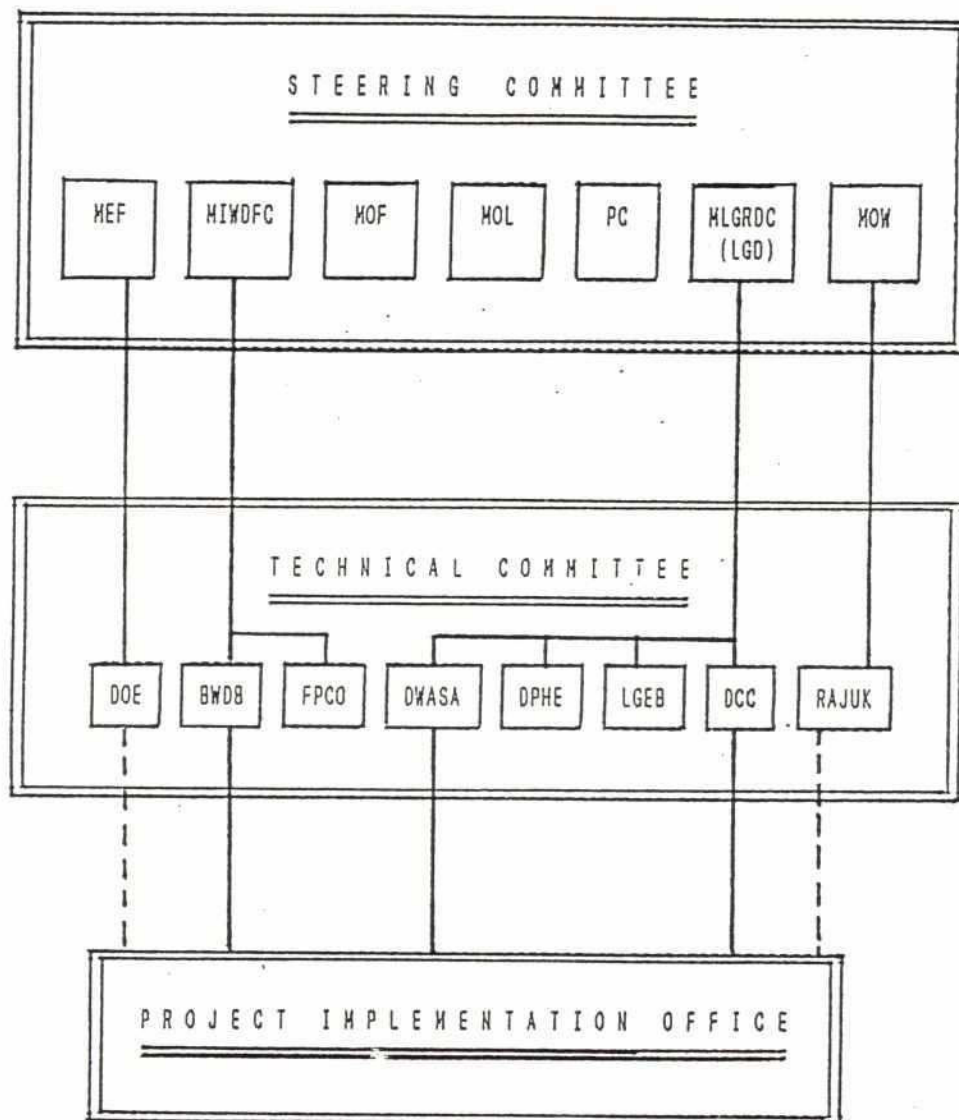
Similarly, the Technical Committee set up under the FAP/FPCO that has been operative during the Project formulation phase will continue during Project implementation to provide guidance on technical matters and coordinate Project implementation. It will also prepare working papers for consideration of policy-related matters by the Steering Committee. The technical committee has technical level representatives from the agencies included in the Steering Committee.

The overall technical supervision and execution of the Project will be the responsibility of the Bangladesh Water Development Board (BWDB), which will be the lead Project Executing Agency. Other implementing agencies will include DCC and DWASA, while DOE and RAJUK will be involved in Project implementation in a supportive role: the former in the overall monitoring of environmental impacts of the Project, and the latter in land development planning and control. BWDB will implement Parts A and D of the Project, with assistance from RAJUK for improvement of the Central Road; DWASA and DCC will implement Parts B and C respectively.

A Project Implementation Office (PIO) headed by a Project Director at a senior Superintending Engineer/Chief Engineer level will be set up. The PIO, which will incorporate all consultancy services under the Project, will be involved in coordination and management of the following: project facilities, programming, financial planning, detailed engineering design, tendering and construction supervision, design and implementation of PBME activities, socio-economic and engineering surveys, community/NGO participation, and public information campaigns.

Figure 5.1

PROJECT IMPLEMENTATION STRUCTURE



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The PIO will be staffed by full time representatives from the Project implementing agencies (including DOE and RAJUK), and will include Deputy Project Directors from BWDB, DCC and DWASA, at Executive Engineer level, who will be responsible for liaison with their respective agencies. The PIO will have engineering, administration and finance, and community development sections. The staffing of PIO will include seconded staff from respective agencies as well as new staff recruitment. An estimate of the staffing requirements for the PIO has been made and it, along with the operational details of the staff development plan, will be discussed and fully agreed to at Appraisal.

The PIO will maintain records of the progress of all Project activities and be responsible for ensuring timely Project implementation. The Government will ensure timely and adequate staffing in number and experience in PIO and in the implementing agencies throughout Project implementation. Working guidelines for responsibilities and relationships between PIO and implementing agencies will be developed prior to Appraisal.

5.2 Project Implementation Schedule

The recommended Project is planned to be implemented over a period of five years from late 1991 to late 1996, as shown in the Implementation Schedule, Figure 5.2.

The first years work plan involves considerable preparatory activities in most project components that begin in September/October 1991. These will be followed by initial construction activities in February/March 1992. The quick start for many project activities is facilitated by the fact that many of the activities in both the flood protection and drainage components involve modifications and improvements on existing infrastructure. The details of this work plan are shown in Figure 5.3.

For the remainder of the Project period, the work program will follow an annual cyclical pattern, with the surveys, investigations, designs, preparation of tender documents, tendering, and award of contracts being scheduled during the dry season, so that contractors can mobilize at the beginning of each construction season and complete the work program in the scheduled year.

Specific provision has been included to allow essential preparation activities for the first year program to begin soon after appraisal. It is planned that advance action will be undertaken for procurement of goods and services and for recruitment of consultants. For procurement, among other things, this will include completion of field surveys and subsoil investigations, preparation of detailed engineering designs for the first year components for flood control and drainage, preparation of tender documents, prequalification of contractors, and tendering and award for urgent contracts of flood control and drainage (Part A and B) that need to utilize the dry season of FY 1991-1992. Early recruitment of consultants for completion of the design and tendering will be essential for the success of the proposed schedule.

Figure 5.2

PROJECT IMPLEMENTATION SCHEDULE

Activity Item		(1991/92)				(1992/93)				(1993/94)				(1994/95)				(1995/96)								
Fiscal Year:		1991				1992				1993				1994				1995				1996				
Calendar Year:		3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4			
Cal. Quarter:		3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4			
Project Preparation	Establish Project Implementation Office																									
	Mobilise counterpart staff																									
PART A Flood Protection	Select & mobilise Project consultants																									
	Intensive remedial works																									
	Remedial works																									
	Minor remedial works																									
	Slopes (wave) protection																									
	Flood wall stabilization																									
	New flood wall/embankment																									
	Sluices																									
PART B Drainage	Central Road Improvements																									
	Incremental maintenance																									
	Khal rehabilitation																									
	Pipe drain construction																									
PART C Environmental Improvement Program	Secondary & tertiary drains																									
	Incremental maintenance																									
	Slum & Squatter Area Improvement																									
	Solid Waste Management																									
Project Milestones:	Sanitation, Water Supply, & Local Drainage																									
	Incremental maintenance																									
	Project Appraisal																									
	Loan Effectiveness																									
Project Milestones:	Drainage Completion																									
	Flood Protection Completion																									
	Environmental Program & Project Completion																									
	Construction/concentrated activity																									
Legend:	Preparatory activities (surveys, investigations, designs, tenders)																									
Notes:																										

Figure 5.3

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PROJECT IMPLEMENTATION SCHEDULE: YEAR 1 WORK PLAN

Activity				1991					1992					Principal	
				J	A	S	O	N	D	J	F	M	A	M	J
Project Preparation	Project Appraisal														All Agencies/ADB BWDB/DWASA/DCC Cons./BWDB BWDB/DWASA/DCC
	Establish Project Implementation Office														
	Procure equipment & vehicles for PIO														
	Mobilise PIO staff														
	Select Consultants														
Mobilise consultants															
PART A Flood Protection	West Embkt.	Intensive Remedial Works (ICB)	Survey & sub-soil investigation												Cons./BWDB Cons./BWDB BWDB/Cons. BWDB/ADB Cons./BWDB/ADB
			Finalise design concept												
			Detailed design												
			Prequalification of contractors												
			Tender preparation & invitation												
	Minor Remedial Works	Detailed design													BWDB/Cons. BWDB/Cons. BWDB/Cons.
		Tender & contract preparation													
	Construction														
		Flood Wall	Existing Wall	Field inspection/investigation											
	Outline design of remedial works														
	Detailed design of remedial works														
	Tender & contract preparation														
Construction															
	New Wall	Survey & sub-soil investigation	Outline design												Cons./BWDB Cons. BWDB/Cons.
Detailed design															
Slope (Wave) Protection	Detailed design	Tender & contract preparation												Cons./BWDB BWDB/Cons. BWDB/Cons.	
		Construction													
Sluiccas	Detailed design	Tender & contract preparation												BWDB/Cons. BWDB/Cons. BWDB/Cons.	
		Construction													
Central Road	Complete topographical survey	Detailed design of improvement works												RAJUK/Cons. Cons. RAJUK/Cons. Cons./RAJUK	
		Tender & contract preparation													
		Construction													
Mtce. Program	Prepare earthworks O&M manual	Investigation & design for Year 2 maintenance												Cons./BWDB BWDB/Cons.	
PART B Drainage	Khal Rehab.	Detailed design of rehabilitation works												Cons./DWASA DWASA/Cons. DWASA/Cons.	
		Tender & contract preparation													
		Construction													
Pipe Drains	Detailed design of pipe drains	Tender & contract preparation												Cons./DWASA DWASA/Cons. DWASA/Cons.	
		Construction													
Sec. & Tertiary Drains	Detailed design of secondary & tertiary drains	Tender & contract preparation												Cons./DWASA DWASA/Cons. DWASA/Cons.	
		Construction													
PART C Environ-mental Program	Procure program equipment	Slum & squatter improvement program												DCC/Cons. DCC/Cons. DCC/Cons. DCC/Cons.	
		Solid waste management program													
		Sanitation, water supply, & local drainage													
Legend:				Preparation/administration activity										Construction activity	
Notes:															

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In view of the urgency of the flood protection and drainage works and to utilize the coming dry season for construction works, it is recommended that the Government request the Bank to provide retroactive financing under the loan, in an amount tentatively estimated at \$5.0 million and covering: (i) engagement of consultants for Project preparation for the interim period (October 1991 to April 1992) including detailed engineering, sub-soil investigations, topographic surveys, prequalification of contractors, tendering and evaluation (\$0.9 million); (ii) minor remedial works on existing embankments/flood walls, slope (wave) protection and sluices (\$1.0 million); (iii) drainage works, involving urgent cleaning of secondary and tertiary drains and installation of priority drainage piping (\$2.6 million); and (iv) office related costs for the PIO (\$0.5 million).

5.3 Consultant Services

A provision of \$ 1.58 million has been made in the cost estimates for domestic consultants, and the scope of work is defined in Appendix 6. They will supplement the in-house detailed engineering design and construction supervision carried out by the implementing agencies. Similarly, for assistance with project management, 408 man months of consulting services (306 man months domestic, 102 man months international) are proposed (See Appendix 6). The scope of consulting services will be further refined and reviewed during Appraisal.

Consultants will be engaged in accordance with the Bank's Guidelines on the Use of Consultants. For purely domestic consultancy contracts, standard Government procedures acceptable to the Bank will be followed.

5.4 Procurement

Procurement of goods and services for the Project will be carried out in accordance with the Bank's/NDF's Guidelines on Procurement in line with the components under their respective financing. Based on considerations of efficiency and economy. Table 5.1 lists tentative procurement packaging, which has been discussed and generally agreed with the implementing agencies and will be refined during Appraisal.

All major civil works contracts, including embankment remedial works and the flood wall under Part A, will be undertaken through International Competitive Bidding (ICB) procedures. Other civil works contracts are expected to be small in size and will require the use of local materials and techniques, and thus would not be attractive to foreign bidders. Such works are planned to be awarded under Local Competitive Bidding (LCB) procedures acceptable to the Bank.

Solid waste collection trucks and associated containers under Part C and vehicles under Part D will be procured following ICB/International Shopping (IS) procedures. The remaining equipment, such as waste collection hand carts and office equipment, will be small in size and would be procured locally under LCB/direct purchase procedures.



Table 5.1

Indicative Procurement Packaging

Taka Million

Item			Total Cost (Base Cost)	ICB	IS	LCB	Remarks	
PART A Flood Protection	Civil Works	Intensive & Remedial Works	325.52	325.52			ICB contract(s)	
		Minor Remedial Works	2.00			2.00		
		Slope Protection	38.46			38.46		
		Flood Wall	105.06	105.06			ICB contract	
		Sluices	37.08			37.08		
		Central Road Improvements	155.00	155.00				
		Incremental Maintenance	80.24			80.24	Multiple Contracts	
		Equipment & Materials					Equipment & materials required for construction to be procured through civil works contracts	
		Sub-Total Part A:		743.36	585.58	0.00	167.77	
		PART B Drainage	Civil Works	Khal Rehabilitation	784.66			784.66
Pipe Drain Construction	361.48					361.48	Multiple Contracts	
Secondary & Tertiary Drains	111.94					111.94	Multiple Contracts	
Incremental Maintenance	67.02					67.02	Multiple Contracts	
Equipment & Materials							Equipment & materials required for construction to be procured through civil works contracts	
Sub-Total Part B:		1,325.00	0.00	0.00	1,325.00			
PART C Environmental Improvement Program	Civil Works	Slum/Squatter Area Impvmt.	61.90			61.90	Multiple Contracts	
		Solid Waste Management	8.50			8.50	Multiple Contracts	
		Sanitation, Water Supply, & Local Drainage	135.61			135.61	Multiple Contracts	
		Incremental Maintenance	14.50				Multiple Contracts	
		Equipment & Materials	Solid Waste Trucks	72.00		72.00		Phased procurement
		Solid Waste Containers	24.00		24.00		Phased procurement	
		Motorcycles	4.10			4.10		
		Barrows	10.00			10.00		
		Portable Toilets	1.80		1.80			
		Drain Gulley Sweeper	2.60		2.60			
	Desludging Trucks	4.40		4.40				
	Training Aids	4.00			4.40			
	Sub-Total Part C:		343.41	0.00	104.80	224.61		
	PART D Implementation Assistance	PIO	Office Equipment	7.60			7.60	
			Vehicles	8.80		8.80		
Consultancy Services		Sub-Soil Investigation	5.00			5.00		
		Dtd.Dsgn.& Const.Sprvn. Project Management	57.70 113.50	113.50		57.70	Multiple Contracts	
Sub-Total Part D:		192.60	113.50	8.80	70.30			
TOTAL:			2,604.36	699.08	113.60	1,777.68		
Notes:								

5.5 Disbursement

It is planned that the PIO will establish a Special (Imprest) Account in Bangladesh Bank to ensure the timely release of the Loan proceeds for the purpose of making payments in local currency for Project implementation. This account shall be denominated in U.S. dollars, and shall be operated and maintained in accordance with the Bank's Guidelines on Imprest Funds and Statement of Expenditure Procedures.

5.6 Land Acquisition and Resettlement

In Western Dhaka, much of the land required for flood protection has already been purchased for the construction of the current embankment. Despite this, it is foreseen that some new land will need to be acquired to allow the construction or expansion of flood control embankments and walls, pumping stations, sluices, and other project infrastructure. In some cases, this will involve the resettlement of resident populations, particularly slum dwellers. Funds for land acquisition and resettlement will be provided as part of the Government's contribution to the project.

Ongoing donor assisted projects with DCC/DWASA have been substantially delayed due to difficulties in land acquisition and inadequate budgetary provisions. A detailed operational plan for land acquisition and resettlement of the affected population, and alternative recommendations for land control measures, are being developed. It will be essential to acquire the needed land prior to planned implementation in order to minimize risks associated with project implementation.

5.7 Operations and Maintenance

Responsibility for operations and maintenance activities is divided between the implementing agencies along the same lines as project activities. BWDB would be responsible for the flood protection infrastructure, DWASA for the major drainage works, and DCC for some of the solid waste, sanitation, local drainage, and water infrastructure. Note that in the case of some of the activities under the Environmental Improvement program, O&M will be the responsibility of the beneficiaries and not DCC. This is particularly true for the Slum Improvement component.

Guidelines for handling specific O&M activities still need to be defined by the institutions involved. The Project design gives considerable attention to O&M issues, including: streamlining institutional responsibilities, strengthening the role of DCC, and developing O&M guidelines and procedures during the implementation period.

As was discussed in Section 4.7, the Government will need to earmark adequate resources for O&M needs. Mechanisms for raising these funds are discussed in the section on cost recovery in Chapter 6.

5.8 Reports, Accounting and Audits

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Regular progress reports will be prepared for the individual Project components and submitted by the PIO to the Bank and the Government agencies concerned on a quarterly basis. The progress reports will be in such form and detail as the Bank may request, including information on the physical and financial progress of works and the status of other related organizational and financial issues. Within three months of physical completion of the Project, a Project Completion Report will be prepared and submitted to the Bank by the PIO.

It is planned that the budgets for the implementing agencies will be managed by the PIO. While separate accounts will be maintained by the Implementing Agencies for the respective Project components, the record keeping will be centralized at PIO. The PIO will submit to the Bank consolidated unaudited Project accounts within six months of the close of each financial year, and audited Project accounts, by auditors acceptable to the Bank, within nine months of the close of each financial year.

5.9 Community and NGO Participation

Community and NGO participation is an important feature of the Project design and implementation, particularly in relation to information programs, PBME activities, O&M, and implementation of environmental improvement programs (e.g. sanitation, slum area improvement). It is recommended that the PIO have a community development cell together with adequate allocations for community information campaigns and related costs. To enhance the beneficial impact of the Project, the PIO, in association with the implementing agencies will develop a coordinated public information/public education campaign. The campaign, which will be sustained over the implementation period of the Project, would focus on the proper use of the facilities provided and on encouraging active community participation (including payment of fees and charges as well as assistance in the maintenance of public facilities) in the implementation of the integrated flood protection scheme.

NGO's can play an important role in these activities. There are several such groups in the Dhaka area which are currently providing support to slum and squatter areas. The consultants are in the process of identifying and developing contacts with some of these groups. This process would be continued by the PIO once it is created.

5.10 Institutional Support Measures

Considerable institutional strengthening of the involved agencies will be required, particularly directed towards improved financial management by DCC and DWASA. Both of these institutions require training and staff development programs, additional staff recruitment, and international/domestic consultancy support. As described in Section 5.3, provision is included in the Project for consulting services support at the PIO; other institutional strengthening aspects are discussed in the following.

There is ample scope for the privatization of some urban management and O&M related activities. This would prevent an overextension of the existing management capacity of both agencies. This aspect is incorporated into an Action Plan that is discussed further in Chapter 8.

The Government has also made a request for provision of an advisory technical assistance in conjunction with the loan for land development controls and procedures for Dhaka. Following major investments in flood protection and drainage, considerable low-lying area will become suitable for intensive urban use, with manifold increases in land values. It is important that the public sector should be able to capture part of the increases in land values, and that effective land use controls be developed. Coordination is required among the Ministries of Finance, Planning, and Land, RAJUK and the Dhaka City Corporation to develop appropriate policies to address matters relating to land development/transfer taxes, zoning, and development and land use controls, together with appropriate legislative cover. This TA activity is outlined in detail in Chapter 11 and in Appendix 12.

The Project does not include any additional consultancy services for institutional strengthening at the individual executing agency level so as to avoid duplicating ongoing assistance for DCC and DWASA under UNDP/UNCHS/World Bank programs. DWASA is in the process of improving its billing and accounts receivable control through computerization. DCC will soon have an advisory support, through the UNDP Project, which is aimed at improved revenue generation, budgeting, accounting and general financial control. The success of these financial management undertakings at both Dhaka WASA and DCC will also improve the overall financial capacity of these two executing agencies. This matter will be closely monitored by the Project during implementation and the Government will ensure that the various reports of these consultants are provided to the Bank, and Bank comments are given due consideration.

5.11 Project Benefit Monitoring and Evaluation

Within six months of the loan effectiveness, the PIO will develop a comprehensive PBME system with assistance from the Project management consultants. The project benefit monitoring and evaluation (PBME) activities will be coordinated by the PIO with the active involvement of the DOE. The actual carrying out of PBME activities, including the establishment of bench marks, data collection, and analyses will be the responsibility of the respective implementing agencies.

It is planned that the PBME system will become part of the Management Information Systems (MIS) of the implementing agencies. Among other things, it will involve continuous monitoring of the environmental and socio-economic indicators, including monitoring of the Project design/EIA, involving a review of the measures incorporated to maximize positive Project impacts and the mitigating measures being undertaken to minimize the adverse effects. It is planned that the indicators to be monitored would be developed further during Project Appraisal.

6.0 FINANCING PLAN

This chapter provides the financing plan for the recommended Project, or Phase 1 of the overall flood protection plan for Dhaka City. The complete flood protection and drainage program as a whole is expected to be implemented over a 10 to 15 year period and the financing for further stages will be arranged at a later date.

6.1 Summary of Project Costs

The cost of the recommended Project is estimated at \$124.7 million equivalent, including a direct and indirect foreign exchange cost component of \$36.70 million (29.4%) and a local currency cost of \$88 million. The cost summary is shown in Table 6.1 and detailed cost estimates are given in Appendix 5. These cost estimates will be further refined by the Consultants/Executing Agencies and reviewed during Appraisal.

The above total includes physical and price contingencies; as well as interest during construction. Physical contingencies account for \$9.7 million, and most items are calculated at 8% to 10%, with 15% for consultants and project administrative support. Price contingencies are estimated at \$8.16 million based on a 6.0% rate for local costs and a 4.9% rate for foreign costs up to 1994 (3.7% after that). Interest during construction accounts for a further \$5.5 million.

Out of a total cost of \$119.2 (excluding interest during construction), \$97 million is almost evenly split between the Flood Protection and Drainage portions of the Project. Another \$14.6 million corresponds to the Environmental Improvement components, and \$7.7 million for implementation assistance (See Table 6.2).

A total of approximately \$91.7 million, or 73.5% of Project costs, are eligible for Bank financing, while a further \$5 million is to be provided by the Nordic Development Fund. The central government and local agencies will be responsible for the remaining \$28 million, or 22.5% of Project costs.

6.2 Loan Agreement

The proposed Bank loan is for \$91.7 million, if approved by the Bank's Management and agreed to by all parties. The Nordic Development Fund is expected to finance an additional \$5.0 million of Project costs, at terms similar to the Bank Loan. These terms include a 0.75% service charge per annum and a 0.5% commitment fee on amounts which have not been drawn one year after the credit agreement becomes effective.

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TABLE - 6.1
Summary of Project Costs
(\$ million)¹

	Foreign	Local	Total
1. <u>Base Costs</u> ²			
Land	-	6.99	6.99
Materials and Equipment ³	9.03	13.83	22.86
Civil Works	15.92	42.36	58.28
Incremental O&M	1.64	4.99	6.63
Incremental Administration	0.32	1.47	1.79
Consulting Services	1.59	3.20	4.79
Subtotal	28.50	72.84	101.34
2. <u>Contingencies</u>			
Physical ⁴	2.94	6.76	9.70
Price ⁵	2.06	6.10	8.16
Subtotal	5.00	12.86	17.86
3. <u>Interest During Construction</u>			
Service charge on Bank loan	3.20	-	3.20
IDC on Domestic Borrowing ⁶	-	2.30	2.30
Subtotal	3.20	2.30	5.50
TOTAL ⁷	36.70	88.00	124.70

¹ At TK. 36.5 = 1 US\$

² June 1991 Prices

³ Includes O&M equipment and materials

⁴ 15 percent for consultants and project administration support, and 8-10 percent for various items of civil works and materials and equipment.

⁵ Price escalation includes (a) for foreign costs, 4.9 percent per annum during 1992-1994 and 3.7 percent per annum thereafter; and (b) for local costs, 6 percent per annum throughout.

⁶ This comprises interest on the on-lent portion of funds.

⁷ The local cost includes duties and taxes estimated at \$ 14.53 million.



Table 6.2

Financing Plan
Sources and Allocation of Funds by Agency and Component

US \$ MILLION

PROJECT COMPONENT	TOTAL COST TO BE FINANCED	EXTERNAL FINANCING (ADB/NDP)			BANGLADESH GOVT. FINANCING			TOTAL FINANCING SOURCES
		TOTAL	NATIONAL BUDGET ALLOC.	SUB-LOAN	NATIONAL BUDGET ALLOC.	DHAKA WASA	DCC	
PART A: FLOOD PROTECTION	48.3	35.8	35.8	0.0	12.5			48.3
PART B: DRAINAGE	48.7	40.0	40.0	0.0	7.4	1.3		48.7
PART C: ENVIRONMENTAL IMPROVEMENT :								
- Slum Improvement	2.5	2.4	1.2	1.2	(0.0)		0.1	2.5
- Solid Waste	6.6	3.0	1.5	1.5	1.3		2.3	6.6
- Sanitation, Water Supply & Loc.Drainage	5.5	4.8	2.4	2.4	0.2		0.5	5.5
PART D: IMPLEMENTATION ASSISTANCE	7.7	7.7	7.7	0.0	0.0			7.7
GRAND TOTAL	119.2	93.5	88.5	5.1	21.4	1.3	2.9	119.2

Exchange rate: US\$ 1 = Taka 36.5

Above figures do not include interest during construction of \$ 5.5 million, of which \$ 3.2 million is on the external financing and \$ 2.3 million is on the subsidiary loan.

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The Bank and NDF loans will finance: (i) the entire foreign exchange cost, including the service charge on the Bank loan estimated at \$3.2 million; (ii) all local currency costs relating to civil works, equipment and materials, excluding duties and taxes; (iii) all engineering and management costs (including all consulting services and incremental staffing); and, (iv) all incremental operation and maintenance costs for BWDB and 50% of the incremental operation and maintenance costs for DWASA and DCC.

The Bank loan is proposed to have a term of 40 years, including a grace period of 10 years and a service charge of 1% per annum.

The Government of Bangladesh, DCC and DWASA will meet the balance of the costs of \$28.0 million not covered under the Bank/NDF loans, including \$6.99 million for land acquisition, \$14.53 million for duties and taxes, \$4.2 million for incremental operation and maintenance costs, and \$2.28 million of IDC on domestic (subsidiary) loans. The allocation of Bank/NDF and Government funding for various Project components is shown in the preceding Table 6.2. Proposed funding arrangements are shown below in Table 6.3.

TABLE - 6.3

Proposed Project Funding Arrangements
(\$ million)

	Foreign Exchange	Local Currency	Total
<u>External Sources</u>			
Bank Financing	31.70	60.00	91.70
NDF Financing	5.00	-	5.00
<u>Domestic Sources</u>			
Central Government	-	21.50	21.50
DCC	-	5.20	5.20
DWASA	-	1.30	1.30
Total	36.70	88.00	124.70

6.3 Agency Fund Requirements

The Environmental Improvement program (Part C) is estimated to cost \$14.6 million, of which most will be expended by the DCC. Of this amount, the DCC will need to provide \$2.9 million to directly cover costs. The DCC will also be receiving external financing that will be channelled through the central government.

It is tentatively planned that the funds to be provided to DCC will be on-lent on the basis of a mix of 50% grants and 50% loans. The loan portion is planned to carry an interest rate of 12.5% per annum and be repayable over a period of 20 years, including a grace period of 5 years. The grant:loan mix has been tentatively determined at fact finding based on the nature of Project components, potential for cost recovery, financial position and affordability and considerations of basic needs/poverty alleviation. Interest on the loan portion will cost DCC another \$2.3 million; bringing the total cost to DCC up to \$5.2 million (or Tk. 189.8 million). Appendix 11 contains detailed revenue and expenditure projections for DCC.

DWASA will be primarily responsible for the Drainage portion (Part B) of the Project, which is estimated to cost \$48.7 million. Of this amount, only \$1.3 million (or Tk. 47.45 million) are to come out of agency funds. The remainder will come from the national budget (\$7.4 million) and internal grants from external loans (\$40 million).

The current financing plan is based on 100% grant financing for DWASA on the basis that the provision of improved drainage facilities is a public good and that cost recovery for capital investments will be indirect. However, to increase the efficiency of DWASA operations a small amount of the capital cost of drainage (between 2% to 5%) could be provided to DWASA on loan terms similar to those for DCC, to serve as a pilot scheme for this type of service. It has been proposed that DWASA would recover the enhanced costs of operations and maintenance through the imposition of additional drainage-fees/charges in conjunction with their existing system of charging for water supply and sewerage; as discussed in the section on Cost Recovery below. This proposal is still being reviewed and if approved, would increase DWASA's share of costs beyond the original \$1.3 million.

The central government will need to provide \$21.5 million in Project costs as well as interest payments on external loans. Of this amount, \$12.5 million will be expended by BWDB for the Flood Protection component.

6.4 Revenue Improvement

Both DCC and DWASA are currently undertaking major projects under UNDP/UNCHS/World Bank programs to improve their financial and economic management. It is expected that these programs will begin to take effect during the life of this Project, and will provide the basis for revenue

improvement. This study has developed revenue improvement and cost recovery options that are particularly pertinent to meeting the cost requirements of this Project and they are discussed in detail in the next section.

6.5 Cost Recovery

6.5.1 Background

Out of the total Project cost of US\$124.7 million (spread over a five year period, FY 1991/92 through FY 1995/96), about 6.8% represents incremental costs of administration, operation and maintenance of the completed project components. About 78.5% of the Project cost is expected to be financed from concessional loans from the ADB and NDF. As a result, it is envisioned that the GOB will have to provide annual budgetary allocations for debt service requirements starting in the year 2002. Given its limited financial resources, the Government needs to recover both debt service requirements and the O&M costs from the project beneficiaries.

A major economic benefit of the Project will be the expansion of Dhaka's economic infrastructure in the form of residential dwellings, commercial and industrial real estates into the low-lying, predominantly agricultural areas presently subject to seasonal flooding. Given these benefits, there is a substantial scope for the Government to recover costs associated with the Project.

Various cost recovery options are available, either direct or indirect, at the national or city level, which may be considered for adoption. These options, together with an indicative estimate of their financial impacts, are discussed below.

6.5.2 Direct and Indirect Cost Recovery

Direct cost recovery refers to a fee or charge levied that would corresponded to a discreet good or service provided. This type of cost recovery is important because it discourages waste and over utilization, and also enables officials to extend the service provided to more people, including the ultra-poor who are clearly unable to pay.

Indirect cost recovery refers to a general increase in tax revenues available to the government which occurs as a result of an increase in economic activity, and is reflected in higher incomes or land values.

While direct cost recovery mechanisms are generally preferable, they may not be possible for this particular Project. This is due to the fact that (a) there is a poor existing record for direct cost recovery in Bangladesh, and (b) most flood protection projects do not usually lend themselves particularly well to direct cost recovery, although some project sub-components may.

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The problems with direct cost recovery in Bangladesh should not be underestimated. Discussions with Bangladesh officials and donors indicate that cost recovery has not received much attention in the implementation of past projects. This has resulted in the development of numerous projects for which the recurrent costs have become a serious drain on limited fiscal resources.

As this situation cannot persist indefinitely, it is important to identify and implement mechanisms to make the recurrent project costs affordable for the government. But this will not be easy as a brief survey conducted for this analysis found that systemic problems and formidable institutional obstacles would be present no matter how clever the design of the cost recovery mechanism for any particular project.

A World Bank report (An Agenda for Tax Reform) notes the complete absence of cost recovery mechanisms in educational and health programs in the country and a lack of administrative capabilities that would facilitate their introduction. Even the power sector, where cost recovery should be relatively straightforward (monthly electric bills), has demonstrated serious problems with systems losses. As a result, the Bangladesh Power Development Board is in serious financial difficulty.

A more relevant example of cost recovery is the experience of the BWDB in the recovery of O&M costs for its main irrigation systems. Currently, most BWDB projects have a backlog in fee assessments of two years or more. As of June 30, 1989, about Taka 3.5 million (about US\$110,000) had been collected for FY 1989, or about 10% of the amount assessed. (World Bank, Staff Appraisal Report.)

The poor performance of BWDB in the collection of water rates is due in part to the fact that the supply of irrigation water in many of the projects is insufficient or irregular, and that assessments and collections are cumbersome and require too much staff. While these factors may be remedied, the theoretical case for cost recovery in irrigation is stronger than for flood protection since costs and benefits of irrigation facilities are generally much larger, can be more readily identified and quantified, and beneficiaries of irrigation are generally in a better financial position (and have more motivation) to contribute to a project's O&M costs, because the benefit they receive is directly tied to their ability to produce.

A second, more fundamental problem with direct cost recovery for the Project is the nature of the benefits arising from flood protection. The GOB's ability to impose direct charges is limited by three factors:

- i) the fact that flood protection in Bangladesh, as in many countries, is considered a social service for which no charges have traditionally been collected. Thus, the important element of willingness to pay may be absent.

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- ii) benefits of flood control and drainage works vary from one plot to another, depending on location, elevation, and soil quality. It would be very difficult to determine fair rates as a reflection of the benefits obtained by Greater Dhaka residents and their ability to pay.
 - iii) it would be difficult to withhold flood protection services from someone who refuses to pay a direct fee, as one could do in theory with water, power supply, health, and education. Flood protection thus has the characteristics of a public good.

Given these problems with direct cost recovery, indirect cost recovery would be preferable, except in the case of certain project components as discussed below. Currently, O&M costs are financed from general tax revenues. To assure the availability of sufficient funds to cover these costs over the life of the Project, mechanisms should be introduced which meet the following criteria:

- i) tax revenues should increase sufficiently as a result of the project to cover O&M costs;
- ii) these additional tax revenues need to be channelled to the institutions responsible for the O&M of the flood control and drainage systems;
- iii) any additional fees or taxes should fall primarily on residents of the project area; and
- iv) existing systems for assessment and collection should be used, when possible, in order to avoid creating new bureaucracies and burdening and complicating the tax structure.

As the major economic benefits of the Project will be reflected in a rise in land values, the preferable means for indirect cost recovery should be land based taxes. In the next section several national and local land and property based taxes that could be combined to provide a cost recovery mechanisms for the Project are reviewed.

6.5.3 Options for Cost Recovery

A. National Level

The three national taxes considered below, the Land Development Tax, the Non-Judicial Stamp Tax, and the Capital Gains Tax should all show increased revenues as a result of the Project. With some minor changes in the structure of these taxes, the additional revenues should be more than sufficient to cover O&M costs and they will primarily come from project beneficiaries. The problem with all three taxes as a means of indirect cost recovery is that revenues go to the GOB treasury. There are no established mechanisms to earmark specific revenues collected for project O&M. Therefore a means would have to be worked out with the central

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government to allocate the revenues for Project O&M costs. The following discussion of each of these taxes assesses their advantages and disadvantages.

Land Development Tax:

This annual tax, administered by the Ministry of Land, is based solely on the acreage of land ownership. This approach avoids the problem of estimating an intrinsic value for the land. Historically, this tax has not been particularly efficient, as collection costs have averaged about 60% or higher of the amount collected.

Recently, the government has modified the land Development Tax to exclude agricultural land holdings below 8 acres in size. The current rate structure has been greatly simplified compared to previous ones, and is presented in Table 6.4. While revenues have increased in recent years, they could begin to decrease as a result of the new simplifications. But this should be compensated by a reduction in administrative costs.

Table 6.4

Land Development Tax Rates

<u>Agricultural Land:</u>	<u>Tk Rate per Decimal</u>
Less than 8.33 Acres	nil
More than 8.33 Acres	2.0
<u>Non-Agricultural Land:</u>	
Commercial and Industrial	100
Residential	20

Source: Ministry of Land

Since the Land Development Tax is specific rather than ad-valorem, no incremental revenue would be realized per se from the increase in land values. But it seems very likely that revenues from the Dhaka area will increase as a result of the Project as land is upgraded to the higher revenue yielding residential and commercial/industrial uses.

This can be encouraged by improving the implementation of the re-classification of agricultural land to non-agricultural land so that it is done as soon as actual development has taken place. Additional internal controls may have to be instituted in connection with the land

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classification work. Timely re-classification of agricultural lands into non-agricultural land will potentially translate into a substantial increase in tax assessments.

A more radical, but potentially more lucrative, reform would be to change the basis for the land development tax from "area" to "ad valorem", using market value. If we assume that a 50% increase in the amount of tax assessment will initially result from the change in the tax base, and given the existing collection efficiency, an additional land development tax of about Taka 400 million (\$11 million) may be realized during the first year of implementation. This would be more than sufficient to cover project O&M costs. Instituting such a reform would be quite complex and needs to be explored further with the Ministry of Land and the national tax reform program.

The Non-Judicial Stamp Tax:

The non-judicial Stamp tax is the most important tax on the value of transferred land and property in Bangladesh. It is administered by the National Board of Revenue. The rates range from 10% for declared value under Tk 100,000 to 18% for declared value exceeding Tk 100,000. This guarantees that transfers of more valuable urban or flood protected property will be assessed at a higher rate. The Stamp Tax is therefore progressive, although this progressivity is based on the total value of the transferred property, and not on the income or wealth of either the buyer or seller.

One weakness of this tax is that despite potential fines of 10% to 15% of the value of the land, the undervaluation of property transfers is very common, and there is a strong incentive for landowners to split property into smaller units to avoid high marginal rates.

Despite this problem, revenues from this tax have exhibited very substantial growth since 1976/77. Landowners have an incentive to pay the tax since it legitimizes land and property transfers. It is also relatively inexpensive to collect.

Revenues from the Stamp Tax will increase along with land values, though this will depend in part of the scope of the activity in the land market. Revenues could be further enlarged by improving enforcement and by fixing a minimum value for the purpose of land and property transfer.

The issue is whether any of these revenues can be channelled back to the Project for O&M. One possibility worth exploring is that the central government could introduce a zoning system for Dhaka that would allow the identification of increased revenues from the project area and then earmark some of the increase revenue as a type of "revenue sharing" for Project O&M costs.

If the central government is unwilling or unable to earmark funds for legal or other tax reasons, then an alternative would be to attach a flood-protection related surcharge to the non-judicial stamp tax for land and property transfers in the Dhaka metropolitan area.

A potential drawback of an added surcharge is that it could further exacerbate a current trend in which the high rate of the stamp tax discourages land transfers that would otherwise make economic sense. This is particularly important to keep in mind given that for the full benefits of flood protection to be realized, the development of new areas should not be discouraged.

Capital Gains Tax:

Land and properties are subject to a capital gains tax. Unfortunately, the government's current tax accounting practices appear to consolidate capital gains with other forms of income tax and it cannot be readily extracted and quantified. Therefore, little is known about the level of collections in the past on capital gains from land and property, either at the national level or in the Project area.

The capital gains tax on land and properties has some similarities to the non-judicial Stamp Tax: it is periodic in that it is levied only when land is transferred; and the amount of the tax is also related to sales price, though the amount actually levied depends on the level of the capital gain and the applicable capital gains rates.

As such, it has some of the same advantages and disadvantages as the non-judicial Stamp Tax; as well as the added disadvantage that the lack of data makes it impossible to assess any increases that are due to the Project or any specific amounts that should be earmarked for O&M activities.

B. Local Taxes and Charges

The local taxes that are relevant to this Project are charged directly by three of the primary participating agencies who will be involved in the Project: the Dhaka City Corporation, Dhaka DWASA, and RAJUK. As a result, these taxes and fees have a major advantage over the national taxes in that revenues flow directly to the interested parties.

Unfortunately, the utility of some of these local taxes as a means of indirect cost recovery is limited in that generally revenue increases are not tied as directly to increases in land values. Furthermore, all three agencies face serious administrative limitations in their ability to manage the taxes and fees. As is discussed in Chapter 5, the project team feels that there could be benefits from the privatization of many of the activities.



DCC Taxes and Charges:

About half of the environmental improvement facilities which will be operated by DCC are targeted mainly for poverty alleviation in the slums. The other half may be attributed to services for which the cost may be recovered from the users (i.e. solid waste, public toilets and standpipe water supplies). In view of this, it is tentatively assumed that the cost of the project component would be passed on to DCC on a 50% grant/50% loan basis.

DCC's current cost recovery mechanisms primarily involve indirect cost recovery schemes under the holding tax. The holdings tax is composed of three elements: a tax on the property rental value (7%), a charge for solid waste/conservancy services (3%) based on rental values, and a charge for street lighting (2.5%), again based on rental value. DCC also receives 1% from the Non-Judicial Stamp Tax in the form of the Immovable Property Transfer Tax, but DCC's revenue from this IPTT has traditionally been fairly low, averaging less than half a million dollars per year.

The holdings tax is one of the few local taxes for which revenues will increase automatically because of the Project. This is because revenues are linked directly to both land values where rental units currently exist and to the increase in the number of rental units that takes place with the physical expansion of urban areas made possible in part by the project. Furthermore, for the public toilets and standpipe/tubewells provided under the Project, DCC should be able to recover its O&M costs through standard user fees.

Unfortunately, for the slum improvement and solid waste components the additional revenue from the holdings and IPTI taxes will probably not be sufficient to cover project O&M costs. This conclusion is based on a detailed projection of DCC's revenues and expenditures over the next few years (see Appendix 11). Thus, additional charges will be necessary.

One possibility is for DCC to adjust the present charge for solid waste/conservancy services by the amount needed to generate revenues which can be allocated for the incremental O&M costs and debt service requirement for the environmental improvement facilities comprising Part C of the Project. Annual incremental O&M costs and debt service requirements for Part C are estimated to be about Taka 90 million, at mid 1991 prices. Spread over the estimated 120,000 holdings in the project area, recovery of the annual O&M and debt service requirements would mean an additional charge of Taka 750 per holding. This amount may be recovered through a 100 per cent increase in the solid waste/conservancy rate presently assessed (based on annual rental value of the property).

Before this is done, however, DCC needs to greatly improve the efficiency of its financial management systems. A recent study¹ has outlined a number of general problems associated with DCC municipal taxes. First, the basis of property valuation is "actual rent" and not "market rent." Second, in any case, the "actual rent" is easily manipulated through false documentation, often in collusion with tax assessors. Third, lower level tax officials are poorly paid and trained, and have few career prospects. As a result, according to this study, "inefficiency and corruption are endemic in the system". Furthermore, though DCC collects more than Tk 770 million in municipal taxes every year, it is owed over Tk 410 million in back-payments.

Given these inefficiencies, it may be hard to justify a large increase in charges until current efforts to improve DCC's financial management have an effect. Thus an alternative to the suggestion made above would be for DCC to adjust the basis of the annual rental value of the property from that of actual reported value to "market value". This could then be accompanied by a lower percentage increase in the solid waste/conservancy rate (e.g. 50%).

DWASA Charges:

DWASA is expected to play a fairly major role in the Project as the lead agency for improvement of Dhaka's drainage system. The investment cost of drainage projects does not normally lend itself to cost recovery; be it from the points of view of institutional aspect or from the beneficiaries' willingness to pay. In view of this constraint and the substantial amount of investment cost, it is a widely accepted practice among developing countries in Southeast Asia to have the investment cost of drainage projects financed by the government, rather than by autonomous public enterprises. While there is merit in having DWASA finance even a modest amount of the investment cost in order to prod the enterprise to improve its operating efficiency and financial management, it is tentatively assumed that the investment cost of the drainage works will be fully financed by a grant from the national government.

DWASA needs to generate revenues sufficient to cover the O&M costs of the drainage component that it will implement and subsequently operate. Unfortunately, the Project will have little immediate effect in raising revenues as the increase in fees received from further development will be matched by the expense of expanding water and sewerage services to those areas, and DWASA will need to find other methods of increasing revenues.

Currently, Dhaka WASA levies water charges of Tk. 2.76 per 1,000 liters of water. For those who have sewerage connections, the charge is the same as water. Those holdings which don't have a direct connection, but are within 200 feet of one, have to pay a portion of the water charges.

¹ Social Formation in Dhaka City: by Kamal Siddiqui, et. al.

In 1989, DWASA was assigned responsibility for the development and O&M of Dhaka's main drainage system. The costs of the drainage system continue to be financed from DWASA's water and sewerage revenue, to the further detriment of DWASA's overall financial situation.

Like DCC, DWASA needs first to sharply improve its collection rate, particularly for water. About 56% of the water produced by DWASA is unaccounted for. An estimated 30% of the losses are through leakage, and an estimated 26% through administrative losses. Thus, there is ample room to reduce leakage (which in neighboring countries is in the range of 15% to 20%) and to improve revenue efficiencies.

DWASA is currently involved in a proposed fourth Dhaka Water Supply and Sanitation Project with the World Bank. This project is attempting to correct several problems which directly limit its ability to implement cost recovery. DWASA is also undertaking a study, funded by IDA, on waste prevention and leak detection, which should lead to recommendations to prevent water loss and increase revenue. Unfortunately, the impact of these projects may not be sufficient in the short run.

One option to recover the O&M costs would be for DWASA to add a drainage charge on the water bills of its consumers. This would be practicable from the point of view of coverage inasmuch as over 80% of registered holdings within the City have individual water service connections. Annual incremental O&M costs for the drainage component are estimated to be about Taka 21 million, at mid 1991 prices. Assuming that only water consumers in the Project area are to be assessed the additional charge for drainage, the monthly charge for drainage would amount to about Taka 18 per holding, or about Taka 4 per household.

A second option is for the national government to allow Dhaka WASA to retain a portion of the 15% development surcharge on the water and sewerage charges DWASA presently collects on behalf of the national government. In 1989/90 DWASA earned about Taka 350 million in water and sewerage revenues. Under this option DWASA may be able to cover the annual O&M costs for drainage if the national government allows it to retain half of the development surcharge presently collected.

RAJUK Development Charges:

Private land developers are supposed to obtain RAJUK's permission before undertaking any land development project. RAJUK would therefore be in a position to assess a lump-sum (one-time) development fee which could be used to meet overall development costs for the Greater Dhaka region related to the Project.

The lump-sum charge would be payable by the developer and based on the size and value of the development. The rationale for the charge would rest on the extra burden that the development would place on the infrastructural needs of the Dhaka metropolitan area as a result of the Project. This development charge would be less related to Project O&M than to infrastructural needs such as roads, drainage and parks.

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6.5.4 Conclusions on Cost Recovery

The primary conclusions of this section are as follows:

- i) past efforts at cost recovery for projects in Bangladesh have met with very limited success;
- ii) improving cost recovery is critical to the improved fiscal performance of the GOB in general, and the sustainability of this Project in particular;
- iii) in general, cost recovery for a flood protection project is best met through indirect (tax revenue) rather than direct means (user fees);
- iv) since a major benefit of the Project will be an increase in land values, the best means of cost recovery would be land-based taxes that capture some of this increase in value. Utilizing and strengthening existing land and property taxes is recommended, rather than creating new taxes and bureaucracies;
- v) it is estimated that the revenues from these taxes should increase sufficiently as a result of the Project to potentially cover project O&M costs. Unfortunately, each of these taxes faces constraints that must be overcome if they are to be used as a means of indirect cost recovery for project costs;
- vi) the options examined for using land and property based taxes included three main national taxes: the Non-Judicial Stamp Tax, the Land Development Tax, and the Capital Gains Tax on land and property. All three should experience increasing revenues as a result of the Project. The primary difficulty is in earmarking these additional revenues for the Project. Several means for directing a portion of these revenues to Project O&M costs are discussed and may be possible in the case of the first two taxes mentioned above;
- vii) three applicable local based taxes and charges are also discussed. Both DCC and DWASA levy taxes and service charges in the Dhaka metropolitan area. These should grow as land and property values increase, but probably not sufficiently to cover increased O&M costs. Therefore, both agencies may need to increase/modify their taxes and charges, as well as improve their management and financial systems in order to make more efficient use of those taxes and charges they levy but often fail to collect. A development fee could also be collected by RAJUK on new development areas; and
- viii) final recommendations on tax-based cost recovery should be compatible with Bangladesh's ongoing program of tax reform.



7.0 PROJECT JUSTIFICATION

The economic justification of this project has been separated into two distinct analyses. The first and primary analysis focuses on the project as a whole, while the second covers the Slum Improvement component. Sections 7.3 through 7.7 report on the first analysis and Section 7.8 describes the second. A financial analysis of the Solid Waste and Sanitation, Water Supply and Local Drainage components is provided in Section 7.9.

Please note that the analyses provided here are based upon the scope and costs identified at the time of Fact Finding. The cost estimates are undergoing further refinements, and agreement on the Project scope is expected to be finalized during Appraisal. These refinements are not, however, expected to be of a magnitude that would substantially change the overall conclusions reached herein.

7.1 Summary

The primary results from the cost-benefit analyses of the project, to date, are as follows:

- i) the major economic and financial benefit from the Flood Protection and Drainage programs of the project will be the expected increase in land values for low lying and medium elevation areas which are subjected at present to regular and periodic flooding. Flood protection and control will lead to an expansion of Dhaka's economic infrastructure in the form of residential dwellings, industry and other types of real estate. These benefits, which can be estimated by projected increases in land values, appear to be significantly greater than project costs.
- ii) a second important benefit from the project will be protection of Dhaka's existing economic infrastructure, primarily on higher lands, that is subject to damage from exceptional flooding.
- iii) about 65% of Dhaka's poorer inhabitants are presently subject to regular flooding and would benefit from substantially better environmental conditions which the project will promote through flood protection and control, and ancillary activities.
- iv) the slum improvement component was found to offer quantifiable economic benefits that do not exceed the costs involved, when discounted for the cost of capital. But this component can still be justified if the large number of non-quantifiable benefits are taken into account.
- v) financial analysis of the Solid Waste and the Sanitation/Water Supply/Local Drainage components demonstrate that these components are fully justified in financial terms.

7.2 Project Area, Beneficiaries & Costs:

The Project covers those portions of the Dhaka metropolitan area that are under the responsibility of the Dhaka City Corporation (DCC). The project area consists of 260 sq km and contains an estimated population of 4.8 million. Approximately 4.2 million people, or some 87% of the city population, reside in the Western portion of the project area; which comprises about 136 sq km (See Figure 7.1). The eastern part of the city is less dense, with considerable areas still under agricultural and non-urban uses.

The cost of flood protection and drainage components for an integrated flood protection program to protect the entire city from floods of 100 year frequency is estimated at over \$450 million (See Chapter 4). In view of the large investment this would require, the flood protection program will need to be implemented in stages over a period of 10 - 15 years.

The staging of the overall project takes into account the cost effectiveness of the required investments. Factors taken into consideration include the need to: protect existing densely populated residential, industrial and commercial areas; increase pumping capacity as more intensive urban land use of peripheral areas takes place; and increase internal safety within areas protected during each stage (by dividing protected areas into self-contained compartments through the building of internal embankments).

Based on these considerations, the recommended Project comprises Stage I of the overall flood protection and drainage scheme, and is focused on completing and improving the flood control and drainage systems in the western portion of the city, as mapped in Figure 7.1. The cost for the recommended Project is estimated at \$124.7 million, as discussed in Chapter 6 and presented in Table 6.1. Table 7.1 contains annual cost projections in Taka for each component of the Project.

7.3 Methods Used and Approach to Economic Valuation

Owing to time and budget constraints, it was agreed in the terms of reference that the DIFPP portion of the Flood Action Plan would rely on readily available secondary data. Accordingly, no provisions were made in the project budget for additional new surveys.

Instead, the project has been able to benefit from the cooperation of several GOB and donor agencies. JICA has been particularly cooperative in supplying data from many of their detailed surveys in the 850 sq km area which will be the subject of their FAP-8A Master Plan, and which incorporates the area that is the subject of our study. The World Bank has also provided a number of useful reports.

nb

Figure 7.1
Project Area Map

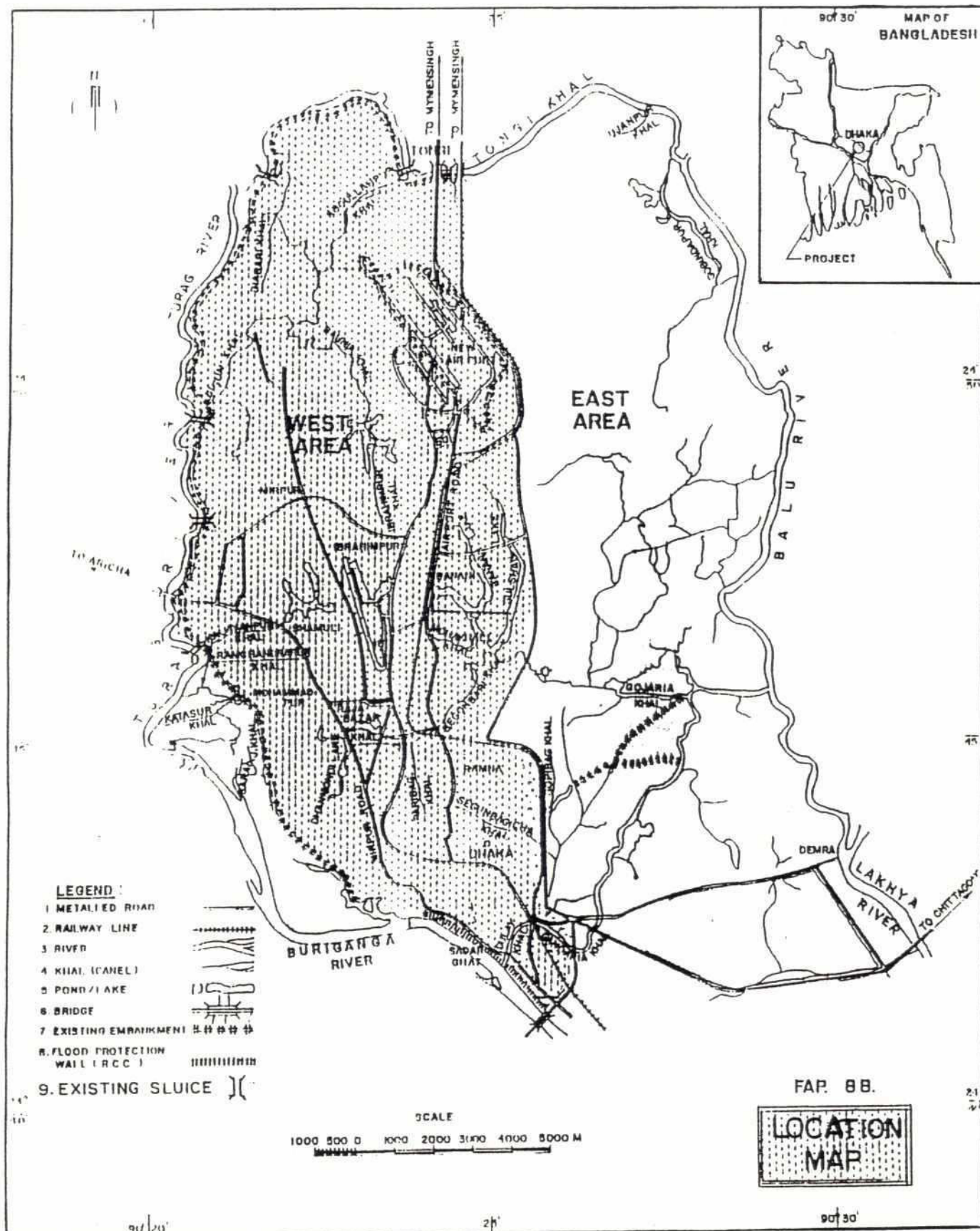


TABLE 7.1

SUMMARY OF COSTS (TK. IN MILLION)

DHAKA INTEGRATED FLOOD PROTECTION PROJECT (STAGE ONE)

		91-92 (FY)	92-93 (FY)	93-94 (FY)	94-95 (FY)	95-96 (FY)	96-97 (FY)	TOTAL
Part A		114.58	723.01	750.94	108.48	32.20	33.99	1763.20
Part B		735.04	688.26	287.62	20.43	21.56	22.76	1775.67
	a	5.83	52.26	54.71	64.64	31.18	30.96	239.58
Part C	b	5.28	14.07	18.47	15.69	16.45	21.27	91.23
	c	30.38	70.46	33.23	21.04	22.61	22.86	200.58
Total: a+b+c		41.49	136.79	106.41	101.37	70.24	75.09	531.39
A+B+C		891.11	1548.06	1144.97	230.28	124.00	131.84	4070.26
Part D		55.80	55.80	41.86	41.86	41.86	41.86	279.04
A+B+C+D		946.91	1603.86	1186.83	272.14	165.86	173.70	4349.30

Abbreviation:

* Cost excludes interest during construction period.

Part A: Flood Protection

Part B: Drainage

Part C: Environmental Improvement

- a) Solid Waste
- b) Slum Improvement
- c) Sanitation, Water Supply & Local Drainage

Part D: Implementation Assistance

This analysis generally follows the "Guidelines on Economic Analysis" provided by the GOB's Flood Plan Coordination Organization (FPCO) though some modifications were necessary because of the more urban nature of the project area in comparison to other areas. Greater weight has been given to the appreciation in land values resulting from conversion of low-lying agricultural and marginal and fringe lands to urban uses. The value from housing and other construction on this land is expected to far outweigh the increase in agricultural productivity within the project area.

There are two approaches to evaluating project benefits. One is the income-flow approach, and the other is the asset-value approach. The first approach is used in evaluating projects where changes in output and income generated by the projects can readily be assessed, such as industrial and agricultural projects.

The second, the asset value approach, is a commonly accepted approach in projects where changes in output and income generated are not so readily apparent, such as urban land improvement, housing, and flood protection projects. The Asian Development Bank, for example, has used this approach in evaluating such projects as the Low-Cost Urban Housing Project (Korea), the Bandung Urban Development Project (Indonesia), and the Karachi Urban Development Project (Pakistan).

In this particular case, the project has used the guidelines on the asset value approach provided by the ADB to estimate the benefits arising in low lying areas from the project's effect in increasing the value of those lands. The benefits of the project on already developed higher lands are estimated through a calculation of the value derived from the avoidance of flood damage to existing property. The sum of these two estimates is used to represent the quantifiable economic benefits arising from the project. Other less quantifiable benefits are also discussed below.

7.4 Benefits from an Increase in Land Values

7.4.1 The Role of Current Land Use Patterns

The topography of the project area has relegated a substantial portion (45% of the land) to fairly low opportunity cost agricultural endeavors at the same time as the urbanized areas are seriously overcrowded (see Table 7.2 following). Dhaka suffers from a severe shortage of usable land for continued expansion, which has hindered the normal development of the city.

The major features of land use, as noted in the JICA study, are:

- i) an intensity of land use brought about by increasing population pressure;
- ii) the lack of a transportation system which would allow for a more extensive development pattern;

- iii) the wide scatter of very poor and dense slum and squatter settlements, which house a third of the city's population in very small areas.

Table 7.2

Major Land Use Categories
Dhaka (1990)

	(ha)	(%)
Residential	5,320	19.3%
Commercial	410	1.5%
Industrial	340	1.2%
Institutional	1,630	5.9%
Roads & Other	2,930	10.6%
Village	1,110	4.0%
Agricultural	12,370	44.9%
Water Bodies	3,430	12.5%
Urban Total	10,630	39.0%
Rural Total	<u>16,910</u>	<u>61.0%</u>
	27,540	100.0%

Source: JICA, Interim Report, March 1991

The JICA study noted a major factor in determining urban versus rural land use is freedom from flooding. High land or relatively flood free land that is close to the city and major commercial areas will be rapidly developed.

Transportation is also critical in patterns of land use. For the majority of the city's inhabitants, the need to live near work, or near transportation to work, determines the place of habitation. Thus, population densities will continue to be higher in inner city zones and near major transport corridors. The provision of mass transit to more distant flood free areas would however increase the attraction of more distant land relative to central locations. At the same time, improved transportation without providing security from flooding will also have a limited effect in deconcentrating the city.

Therefore, creating greater physical security from flooding in the low lying lands provides the greatest potential for the project to add economic value. Flood control and protection will enable the expansion of the existing economic infrastructure of Dhaka (residential dwellings, offices, factories.

Benefits will also come in part because low-lying areas will not have to be raised as much as previously to prevent damage from normal flooding. The costs for land filling alone are about 150 to 250 Taka per cubic meter. After the project, they will still have to be raised to protect against internal flooding, but to a much lesser extent.

These benefits can be measured by the increase in the land's value. Land values are good measures of the benefits that will come from the improvement in land quality. Land prices take into account the discounted value of the cash flow attributable to land, above and beyond other factors of production (labor, capital). This is particularly true if land prices arise from a competitive market. Thus, the structure of the land market in the Dhaka area becomes important.

7.4.2 The Market for Land in the Project Area

The market for land is dominated by the private sector, as the vast majority of land is in private hands. The Government owns only about 7% of the land in the Dhaka area, and has a limited ability to intervene in the land market.

Real estate development is also the domain of the private sector, primarily through large cooperatives such as Eastern Housing Limited and East-West Properties. RAJUK is the primary public sector land development agency and has undertaken extensive planned development throughout Dhaka in the past. It will continue to play an important role in the future.

Population increase and rapid urbanization are the primary causes of demand for urban land in Bangladesh. Specific identified sources include:

- i) remittances from Bangladesh citizens who work overseas. It has been estimated that about a third of their remittances go into the purchase of land. One motive for this purchase is to eventually build a home in Bangladesh; and
- ii) the use of land as a means of savings because the underdeveloped financial markets in Bangladesh lead to a lack of alternate attractive means for saving money and maintaining purchasing power. Investment in land has historically been a superior hedge against inflation compared to term deposits, where the maximum rate of interest has been 16% per year against a measured inflation rate that has averaged about 15% a year.

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The demand for land has been in a slump following the Gulf War which curtailed incomes and remittances from overseas. With the fall in demand, land prices have been depressed. However, purchases of low-lying agricultural land near the existing western embankment by land developers is a notable exception. In any case, as work resumes in the Gulf and remittances regain former levels, one can expect demand and prices to pick up again.

Discussions with real estate developers, real estate agents, RAJUK, and others reflect a consensus that most of the land made available for development by the project will go towards meeting the demand for residential accommodation.

Dhaka has an acute housing shortage. Because of limited resources, high standards for construction, and high prices for urban land, the provision of formal housing is only a small fraction (4% by some estimates) of current need.

In addition to the scarcity of useable land, lack of finance also acts as a constraint on real estate development. Housing finance is poorly developed, and mortgages are generally unavailable. Housing construction by the Government is very limited, and mainly for civil servants.

Over the years, most conventional housing has been built by the private sector. Given the scarcity of housing, it is not surprising that the market for rental housing is very profitable in Bangladesh. In some instances entire slum communities have developed as a result of enterprising landlords who develop the land, build kutchha housing with rudimentary services, and then rent the structure to lower income families.

Both RAJUK and the cooperatives target their developments exclusively at the middle and upper income groups. HSD, which has the responsibility to provide housing for the lower income groups, has not been effective in the past.

With a few exceptions, most housing for the poor has been developed without planning along the urban fringes, in high density pockets in the urban core, in low lying vacant lands subject to regular flooding, and on vacant public lands. Nearly all these areas have inadequate basic services for water, sanitation, drainage, access, or public services such as solid waste collection, health and education facilities.

The dominance of the private sector in real estate and housing development supports the use of land prices as an indicator of the increased value of the land that results from flood protection activities.

7.4.3 Estimating the Benefits from Land Appreciation

The implications of flood protection for increasing the value of land and economic activity in the greater Dhaka area have not been lost on the city's land developers and housing societies. They expect that, with the completion of the western embankment, low lying agricultural land will be



subject to a sharp increase in value (in some cases by multiples of 2 to 5 times). Presumably, these private sector entrepreneurs are in the best position to make judgments on the value of new economic activities to be generated.

In this analysis, market prices have been used as the basis for quantifying benefits, adjusted for speculative element in the pricing of land. Projections of the pattern of development of the land made available by the project over the next 20 years is a function of further projections of population growth and incomes over that time period, as well as estimates as to which low lying areas will be most attractive for new development.

The JICA study estimates that from 1981 to 1990, the built-up area in Greater Dhaka increased from 104 square kilometers (39% of the city) to 114 square kilometers (43%). They also project that the population growth rate for Dhaka city will diminish in the coming years, to an average of 4.6% from 1990-2000, and 2.0% between 2000-2010, resulting in populations of 7.1 million in 2000, and 8.7 million in 2010.

According to JICA's projections, much of this growth will be absorbed by increased densification in existing developed areas, and the demand for new land for development will grow at a lower rate averaging about 2.2% for the period up to 2010. In spite of this, however, it is estimated that the built-up area will increase from its 1990 level of 114 square kilometers (43% of the city area) to 177 square kilometers (67% of the area) over the next 20 years.

The major growth pressures will occur along the perimeter of existing built-up areas, on what are now marginal or agricultural lands. The primary demands for new development are expected to take place in the West Embankment, Eastern Dhaka, Mirpur and the Eastern Embankment areas. Of these, only Mirpur has extensive publically owned lands. Appendix 7 summarizes the growth in these areas by Dhaka districts.

In order to estimate the benefits, the following assumptions/caveats have been made:

- i) the total number of hectares of increase in built up land estimated by JICA for the years 2000 and 2010 will be added evenly throughout the decade;
- ii) the estimates of percentage price increases attributable to the project, while indicative only, are reasonable averages for what in reality are a vast range of different land types, locations, and prices in each of the districts indicated;
- iii) the price increases in land attributable to the Project do not include speculative elements, or other factors or distortions that would result in the market price differing from the economic price of land;

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- iv) as was mentioned earlier, only those lands which are predominantly low-lying are included here. The benefits from the high areas are captured in the "flood damages avoided" estimates considered below.

By multiplying the increase in land prices per hectare attributable to the project by the number of hectares developed each year, the annual stream of benefits attributable to the project is derived. This stream of benefits is then discounted by the standard rate of 12% to give the net present value of this particular project benefit.

Given the large errors possible in this type of valuation, care has been taken to err on the side of conservatism by estimating the benefits on the low side. For instance:

- i) many people interviewed indicated that they thought that the development of land would take place much more rapidly than indicated by the JICA study. They point out, for example, that development is already taking place in some areas that JICA predicts will remain undeveloped even after 2010;
- ii) another source of conservatism is counting only the appreciation in land values once the land is actually developed. In fact, it would probably be more appropriate to realize the benefit once the flood protection is afforded to the land, since it effectively takes on new economic characteristics whether or not the land is actually developed. Realizing the benefits shortly after the project is completed, of course, would increase the net present value significantly; and
- iii) the lower range of the likely increases in prices of land has been used.

7.5 Benefits from Flood Damage Avoidance

Another major benefit to be derived from the Project will be a reduction in damage from flood and rain waters in the project area through the completion of the embankment around the Greater Dhaka area, and improvements of the drainage system.

The benefits of flood protection can be measured as the difference in expected damage from flooding "with the project" and "without the project" and are estimated based on damages from recent floods. Benefits arising from flood damage avoidance include reductions in: (i) household damages and losses; (ii) business revenue losses; (iii) public institutions and services damages and losses; (iv) costs of evacuation, relief, and rehabilitation of victims, and emergency measures; and (v) road user damages and losses.

Average annual benefits are computed by summing up the benefits expected by prevention of flooding at a particular flood stage, multiplied by the probability of occurrence of that stage in any given year.

7.5.1 Experience with Flooding in Greater Dhaka

Heavy rainfall, high surrounding water levels and an inadequate and poorly maintained drainage system all contribute to flooding in the Greater Dhaka area. Major floods recorded in the Dhaka Metropolitan area occurred in 1954, 1955, 1970, 1974, 1987 and 1988.

The central parts of the city are high enough to remain generally free from flooding, but low-lying fringe areas are inundated by 2-4 meters of water for several months. Major floods, however, such as those in 1987 and 1988, affect even the central parts of the city.

Under FAP-8A, JICA has prepared an assessment of the flood damages in 1987 and 1988. Flood Damage Records as collected by JICA from the agencies concerned are summarized in Table 7.3. Because of the lack of comprehensiveness of the sources used in collecting this data, JICA undertook a flood damage sample survey in the Dhaka area. The results of this survey indicate that the official figures used for earlier flood damage estimates, as shown in Table 7.3, considerably understate the probable actual damages.

Table 7.3

Flood Damage - 1987 & 1988

(in Quantity)

	<u>1987 Flood</u>	<u>1988 Flood</u>
No. of affected people :	497,000	805,843
No. of human deaths :	38	63
No. of damaged Homesteads :	43,735	146,894
Length of damaged road (Km) :	241	660
Area of damaged crops (ha) :	13,820	17,099
No. of livestock deaths :	2,282	1,519
No. of damaged education facilities :	298	379

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The return periods of the 1987 and 1988 floods are estimated to be 10 years and 70 years respectively. Flood damages for the average annual external floods and internal floods were found to be much less substantial due to the general lack of development of lands prone to seasonal floods. The overall picture is summarized in Table 7.4.

Table 7.4

External Flood Conditions

	Area ha	Flood Area ha	Flood Depth (m)			Flood duration (day)			Affected People
			Max	Avg.	Min	Max	Avg.	Min	
Annual Flood	27527	12915	0	0	0	0	0	0	
1987 Flood	27527	17801	1.65	0.51	0	32.0	12.4	0	964651
1988 Flood	27527	22125	3.20	0.94	0	65.0	22.8	0	2233418

Internal Flood Conditions

	Area ha	Flood Area ha	Flood Depth (m)			Flood duration (day)			
			Max	Avg.	Min	Max	Avg.	Min	
Annual Flood	27527	1013	0.61	0.38	0	0.9	0.6	0	
Worst Flood	27527	1051	4.00	0.48	0	6.0	1.4	0	

7.5.2 Physical Flood Damage Potential

Based on the survey results, JICA went on to make projections on the extent of the damage should similar size floods occur in the future. These projections indicate that if the project is not implemented, a repetition of 1987 and/or 1988 scale floods in 1990 and/or 2010 would not only affect much larger populations (as Dhaka grows), but also affect a significantly larger percentage of the city's population. These estimates are presented in Table 7.5.

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Table 7.5

Affected Population in 1990 and 2010 - (Dhaka)

Year	1/10 Return Period e.i. 1987	1/70 Return Period e.i. 1988	Internal flood	Total
1990	1,547,397 (34.6%)	2,468,928 (55.2%)	594,499 (13.3%)	4,472,633
2010	3,977,411 (46.3%)	5,721,055 (66.6%)	856,965 (10%)	8,588,909

Table 7.6 describes the expected effects on property in terms of the numbers of homes, shops, factories, and institutions that would be damaged if 1987 and 1988 scale floods in 1990 and 2010.

Table 7.6

Estimated Physical Damage to Properties in 1990 and 2010

	1990				2010			
	Houses	Shops	Factories	Inst.	Houses	Shops	Factories	Inst.
Scale of flood 1987	274611	8354	882	8223	424790	14093	1344	14643
Scale of flood 1988	685360	17423	1532	19698	963850	27380	2307	31096

7.5.3 Estimated Flood Damage Avoidance Benefits

As was mentioned earlier, the economic benefits arising from the prevention of flood damage can be estimated based on the amount of the losses that would otherwise occur. The value of the estimated physical losses from potential future 1987 and 1988 scale floods (as listed in Table 7.6) is presented in Table 7.7 below.

Table 7.7

Value of Estimated Damage to Properties in 1990 and 2010

(Million Tk.)

	1990 (year)	2010 (year)
Scale of flood - 1987	2723.50	8603.30
Scale of flood - 1988	7917.80	24703.70
Average annual flood	1174.70	3408.00

These estimates, however, understate the flood damage that is avoided because they don't include damage to infrastructure, vehicles and livestock. Flood damage to these items accounted for 20% of total damage in 1987 and 24% in 1988. As a result, an additional allowance of 20% has been taken by JICA.

Therefore, if the flood protection and drainage scheme were not implemented before the year 2010, potential flood damage would be as presented below in Table 7.8. These figures represent the benefits arising from the project due to flood damage avoidance in those years. Benefits from flood damage avoidance for each of the intervening years have been calculated using a regression analysis based on the JICA projections.

Table 7.8
Benefits from Flood Damage Avoidance
(Million Tk.)

Project	1987 - Scale Flood	1988 - Scale Flood	Avg. Annual Flood
Year 1990			
G. Dhaka West	2,419.1	7,605.9	1,042.6
G. Dhaka East	745.6	2,548.2	326.1
Total :	3,164.7	10,154.1	1,368.7
Year 2010			
G. Dhaka West	6,525.4	19,448.5	2,787.4
G. Dhaka East	2,917.7	10,122.8	1,279.7
Total :	9,443.1	29,571.3	4,067.1

7.6 Other Benefits

The investments in the Project itself, plus the impact of the improved security, are expected to assist in stimulating the overall economic activity in Dhaka. This is expected to generate new employment opportunities, many of which will be of benefit to the poor.

As one housing development company argues, there should be dynamic benefits from forward and backward linkages from the expected stimulus to construction. Forward linkages would include increased production of household accessories, such as furniture, electrical fittings, and sanitary fittings. Backward linkages would include increases in production of construction materials, such as cement, bricks, glass, wood, and iron materials. The domestic resource content of construction activity is high. Construction is a highly labor-intensive activity, and should create new jobs.

Recurrent annual damages impact most severely on the poorest segment of the population, and reductions in flood frequencies and levels will have the greatest beneficial impact on this segment of the community. The project also includes components which are specifically targeted on improving the living conditions of a large number of people, the majority of whom belong to low-income groups and live in extremely poor environmental conditions, resulting in the following additional social benefits:

- o Health and Welfare. Flood protection and better drainage, will help to reduce disease vectors. Other project subcomponents such as slum improvement and better solid waste disposal will contribute to better health and productivity.
- o Prevention of loss of life. The GOB estimates that 68 people died in the 1987 flood, and 149 in the 1988 flood.
- o Some of Dhaka's ultra poor, primarily the squatters, are the most prone to suffering and displacement from the annual flooding in the lower lying areas.
- o Road Maintenance. A decrease in the need for maintenance of road network in Greater Dhaka. During the floods of 1988 about 400 km of roads in Dhaka were damaged and about 60% of the 1900 km internal road system was submerged.
- o Prestige Factor. The fact that the capital city of the country will be better protected against flooding should help to bolster the country's international image.

7.7 Economic Evaluation of DIFPP

7.7.1 Assumptions

The economic life of the Dhaka Integrated Flood Protection Project (DIFPP) has been assumed to be 20 years. The opportunity cost of land has been assumed to be equal to the current market price of land. All other costs are treated as net of duty and taxes. The following conversion factors (taken from the GOB Planning Commission's Guidelines and guidelines for economic analysis provided by the ADB) have been applied to obtain the economic costs and benefits:

Civil works	:	0.82
Foreign component of machinery/equipments	:	1.00
Local component of machinery/equipment	:	0.82
Foreign component of recurrent cost	:	1.00
Local component of recurrent cost	:	0.82
Other costs	:	0.82
Increase in land value	:	1.00
Flood damage (cost/benefit)	:	0.82

The salvage value of land (100%) and civil works (5%) has been added with the benefit of the last year of the project life. the opportunity cost of capital is assumed to be 12%.

The Economic Rates of Return (ERR) have been calculated separately for DIFPP as a whole and also for the recommended Project, the westerly half or Phase 1 of DIFPP. In both cases, three combinations of the benefits discussed above have been considered, including: (i) increase in land values; (ii) avoidance of flood damage; and (iii) a combination of increase in land values and avoidance of flood damage.

7.7.2 Calculation of ERR:

For the DIFPP as a whole, the estimated ERR's are as follow:

- i) when benefits for both an increase in land value and avoidance of flood damage are used, they provide a hefty ERR of 25.39%, and a very positive NPV of the project when the benefits stream is discounted at 12%;
- ii) on the basis of increase in land value alone, the ERR is 23.60%, which is almost double the opportunity cost of capital and also represents a very positive NPV; and
- iii) on the basis of avoidance of flood damages alone, the ERR of DIFPP has been calculated at 10.71%, which is lower than the opportunity cost of capital and thus a negative NPV for the project.

The estimated ERR's of the recommended Project (Phase 1) portion are as follow:

- i) a combination of benefits provides a very high ERR of 49.79%, and a very high positive NPV of the project, when the benefits stream is discounted at 12%;
- ii) on the basis of increase in land value alone, the ERR is also very high at 39.38%, which represents a positive NPV; and
- iii) on the basis of avoidance of flood damage alone, the ERR of Dhaka West has been estimated at 17.22% which is over 5% higher than the opportunity cost of capital. When discounted at 12%, the net benefits stream also shows a positive NPV for the project.

Detailed calculations for the overall DIFPP and for the recommended Project (Phase 1 - Dhaka West) are shown in Appendix 8.



7.7.3 Sensitivity Analysis

Two separate sensitivity analyses were carried out to test the ERR of the overall DIFPP and the recommended Project. The first assumes that there will be a slippage of one year in the benefit streams. The results of this analysis are shown below in Table 7.9. Further sensitivity analysis was carried out to test the sensitivity by assuming a 25% decrease in the benefits accruing from the increase in land values and avoidance of flood damage. The results of this are shown in Table 7.10. Details of the calculations are given in Appendix 8.

Table 7.9
Sensitivity Analysis - One Year Slippage

Benefits	ERR	NPV of Net Benefits Stream Discounted at 12%
<u>The Overall DIFPP:</u>		
Increase in land value	15.15%	Positive
Avoidance of flood damage	9.51%	Negative
Increase in land value and avoidance of flood damage.	18.06%	Positive
		(Tk. 7,715.76 million)
<u>The Recommended Project (Phase 1):</u>		
Increase in land value	36.55%	Highly positive
Avoidance of flood damage	14.15%	Positive
Increase in land value and avoidance of flood damage.	30.02%	
		(Tk. 12,254 million)

Table 7.10
Sensitivity Analysis - 25% Less

Benefits	ERR	NPV of Net Benefits Stream Discounted at 12%
<u>The Overall DIFPP:</u>		
Increase in land value and avoidance of flood damage.	18.92%	Highly Positive
		(Tk. 6,294 million)
<u>The Recommended Project (Phase 1):</u>		
Increase in land value and avoidance of flood damage.	39.85%	Highly Positive
		(Tk. 12,254 million)

7.7.4 Conclusions:

The estimated ERR's and sensitivity analysis provided above indicate that both the recommended Project (Phase 1), and the DIFPP as a whole, are attractive and economically viable.

In addition, the recommended Project (Phase 1) is clearly justified as of being of primary importance within the overall flood protection and drainage scheme because of its higher ERR's in comparison to the project as a whole. This is a reflection of: (i) the lower completion costs involved in protecting Dhaka West alone; and (ii) the larger benefits derived from protecting the more valuable existing assets in that portion of the city from future flood damage.

7.8 Economic Evaluation of the Slum Improvement Component

7.8.1 Introduction

The Slum Improvement component will cost \$2.5 million and is divided into two activities. The first includes the provision of basic low-cost water supply, sanitation, footpaths, street lighting, roadside drainage, and solid waste storage in slum areas to the benefit of approximately 8,000 families. The second includes providing basic services to complete the partially built homes (City Polli) of the families of 750 part-time municipal workers currently squatting on public properties. Because these activities are of entirely different natures, they are considered separately.

An economic analysis for the first of these activities is presented below. The City-Polli activity is justified under the project because it will assist homeless part-time city workers in meeting their basic needs. These workers are directly responsible at the neighborhood level for many of the sanitation and solid waste activities which will be important to the success of the project.

7.8.2 Methods and Assumptions

As with the earlier analysis presented in this chapter, the asset value approach to measuring the benefits of this component of the project was adopted. The benefits from slum improvement are estimated through rental value increases that result from this activity.

Because the specific slum areas that will benefit have not yet been defined, it was not possible to calculate detailed value increases. As a result, assumptions were made as for similar ADB supported slum improvement programs in Bangladesh within the Secondary Towns Infrastructure and Services Development Project using an assumed rental value increase of 25%.

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Economic costs and benefits have been shadow priced using the following conversion factors:

Civil works - foreign	:	1.00
Civil works - domestic	:	0.82
Foreign component of machinery/equipment	:	1.00
Local component of machinery/equipment	:	0.82
Foreign component of recurrent cost	:	1.00
Local component of recurrent cost	:	0.82
Other costs	:	0.82
Increase - rental value	:	1.00

Recurring costs have been assumed at 2% of capital costs. It is also assumed that most of the maintenance will be carried out by the beneficiaries of the project. The economic life of the project has been estimated at 20 years.

7.8.3 Evaluation Results and Conclusions

The estimated ERR for this component of the project was found to be 9.67%, which when discounted at 12% yields a slightly negative NPV (see Appendix 9).

While this NPV may not be encouraging, the project component can be still be justified based on additional social benefits which are not incorporated in increased rental values. In particular, the investment becomes worthwhile when considering the positive health effects of improved water supply, sanitation, and solid waste management.

7.9 Financial Analysis

Financial analyses have been prepared for the solid waste and sanitation/ water supply/local drainage components.

7.9.1 Solid Waste Component

The Solid Waste component of Part C of Stage One of the project is expected to cost Tk. 239.58 million during the five years of project implementation. Recurring O&M costs over the remaining 6 years of the assumed economic life of the project have been estimated at 14% of total capital costs per year, or Tk. 23.55 million. Thus, total recurring costs will be Tk. 141.55 and the total cost used in calculating the financial internal rate of return is Tk. 381.10 million.

For purposes of the FIRR, the primary source of benefits will derive from the conservancy fees charged by DCC for solid waste collection on holdings receiving service as a result of the project. The current number of holdings served is estimated at 141,000. We assume an increase in the coverage of new holdings of 3.6% per year. Conservancy fees are estimated at the current rate 3% of the rental value per holding for the first two years of the project, and at 6% from the third year onwards. This increase in the conservancy fee rate is based on current IBRD recommendations.

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Further benefits will be derived from the value of sanitary land filling; which is estimated at Tk. 362,281 per truck/year. Total benefits used in calculating the FIRR are Tk. 615.03 million.

Based on these assumptions, the estimated FIRR is positive at 18.58%. The robustness of this result was tested through a sensitivity analysis involving a 10% decrease in benefits, a 10% increase in costs, and a one year slippage in the realization of these benefits. As can be seen in Table 7.11 below, the FIRRs remain positive throughout, though they do become quite low. This would underscore the importance of increasing the conservancy fees as a means of cost recovery. Calculations are provided in Appendix 10.

Table 7.11

FIRR and Sensitivity Analysis - Solid Waste

Assumptions	FIRR
Original Calculation of FIRR	18.58%
10% decrease in Benefits	14.27%
10% increase in Costs	14.67%
10% decrease - Benefits & 10% increase - Costs	10.52%
One year delay - Benefits	15.04%
All three assumptions together	3.92%

7.9.2 Sanitation, Water Supply & Local Drainage Component

The economic life of the Sanitation, Water and Local Drainage component of Part C of the project is assumed at 20 years (8 years for the public toilets). This component is expected to cost Tk. 200.58 million (\$ 5.5 million) during the five years of project implementation. Recurring O&M costs over the remaining 15 years of the assumed economic life of the project have been estimated at 5% of the cost of civil works and Tk. 0.48 million per year for equipment. Thus, total recurring costs will be Tk. 131.55 and the total cost used in calculating the financial internal rate of return is Tk. 332.13 million.

Benefits are estimated as the sum of the income provided by user fees that will be imposed on some of the services rendered under this component of the project. These user fees have been estimated as follows:

- o Revenue from public standpipe/tubewell use: to DWASA, Tk. 152 per unit per day; and to central government, a duty of 16.5% of the fees collected by DWASA.

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- o Fees on use of public toilets: Tk. 300 per toilet per day.
 - o Rental fees for mobile public toilets: Tk. 150 per toilet per day.
 - o The sanitary latrines will bring in income in the form of a down payment of 20%, with the remainder paid over two years at an interest rate of 18% per year.
 - o No income is expected from the local drainage investments.

Based on these assumptions, the estimated FIRR is quite positive at 25.24%. The robustness of this result was tested through a sensitivity analysis involving a 10% decrease in benefits, a 10% increase in costs, and a one year slippage in the realization of these benefits. As can be seen in Table 7.12 below, the FIRRs remain positive in all cases. Calculations are provided in Appendix 10.

Table 7.12

FIRR and Sensitivity Analysis - Sanitation, Water & Local Drainage

Assumptions	FIRR
Original Calculation of FIRR	25.14%
10% decrease in Benefits	22.54%
10% increase in Costs	22.78%
10% decrease - Benefits & 10% increase - Costs	20.30%
One year delay - Benefits	20.44%
All three assumptions together	16.64%

7.10 Affordability to Implementing Institutions

The affordability of the project to DCC, DWASA and the central government has been analyzed in the section on cost recovery (Section 6.5). If the recommendations made in that section are followed, then these entities should be able to cover project costs.

8.0 RISK ANALYSIS AND RECOMMENDATIONS

8.1 Major Risks

The main risks which have been assessed during preparation of the Project include the following:

- a) delays in Project start-up due to slow recruitment of staff and establishment of the PIO;
- b) delays in recruitment of consultants, preparation of detailed engineering designs and award of contracts for the first years work programs;
- c) delays in prequalifying contractors and suppliers, and/or delays in tendering and contract award, leading to delayed construction starts;
- d) delays in implementation scheduling due to lack of inter-agency coordination, inadequate local fund allocations, protracted land acquisition delays, poor contractor performance, etc.;
- e) insufficient quality and/or financial controls during construction to assure proper contractor performance and satisfactory construction of facilities;
- f) inability of the implementing agencies to fulfill all of the staffing requirements resulting in poor coordination and delayed implementation of the proposed investment program,
- g) slow progress in effecting the institutional improvements under ongoing UNDP/UNCHS/World Bank assistance, leading to improved financial management by DCC/DWASA;
- h) failure to develop acceptable methods and/or levels of cost recovery adequate to support the annual costs of the required operations and management of the facilities;
- i) failure to take full advantage of cost recovery opportunities created by an increase in land values that will accompany the development of previously flood prone low-lying areas;
- j) failure to develop appropriate O&M procedures, or to provide adequate staffing, equipment or levels of funding for recurrent operations and maintenance needs.



8.2 Recommendations for Safeguarding Against Risks

In general, the Project has been formulated in a manner designed to safeguard against or minimize the above risks. The project team has worked closely with the implementing agencies and the ADB to develop realistic and achievable action plans, and to develop technically appropriate solutions to the unique problems associated with the Project. The Project proposals are in accordance with the national development objectives and have received the full support of the Government.

The proposed implementation schedules have taken into consideration the complex nature of the proposed investments and the flow of work has been designed so that the work loads are lightest in the first and last years of the project to: (i) allow the implementing agencies adequate time to establish their systems and procedures before the full impact of the enhanced development activities come on-stream; and (ii) to allow adequate time for completion of any carry-over works in the last program year should implementation be delayed during the course of the Project. The need for particular attention to ensuring proper contractor performance and quality control during construction is fully recognized and agreed by all parties.

In spite of this, however, the first program year is going to be one of the hardest and most critical years for getting the Project off to an effective start. The success of the first year program will be wholly dependent upon early action by the government and implementing agencies, and close adherence to the Preconstruction and Preparatory Activities described in Chapter 10 will be essential for a successful start to the entire Project.

The following Table 8.1, Action Plan, presents a time bound institutional and financial action plan designed to meet some of the concerns, including: (i) improving inter-agency coordination in planning and implementation of the development programs; (ii) identifying and removing constraints in the functioning of the city economy; (iii) improving/facilitating greater private sector activity; and improving urban management and O&M practices. This plan has been reviewed and agreed by the government during the Bank Fact Finding Mission, and will be reviewed and updated during the Appraisal Mission and annually thereafter. In addition, a time bound land acquisition schedule will be developed in coordination with the implementing agencies during Project Appraisal.

Risks associated with land management and a possible failure to take full advantage of the cost recovery opportunities that will arise from the development of low-lying areas will be reduced through a specific technical assistance program that is detailed in Chapter 11.

TABLE 8.1
ACTION PLAN

Objective/Task	Action By	Completion Date
I. <u>PROJECT IMPLEMENTATION</u>		
1. Establish PIO, appoint PD, designate key staff and arrange support facilities.	MIWDFC	30 September 1991.
2. Complete staff deployment/consultant recruitment.	PIO	30 April 1992.
3. Develop Operational details of implementation of (a) slum improvement program, (b) management of stand pipes.	DCC	31 December 1992.
II. <u>DEVELOP O&M CAPABILITY</u>		
1. Establish detailed O&M procedures.	BWDB/DWASA/ DCC.	31 March 1992
2. Prepare multiyear O&M program (Staff/equipment/finance).	-do-	30 June 1992
3. Implement periodic and special maintenance program.	-do-	Throughout the Project.
4. Develop staff O&M training program.	-do-	-do-

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III. STRENGTHENING OF FINANCIAL MANAGEMENT

- | | | |
|--|-----------|---------------|
| 1. Improvement in local revenue mobilization : establish a detailed plan with time-bound annual growth targets based on improvements in collection of arrears, reassessment of property values, property tax mapping, improving collection of current taxes, better cost recovery practices, and control of operating costs. | DCC. | 31 Dec. 1992 |
| 2. Installation and progress report on improved financial accounting, budgeting and planning systems (including computerization). | DCC/DWASA | 31 Dec. 1992. |

IV. URBAN MANAGEMENT

- | | | |
|---|---|---------------|
| 1. Formulate proposals for (a) privatization of urban infrastructure services, including billings and collection of taxes and charges and O&M, and devise a program of phased implementation; and (b) better cooperative framework for public-private sector operations in the Dhaka Metropolitan Area. | DCC/DWASA | 31 Dec. 1992 |
| 2. Develop urban land development controls for Dhaka including (a) land development standards, regulations and control mechanisms, (b) improved cost recovery methods for providing infrastructure and services, and (c) rationalizing the use of Government-owned lands. | RAJUK (in association with Ministry of Land and DCC). | 30 June 1993. |

9.0 ENVIRONMENTAL IMPACT ASSESSMENT

9.1 Introduction

The Dhaka Integrated Flood Protection Project (FAP-8B), is part of the Bangladesh Flood Action Plan (FAP). Based on recommendations of the Committee for Flood Control and Drainage of Greater Dhaka as approved in March 1989, the complete flood protection scheme for Dhaka City involves: (i) construction of embankments and flood protection walls along the Tongi Khal, Turag and Buriganga rivers, Dhaka-Narayanganj roads and Balu river to protect the Dhaka City Corporation area of around 265 sq km; (ii) raising and new construction of internal roads cum embankments; (iii) installation of pumping stations to drain internal water; and (iv) re-excavation and restoration of 12 drainage canals.

During 1989-90, considerable work, costing Tk. 4,000 million, was undertaken by GOB on the first phase of the scheme, covering the highly urbanized westerly half of the city with about 87% of the population, using its own resources. This includes construction of westerly embankments and flood walls, some of the programmed pipe sluices, road construction and raising, flood protection of the international airport and restoration of sewerage works in the city. However, most of this work was started without adequate investigation, coordination and quality control. As a result there have been some serious failures and erosion of large sections of the embankment, drainage congestion due to blocking of the natural drainage paths, and objections to the construction from taxpayers in the old Dhaka area where businesses are seen to be affected. The flood control and drainage system is not yet complete, nor is it operative. For the benefits to be realized and for the system to be made secure, it is essential that construction deficiencies be corrected, flood protection and drainage venting works be completed, and improvements to the internal drainage system be done. These activities are planned under the Project, as part of a longer term program.

The cost of integrated flood protection of Dhaka to protect the entire city from floods of 100 year frequency is estimated at over \$400 million. In view of the large investment requirements, the flood protection program will need to be phased over a period of 10-15 years. In planning the phasing of the flood protection program, cost-effectiveness of investments has been considered: protecting the densely populated/existing industrial and commercial areas is the first priority; followed by increased pumping capacity and increased safety. Such an approach will: (i) give the Government more time to develop appropriate urban land management policies for newly urbanizing areas; (ii) improve economic justification as land value increases take place; and (iii) permit an incremental approach to flood protection in line with affordability of investments.

A feasibility study for the integrated flood protection of Dhaka, financed by ADB, commenced in January 1991. The project is being formulated in the context of an Integrated Environmental Management Plan (IEMP) completed in May 1991, presented in Interim Report No. 1, and summarized in Chapter 3 of this report. Following completion of the feasibility study in July

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1991, consultant assistance in project refinement and detailed engineering continues until September 1991. This environmental impact assessment (EIA) is based on: (i) evaluations prepared by the consulting team under the Bank TA, as presented in the Inception Report and Interim Report No. 1; (ii) comments provided by the Flood Protection Coordination Organization (FPCO) interministerial review panel; (iii) comments of the Bank Office of the Environment; and (iv) the Progress EIA (PEIA) for the government-funded flood protection improvements prepared by the Department of Environment (DOE) in 1989-90, and the . The latter document and this EIA were prepared with the assistance of Bank-financed consultants under the National Environmental Monitoring and Pollution Control Project.

9.2 Description of The Project

The Project relates to Dhaka, the national capital, which is estimated to have a population of about 6 million in the metropolitan area (DMA). The area under the responsibility of the Dhaka City Corporation (DCC), covering an area of 265 sq km, contains an estimated population of 4.8 million. Most of the population of the city is concentrated in the western part; the eastern part of the city is less dense, with considerable areas still under agricultural and non-urban uses. The Project covers the most densely populated western part of the Dhaka city comprising about 136 sq km, which accommodates a population of 4.2 million or some 87 percent of the city population.

The underlying rationale for the Project is to improve the urban efficiencies and environmental conditions (particularly for the urban poor) in Dhaka City for promotion of sustainable long term economic development. The objective of the Project is to undertake an integrated urban development program consisting of: (i) flood control and drainage works; (ii) complementary environmental improvement programs in low cost water supply and sanitation programs for low income residents, solid waste management, slum and squatter area improvement, and pollution abatement; and (iii) institutional strengthening for improved efficiencies in urban management and revenue generation. The IEMP has been formulated as a long term integrated development strategy for Dhaka, requiring close coordination and integration of parallel programs for optimum success. Also, the Project has been formulated in the context of an overall Flood Action Plan (FAP) coordinated by the FPCO of the Government of Bangladesh (GOB). In particular, intensive coordination with the JICA Drainage Master Plan, and FPCO guidelines for economic analysis and environmental impact assessment of flood control projects, has guided and will continue to guide formulation of the Project.

The proposed Project involves implementation of recommendations from the project preparatory technical assistance (ADB TA 1318-BAN). Table 9.1 itemizes the agreed Project components and the agencies of the GOB responsible for their implementation. The central component involves flood control and drainage, including: (i) remedial work for repair of embankments constructed by GOB (some of which require re-building) together with additional sluices and operation and maintenance program; (ii) remediation of primary and secondary drainage channels within the Dhaka



area; and (iii) improvement of the central spine road. The flood protection component is being developed in conjunction with the drainage master plan for Dhaka (FAP-8A, under JICA) and includes development of standards for drainage works, as well as operations and maintenance guidelines and procedures.

Table 9.1

SUMMARY OF AGREED PROGRAMS

DESCRIPTION	LEAD AGENCY
<u>FLOOD CONTROL AND DRAINAGE</u>	
Prepare Drainage Development Standards	PIO
Prepare Operation & Maintenance Guidelines/Procedures	BWDB/PIO
Repair/Complete Westerly Embankments/Walls	BWDB
Raise Internal N-S Road System	RAJUK
Construct Sluices/Closures Along Easterly N-S Road	BWDB
Rehabilitate/Upgrade Main Drain System	DWASA
Rehabilitate/Upgrade Secondary Drain System	DWASA
Rehabilitate/Upgrade Local Drain System	DCC
Provide Temporary Pumping Facilities	BWDB/BADC
<u>WATER SUPPLY AND SANITATION</u>	
Urgent Water Supply for Slum and Squatter Areas	DCC/DWASA
Low Cost Sanitation Program	DCC
Septic Tank Desludging and Control Program	DCC/DWASA
Public Information Program	PIO/DOE
<u>SOLID WASTE MANAGEMENT</u>	
Local Collection Rehabilitation & Expansion Program	DCC
Training and Health Equipment for Sanitation Workers	DCC
<u>SLUM AND SQUATTER AREA IMPROVEMENTS</u>	
Comprehensive Slum Improvement Program	DCC
<u>TRAINING AND INSTITUTIONAL STRENGTHENING</u>	
Solid Waste Operations and Management Strengthening	DCC
Review of Govt. Land Ownership & Land Use Policies	RAJUK
Review of Development Policies, Controls & Legislation	RAJUK

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The complementary environmental improvement program includes water supply, solid waste management and slum area improvements. The water supply and sanitation component involves provision of standpipes and a low cost sanitation program mainly for slum settlements. A program for desludging septic tanks and control of sludge from these sources is also proposed. Finally, a public information component is included to heighten awareness of public health issues associated with water supply and sanitation.

Solid waste management involves rehabilitation of local collection stations (trash bins), supply of trucks and handling equipment, expansion of solid waste disposal services into new areas, and upgrading of worker conditions through training and provision of health equipment.

Slum and squatter area improvements will be introduced using techniques based on the UNICEF approach, in which local involvement is stimulated, and local residents are given significant continuing roles in the management of slum areas.

The Project is scheduled to commence in the current 1990-91 financial year. Urgent flood protection and drainage improvement components are to receive priority attention, with completion scheduled within the first three years, while the entire Project is to be completed over a five year period.

9.3 Description of the Environment

9.3.1 Physical Resources

Dhaka City is comprised of flat terrain seldom varying more than 4 m in elevation. The City is surrounded by waterways and interlaced with natural drainage channels and lakes which make up 19% of the total land area of 265 sq km. Deltaic soil types predominate, and are variable within a limited range, including clays, silty clays and sand at varying depths. Traditional land uses exploited the natural fertility of the soil, brought about by annual inundation from the region's major river systems. Soils remain saturated most of the year. Deep aquifers yield plentiful supplies of groundwater, the source of most of the city's water supply.

9.3.2 Ecological Resources

The area has bountiful vegetation typical of a settled and tropical environment. Native ecology has almost entirely been displaced by agricultural and urban land uses. Aquatic life in the major waterways is affected by human pollutants, yet still is relatively plentiful. Secondary waterways, lakes and natural drainage channels within the circumference of the major rivers may harbor fish, depending on their proximity to urban wastewater discharges. Many of these internal waterways are devoid of aquatic life due to pollution loads.



9.3.3 Human and Economic Development

By 1990, 39% of the land area within Dhaka City was in urban use, with the balance considered rural or semi-rural. The current population residing within the Dhaka City Corporation is estimated to be 4.8 million, with surrounding areas containing an additional 2.2 million people. About 25% to 30% of the urban population are low income slum and squatter dwellers.

Industrial activities include tanneries, textile manufacturers, pharmaceutical plants, steel mills, and a variety of other small and medium industrial units. Industrial zones within the City include Hazaribagh and Tejgaon, with a scattering of activities within Old Dhaka.

Infrastructure is typical of an urban setting. Many aspects of infrastructure are either non-existent or in degraded condition, such as systems for sewage collection and treatment (serving 15% to 20% of the population), water supply (serving 60%), drainage and solid waste handling and disposal.

Infrastructure, planning and management of Dhaka City is provided by the Dhaka City Corporation (DCC), the Dhaka Water and Sewage Authority (DWASA), and the Capital Development Authority (RAJUK). Being the capital of Bangladesh, many Government agencies are located in Dhaka and have roles in management of internal affairs. The project will be implemented by the Bangladesh Water Development Board (BWDB), DCC and DWASA, with assistance from RAJUK and the Department of Environment (DOE).

9.3.4 Quality of Life Values

A wide diversity of income levels exists among the residents of Dhaka, which is perhaps best reflected in land use. There is a low proportion of parks, roads, commercial and industrial areas in comparison to major residential use; the prevalence of densely populated slums and squatter areas housing a third of the population; and the disproportionately large areas used for housing upper income groups.

Public health is a critical cause for concern within the area. Child mortality among slum dwellers is in the range of 130 to 160 deaths per thousand population, three times the levels found among upper income groups within the study area. The conditions within slum communities with respect to sanitation, water supply and solid waste are particularly acute.

The low-lying elevations within the City are subjected to annual flooding. Floods in 1987 and 1988 caused excessive hardship and loss of life. About 200 sq km, or 75% of the total area of 265 sq km, were submerged to depths ranging from 0.3 meters to over 4.5 meters and about 2.5 million people, or 60% of the city population were directly affected by these floods.

9.4 Anticipated Environmental Impacts and Mitigation Measures

9.4.1 Flood Control and Drainage

The Project is geared to rectifying environmental, safety and quality of life issues that were raised concerning the national government initiative on flood protection and drainage for the Dhaka area. The project is oriented toward remediation of inadequate design and construction, and in addition makes significant contributions toward solution of pervasive environmental issues within Dhaka City, all of which are linked. Chapter 11 of the FAP-8B Interim Report directly addresses the environmental, safety and quality of life issues of the flood protection and drainage component. Only a brief summary is included here.

The potentially disastrous impacts of a breach in the embankment/wall could be worse than the current situation as a breach would be sudden and unexpected and people would not have time to move out of the flood wave. While the highest standards of engineering design and construction quality control will be adopted, some additional studies of risk assessment, time to maximum flood after a breach, and assessment of damage potential are recommended. Review of the engineering design to minimize potential damage, development of land use controls, and possible compartmentalizing of potentially flooded areas are also proposed as a part of the Project. In addition to all of these precautions, prior to putting the flood protection system into operation, an emergency management plan under FAP-11 (Flood Disaster Preparedness Program) will be developed and tested.

Location of the original embankments gave inadequate attention to social impacts, resulting in threats to the safety and effectiveness of the flood protection works due to people cutting sections of the dikes and walls, as well as severance of properties causing extreme problems for some residents. New dike/wall alignments will be based on social and engineering considerations, with all communities along proposed alignments surveyed and mapped, and mitigation measures proposed following an extensive program of public participation. Compensation and assistance with resettlement will also be required for affected families.

Without careful design, the flood protection proposals could cause some negative impacts on the city's stormwater drainage system. However it is proposed that drainage design would take into account the current drainage patterns and through excavation of previously blocked drains would generally improve the drainage situation. The need for some retention ponds as part of the flood control system behind the embankments/walls will result in pools of water which could stagnate and lead to increased insect populations, such as mosquitoes, and associated disease problems. Ponds will be monitored for harmful insects and sprayed if necessary. It is suggested that retention ponds and other semi-permanent water bodies should be landscaped and used to increase the area of public open space in the city.

Concern has been expressed that communities outside the protected area may be made worse off in the event of a flood. Backwater curves for areas outside the walls will be checked and remedial actions taken if necessary. Excluded communities should be included in the public participation process, so that they can be educated about the project, express any concerns and offer possible remedial measures which they would like to see implemented.

As already observed in Dhaka, people will migrate into the protected areas and even build residences on the embankment. A study of migration patterns will be undertaken to determine the likely extent and settlement pattern of new migrants into the protected areas. Measures to discourage migration to the protected area at an unacceptable rate or into undesirable areas will be adopted through appropriate land use controls.

The construction of dikes and walls will block some waterways serving commercial boat traffic and cut a number of establishments off from their transportation routes. The most important case is the Gajaria Khal connecting to the Balu River. A lock or substitute access road is being considered for this area.

The impacts on aquatic life, especially fish, are not clear, although likely to be negative as the various species have probably adapted to the current flooding regime. A detailed study is proposed under FAP-16 (Environmental Study) with possible mitigation measures to include some degree of controlled flooding in certain areas.

The remaining environmental management components of the project are benign in the sense that each directly confronts existing environmental, sanitation, public health and human habitation shortcomings. It is important to consider the secondary impacts that may develop around the environmental components of the proposed investment projects. However further details on these components are required to provide a basis for environmental assessment. Some recommendations can be made for incorporation into future terms of reference for these project components. In addition, further environmental assessments of appropriate content and scope may be needed for each component, and should be prepared during their design stages. In most cases, adequate consideration of good engineering design principles and incorporation of local expectations and patterns of use will be sufficient to assure maximum functionality and minimum levels of secondary environmental impact.

9.4.2 Water Supply and Sanitation

The sub-components under this sector include management studies, dissemination of information concerning public health, and small-scale infrastructure improvements. The first two types of work have no direct environmental consequences related to execution. The infrastructure work may have secondary impacts, even though the overall effects are benign. These are considered in the following paragraphs.

(a) Urgent Water Supply for Slum and Squatter Areas:

The work will involve extension of water distribution piping into slum areas and provision of approximately one stand pipe for every ten households. Possible environmental impacts include:

- (i) disruption of paths of travel during pipe laying and possible easement problems. Both these impacts are minor in comparison to the benefits gained by people inhabiting the service area. The small scale technology needed for this work will lead to only temporary disruption during construction. Acquisition of easements may impact individual households; however the temporary dwellings in these areas can be relocated to nearby areas. The project should guarantee settlement rights in nearby areas for individual households that are affected by the location of the pipe alignment.
- (ii) bacteriological contamination of installed water supplies due to low water pressure. This problem exists throughout Dhaka City at the present, and the piped water supplies will provide far better sources of water to the slum dwellers than are presently available to them. Nevertheless the design of the system should incorporate materials and workmanship that will prevent line leakage and guarantee safe quality of water at least from the point of take-off from existing distribution mains.
- (iii) unsanitary conditions in the immediate vicinity of the stand-pipes due to leakage, continually flowing taps or inadequate drainage. The design of the distribution points should incorporate good local area drainage, concrete aprons at a higher grade than the surrounding ground elevation, and improved footpaths to the location. Long-life, positive shut-off valves that are designed for intensive use should be incorporated into the project specifications.

(b) Low Cost Sanitation Program:

This component consists of (i) installing twin-pit water seal latrines in slum areas, (ii) construction of community sanitation latrines in public areas, and (iii) improvement of existing on-site disposal systems to reduce or eliminate the discharge or overspill of partially treated human wastes. Because these elements do not involve routing of buried sewer lines, little or no disruption during the construction phase is anticipated. Potential environmental impacts are mainly concerned with use of the facilities, as follows:

- (i) unsanitary conditions will develop either within or in the immediate area of the latrines. Generally this has not been a problem for the existing community latrines in Dhaka City, as these are privately operated, a fee is charged for the service, and a lease/royalty is due the Dhaka municipality. Operators maintain generally clean conditions. Twin-pit water seal latrines in slum areas may develop

unsanitary conditions due to over-use and maintenance neglect. The project should assure operating budgets for maintenance, including desludging and wash-down. User fees and private maintenance contracts may be necessary to assure long term functioning of the facility. The design should provide access for desludging.

- (ii) insect vectors could affect those living nearby. The pits for the latrines will be sealed to prevent free movement of insects.
- (iii) disposal of residues from desludging will need to be handled properly. This issue is addressed as part of the septic tank desludging component in item 4.2 (c).

(c) Septic Tank Desludging and Control Program:

This element involves initiating a long term municipal program for desludging of septic tanks in the Dhaka area, and transport of the sludge to the Pagla Treatment Plant for disposal. This proposal will have direct positive benefits in performance of on-site treatment units. Negative impacts again are virtually non-existent, and concern sludge transport and the capacity of the Pagla plant to receive the waste sludge.

Without proper management, sludge will be transported improperly and open dumping of sludge to open water courses will occur. The management proposal for this work will incorporate safeguards against these eventualities. These might include training of DWASA personnel in the correct handling and environmental risks of sewage sludge and development of a logical and realistic approach for day-to-day operations.

The Pagla Plant is not equipped to receive and dispose of the wastes properly and needs to be equipped with sludge handling and disposal facilities. Therefore to achieve net positive benefits, adequate facilities must be provided.

(d) Other Water Supply and Sanitation Components :

The remaining items involve studies, mapping and maintenance operations for correcting leakage. Environmental impacts are insignificant for all these items.

9.4.3 Solid Waste Management

There are two components within this sector: rehabilitation and expansion of local collection stations, and equipment for personnel safety and health. Neither of these components have any negative environmental impacts that will not be addressed through facility design and/or equipment purchase. The project consulting team will of course be responsible for cost effective proposals for best utilization of expenditures under these two components.

9.4.4 Slum and Squatter Area Improvements: Comprehensive Slum Improvement Program

The thrust of this work is to "provide additional support to complement and extend the LGEB/UNDP SIP program to a level sufficient to meet the needs of all slum and squatter areas within Dhaka where the dwellers meet the basic requirements for security of tenure and willingness to participate and pay for a portion of the services provided."

The LGEB/UNDP SIP (slum improvement) program provides modest infrastructure and services within slums through motivation and community participation. Improvements generally encompass water supply, sanitation, solid waste collection, drainage, foot path access and outdoor lighting.

This program is wholly beneficial, and due to the modesty and small scale of infrastructure, no environmental damages are expected to result either in the construction or operations stages of the work.

9.4.5 Training and Institutional Strengthening

This component includes PIO assistance during implementation for studies for pollution control source assessment, strengthening of financial management, administration and solid waste operations within DCC, a review of Government land ownership and policies, and a study concerning development policies, controls and legislation within RAJUK.

None of these elements involve investment in physical infrastructure; therefore there are no environmental impacts associated with their implementation.

9.5 Alternatives

Interim Report No. 1 prepared for FAP-8B considered a wide range of alternatives for flood protection both from environmental and economic points of view. The reader is directed to that report for further information on that component of the project.

As previously stated, the remaining components are geared explicitly toward environmental improvement. While the Interim Report, as summarized in Chapter 3 of this report, has put forth a number of recommendations for near term and for long term implementation by both local and national agencies and by international funding groups, the selection of specific items for incorporation into the Project is dictated primarily by considerations of cost effectiveness in the use of available funds. As stated, the need for these and similar projects for slum improvement, sewage collection and treatment, industrial pollution control and a host of other infrastructure and social ills is unlimited in Dhaka City. The selection of Project Components has been based on packaging together the most cost effective components related in a logical manner to the primary thrust of the project (flood control and drainage) for near term implementation. The selected environmental improvement components have

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been formulated within the framework of the IEMP to reinforce the overall impact of the Project on an area-wide basis, with particular emphasis on the needs of low income groups.

9.6 Cost Benefit Analyses

As expansion of Dhaka is severely constrained by the risk of flooding, the major economic benefit of the Project will be the expansion of Dhaka's economic infrastructure (residential dwellings, commercial and industrial real estate, transportation) into the low-lying, predominantly agricultural areas presently subject to seasonal flooding. The major economic benefit is measured as the increase in land values immediately after the completion of the project, treated conservatively as a one-time increase spread over a period of twenty years in pace with the projected demand for new urban development areas. A second important benefit will be protection of existing economic infrastructure on higher lands, which is subject to damage from seasonal and exceptional flooding. Improved drainage will help remove stagnant water leading to improved environmental conditions and some health benefits. The Project will also help improve the living conditions of a large number of people, the majority belonging to low-income groups at present living in extremely poor environmental conditions in low-lying areas in the western part of the city. The complementary environmental improvement works are all aimed at these low-income groups presently residing in slum conditions.

For the major component of flood protection and drainage, the benefits to 87% of the urban population or about 4.2 million persons will far outweigh the costs for this component, which not only improves property values but also is geared specifically towards protection of human life and livelihood. Assuming that the results of previous investigations are incorporated into future design and construction, the economic costs associated with any negative environmental impacts outlined above will not significantly affect the cost-benefit equation.

From the preliminary economic analysis, initial calculations show that the increase in land values alone will be more than sufficient to cover the economic costs of the project, at a 12 per cent discount rate. If the project is taken as a whole, then the cumulative environmental improvement measures must be weighed in on the benefit side of the equation. While the costs of these components are generally minor, their effects of human health and livelihood will be significant and wholly beneficial.

Individual environmental improvement components can be considered from the standpoint of cost effectiveness: whether or not the benefits accrued from individual investment decisions represent the best possible use of funds. At this stage the selected environmental improvement components represent the best possible, cost-effective, proven technology/approach gleaned from previous experience in Dhaka and other cities with similar problems. Further investigation of costs and benefits of each component will be undertaken during appraisal.

9.7 Institutional Requirements and Environmental Monitoring Program

9.7.1 Institutional Requirements

A Project Implementation Office (PIO) is proposed to be established for implementing the integrated flood protection project, in order to bring together the various agencies which will be involved with the work. Details on staffing and terms of reference will be provided at the appraisal stage.

The environmental improvement components address institutional issues in a variety of ways. These include policy issues; administrative capabilities and arrangements; operational skills and training; financial aspects of cost recovery for water supply, sanitation and solid waste management in particular; creation of cells within the city administrative offices to address specific issues; policies and programs within the Department of Environment; technical studies for improvements in management; surveys for the provision of information and other types of institutionally related components. Consideration of ongoing and proposed institutional strengthening activities under other projects, mainly World Bank and UNDP assisted programs, have been considered in the Project formulation, and adequate institutional arrangements have been incorporated into the project design.

9.7.2 Environmental Monitoring Plan

Environmental monitoring should focus on two aspects of the project: (i) minimizing environmental impact during the construction and remediation of the embankment; and (ii) monitoring environmental improvements that result from specific project components. The environmental monitoring plan should build to the extent possible on existing monitoring programs of DOE and DWASA, and utilize existing facilities, making provisions for necessary strengthening of operational budgets in order to assure that the work can be performed.

(a) Impact Minimization During Construction:

Interim Report No. 1 notes that erosion control is a significant issue both during construction and operations. Erosion can affect local water quality, and recommendations are in place for inclusion of erosion control costs in the project capital budget.

A program for measurement of surface water turbidity in the vicinity of construction areas can easily be incorporated in the tender documents. Turbidity may be measured in the field using relatively simple techniques, such as a Secchi disk, or through use of nephelometric readings in a laboratory or in the field. In order to gain an indication of the contributions to total turbidity arising from construction of the embankment and internal drainage works, readings would need to be taken both upstream and downstream of flowing water bodies, or before and after rainfall events in still water bodies. The results of these measurements could be used to indicate preferred methods of erosion control during

construction operations. Excessive turbidity levels would indicate the need for improving erosion control measures in subsequent construction operations.

(b) Monitoring Environmental Improvements:

Depending on the timing for implementation of the environmental improvement components of the project, the following types of measurable improvements in environmental and public health parameters are possible: (i) surface water quality parameters in rivers (specifically the Buriganga) and in internal drainage systems (the khals within Dhaka); (ii) epidemiological parameters (frequency and susceptibility to gastrointestinal and/or respiratory illness) among slum populations served by the improvement programs; (iii) drinking water quality (chlorine residual and coliform count) in the overall water supply system and in the extensions made into slum areas; (iv) quantities of solid wastes found deposited on land and in waterways; and (v) shallow groundwater quality in the vicinities of industrial outfalls and landfills. The rather small magnitude of the improvements that are planned in relation to the sizes of the overall problems would indicate that improvements may be measurable only in the immediate vicinity where project components are being implemented. However good monitoring data can be used to convince future projects to adopt those measures which have been shown to bring about improvements in environmental quality.

Measurable improvements in surface water quality of the khals may occur from the rehabilitation/upgrading of main/secondary/local drainage systems, and in local areas from slum rehabilitation and improved solid waste management. Water quality parameters in the Buriganga and in the khals are presently monitored by the Dhaka Division of DOE. The river monitoring program has been evaluated and recently upgraded. The monitoring of internal drainage water quality should be extended to include 10 to 15 monitoring points on a quarterly basis for pH, conductivity, TDS, TSS, oil and grease, BOD and DO. The locations for monitoring should be selected following a field reconnaissance, and should incorporate the elements of the induced drainage scheme that will result following completion of the flood control works. Other parameters in addition to those mentioned above should be included in special circumstances where industrial discharges are involved.

A reduction in the quantity of floatable materials should result both from sanitation and solid waste management measures. An accurate sampling of the content of floatables is difficult to obtain, being influenced by surface winds and other factors. One possibility is to equip khals with manually cleaned bar screens at culvert crossings, and to clean these screens at regular intervals, taking a volumetric measurement of the materials impinging on the screens. Depending on the local configuration of the water body (flow velocity, surface area and wind fetch) a relatively accurate temporal comparison may be obtained.

Though there are no specific aspects of the Project to enhance chlorine residual in the water supply system, a program of monitoring chlorine residual would be beneficial if followed by improved dosing in order to maintain adequate levels for bacteriological safety. This should extend throughout the distribution system, and should include the extensions that are planned under the Project.

There is a need for limited investigation of shallow groundwater quality in the vicinities of solid waste dumps and industrial outfalls. Not much is currently known about this problem. In the long term, shallow polluted groundwater may affect deeper aquifers if draw down in the latter becomes excessive. Shallow drinking water wells may also be affected, a factor which might influence decisions on extension of drinking water supply and distribution within Dhaka City. The design of a monitoring system, in order to be cost effective yet still yield meaningful results, requires considerable attention by a qualified contaminant hydrogeologist.

Epidemiological surveys provide the most direct means, over time, to measure the benefits of the slum improvement program components. These also require careful design by a public health specialist. Many of the environmental improvement components are directly related to public health. A reduction in gastrointestinal illnesses should be immediately measurable in slum areas served with piped water supplies. Infant mortality may be significantly reduced. Other distinctive health benefits can be expected; and it would be highly beneficial over the long term to document these improvements to the best possible extent, in order to serve as a guide for future project preparations, and to understand better the implications for cost and benefit analysis.

Within six months of the loan effectiveness, the PIO will develop a comprehensive PBME system with assistance from the Project management consultants. The PBME activities will be coordinated by the PIO with active involvement of the DOE. The actual carrying out of PBME activities, including the establishment of bench marks, data collection, and analyses will be the responsibility of the respective implementing agencies.

9.8 Public Involvement

There are three basic mechanisms for public involvement in the Project work. First, the Project is designed to alleviate human (individual and societal) problems. The environmental components are oriented specifically to human needs. For many of the Project elements, canvassing public opinions and modes of behavior will be necessary for effective Project design. (This applies specifically to the water and sanitation, and the slum improvement components). For at least one component, public information (which would infer involvement) is an explicit aim. Finally, the Report specifically refers to the need (and excellent potential for) involvement of NGOs in aspects of the upcoming work effort, specifically because of their history of work with slum dwellers in the Dhaka area. NGOs are probably best qualified to assist in cost effective implementation of those aspects of the Project dealing directly with the public.

At this stage in the development of the Project, there are no explicit requirements for public meetings related to the work effort, or mechanisms described for receiving public comments on its various aspects. Because of the significant levels of direct human involvement (i.e. provision of human services, settlement of severance and resettlement problems, etc.) the ways through which the public will be involved with the Project need to be stipulated, including how public participation can influence the approach to design and implementation.

9.9 Conclusions

The Project FAP-8B (technical assistance and implementation stages) originated from the need to correct inadequacies in flood protection embankments which, if left unattended, threatened human life through catastrophic failure and, at the least, brought about severe impacts in daily living as well as some degree of social inequity. The remedial nature of this work, following as it did on the heels of efforts by the GOB to mitigate future flood hazards, leaves open only two relevant questions: (i) whether the Project in its present formulation provides every possible (or economically justifiable) means to minimize environmental impact; and (ii) whether there are irreversible losses that will occur as a result of its implementation.

The flood protection and drainage component has been wholly directed to rectifying design and construction problems; thus it can be concluded that every effort has been made to minimize environmental impact, to the degree possible within the scope of the available budget.

The environmental assessment effort related to this Project has been extensive, beginning with the Progress EIA prepared by DOE, and including the TA consultant's work. No irreversible impacts have been noted as a result of the work proposed under the Project. Irreversible losses may well occur if the Project does not proceed, as the Project addresses means for averting catastrophic failure of the embankment during times of flooding, with consequent loss of life. It has been noted in Interim Report No. 1 that:

"no design or construction method can be entirely free of risk of collapse of a dike or wall. While foundation investigations and analyses are not complete at the time of writing, there is an understanding that soil conditions are poor, both for the embankment foundation and for the supply of construction materials. The integrity of the design is also dependent on adequate inspection and maintenance during the operational life of the system. Maintenance of infrastructure is a major problem in Bangladesh, as in other developing countries, and therefore the potential for failure through lack of maintenance must be considered."

Thus, while risk cannot be eliminated, it may be reduced to insignificant levels through proper design, analysis and evaluation. Much of this work will continue, such as (i) risk assessment for dike failure, (ii) hydrological assessment of the resultant flood wave during failure, (iii) assessment of damage potential, particularly for public institutions, and

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(iv) compartmentalizing of flood prone areas. Early warning systems (sirens and public broadcasts) as well as other disaster preparedness measures are proposed. Thus every conceivable measure (economically justifiable) to reduce risk and eliminate the possibility of irrecoverable loss has been evaluated.

Further, the Project includes complementary components for environmental enhancement within an Integrated Environmental Management Plan. These components address specific environmental problem areas that are linked to, but not directly dependent upon, implementation of the flood protection works. Unlike many past flood control projects, the present Project is focused on human needs throughout all of its aspects. The human focus is not compensatory, as there are few if any aspects of the Project that do not attend to the needs of the populace within the Dhaka urban area. Thus there are virtually no aspects of the Project that require compensation. Under the circumstances, benefits can be seen to far outweigh costs, and the Project should proceed.

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10.0 PRECONSTRUCTION AND PREPARATION ACTIVITIES

10.1 Major Preparatory Activities

The major Project preparatory activities are detailed on the attached schedule, Table 10.1. Some are once only actions that need to be taken prior to the effectivity of the loan, while others are continuing activities which will carry over into the Project implementation period.

Key amongst these activities is the need for early establishment of the Project Implementation Office (PIO). This unit should be responsible for initiating and undertaking the preconstruction activities, and early identification and recruitment of key Project personnel should ideally be done before the Project Appraisal.

In order to maintain the tight time schedule proposed for this Project and to ensure effective implementation of the first years work program, an early recruitment of consultants is required. This includes recruitment of consultants for Project implementation assistance, for detailed engineering design of the first years work components, and for the proposed additional topographic surveys and subsoil investigations which are a prerequisite to the preparation of the detailed designs for the urgent embankments remedial works. To achieve this, the consultants short list should be prepared immediately for approval during the Project Appraisal Mission, since recruitment of consultants is sometimes made a precondition of loan effectivity. As a special case, and for the first years activities only, it is recommended that the GOB request the ADB for permission to extend the services of the existing T.A. consultants for completion of the first years field investigations, detailed engineering design works, contractor prequalification and tendering.

The preparation and negotiation of any subloans and lending agreements between the National Government and the various Implementing Agencies should be carried out after loan negotiations, when the terms, conditions and covenants of the loans will be known. The subloan agreements should be concluded before the loan becomes effective and disbursements commence.

Land acquisition is a vital and often time consuming activity which, if not completed on time, can cause serious delays to implementation. It is sometimes a condition of loan that a specified amount of the land needed for the project must be acquired before the loan can become effective. Although new land acquisition has been kept to a minimum for the Project components, the land acquisition process should start immediately after appraisal for any additional land required when the location and land requirements should be known.

10.2 Other Activities to be Undertaken Prior to Procurement

It is important that procurement/construction contracts for the first batch of components be ready for award so that physical implementation can commence as soon as the loan becomes effective so that the first years program is achieved. In order to achieve this the early recruitment of consultants (as described above) is an essential prerequisite.

The detailed engineering design activities must be completed to a sufficient level of detail with adequate documentation to enable competent contractors to prepare reasonable bids and submit competitive tenders. If tenders are to be received during the last quarter of 1991 or the first quarter of 1992, then the preliminary activities for the detailed design, such as conducting supplemental field investigations, must be commencing now. The actual design work should commence not later than November 1991.

Similarly, to conform with ADB procurement guidelines the award of most contracts is normally by competitive tender. This can be a time consuming process with considerable preparatory work to be completed to pre-qualify contractors, organize the tender evaluations, and award the contracts. In order to complete these activities the pre-qualification of contractors should commence immediately after appraisal so that the tendering process can begin as soon as the designs and documentation are complete.

An important implication of this preconstruction preparation schedule is that the costs of all agreed topographic surveys, subsoil investigations, engineering services and construction/procurement works are eligible for funding through the loan, provided that related expenditures are incurred after completion of the Project Appraisal. If these tasks are undertaken prior to loan effectivity - and it is essential that they are - then GOB resources will be required to provide the interim financing, and the loan agreement must be made to ensure that retroactive financing is available.

TABLE 10.1

FURTHER PROJECT PREPARATORY ACTION

Action Required	Action By	Completion Date
<u>A. Technical Aspects</u>		
(i) Finalization of outline design of embankment, construction schedules and cost estimates.	BWDB/Consultants	31 August '91.
(ii) Completion of survey of Central Road and prepare outline works design, schedule, and cost estimates.	RAJUK/BWDB/Consultants	31 August '91.
(iii) Completion of survey of existing flood wall and prepare plan for remedial works where required.	BWDB/DCC/Consultants	31 August '91.
(iv) Finalization of scope of Drainage component (Part B).	DWASA/Consultants	31 August '91.
(v) Refinement of scope of Environmental Improvement component (Part C).	DCC/Consultants	31 August '91.
(vi) Preparation of detailed construction schedule for all components.	BWDB/DWASA/DCC/Consultants	31 August '91.
<u>B. Preparatory Activities</u>		
(i) Preparation and approval of PCP.	MIWDFC/BWDB (in Consultation with other agencies and consultants)/Planning Commission/ECNEC.	25 July '91. 31 Aug. '91.
(ii) Preparation and Approval of PP.	-do-	31 Sept '91/ 30 Nov. '91.

(iii) Preparation of detailed staff deployment plan (secondments/ new recruitment).	MIWDFC/FPCO/Consultants.	31 Aug. '91.
(iv) Preparation of detailed plan for recruitment of staff and establishment of slum Improvement cell.	MLGRDC/DCC	31 August '91.
(v) Shortlisting of implementation consultants.	MIWDFC in consultation with Bank.	15 Sept. '91.
(vi) Recruitment of implementation consultants.	MIWDFC/PIO	30 April '92.
(vii) Prequalification of contractors.	PIO/Consultants	31 Oct. '91.
(viii) Preparation of tender and procurement documents.	PIO/Consultants	31 Oct. '91.
(ix) Preparation of detailed land acquisition program.	DCC/DWASA/Consultants	31 Aug. '91.
(x) Provision of Supplementary Budget for FY1991-92 construction works.	PIO/BWDB/DCC/DWASA/PC/MOF	31 Oct. '91.
(xi) Recruitment of Consultants for Subsoil investigations and detailed design/supervision.	PIO/BWDB/Consultants	31 Oct. '91.

C. Administrative Matters

(i) Establishment of Project Implementation Office (PIO).	MIWDFC in consultation with BWDB, DWASA, DCC	30 Sept. '91.
(ii) Appointment of Project Director (PD), Deputy Directors, Skeleton Key Professional/Support Staff.	-do-	30 Sept. '91.
(iii) Office rental for PIO.	PD	30 Nov. '91.
(iv) Recruitment of new staff for PIO.	PIO in consultation with executing agencies.	30 Dec. '91 to mid 1992.
(v) Procurement of Office equipment/vehicles (Direct Purchase).	PIO	30 Dec. '91 to mid 1992.

D. Retroactive Financing

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|---|------------------|---------------|
| (i) Detail Proposal for retroactive financing (engineering, consultancy, construction). | BWDB/Consultants | 15 Sept. '91. |
| (ii) Approve extension of bridging services (Oct. 91-April 92) for consultants. | MIWDFC/Bank | 30 Sept. '91. |
| (iii) Obtain internal Govt. permission for expenditures on items identified under (i) and (ii) above. | MIWDFC | 30 Sept. '91. |

E. Financial Matters

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|--|---------------|--------------|
| (i) Constitute Committee to Review Cost Recovery Options. | MIWDFC/PC/MOF | 20 July '91. |
| (ii) Communicate Govt. reviews on (a) proposed cost recovery options, (b) grant/loan mix and terms of relending for DCC/DWASA to Bank. | MIWDFC/ERD | 15 Aug. '91. |

11.0 TECHNICAL ASSISTANCE

11.1 Introduction

During this study period it became apparent that:

- i) the unregulated and uncontrolled urban growth in Dhaka City has been creating serious drainage problems, particularly where this growth has impinged upon traditional drainage channels and low-lying pond areas. Drains have been indiscriminately blocked, natural retention ponds have been filled, and as a result local flooding during rainy periods has been increasing in both frequency and duration over recent years. The regulating agencies - mainly RAJUK and DCC - have no defined development standards or effective control mechanisms to address these problems;
- ii) following major investments in flood protection and drainage, considerable low-lying areas will become suitable for intensive urban use, resulting in manifold increases in land values and increasing demands on scarce public services. Although it is important that the public sector should be able to capture a part of the increases in land values and/or recover the costs of the escalating needs for providing public infrastructure and services, no mechanism presently exists to enable the public sector agencies to do so; and
- iii) there are large tracts of government owned land in Dhaka City which have been unused or underutilized for many years, or which have been taken over by squatters, and for which no long term land use plans have been formulated. There is a need to determine the actual extent of this underutilization, and to develop strategies for rationalizing the needs and uses for these lands for the benefit of the government and the public.

Although there are a number of projects and programs which are proposed to be taken up in the near future to address the urban drainage, planning and management issues (see Section 11.4), none have been specifically designed to meet these needs. Accordingly, the technical assistance proposed in the following sections has been formulated to address these issues in order to develop policies and strategies to ensure that the investments in improved flood control and drainage facilities are complimented by appropriate land use development standards and controls, and are not negated by uncontrolled and unrestricted growth.

11.2 Background and Need

As a continuum of TA No. 1318-BAN for Dhaka Integrated Flood Protection Project the proposed technical assistance will assist in meeting the urgent land development control needs which have been identified as a priority for Dhaka City. These include: (i) developing appropriate land development standards, regulations and control mechanisms/procedures to ensure that the investments in improved flood control and drainage facilities are

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complemented by appropriate land use development standards and controls, and are not negated by uncontrolled and unrestricted growth; (ii) developing improved cost recovery methods for meeting the escalating needs for providing public infrastructure and services occasioned by the expansion/densification of the urbanized areas in Dhaka; and (iii) rationalizing the needs and uses of vacant and underutilized Government owned lands within Dhaka city.

11.3 Objectives

The proposed technical assistance will help the Government formulate appropriate land development requirements, policies, standards, regulations and control procedures in order: (i) to facilitate the orderly urban growth of Dhaka City, to ensure that the benefits of improved flood control and drainage are complemented by appropriate land development standards and are not negated by uncontrolled growth, and (ii) to develop improved policies, including cost recovery mechanisms, for meeting the needs for upgrading public infrastructure and services occasioned by urban growth. In addition, the proposed technical assistance will assist the Government in reviewing Government land ownership and needs in Dhaka City, and in developing new policies and strategies for optimum utilization of vacant or underutilized Government lands.

11.4 Scope and Work Program

The technical assistance provides for expert consultant services to assist the Government in: (i) preparing improved building/land development standards and regulations; (ii) developing new land development policies and cost recovery mechanisms to support the cost of providing public infrastructure; and (iii) rationalizing the needs and uses of underutilized Government land holdings in Dhaka City. The work will comprise of three parts as follow:

Part A: Building/Land Development Standards and Regulations: The consultants will assist to:

- (i) review existing land development standards, regulations and procedures within Dhaka City;
- (ii) develop and recommend improved land development standards, building regulations and controls; and
- (iii) develop and recommend new land development/building approval procedures for developments in Dhaka City.

Part B: Land Development Policies and Fees: The consultants will assist to:

- (i) review existing land development policies and land development taxation methods applied in Dhaka City;

- (ii) analyze the development requirements and the amount, sources, recipients and utilization of existing land taxes;
- (iii) analyze the impact of increased offsite service needs and costs to the public sector resulting from new land development and urban densification;
- (iv) recommend appropriate policies for modifying existing land development requirements, with particular consideration to the practicality, affordability and impacts of introducing new regulations for land developers to provide onsite and/or offsite public infrastructure and services such as roads, drains, drainage retention ponds, water supply systems, schools, health centers, parks, etc.;
- (v) recommend appropriate policies for modifying existing land development taxation, with particular consideration to the practicality, affordability and impacts of introducing new land development fees to assist in providing public infrastructure and services for development within Dhaka City;
- (vi) prepare draft legislation for any new development policies and/or development fees recommended.

Part C: Review of Government Land Ownership and Needs: The consultants will assist to:

- (i) review the existing Government land ownership and needs within Dhaka City;
- (ii) prepare an inventory of all Government owned lands in Dhaka, along with a description of present use, future projected uses and a statement of need for vacant or underutilized land; and
- (iii) recommend appropriate Government policies and strategies for rationalizing the use of vacant and/or underutilized Government owned lands with particular consideration to potentials for disinvesting the lands, converting the lands for public use, converting the lands for use for low income residential use, and/or transferring/leasing/selling to squatters/settlers to provide long term security of tenure.

The technical assistance program will be carried out over a period of eight months starting about mid-1992. The assistance will require 16 man months of international consultants and 28 months of domestic consultants specialized in municipal land management, municipal finance, land use policy, and land use control and building regulations.

The likely project timing coincides with a number of other important and inter-related technical assistance programs in Dhaka City and the national urban sector, including:

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- o the implementation of the Dhaka Integrated Flood Protection Project to be undertaken with ADB and NDF assistance,
 - o the preparation of the Greater Dhaka Flood Protection Master Plan being completed with JICA assistance,
 - o the on-going support for Urban Management and Municipal Services Programmes in Dhaka and Chittagong (UNDP/UNCHS/IDA),
 - o the proposed Urban Shelter Sector Study intended to indicate broad strategies for the sector and assisted action programs (UNCHS/ADB/IBRD),
 - o the preparation of Structure Plan, Master Plan and Detailed Area Plans for Dhaka and Chittagong with a strong emphasis on improved land management (UNCHS/UNDP),
 - o the proposal for a National Land Use Planning Project,
 - o the proposal for development of a national Urban Land Management strategy with an emphasis on modernizing urban land records and formulating urban land management policies (UNDP), and
 - o the preparation of the Greater Dhaka Metropolitan Integrated transportation Study (UNDP/UNDTCD).

The study team will be responsible to coordinate their activities with those of other related projects and to cooperate with other study teams to ensure that recommendations made are complementary.

11.5 Cost Estimate and Financing Arrangements

The total cost of the technical assistance is estimated at US \$596,000, including \$382,000 in foreign exchange and \$214,000 equivalent in local currency costs. It is proposed that the entire foreign exchange cost and \$190,000 of the local currency cost be financed on a grant basis from the Bank. The local cost financing will include domestic travel and transportation, field office rental and equipment, and surveys of Government owned land uses. The Government has agreed to provide the remainder of the local currency requirements, estimated at \$24,000 equivalent, which includes the provision of local staff, vehicle operation and office supplies.

11.6 Implementation Arrangements

The Government will establish an interministerial Steering Committee chaired by the Mayor of Dhaka City Corporation with representatives from all concerned Ministries for ensuring effective inter-ministerial and inter-departmental liaison, and for reviewing and approving consultant

recommendations. Radjahani Unnayan Kattripaka (RAJUK - the Capital Development Authority) will be the principal Implementing Agency for the technical assistance. The RAJUK Chairman will be the consultants counterpart, and the Chief of Planning will act as the coordinator for the consultants activities.

The consultants will establish an office in Dhaka in coordination with RAJUK.

The consultants will submit an inception report at the end of six weeks of service, a mid-term report at the end of four months, a draft final report at the end of seven months, and a final report upon completion of services.

Outline Terms of Reference and costs estimates for the consulting services are detailed in Appendix 12.

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LIST OF STUDY TEAM MEMBERS

A) Louis Berger International, Inc.

R. Berlin	Team Leader/Municipal Planning Engineer
M. Williams	Drainage Design Engineer
M. Everitt	Road Engineer
J. Horta	Soils & Materials Specialist
A. Blelloch	Environmental Management Specialist
M. Raabe	Environmental Engineer
M. McLindon	Development Economist/Financial Analyst
D. Crowther	Development Economist/Financial Analyst
N. Williams	Geotechnical Expert

B) Associated Consulting Engineers (Bangladesh) Ltd.

F. Ahmed	Municipal/Environmental Planning Engineer
M. Islam Miah	Design Engineer
S. Uddin Ahmed	Intermediate Engineer

C) Desh Upodesh Ltd.

S. Islam	Flood Control/Planning Engineer
A. H. Chowdhury	Road Engineer
M. G. Mostafa	Intermediate Engineer
M. A-As-Saqui	Agronomist

D) Technoconsult International Ltd.

B. A. Hamid	Financial Analyst/Institutional Development Specialist
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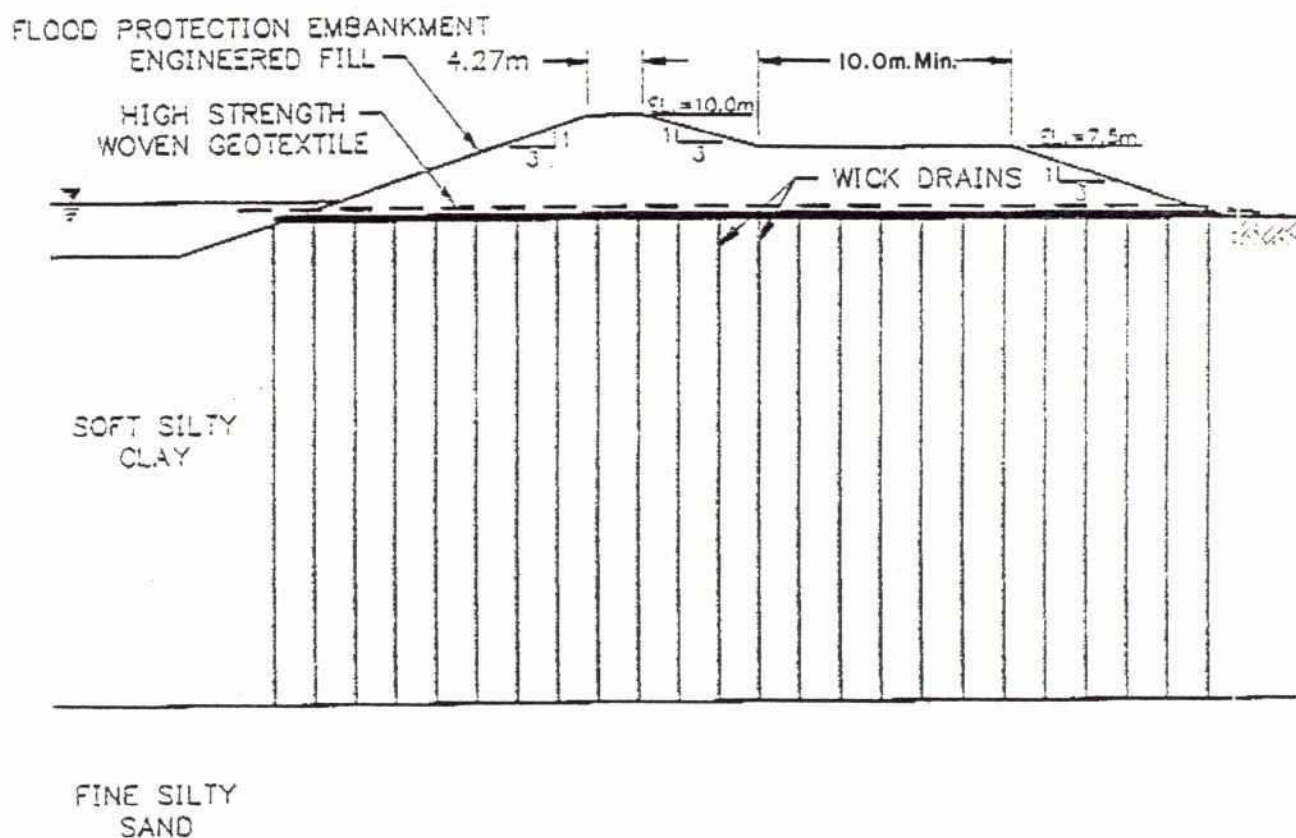
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APPENDIX

SECTION A - FLOOD PROTECTION

TYPICAL CROSS-SECTION FOR INTENSIVE REMEDIAL WORK
ON EXISTING WEST EMBANKMENT

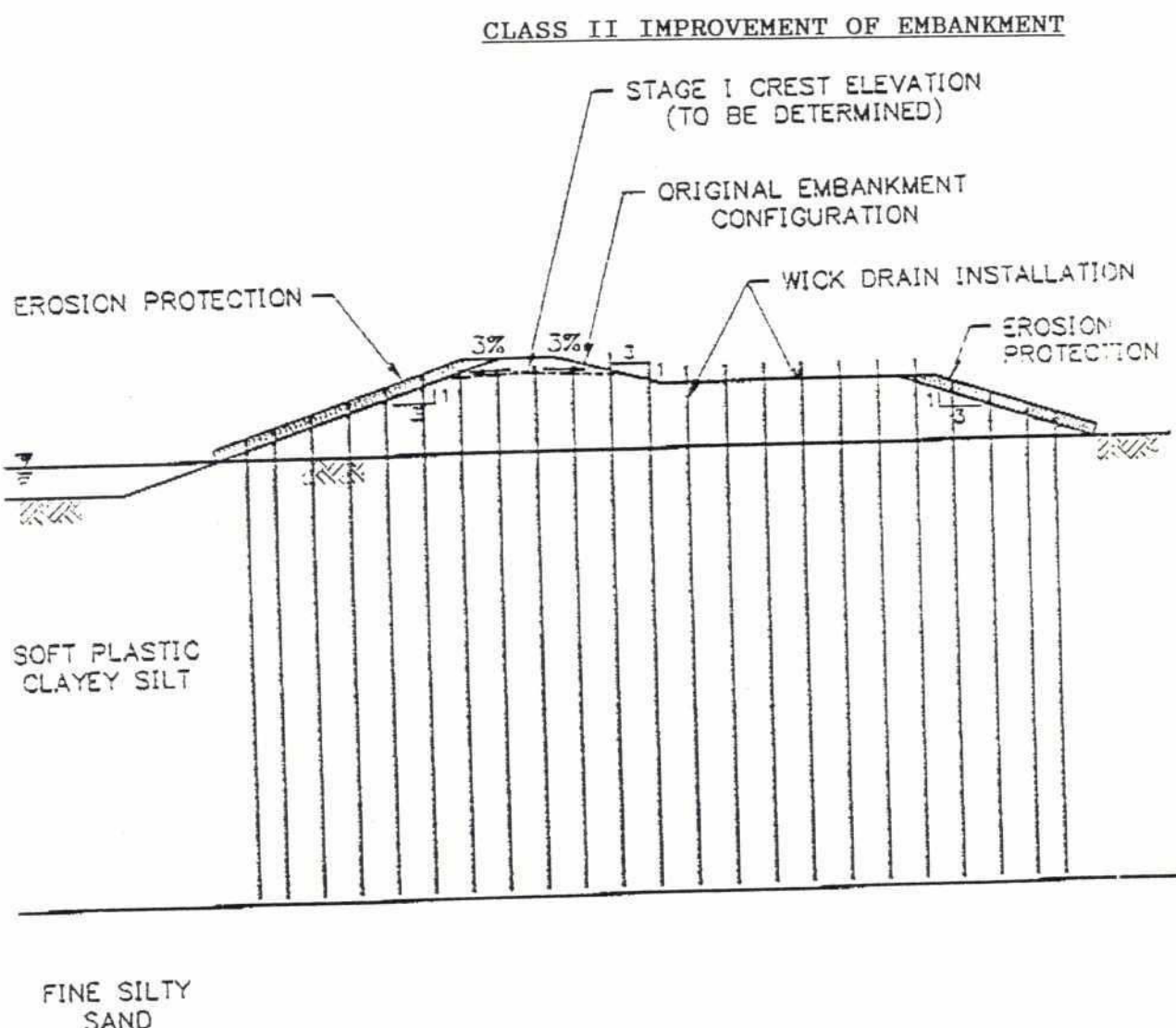
CLASS I IMPROVEMENT OF EMBANKMENT



PRELIMINARY CONCEPTIONAL SHORT-
TERM REMEDIAL DESIGN FOR THE
PHASE I EMBANKMENT IN THE
CLASS I AREAS

SEC A. (CONT.)

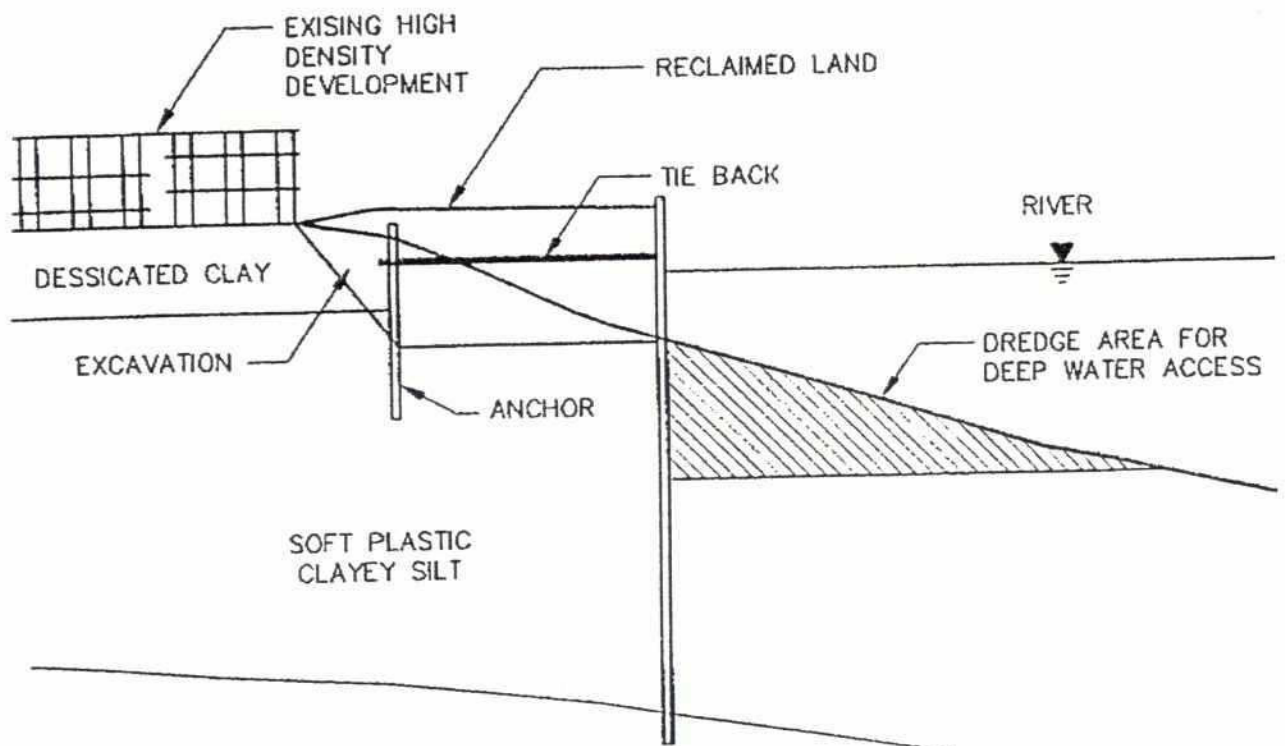
TYPICAL CROSS-SECTION FOR MODERATE REMEDIAL WORK
ON EXISTING WEST EMBANKMENT



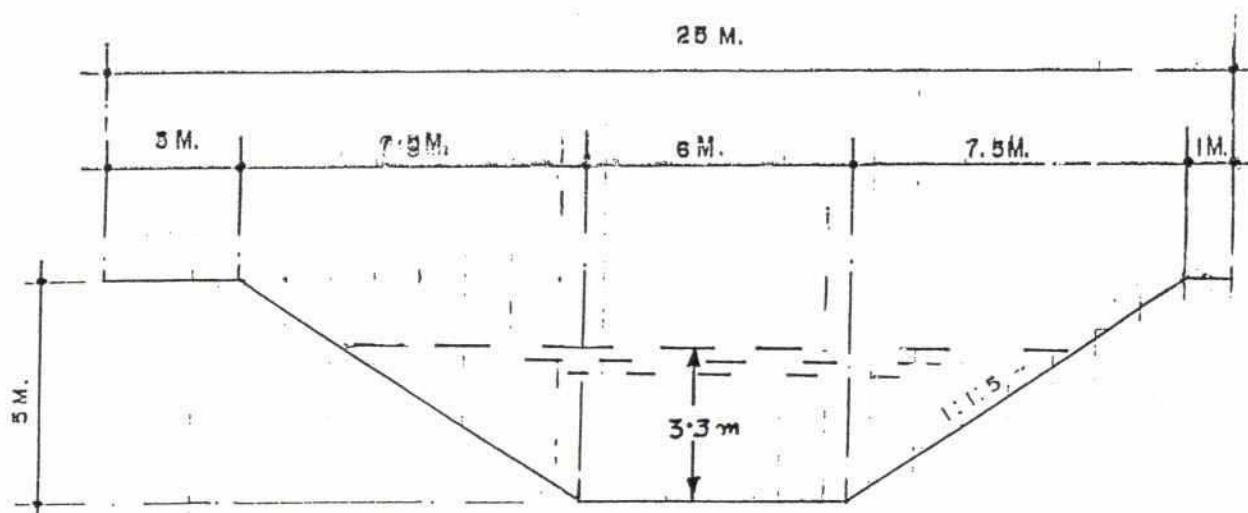
OPTION FOR REMEDIATION OF CLASS
II AREAS OF THE EMBANKMENT, USING
LIMITED EXCAVATION, WICK DRAINS
TO CONSOLIDATE EMBANKMENT AND
SUBGRADE SOILS, AND STAGED
CONSTRUCTION

SEC. A (CONT.)

TYPICAL CROSS-SECTION FOR EXTENSION OF
FLOODWALL IN OLD DHAKA WEST AREA



SHEET PILE WALL ALTERNATIVE,
ILLUSTRATION RECLAIMED LAND
ON DEEP WATER CHANNEL



TYPICAL KHAL SECTION:

Scale = 1:50

EXISTING SECTION OF KHAL = 12.86 m (assumed)

THE REQUIRED WIDTH OF KHAL = 25 m (typical section taken)

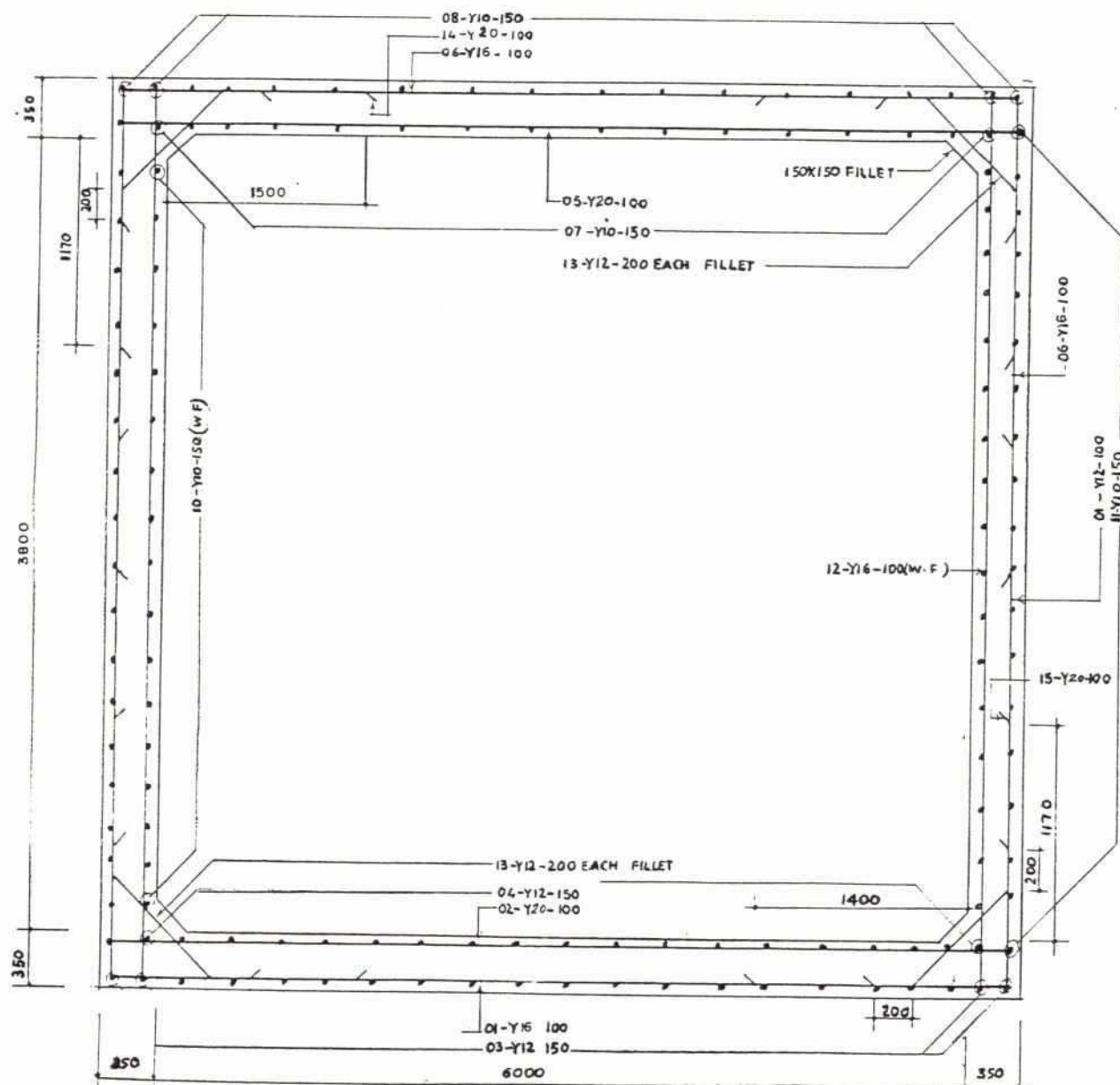
HENCE WIDTH OF LAND PER METRE OF LENGTH = $25 - 12.86 = 12.14$ m

FOR ONE KILO-METRE OF LENGTH OF KHAL = $12.14 \times 1000 = 12140$ m²

= 2.999 acres

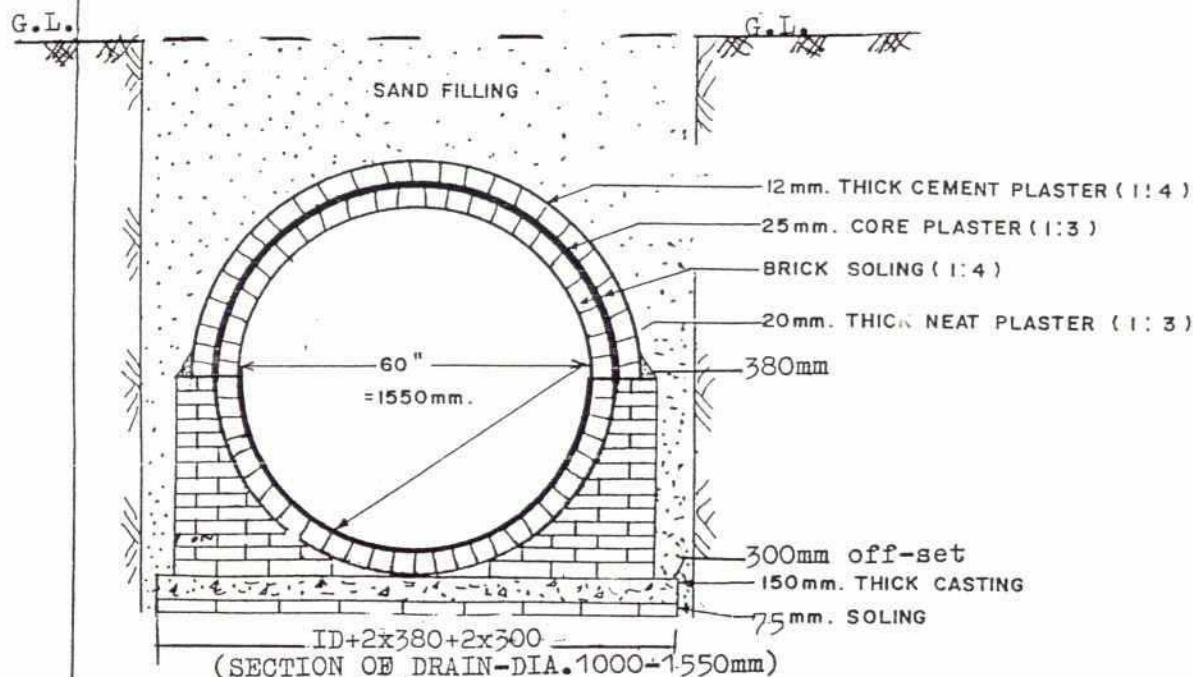
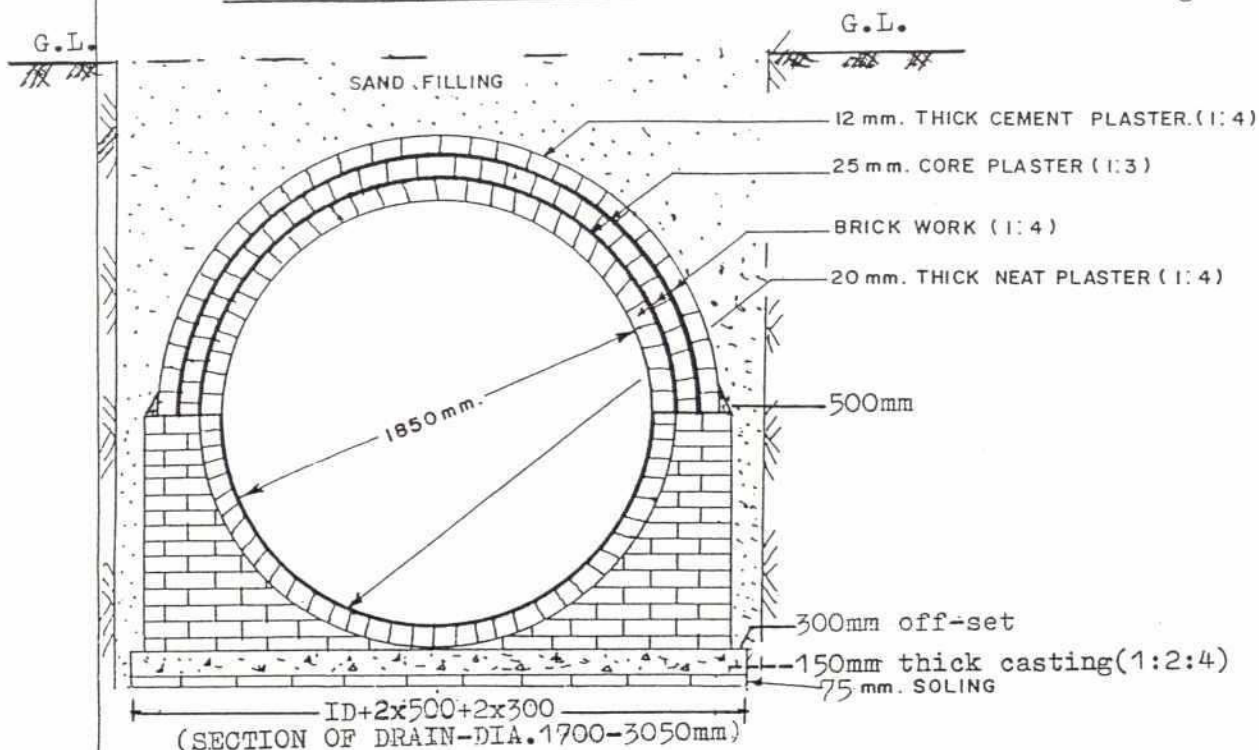
= 3 acres/km.

A TYPICAL SECTION OF BOX CULVERT



BOX SECTION REINF DETAILS (TYP)

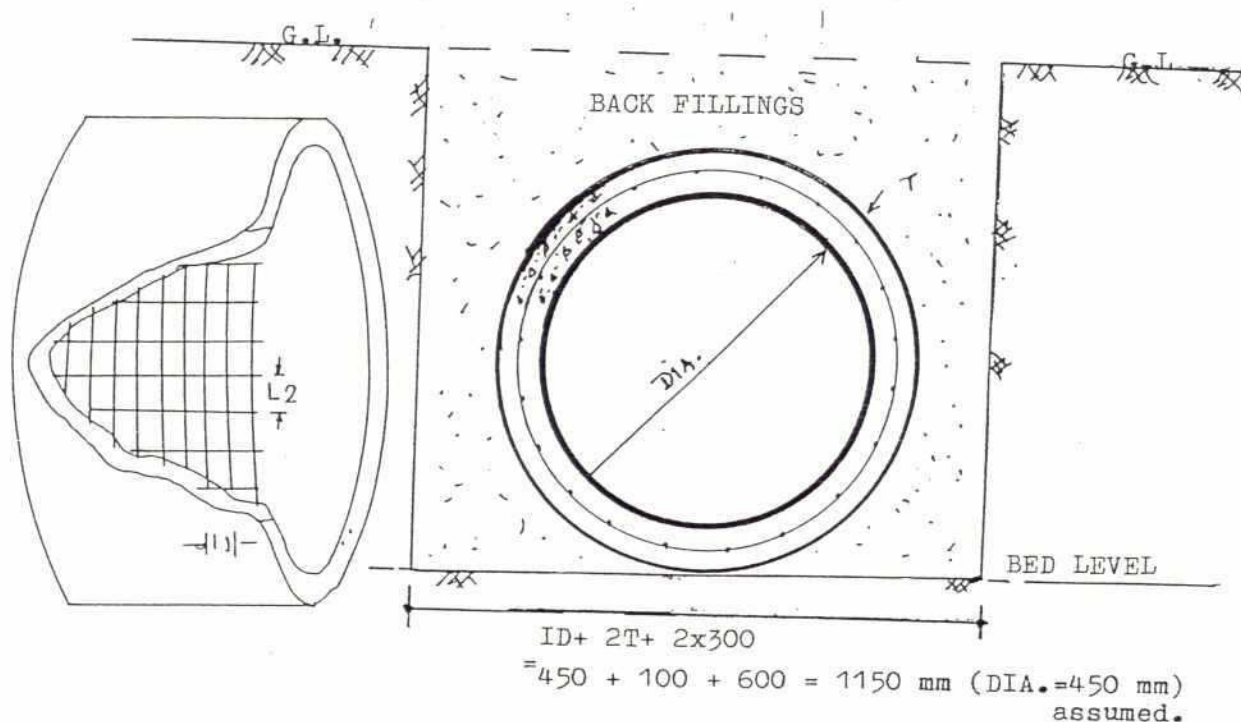
CROSS SECTION OF MASONRY DRAIN



Notes:

- i. Back filling the trenches is made by the excavated earth in the reaches other than the road sides; by sand and earth in the ratio of fifty-fifty at the road side portions; and by 100% sand along road portions.
- ii. If foundation is on loose soil then loose concrete (1:1 of sand and khoa) is used for consolidation.
- iii. If more slushy earth is encountered within the foundation soil then RCC may be provided.
- iv. In case of alignment passing through the ditch or canal & the earth is found to be also very loose then green salballah piles with or without RCC in bed may be used.

CROSS SECTION OF R.C.C. PIPE DRAIN



SINGLE REINFORCEMENT

INTERNAL DIAMETER	THICKNESS	REINFORCEMENT					
		CIRCULAR TRANSVERSE			HORIZONTAL LONGITUDINAL		
		L_1	wire gage	dia of wire	L_2	wire of gage	dia of wire
450 m.m.	50 m.m.	75 m.m.	9	0.492 m.m.	150 m.m.	9	0.492 m.m.
750 m.m.	62. mm	75 m.m.	5	0.688 m.m.	200 m.m.	7	0.590 m.m.

NOTES:

- BACK FILLING IS MADE BY THE EXCAVATED EARTH IN PORTIONS OTHER THAN THE ROAD SIDES;
- BACK FILLING IS MADE IN ROAD SIDE PORTIONS AT THE RATIO OF 50:50 (SAND AND EARTH);
- BACK FILLING IS MADE BY 100% SAND AT ROAD PORTIONS;
- IF FOUNDATION IS ON LOOSE SOIL THEN LOOSE CONCRETE IN THE RATIO OF 1:1 (SAND:KHOA) IS USED FOR CONSOLIDATION.

EXECUTIVE SUMMARY

Immediate, short-term, and long-term remedial design alternatives have been developed for the Phase I Embankment of the Dhaka Integrated Flood Protection Plan. The Phase I Embankment was constructed around the densely populated western portion of the Greater Dhaka Area as part of a crash flood control program. Construction of the Phase I Embankment was undertaken by the Government of Bangladesh, as part of a coordinated effort involving the Bangladesh Water Development Board (BWDB), Dhaka Water and Sewage Authority (DWASA), Dhaka City Corporation (DCC), Rajdhami Unnayan Kattripaka (Capitol Development Group) (RAJUK), and the Bangladesh Army.

The constructed flood protection works consisted of about 18.1 miles (29.2 km) of embankment, 4.4 miles (8.5 km) of reinforced concrete flood protection walls (R/C walls), 1.2 miles (2.0 km) of new roads, 5.3 miles (8.5 km) of road improvements, sluice construction, and cleaning and repair of drainage khals and sewage systems. Flood protection barriers were also constructed around Zia International Airport and around the Dhaka Narayanganji-Demra zone south of the city.

Inspection of the embankments following construction showed extensive damage. A damage survey was performed by Berger and GeoSyntec Consultants to identify the conditions leading to failure of the embankment. The survey identified the following factors which likely affected the performance of the embankments:

- Lack of Moisture Control;
- No Compaction;
- Inadequate Erosion Protection; and
- Lack of Subgrade Improvement.

Approximately 15,420 ft (4700 m) of the embankment is subject to imminent and catastrophic failure resulting from inadequate subgrade

shear strength. These areas are termed Class I areas and require immediate and short-term remedial actions. Due to the very low shear strength of the subgrade soils in these areas, it would not have been possible to prevent failure of the embankment, or to achieve adequate compaction of the embankment, without subgrade improvement.

Approximately 10,000 ft(3050 m) of the embankment is extensively damaged and requires repair, but will not likely fail catastrophically. These sections of the embankment are termed Class II areas and require short-term remedial actions. This damage could have been minimized by proper compaction and moisture control.

Approximately 10,330 ft (3150 m) of the embankment was damaged by erosion. This damage could have been minimized if the conventional jute and sod erosion protection materials had been placed prior to subjecting the embankment to wave loading and if the embankment had been constructed with proper compaction and moisture control.

A preliminary damage survey of the R/C wall indicates damage due to cracking, erosion (piping) under the walls, and inadequate design of wall for overturning. Additional studies are required to determine the extent of damage to the R/C wall and to prepare remedial designs for the wall.

An evaluation was performed to assess the stability of the embankment at Location H3, Station 13+900, near Sluice 2 on the western embankment. The factors of safety for bearing capacity and deep stability of the embankment were much less than 1.0, indicating imminent failure. The analyses were conformed by several catastrophic failures in the Class I areas.

Due to the low shear strength of the highly plastic clayey silt, subgrade improvement is required to stabilize the embankments on the Class I areas. This will require:

- excavation of the embankment in the Class I areas to an elevation of about 6.6 to 9.8 ft (2.0 to 3.0 m) PWD;
- installation of wick drains;
- placement of a high strength geosynthetic for base reinforcement;
- staging of construction to promote consolidation of the subgrade soils;
- compaction of embankment soils in 8-in (20-cm) lifts; and
- placement of erosion protection materials.

Notwithstanding the poor subgrade soil conditions, the preliminary analyses indicate the embankment can be reconstructed in the Class I areas with static factors of safety for bearing capacity and deep stability of greater than 1.3.

Additional studies are required to select and design the appropriate remedial measures on the Class II and Class III areas. These studies will include additional field investigations, analyses, and feasibility studies.

Several options were identified for construction of the flood protection works in densely populated areas. These options include sheet pile walls and reinforced soil walls. These options are attractive because they allow reclamation of land at elevations greater than the 100 yr flood elevation.

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5. CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

GeoSyntec Consultants conducted a damage survey of the existing Phase I Embankment in the Dhaka Flood Protection Project, reviewed available data and information, performed preliminary conceptual designs for embankment reconstruction, and assessed the stability of the existing Phase I Embankment. Based on this work, the following conclusions may be drawn:

- Approximately 18.1 miles (29.2 km) of the Phase I Embankment have been constructed. Of that total, 37.3 percent, or 6.8 miles (11 km) are unstable.
- About 2.9 miles (4.7 km) of the Phase I Embankment was constructed over deep, very soft, highly plastic clayey silt. Preliminary analyses indicate that the factors of safety for bearing capacity and deep stability in these areas are much less than 1.0. This finding is supported by the fact that many of these sections of the embankment have already failed. Some of these sections have failed and have been repaired more than 10 times. These areas are termed Class I areas.
- Approximately 1.9 miles (3.1 km) of the Phase I Embankment will likely fail during the next year, but the mode of failure will not likely result in catastrophic failure of the embankment. These areas are termed Class II areas.
- About 2.0 miles (3.2 km) of the Phase I Embankment have been damaged by erosion. These areas are termed Class III areas.
- Damage to the embankment in the Class I areas could not have been avoided without subgrade improvement. The subgrade soils in these

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areas consist of deep, very soft, highly plastic clayey silt. The subgrade soils have inadequate shear strength to support the embankment loads, and would have failed regardless of the care used to construct the embankments. Subgrade improvement will be necessary to construct stable embankments in the Class I areas.

- Damage to the embankment in the Class II areas could have been greatly minimized if the embankment had been properly compacted with adequate moisture control. Instability of the embankment in these areas is caused by the very low shear strength of the soft, wet, plastic, poorly compacted embankment soils.
- Poor compaction and moisture control during construction is due to a lack of performance-based criteria in the specification. Payments to the Contractor for soil placement should be directly linked to compaction results.
- Damage to the embankment in the Class III areas was caused primarily by erosion. This damage could have been minimized if the jute and sod erosion protection materials were placed before the embankment was subjected to wave loading, and if the embankment had been adequately compacted with moisture control.
- Due to the potential for catastrophic failure in the Class I areas, immediate remedial measures should be implemented before the embankment is placed in service. These actions include excavation of the embankment back to an elevation which is stable for short-term conditions (about 6 months), until appropriate short-term remedial measures can be implemented.
- A feasibility study and additional laboratory data are required to determine the most appropriate and cost-effective medium and long-term remedial alternatives.

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- Geojute products should be used for erosion protection of the embankment. However, due to the long-term strength and drainage requirements, geojute products are inappropriate for base reinforcement or vertical drainage.
- The R/C wall has been damaged by cracking, erosion and piping under the wall. In addition, erosion uncovered portions of the wall which may not be adequately designed to resist overturning during periods of high water.
- A damage survey and comprehensive review of the design of the reinforced concrete wall should be conducted as an immediate remedial measure. Short-term remedial measures should include repairs to cracks and subgrade soils, and redesign of the wall where it is warranted.
- Long-term remedial measures for the R/C wall in highly populated areas should include a feasibility study to determine the most appropriate long-term remedial measures. The use of sheet pile walls and reinforced earth walls should be investigated because they can be designed to meet the design requirements and they create additional land area above the 100 yr flood elevation which could be sold to help finance the cost of wall construction.

5.2 Recommendations

The recommendations listed below are based on the existing data and information, and on the damage survey conducted by Berger and GeoSyntec Consultants. These recommendations will be refined as additional data and information are generated through the laboratory testing program, field investigations, and engineering analyses.



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- Do not put the Phase I Embankment into service until the immediate remedial measures have been implemented.
- Implement an immediate remedial measure which provides an adequate factor of safety for short-term loading conditions (about 6 months).
- Implement the short-term remedial measures for the Phase I embankment during the next construction season. Preliminary analyses indicate a strong likelihood of catastrophic failure of the embankment along a significant portion of the alignment. This constitutes a high risk to individuals living in lowlands adjacent to the embankment which must be mitigated as rapidly as possible.
- Conduct a feasibility study to determine the most cost effective medium and long-term remedial alternatives which can be implemented in the Class II and Class III areas.
- Perform finite element analyses to evaluate the effectiveness of the remedial designs and to determine the performance requirements for the base reinforcement in the Class I area.
- Work closely with the donor agencies to select remedial alternatives which add value and could potentially be used to recover funds to pay for the wall.
- Implement an inspection and maintenance program for the Phase I embankment.
- Review strategies and prepare design standards for the eastern portions of the embankment so the problems encountered with the western embankment do not recur.

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- Develop specifications which identify compaction as a separate pay item linked to compaction achieved as verified by construction quality assurance testing.
- Contractor must submit method and equipment for construction and compaction of embankments in concert with the bid. Methodology to achieve requirements of the specifications must be approved by the engineer.
- Effective remediation of the embankments, and construction of stable embankments in the future require the use of geosynthetics. Since geosynthetic materials are vital to the project, and the project is of strategic importance to the Government of Bangladesh, all taxes, duties, and import fees should be waived.
- Contractors should be prequalified based on: (i) technical ability; (ii) appropriate experience; (iii) financial stability; (iv) managerial expertise; (v) available equipment; and (vi) proven record of quality construction.

PROJECT COST ESTIMATES: SUMMARY

Taka Million

Item		Foreign Currency	Local Currency (b)	Total		
I BASE COST (a)						
Part A	Flood Protection	527.87	943.78	1,471.65		
Part B	Drainage	312.34	1,249.74	1,562.08		
Part C	Solid Waste	66.28	123.25	189.53		
	Sanitation, Water Supply, & Local Drainage	41.77	122.20	183.97		
	Slum & Squatter Area Improvement	22.11	48.89	71.00		
Part D	Incremental Administration	11.75	53.50	65.25		
	Consulting Services	69.50	116.70	176.20		
Sub-Total Base Cost		1,041.62	2,658.06	3,699.68		
II CONTINGENCIES						
Physical Contingencies (c)		107.14	246.16	353.30		
Price Contingencies (d)		75.18	221.18	296.36		
Sub-Total Contingencies		182.32	467.34	649.66		
TOTAL PROJECT COSTS		1,223.94	3,125.40	4,349.34		
Notes: (a) Base costs are mid-1991 costs.						
(b) Includes an estimated \$ 14.53 million equivalent in duties & taxes.						
(c) Physical contingencies are estimated at 10% of base cost (15% for consulting services).						
(d) Price contingencies are estimated as follows:						
	1992	1993	1994	1995	1996	1997
FEX	4.9	4.9	4.9	3.7	3.7	3.7
LOC	6.0	6.0	6.0	6.0	6.0	6.0
General Note: Costs of each Part are given in subsequent pages. Details of Items of work under each component and annual phasing of expenditures are being provided to the involved agencies separately.						

DHAKA INTEGRATED FLOOD PROTECTION PROJECT (FAP 88)
SUMMARY OF ANNUAL SECTORAL COSTS BY CATAGORY

PART A: FLOOD PROTECTION

All Costs in Taka x 1,000,000 (Million Taka)

DESCRIPTION	TOTAL COST	1991-92 COST	1992-93 COST	1993-94 COST	1994-95 COST	1995-96 COST	1996-97 COST
LAND ACQUISITION	17.85	17.85	0.00	0.00	0.00	0.00	0.00
CIVIL WORKS	663.11	87.93	265.39	246.04	63.75	0.00	0.00
EQUIPMENT SUPPLY	710.45	0.00	355.23	355.23	0.00	0.00	0.00
INCREMENTAL O & M	80.24	0.00	1.89	11.09	20.30	23.48	23.48
BASE COST SUB-TOTAL	1471.65	105.78	622.50	612.36	84.04	23.48	23.48
PHYSICAL CONTINGENCY	145.38	8.79	62.25	61.24	8.40	2.35	2.35
PRICE CONTINGENCY	146.19	0.00	38.26	77.36	16.04	6.37	8.16
TOTAL COST	1763.22	114.58	723.01	750.95	108.48	32.20	33.99

DHAKA INTEGRATED FLOOD PROTECTION PROJECT (FAP 88)
SUMMARY OF ANNUAL SECTORAL COSTS BY CATAGORY

PART B: DRAINAGE

All Costs in Taka x 1,000,000 (Million Taka)

DESCRIPTION	TOTAL COST	1991-92 COST	1992-93 COST	1993-94 COST	1994-95 COST	1995-96 COST	1996-97 COST
LAND ACQUISITION	237.08	129.20	107.88	0.00	0.00	0.00	0.00
CIVIL WORKS	1257.98	550.76	486.51	220.71	0.00	0.00	0.00
EQUIPMENT SUPPLY	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INCREMENTAL O & M	67.02	0.00	6.88	12.97	15.72	15.72	15.72
BASE COST SUB-TOTAL	1562.08	679.96	601.28	233.68	15.72	15.72	15.72
PHYSICAL CONTINGENCY	132.50	55.08	49.34	23.37	1.57	1.57	1.57
PRICE CONTINGENCY	81.09	0.00	37.64	30.58	3.13	4.27	5.47
TOTAL COST	1775.67	735.03	688.26	287.62	20.43	21.56	22.76



DHAKA INTEGRATED FLOOD PROTECTION PROJECT (FAP 88)
SUMMARY OF ANNUAL SECTORAL COSTS BY CATEGORY

PART C: ENVIRONMENTAL IMPROVEMENT; SLUM IMPROVEMENT
All Costs in Taka x 1,000,000 (Million Taka)

DESCRIPTION	TOTAL COST	1991-92 COST	1992-93 COST	1993-94 COST	1994-95 COST	1995-96 COST	1996-97 COST
LAND ACQUISITION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CIVIL WORKS	61.90	4.38	11.26	13.76	10.00	10.00	12.50
EQUIPMENT SUPPLY	5.50	0.38	0.63	0.88	1.38	1.00	1.25
INCREMENTAL O & M	3.60	0.05	0.23	0.41	0.77	1.08	1.08
BASE COST SUB-TOTAL	71.00	4.80	12.11	15.04	12.14	12.08	14.83
PHYSICAL CONTINGENCY	7.10	0.48	1.21	1.50	1.21	1.21	1.48
PRICE CONTINGENCY	13.14	0.00	0.75	1.93	2.34	3.16	4.96
TOTAL COST	91.24	5.28	14.07	18.47	15.69	16.45	21.27

DHAKA INTEGRATED FLOOD PROTECTION PROJECT (FAP 88)
SUMMARY OF ANNUAL SECTORAL COSTS BY CATEGORY

PART C: ENVIRONMENTAL IMPROVEMENT; SOLID WASTE
All Costs in Taka x 1,000,000 (Million Taka)

DESCRIPTION	TOTAL COST	1991-92 COST	1992-93 COST	1993-94 COST	1994-95 COST	1995-96 COST	1996-97 COST
LAND ACQUISITION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CIVIL WORKS	8.50	0.30	2.13	2.88	1.83	1.38	0.00
EQUIPMENT SUPPLY	109.65	5.00	40.65	32.00	32.00	0.00	0.00
INCREMENTAL O & M	71.38	0.00	2.22	9.72	16.27	21.56	21.63
BASE COST SUB-TOTAL	189.53	5.30	44.99	44.60	50.09	22.93	21.63
PHYSICAL CONTINGENCY	18.95	0.53	4.50	4.46	5.01	2.29	2.16
PRICE CONTINGENCY	31.09	0.00	2.78	5.65	9.54	5.96	7.16
TOTAL COST	239.58	5.83	52.27	54.71	64.64	31.18	30.95

DHAKA INTEGRATED FLOOD PROTECTION PROJECT (FAP 88)
SUMMARY OF ANNUAL SECTORAL COSTS BY CATEGORY

PART C: ENVIRONMENTAL IMPROVEMENT; SANITATION, WATER SUPPLY AND LOCAL DRAINAGE
All Costs in Taka x 1,000,000 (Million Taka)

DESCRIPTION	TOTAL COST	1991-92 COST	1992-93 COST	1993-94 COST	1994-95 COST	1995-96 COST	1996-97 COST
LAND ACQUISITION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CIVIL WORKS	135.61	27.62	52.02	22.47	11.50	11.50	10.50
EQUIPMENT SUPPLY	8.80	0.00	8.08	0.72	0.00	0.00	0.00
INCREMENTAL O & M	19.56	0.00	0.48	3.85	4.75	5.08	5.40
BASE COST SUB-TOTAL	163.97	27.62	60.58	27.04	16.25	16.58	15.90
PHYSICAL CONTINGENCY	16.40	2.76	6.06	2.70	1.63	1.66	1.59
PRICE CONTINGENCY	20.21	0.00	3.82	3.49	3.16	4.37	5.36
TOTAL COST	200.58	30.38	70.46	33.23	21.04	22.61	22.86

CHRA INTEGRATED FLOOD PROTECTION PROJECT (APP 8B)
DETAILED SECTORAL COST ESTIMATES

PART A: FLOOD PROTECTION
All Costs in Taka x 1,000,000 (Million Taka)

SL. NO.	DESCRIPTION	UNIT	TOTAL		1991-92		1992-93		1993-94		1994-95		1995-96		1996-97	
			QTY.	COST	QTY.	COST	QTY.	COST	QTY.	COST	QTY.	COST	QTY.	COST		
LAND ACQUISITION																
1	Borrow area for stage 2 & finishing	ha	1.50	12	17.85	11.9	17.85									
2																
SUB-TOTAL, LAND ACQUISITION				17.85		17.85										
CIVIL WORKS																
1	Intensive remedial works	km	60.50	4.7	284.35			1.9	114.95	1.9	114.95	0.9	54.45			
2	Moderate remedial works	km	13.28	3.1	41.17			1.2	15.94	1.2	15.94	0.7	9.30			
3	Minor remedial works	km	0.63	3.2	2.00	1.0	0.63	1.2	0.75	1.0	0.63					
4	Slope protection	km	4.93	7.8	38.45	3.9	19.23	3.9	19.23							
5	Sluices	lea	9.27	4.0	37.08	4.0	37.08									
6	Flood wall	km	65.66	1.6	105.06			0.8	52.53	0.8	52.53					
7	Central road improvement/flood proofing	L.S.	155.00	100.0%	155.00	20.0%	31.00	40.0%	62.00	40.0%	62.00					
8																
SUB-TOTAL, CIVIL WORKS				663.11		87.93		265.39		246.04		63.75				
MATERIALS & EQUIPMENT SUPPLY																
1	Geotextiles and wick drains	L.S.	488.82	1	488.82			50.0%	219.41	50.0%	219.41					
2	Steel sheet piling	L.S.	271.63	1	271.63			50.0%	135.82	50.0%	135.82					
3																
SUB-TOTAL, MATERIALS & EQUIPMENT				710.45				355.23		355.23						
INCREMENTAL O & M																
1	Embankment/flood wall maintenance	lyr	5.02	70.97				0.03	9.24		9.24	18.44	21.63			
2	Sluice operation & maintenance	lyr	5.02	9.27				1.85	9.27		9.27	1.85	1.85			
SUB-TOTAL, INCREMENTAL O&M				80.24				1.89		11.09		20.30	23.48			
BASE COST SUB-TOTAL				1471.65		105.78		622.50		612.36		84.04	23.48			
PHYSICAL CONTINGENCY																
1		%	10.02	146.38		8.79		62.25		61.24		8.40	2.35			
PRICE CONTINGENCY																
1				146.19				38.26		77.36		16.04	6.37			
TOTAL COST				1763.22		114.58		723.01		750.95		108.48	32.20			

CHAKA INTEGRATED FLOOD PROTECTION PROJECT (APP 08)
DETAILED SECTORAL COST ESTIMATES

PART B: DRAINAGE

All Costs in Taka x 1,000,000 (Million Taka)

SL. NO.	DESCRIPTION	UNIT	RMS. UNIT COST	TOTAL		1991-92		1992-93		1993-94		1994-95		1995-96		1996-97	
				QTY.	COST	QTY.	COST	QTY.	COST	QTY.	COST	QTY.	COST	QTY.	COST	QTY.	COST
LAND ACQUISITION																	
1	Land acquisition for khal widening	ha	3.23	73.4	237.08	40.0	129.20	33.4	107.88								
2																	
SUB-TOTAL, LAND ACQUISITION					237.08		129.20		107.88								
CIVIL WORKS																	
1	Khal rehabilitation and upgrading	km	10.08	77.8	784.55	24.0	241.64	32.0	322.20	21.9	220.71						
2	New pipe drain construction	km	11.06	32.7	361.48	17.8	197.17	14.9	164.31								
3	Secondary and tertiary drains upgrading	km	6.91	16.2	111.94	16.2	111.94										
SUB-TOTAL, CIVIL WORKS					1257.98		550.76		486.51		220.71						
MATERIALS & EQUIPMENT SUPPLY																	
1																	
2																	
SUB-TOTAL, MATERIALS & EQUIPMENT																	
INCREMENTAL O & M																	
1	Khal and drain maintenance	lyr	1.25%	67.02				6.88		12.97		15.72		15.72		15.72	
2																	
SUB-TOTAL, INCREMENTAL O&M					67.02			6.88		12.97		15.72		15.72		15.72	
GRAND COST SUB-TOTAL					1562.08		679.96		601.28		233.68		15.72		15.72		15.72
PHYSICAL CONTINGENCY																	
1		2	10.0%	132.50		55.08		49.34		23.37		1.57		1.57		1.57	
PRICE CONTINGENCY																	
1				81.09				37.64		30.58		3.13		4.27		5.47	
TOTAL COST					1775.67		735.03		688.26		287.62		20.48		21.56		22.76



DAKRA INTEGRATED FLOOD PROTECTION PROJECT (APP 8B)
DETAILED SECTORAL COST ESTIMATES

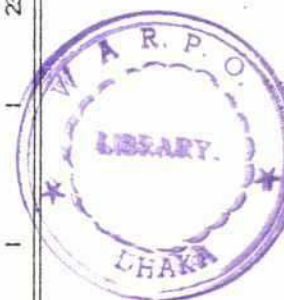
PART C: ENVIRONMENTAL IMPROVEMENT; SLUM IMPROVEMENT
All Costs in Taka x 1,000,000 (Million Taka)

SL NO	DESCRIPTION	UNIT	UNIT COST	TOTAL	1991-92	1992-93	1993-94	1994-95	1995-96	1996-97	
				QTY.	COST	QTY.	COST	QTY.	COST	QTY.	COST
LAND ACQUISITION											
1											
2											
SUB-TOTAL, LAND ACQUISITION											
CIVIL WORKS											
1	Completion works for City Pallis	IL.S.	21.900	100.0%	21.90	40.0%	8.76	40.0%	10.00	2500	12.50
2	Integrated slum improvement program	1th	0.005	8000	40.00	500	2.50	1000	5.00	2000	10.00
SUB-TOTAL, CIVIL WORKS											
					61.90	4.38	11.26	13.76	10.00	10.00	12.50
EQUIPMENT SUPPLY											
1	Motorcycles	lea	0.0750	20	1.50	5	0.38	5	0.38	5	0.38
2	Health and training aids	1th	0.0005	8000	4.00	500	0.25	1000	0.50	2000	1.00
SUB-TOTAL, EQUIPMENT SUPPLY											
					5.50	0.38	0.63	0.88	1.00	1.00	1.25
INCREMENTAL O & M											
1	Civil works (by beneficiaries)	lea	N.C.								
2	Motorcycles	mo	0.003	1200	3.60	15	0.05	135	0.41	360	1.08
SUB-TOTAL, INCREMENTAL O&M											
					3.60	0.05	0.23	0.41	0.77	1.08	1.08
BASE COST SUB-TOTAL											
					71.00	4.80	12.11	15.04	12.14	12.08	14.83
PHYSICAL CONTINGENCY											
1	2	10.0%		7.10	0.48	1.21	1.50	1.21	1.21	1.21	1.48
PRICE CONTINGENCY											
1				13.14		0.75	1.93	2.34	3.16	4.96	
TOTAL COST											
				91.24	5.28	14.07	18.47	15.69	16.45	21.27	

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DHAKA INTEGRATED FLOOD PROTECTION PROJECT (IFPP-88)
DETAILED SECTORAL COST ESTIMATESPART C: ENVIRONMENTAL IMPROVEMENT; SOLID WASTE
All Costs in Taka x 1,000,000 (Million Taka)

SL NO	DESCRIPTION	UNIT	COST	TOTAL	1991-92	1992-93	1993-94	1994-95	1995-96	1996-97	
		QTY.	COST	QTY.	COST	QTY.	COST	QTY.	COST	QTY.	COST
LAND ACQUISITION											
1											
2											
SUB-TOTAL, LAND ACQUISITION											
CIVIL WORKS											
1	Rehabilitate existing collection bins	ea	0.0015	2000	3.00	500	0.75	1000	1.50	300	0.45
2	Construct new collection bins	ea	0.0055	1000	5.50	250	1.38	250	1.38	250	1.38
SUB-TOTAL, CIVIL WORKS											
				8.50	0.30	2.13	2.88	1.88	1.88		
EQUIPMENT SUPPLY											
1	Detachable body garbage trucks	ea	2.400	30	72.00	10	24.00	10	24.00		
2	Demountable containers	ea	0.200	120	24.00	40	8.00	40	8.00		
3	Hand wheel barrows	ea	0.0050	2000	10.00	1000	5.00				
4	Hand tools and health equipment	IL.S.	3.6500	1	3.65	1	3.65				
SUB-TOTAL, EQUIPMENT SUPPLY											
				109.65	5.00	40.65	32.00	32.00			
INCREMENTAL O & M											
1	Civil works	ea	5.02	1.18		0.02	0.12	0.27	0.36	0.49	
2	Containers and tools	ea	20.02	23.40		1.00	3.60	5.20	6.80	6.80	
3	Garbage trucks	no	0.040	1170	46.80	30	1.20	150	6.00	360	14.40
SUB-TOTAL, INCREMENTAL O&M											
				71.38		2.22	9.72	16.27	21.56	21.63	
BASE COST SUB-TOTAL											
				189.53	5.30	44.99	44.60	50.09	22.93	21.63	
PHYSICAL CONTINGENCY											
2			10.02	18.95	0.53	4.50	4.45	5.01	2.29	2.16	
PRICE CONTINGENCY											
				31.09		2.78	5.65	9.54	5.96	7.16	
TOTAL COST											
				239.58	5.83	52.27	54.71	64.64	31.18	30.95	



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DHAKA INTEGRATED FLOOD PROTECTION PROJECT (APP 8B)
DETAILED SECTORAL COST ESTIMATES

PART C: ENVIRONMENTAL IMPROVEMENT; SANITATION, WATER SUPPLY AND LOCAL DRAINAGE
All Costs in Taka x 1,000,000 (Million Taka)

SL NO	DESCRIPTION	UNIT	UNIT COST	TOTAL		1991-92		1992-93		1993-94		1994-95		1995-96		1996-97	
				QTY.	COST	QTY.	COST	QTY.	COST	QTY.	COST	QTY.	COST	QTY.	COST	QTY.	COST
LAND ACQUISITION																	
1																	
2																	
SUB-TOTAL, LAND ACQUISITION																	
CIVIL WORKS																	
1	Construct public toilets/wash houses	lea	0.500	30	15.00	5	2.50	5	2.50	10	5.00	5	2.50	5	2.50	500	2.00
2	Twin pit sanitary FF latrines	lea	0.004	2500	10.00			500	2.00	500	2.00	500	2.00	500	2.00	500	2.00
3	Single pit sanitary latrines	lea	0.003	3000	9.00			500	1.50	500	1.50	500	1.50	500	1.50	1000	3.00
4	Sanitary latrine shelters	lea	0.003	2500	7.50			500	1.50	500	1.50	500	1.50	500	1.50	500	1.50
5	Install public standpipes/tubewells	lea	0.020	1000	20.00			200	4.00	200	4.00	200	4.00	200	4.00	200	4.00
6	Clean & rehabilitate local storm drains	lkm	0.087	120	10.44	60	5.22	60	5.22								
7	Minor drain extension	lkm	0.770	71	54.67	20	15.40	40	30.80	11	8.47						
8	Surface drain rehabilitation	lkm	0.150	60	9.00	30	4.50	30	4.50								
SUB-TOTAL, CIVIL WORKS					135.61		27.62		52.02		22.47		11.50		11.50		10.50
EQUIPMENT SUPPLY																	
1	Mobile public toilets	lea	0.360	5	1.80			3	1.08	2	0.72						
2	Drain gully sweeper	lea	2.600	1	2.60			1	2.60								
3	Septic tank desludging trucks	lea	2.200	2	4.40			2	4.40								
SUB-TOTAL, EQUIPMENT SUPPLY					8.80				8.08		0.72						
INCREMENTAL O & M																	
1	Civil works (except private latrines)	lea	5.021		13.32						2.41		3.31		3.64		3.96
2	Drain and desludging trucks	lea	0.040	156	6.24			12	0.48	36	1.44	36	1.44	36	1.44	36	1.44
SUB-TOTAL, INCREMENTAL O&M					19.56				0.48		3.85		4.75		5.08		5.40
BASE COST SUB-TOTAL					163.97		27.62		60.58		27.04		16.25		16.58		15.90
PHYSICAL CONTINGENCY				12	10.021		2.76		6.06		2.70		1.63		1.66		1.59
PRICE CONTINGENCY									3.82		3.49		3.16		4.37		5.36
TOTAL COST					200.58		30.38		70.46		33.23		21.04		22.61		22.86

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CHARR INTEGRATED FLOOD PROTECTION PROJECT (APP 6B)
SUMMARY OF ANNUAL FC, LC AND COST

PART A: FLOOD PROTECTION
All Costs in Taka x 1,000,000 (Million Taka)

DESCRIPTION	TOTAL		1991-92		1992-93		1993-94		1994-95		1995-96		1996-97	
	FC	LC	FC	LC	FC	LC	FC	LC	FC	LC	FC	LC	FC	LC
LAND ACQUISITION		17.65		17.65										
CIVIL WORKS	227.64	455.47	24.46	63.48	90.78	174.61	86.90	159.14	25.50	38.25				
EQUIPMENT SUPPLY	294.18	426.27			142.09	213.14	142.09	213.14						
INCREMENTAL O & M	16.05	64.19			0.38	1.51	2.22	8.87	4.06	16.24	4.70	18.79	4.70	18.79
GRAND TOTAL	527.87	943.78	24.46	81.33	233.25	389.25	231.21	381.15	29.56	54.48	4.70	18.79	4.70	18.79
PHYSICAL CONTINGENCY	52.79	92.59	2.46	6.35	23.33	38.93	23.12	38.11	2.96	5.45	0.47	1.88	0.47	1.88
PRICE CONTINGENCY	44.82	101.37			12.57	25.69	25.53	51.82	4.59	11.45	0.95	5.42	1.17	6.99
TOTAL COST	625.47	1137.75	26.90	87.67	269.15	463.87	279.86	471.08	37.10	71.38	6.11	26.09	6.34	27.65

SUMMARY OF FINANCIAL FC, LC AND ODET

All Costs in Taka x 1,000,000 (Million Taka)

DESCRIPTION	TOTAL		1991-92		1992-93		1993-94		1994-95		1995-96		1996-97	
	FC	LC	FC	LC	FC	LC	FC	LC	FC	LC	FC	LC	FC	LC
LAND ACQUISITION		237.08		129.20		107.88								
CIVIL WORKS	298.94	959.04	141.06	409.69	113.73	372.78	44.14	176.57						
EQUIPMENT SUPPLY														
INCREMENTAL O & M	13.40	53.62			1.38	5.51	2.59	10.37	3.14	12.53	3.14	12.53	3.14	12.53
GRAND TOTAL	312.34	1249.74	141.06	538.89	115.11	486.17	46.74	186.94	3.14	12.53	3.14	12.53	3.14	12.53
PHYSICAL CONTINGENCY	31.23	101.27	14.11	40.97	11.51	37.83	4.67	18.69	0.31	1.26	0.31	1.26	0.31	1.26
PRICE CONTINGENCY	13.27	67.81			6.20	31.44	5.16	25.42	0.49	2.64	0.63	3.63	0.79	4.68
TOTAL COST	356.85	1418.82	155.17	579.86	132.83	555.48	56.57	231.05	3.95	16.43	4.09	17.47	4.25	18.52

CHARRA INTEGRATED FLOOD PROTECTION PROJECT (IFP 88)
SUMMARY OF ANNUAL FC, LC AND COST

PART C: ENVIRONMENTAL IMPROVEMENT; SLIM IMPROVEMENT
All Costs in Taka x 1,000,000 (Million Taka)

DESCRIPTION	1991-92		1992-93		1993-94		1994-95		1995-96		1996-97	
	FC	LC	FC	LC	FC	LC	FC	LC	FC	LC	FC	LC
LAND ACQUISITION												
CIVIL WORKS	18.57	48.33	1.31	3.07	3.38	7.88	4.13	9.63	3.00	7.00	3.75	8.75
EQUIPMENT SUPPLY	2.10	3.40	0.23	0.15	0.30	0.38	0.38	0.50	0.30	0.30	0.38	0.88
INCREMENTAL O & M	1.44	2.16	0.02	0.03	0.09	0.14	0.16	0.24	0.46	0.48	0.48	0.65
BASE COST SUB-TOTAL	22.11	48.89	1.56	3.24	3.77	8.34	4.67	10.38	3.83	8.31	4.56	10.27
PHYSICAL CONTINGENCY	2.21	4.89	0.16	0.32	0.38	0.83	0.47	1.04	0.38	0.83	0.46	1.03
PRICE CONTINGENCY	3.20	9.94			0.20	0.55	0.52	1.41	0.59	1.75	2.41	3.82
TOTAL COST	27.53	63.72	1.71	3.57	4.35	9.73	5.65	12.82	4.81	10.89	6.15	15.12

OHARA INTEGRATED FLOOD PROTECTION PROJECT (FPP 68)
SUMMARY OF ANNUAL FC, LC AND COST

PART C: ENVIRONMENTAL IMPROVEMENT; SOLID WASTE
All Costs in Taka x 1,000,000 (Million Taka)

DESCRIPTION	TOTAL		1991-92		1992-93		1993-94		1994-95		1995-96		1996-97	
	FC	LC	FC	LC	FC	LC	FC	LC	FC	LC	FC	LC	FC	LC
LAND ACQUISITION														
CIVIL WORKS	2.55	5.95	0.09	0.21	0.64	1.49	0.86	2.01	0.55	1.28	0.41	0.96		
EQUIPMENT SUPPLY	40.10	69.56	1.50	3.50	14.60	26.06	12.00	20.00	12.00	20.00				
INCREMENTAL O & M	23.64	47.75			0.68	1.53	3.14	6.58	5.41	10.85	7.19	14.37	7.21	14.42
BASE COST SUB-TOTAL	66.28	123.25	1.59	3.71	15.92	29.07	16.01	28.59	17.96	32.13	7.60	15.33	7.21	14.42
PHYSICAL CONTINGENCY	6.63	12.33	0.16	0.37	1.59	2.91	1.60	2.86	1.80	3.21	0.76	1.53	0.72	1.44
PRICE CONTINGENCY	8.75	22.35			0.86	1.92	1.77	3.89	2.79	6.75	1.53	4.46	1.80	5.36
TOTAL COST	81.66	157.92	1.75	4.08	18.36	33.90	19.38	35.34	22.54	42.09	9.90	21.29	9.73	21.23

CHAKRA INTEGRATED FLOOD PROTECTION PROJECT (FAP 6B)
SUMMARY OF ANNUAL FC, LC AND COST

PART C: ENVIRONMENTAL IMPROVEMENT; SANITATION, WATER SUPPLY AND LOCAL DRAINAGE
All Costs in Taka x 1,000,000 (Million Taka)

DESCRIPTION	TOTAL		1991-92		1992-93		1993-94		1994-95		1995-96		1996-97	
	FC	LC	FC	LC	FC	LC	FC	LC	FC	LC	FC	LC	FC	LC
LAND ACQUISITION														
CIVIL WORKS	39.27	102.34	5.77	21.65	11.55	40.47	5.89	16.58	3.45	8.05	3.45	8.05	3.15	7.35
EQUIPMENT SUPPLY	3.34	5.46			3.12	4.96	0.22	0.50						
INDEPENDENT O & M	5.16	14.40			0.19	0.29	1.06	2.79	1.24	3.52	1.30	3.78	1.37	4.04
BASE COST SUB-TOTAL	41.77	122.20	5.77	21.65	14.87	45.71	7.17	19.87	4.69	11.57	4.75	11.83	4.52	11.39
PHYSICAL CONTINGENCY	4.18	12.22	0.58	2.18	1.49	4.57	0.72	1.99	0.47	1.16	0.48	1.18	0.45	1.14
PRICE CONTINGENCY	4.41	15.80			0.80	3.02	0.79	2.70	0.73	2.43	0.96	3.41	1.13	4.24
TOTAL COST	50.36	150.22	6.35	24.03	17.16	53.30	8.68	24.56	5.89	15.15	6.19	16.42	6.10	16.76

Part D: Implementation Assistance

Taka Million

Item		Foreign Currency	Local Currency (Note 9)	Total	Remarks
1. Incremental Administration (Project Implementation Office)					
Staff Costs	Professional Staff		7.30	7.30	7 no. staff; see Note 1
	Sub-Professional Staff		4.00	4.00	16 no. staff; see Note 2
	Support Staff		9.50	9.50	25 no. staff; see Note 3
	Sub-Total Staff Costs	0.00	20.80	20.80	
Office & Laboratory Equipment		2.60	5.00	7.60	See Note 10
Vehicles		4.40	4.40	8.80	
Office Rent & Running Costs		4.75	7.30	12.05	
Slum Area Motivation & Training			16.00	16.00	See Note 4
Sub-Total Incremental Administration		11.75	53.50	65.25	
2. Consulting Services					
Sub-Soil Investigations			5.00	5.00	See Note 5 See Note 6
Detailed Design & Construction Supervision			57.70	57.70	
Project Management		59.50	54.00	113.50	
Sub-Total Consulting Services		59.50	116.70	176.20	
SUB-TOTAL BASE COST		71.25	170.20	241.45	
Physical Contingencies		10.10	22.86	32.96	See Note 7
Price Contingencies		0.73	3.91	4.63	See Note 8
TOTAL COST		82.08	196.96	279.04	
Notes: 1. Professional staff seconded from GOB to PIO. 2. Sub-Professional staff seconded from GOB to PIO, supplemented by PIO-recruited staff where necessary. 3. Support staff recruited by PIO. 4. Based on 8,000 families @ Tk. 2,000 per family. 5. Based on estimated requirement of 450 mm @ \$ 3,500 per mm all inclusive (see Appendix 3) 6. Based on 102 international mm @ \$20,000 per mm & 306 domestic mm @ \$3,500 all inclusive (see Appendix 3) 7. Physical contingencies 10% of base cost (15% for Consulting Services) 8. Price contingencies for foreign costs 4.9 % per annum through 1992/94, & 3.7 % per annum thereafter; for local costs, 6 % per annum 9. Local cost includes Tk. 5.9 million in Duties & Taxes 10. Includes Tk. 5 million for upgrading laboratory facilities					

Consulting Services

A. Detailed Engineering Design and Construction Supervision

1. It is envisaged that domestic consultants will assist the PIO and Executing/Implementing Agencies in detailed engineering design and construction supervision. The Terms of Reference (TOR) for the services will encompass the carrying out of soil investigations and various engineering surveys, the preparation of contract drawings, specifications, bills of quantities, engineering calculations and contract documents. They will include provision of assistance to PIO in the prequalification of contractors, the bidding, evaluation, and award of contracts and contract supervision in accordance with the accepted norms of professional services. The TOR will define the areas and likely extent of specialist advice required and the qualifications and experience of staff which would be acceptable to the Government and the Bank.

2. It is estimated that an amount of \$ 1.58 million will be required for detailed engineering design and construction supervision, to be distributed as follows:

for Part A:	\$ 0.70 million	(200 mm)
for Part B:	\$ 0.53 million	(150 mm)
for Part C:	\$ 0.35 million	(100 mm)

All these consultants will be recruited by and based in the PIO.

B. Project Management

3. The Project management consultants team will support and assist the PIO in planning, implementing, and evaluating Project activities, with the overall objective of achieving the physical, financial, and scheduling targets established under the Project. Among other things, the consultants will assist in overall technical monitoring and supervision, PBME activities, community development programs, standards and procedures for O&M, and on-the-job training of counterpart staff. It is estimated that 408 mm of consulting services (102 mm international, 306 mm domestic) will be required for Project management, as shown on Table 1 overleaf.

Table 1 Project Management Consulting Services (man-months)

	Inter- national	Domes- tic	Total
Project Implementation Advisor	48		48
Civil/Hydraulic Engineer	24	48	72
Geotechnical Specialist	12	24	36
Financial/MIS Specialist	18	48	66
Senior Municipal Engineer		48	48
Urban Planner		24	24
Monitoring & Evaluation Specialist		18	18
Community Development Specialist		48	48
Construction Specialist		48	48
Total:	102	306	408

4. Outline terms of reference for these consulting services are given below:

1. Project Implementation Advisor (International)

- (i) assist the Project Director in the overall management of all Project activities and in initiating action where required to maintain progress;
- (ii) coordinate implementation of the various Project activities and ensure that all activities are carried out in a manner that optimises their individual and mutual impact;
- (iii) liaise with the various implementing agencies, including the Asian Development Bank, and arrange for the provision of data on Project planning and progress as is satisfactory to these agencies; and
- (iv) manage the activities of the Consulting team members and ensure that the scheduling of Consultants inputs matches Project requirements as closely as practicable.

2. Civil/Hydraulic Engineer (International & Domestic)

- (i) review the technical designs and implementation plans for Project components prepared by local consultants, and advise on modifications where appropriate;
- (ii) liaise closely with counterpart Project Implementation Office staff on preparation of contracts and specifications for implementation of Project components; and

- (iii) assist with establishment of a quality assurance and control regime for implementation of the Project works, including assisting with the establishment of the materials testing program and the training of local staff in the appropriate laboratory methods and testing procedures.

3. Geotechnical Specialist (International & Domestic)

- (i) advise and assist the designers (local consultants and/or GOB departments) in the preparation of designs and quantity and cost estimates for the embankment rehabilitation works;
- (ii) in conjunction with the Construction Engineer, determine and establish the earthworks testing procedures, ensure these are clearly understood by the contractors and by the responsible Project Office staff, and maintain the testing and earthworks quality control program; and
- (iii) through a structured program of tuition, assist in training GOB and local consultants and contractors staff in any new earthworks design and construction procedures introduced through the Project.

4. Financial/MIS Specialist (International & Domestic)

- (i) review existing GOB financial and physical monitoring and reporting procedures, and design a set of simplified accounting, budgetary, and management information systems for the Project;
- (ii) conduct on-the-job training of financial and accounting personnel, and supervise the implementation of the designed subsystems;
- (iii) prepare loan withdrawal applications and related documentation, and follow through their processing by GOB agencies and the Bank; review the MIS and other financial reports prior to their approval by the Project Director, and prepare other special financial reports as may be requested by GOB and lending agencies from time to time;
- (iv) liaise with the Municipal Financial Advisor for DCC (provided under a UNDP project) and with any future financial management advisor assigned to DWASA; determine overall improvements in the revenue generation and financial management of the two agencies;
- (v) facilitate the annual audit of Project accounts and records and the preparation and submission of associated audit reports; and
- (vi) provide advisory support to the Project finance manager in the review of the financial aspects of contracts, including billings by contractors.

5. Senior Municipal Engineer (Domestic)

- (i) advise on the planning, design, and implementation of all Project works carried out under the authority of the Project municipal and associated agencies (DCC, DWASA, RAJUK);
- (ii) advise on streamlining of municipal management and operation procedures where appropriate, including the establishment of management information systems; and
- (iii) oversee the technical aspects of the works carried out under the Environment Improvement Program, and to advise on modifications where appropriate.

6. Urban Planner (Domestic)

- (i) review the Project implementation proposals and ensure that each component of the Project conforms with existing City and Municipal development plans and standards;
- (ii) advise City and Municipal authorities on the scope for possible improvement of existing plans and standards, based on standards developed for specific Project components, where these are appropriate for more general adoption; and
- (iii) coordinate the urban planning activities of the Project Office with the respective GOB authorities.

7. Monitoring & Evaluation Specialist (Domestic)

- (i) define the methodology for monitoring and evaluating the impact of the Project, with particular reference to the targets agreed at the time of Project appraisal and as may be incorporated as loan covenants;
- (ii) as part of the definition of M&E methodology, establish the benchmark data relating to pre-Project conditions, in conjunction with the relevant GOB agencies; and
- (iii) implement the M&E methodology, furnish required M&E data to concerned authorities, and train GOB staff in application of Project M&E procedures.

8. Community Development Specialist (Domestic)

- (i) through a program of meetings and discussions with concerned agencies, municipal and public officials, and community representatives in the Project areas, ensure public awareness of the Project and Project works, and record and report viewpoints and opinions of these bodies that may be significant with respect to Project implementation;

- (ii) liaise between the Project Office and local people, and mediate and explain to all concerned parties in those cases where clarification of Project activities with respect to local needs and aspirations is required; and
- (iii) establish procedures for dissemination of Project publicity and public awareness materials.

B9. Construction Specialist (Domestic)

- (i) review contractors proposed work plans and methods, and recommend any appropriate changes to meet Project scheduling and quality objectives;
- (ii) establish inspection and quality control procedures for all Project construction works;
- (iii) ensure these procedures are understood by all concerned parties, including contractors and local consultants;
- (iv) implement these procedures and maintain full records of all matters relating to contractor/consultant/Project Implementation Office relations with respect to the construction works; and
- (v) train GOB and contractors/consultants staff in the efficient implementation of the quality control and quality assurance measures adopted for the Project.

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Projection of Urban Expansion

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AREA	LAND USE (HA.) Built-Up Area By District					LAND USE (HA.) Increase in Built-Up Area over previous decade			
	TOTAL	1990	2000	2010		TOTAL	1990	2000	2010
High Established A	1,072	1,072	1,072	1,072	High Established A	1,072		0	0
West Embankment	1,043	330	627	627	West Embankment	1,043		297	0
Old Dhaka	1,166	1,142	1,156	1,156	Old Dhaka	1,166		14	0
Commercial/Indust/	1,541	1,367	1,404	1,404	Commercial/Indust/	1,541		37	0
Mirpur Area	5,653	1,732	2,595	3,300	Mirpur Area	5,653		863	705
Cantonment	3,175	1,717	1,943	2,023	Cantonment	3,175		226	80

Source: JICA

Source: Derived from JICA

ANNUAL INCREASE IN BUILT-UP AREA (HA.)

	1991/92	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99	1999/2000	2000/01
West Embankment	29.7	29.7	29.7	29.7	29.7	29.7	29.7	29.7	29.7	29.7
Mirpur Area	86.3	86.3	86.3	86.3	86.3	86.3	86.3	86.3	86.3	86.3
Other Central Areas	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7
Cantonment	22.6	22.6	22.6	22.6	22.6	22.6	22.6	22.6	22.6	22.6
	2001/02	2002/03	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11
West Embankment	0	0	0	0	0	0	0	0	0	0
Mirpur Area	70.5	70.5	70.5	70.5	70.5	70.5	70.5	70.5	70.5	70.5
Other Central Areas	0	0	0	0	0	0	0	0	0	0
Cantonment	8	8	8	8	8	8	8	8	8	8

Source: Derived from JICA

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DHAKA INTEGRATED FLOOD PROTECTION PROJECT

Appendix - 8

CALCULATION OF ECONOMIC RATE OF RETURN

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(On the basis of increase in land value)

Tk.in million

Year	FY	Net Benefits		Total Net Benefit	Net Benefit Discounted at 12%	
		L.C.	F.C.		L.C.	F.C.
0	1991-92	(1,553.85)	(100.27)	(1,654.12)		
1	1992-93	(1,872.70)	(169.63)	(2,042.33)		
2	1993-94	(2,829.34)	(123.67)	(2,953.01)		
3	1994-95	1,409.45	(210.15)	1,199.30		
4	1995-96	1,718.07	(215.16)	1,502.91		
5	1996-97	2,138.64	(236.88)	1,901.76		
6	1997-98	2,587.19	(192.18)	2,395.01		
7	1998-99	2,541.51	(196.36)	2,345.15		
8	1999-2000	1,531.45	(200.54)	1,330.91		
9	2000-2001	1,481.37	(204.69)	1,276.68		
10	2001-2002	2,608.90	(41.78)	2,567.12		
11	2002-2003	2,456.30	(83.56)	2,372.74		
12	2003-2004	2,456.30	(83.56)	2,372.74		
13	2004-2005	2,456.30	(83.56)	2,372.74		
14	2005-2006	2,456.30	(83.56)	2,372.74		
15	2006-2007	3,889.32	(83.56)	3,805.76		
16	2007-2008	3,889.32	(83.56)	3,805.76		
17	2008-2009	3,889.32	(83.56)	3,805.76		
18	2009-2010	3,889.32	(83.56)	3,805.76		
19	2010-2011	3,889.32	(83.56)	3,805.76		
20	2011-2012	3,804.95	(83.56)	3,721.39		
21	2012-2013	1,654.32	(83.56)	1,570.76		
22	2013-2014	5,446.47	(83.56)	5,362.91		
				47,044.20	7,632.94	(1,153.70)

Economic Rate of Return (E R R) = 23.60%

Official Exchange Rate US \$ 1 = TK. 36.50

Salvage Value

Land @ 100% = 3,517.58

Civil

Works @ 5% = 274.57

Total 3,792.15

DHAKA INTEGRATED FLOOD PROTECTION PROJECT

Appendix - 8

CALCULATION OF ECONOMIC RATE OF RETURN

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(On the basis of increase in land value)
(With one year slippage)

Tk.in million

Year	FY	Net Benefits		Total Net Benefit	Net Benefit Discounted at 12%	
		L.C.	F.C.		L.C.	F.C.
0	1991-92	(1,553.85)	(100.27)	(1,654.12)		
1	1992-93	(1,872.70)	(169.63)	(2,042.33)		
2	1993-94	(2,829.34)	(123.67)	(2,953.01)		
3	1994-95	(5,055.15)	(210.15)	(5,265.30)		
4	1995-96	1,718.07	(215.16)	1,502.91		
5	1996-97	2,138.64	(236.88)	1,901.76		
6	1997-98	2,587.19	(192.18)	2,395.01		
7	1998-99	2,541.51	(196.36)	2,345.15		
8	1999-2000	1,531.45	(200.54)	1,330.91		
9	2000-2001	1,481.37	(204.69)	1,276.68		
10	2001-2002	2,608.90	(41.78)	2,567.12		
11	2002-2003	2,456.30	(83.56)	2,372.74		
12	2003-2004	2,456.30	(83.56)	2,372.74		
13	2004-2005	2,456.30	(83.56)	2,372.74		
14	2005-2006	2,456.30	(83.56)	2,372.74		
15	2006-2007	3,889.32	(83.56)	3,805.76		
16	2007-2008	3,889.32	(83.56)	3,805.76		
17	2008-2009	3,889.32	(83.56)	3,805.76		
18	2009-2010	3,889.32	(83.56)	3,805.76		
19	2010-2011	3,889.32	(83.56)	3,805.76		
20	2011-2012	3,804.95	(83.56)	3,721.39		
21	2012-2013	1,654.32	(83.56)	1,570.76		
22	2013-2014	1,654.32	(83.56)	1,570.76		
23	2014-2015	5,446.47	(83.56)	5,362.91		
				42,150.36	3,603.58	(1,159.21)

Economic Rate of Return (E R R) = 15.15%

Official Exchange Rate US \$ 1 = TK. 36.50

Salvage Value

Land @ 100% = 3,517.58
 Civil Works @ 5% = 274.57

Total 3,792.15

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DHAKA INTEGRATED FLOOD PROTECTION PROJECT

Appendix - 8

CALCULATION OF ECONOMIC RATE OF RETURN

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(On the basis of avoidance of flood damage)

Tk.in million

Year	FY	Net Benefits		Total Net Benefit	Net Benefit Discounted at 12%	
		L.C.	F.C.		L.C.	F.C.
0	1991-92	(1,553.85)	(100.27)	(1,654.12)		
1	1992-93	(1,872.70)	(169.63)	(2,042.33)		
2	1993-94	(2,829.34)	(123.67)	(2,953.01)		
3	1994-95	(782.09)	(210.15)	(992.24)		
4	1995-96	(396.17)	(215.16)	(611.33)		
5	1996-97	(420.44)	(236.88)	(657.32)		
6	1997-98	504.16	(192.18)	311.98		
7	1998-99	549.76	(196.36)	353.40		
8	1999-2000	597.83	(200.54)	397.29		
9	2000-2001	650.19	(204.69)	445.50		
10	2001-2002	1,885.44	(41.78)	1,843.66		
11	2002-2003	1,846.73	(83.56)	1,763.17		
12	2003-2004	1,967.13	(83.56)	1,883.57		
13	2004-2005	2,094.44	(83.56)	2,010.88		
14	2005-2006	2,229.06	(83.56)	2,145.50		
15	2006-2007	2,371.42	(83.56)	2,287.86		
16	2007-2008	2,521.99	(83.56)	2,438.43		
17	2008-2009	2,681.23	(83.56)	2,597.67		
18	2009-2010	2,849.68	(83.56)	2,766.12		
19	2010-2011	3,027.87	(83.56)	2,944.31		
20	2011-2012	3,216.38	(83.56)	3,132.82		
21	2012-2013	3,415.84	(83.56)	3,332.28		
22	2013-2014	7,419.03	(83.56)	7,335.47		
				29,079.56	223.70	(1,153.70)

Economic Rate of Return (E R R) = 10.71%

Official Exchange Rate US \$ 1 = TK. 36.50

Salvage Value

Land @ 100% = 3,517.58
 Civil Works @ 5% = 274.57

Total 3,792.15
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DHAKA INTEGRATED FLOOD PROTECTION PROJECT

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CALCULATION OF ECONOMIC RATE OF RETURN

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(On the basis of avoidance of flood damage)
(With one year slippage)

Tk.in million

Year	FY	Net Benefits		Total Net Benefit	Net Benefit Discounted at 12%	
		L.C.	F.C.		L.C.	F.C.
0	1991-92	(1,553.85)	(100.27)	(1,654.12)		
1	1992-93	(1,872.70)	(169.63)	(2,042.33)		
2	1993-94	(2,829.34)	(123.67)	(2,953.01)		
3	1994-95	(2,863.61)	(210.15)	(3,073.76)		
4	1995-96	(396.17)	(215.16)	(611.33)		
5	1996-97	(420.44)	(236.88)	(657.32)		
6	1997-98	504.16	(192.18)	311.98		
7	1998-99	549.76	(196.36)	353.40		
8	1999-2000	597.83	(200.54)	397.29		
9	2000-2001	650.19	(204.69)	445.50		
10	2001-2002	1,885.44	(41.78)	1,843.66		
11	2002-2003	1,846.73	(83.56)	1,763.17		
12	2003-2004	1,967.13	(83.56)	1,883.57		
13	2004-2005	2,094.44	(83.56)	2,010.88		
14	2005-2006	2,229.06	(83.56)	2,145.50		
15	2006-2007	2,371.42	(83.56)	2,287.86		
16	2007-2008	2,521.99	(83.56)	2,438.43		
17	2008-2009	2,681.23	(83.56)	2,597.67		
18	2009-2010	2,849.68	(83.56)	2,766.12		
19	2010-2011	3,027.87	(83.56)	2,944.31		
20	2011-2012	3,216.38	(83.56)	3,132.82		
21	2012-2013	3,415.84	(83.56)	3,332.28		
22	2013-2014	3,626.88	(83.56)	3,543.32		
23	2014-2015	7,419.03	(83.56)	7,335.47		
				30,541.36	(890.18)	(1,159.21)

Economic Rate of Return (E R R) = 9.51%

Official Exchange Rate US \$ 1 = TK. 36.50

Salvage Value

Land @ 100% = 3,517.58
Civil Works @ 5% = 274.57

Total 3,792.15

DHAKA INTEGRATED FLOOD PROTECTION PROJECT

Appendix - 8

CALCULATION OF ECONOMIC RATE OF RETURN

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(On the basis of increase in land value
and avoidance of flood damage)

Tk.in million

Year	FY	Net Benefits		Total Net Benefit	Net Benefit Discounted at 12%	
		L.C.	F.C.		L.C.	F.C.
0	1991-92	(2,741.46)	(100.27)	(2,841.73)		
1	1992-93	(3,125.85)	(169.63)	(3,295.48)		
2	1993-94	(4,151.72)	(123.67)	(4,275.39)		
3	1994-95	2,450.21	(210.15)	2,240.06		
4	1995-96	2,811.29	(215.16)	2,596.13		
5	1996-97	3,286.95	(236.88)	3,050.07		
6	1997-98	3,793.30	(192.18)	3,601.12		
7	1998-99	3,808.48	(196.36)	3,612.12		
8	1999-2000	2,861.75	(200.54)	2,661.21		
9	2000-2001	2,879.28	(204.69)	2,674.59		
10	2001-2002	4,646.94	(41.78)	4,605.16		
11	2002-2003	4,608.23	(83.56)	4,524.67		
12	2003-2004	4,728.63	(83.56)	4,645.07		
13	2004-2005	4,855.94	(83.56)	4,772.38		
14	2005-2006	4,990.56	(83.56)	4,907.00		
15	2006-2007	6,565.94	(83.56)	6,482.38		
16	2007-2008	6,716.51	(83.56)	6,632.95		
17	2008-2009	6,875.75	(83.56)	6,792.19		
18	2009-2010	7,044.20	(83.56)	6,960.64		
19	2010-2011	7,222.39	(83.56)	7,138.83		
20	2011-2012	7,326.53	(83.56)	7,242.97		
21	2012-2013	5,375.36	(83.56)	5,291.80		
22	2013-2014	9,378.55	(83.56)	9,294.99		
				89,313.73	13,968.12	(1,153.70)

Economic Rate of Return (E R R) = 25.39%

Official Exchange Rate US \$ 1 = TK. 36.50

Salvage Value

Land @ 100% = 3,517.58
 Civil Works @ 5% = 274.57

Total 3,792.15

DHAKA INTEGRATED FLOOD PROTECTION PROJECT

Appendix - 8

CALCULATION OF ECONOMIC RATE OF RETURN

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(On the basis of increase in land value
and avoidance of flood damage)
(With one year slippage)

Tk.in million

Year	FY	Net Benefits		Total Net Benefit	Net Benefit Discounted at 12%	
		L.C.	F.C.		L.C.	F.C.
0	1991-92	(2,741.46)	(100.27)	(2,841.73)		
1	1992-93	(3,125.85)	(169.63)	(3,295.48)		
2	1993-94	(4,151.72)	(123.67)	(4,275.39)		
3	1994-95	(6,095.91)	(210.15)	(6,306.06)		
4	1995-96	2,811.29	(215.16)	2,596.13		
5	1996-97	3,286.95	(236.88)	3,050.07		
6	1997-98	3,793.30	(192.18)	3,601.12		
7	1998-99	3,808.48	(196.36)	3,612.12		
8	1999-2000	2,861.75	(200.54)	2,661.21		
9	2000-2001	2,879.28	(204.69)	2,674.59		
10	2001-2002	4,646.94	(41.78)	4,605.16		
11	2002-2003	4,608.23	(83.56)	4,524.67		
12	2003-2004	4,728.63	(83.56)	4,645.07		
13	2004-2005	4,855.94	(83.56)	4,772.38		
14	2005-2006	4,990.56	(83.56)	4,907.00		
15	2006-2007	6,565.94	(83.56)	6,482.38		
16	2007-2008	6,716.51	(83.56)	6,632.95		
17	2008-2009	6,875.75	(83.56)	6,792.19		
18	2009-2010	7,044.20	(83.56)	6,960.64		
19	2010-2011	7,222.39	(83.56)	7,138.83		
20	2011-2012	7,326.53	(83.56)	7,242.97		
21	2012-2013	5,375.36	(83.56)	5,291.80		
22	2013-2014	5,586.40	(83.56)	5,502.84		
23	2014-2015	9,378.55	(83.56)	9,294.99		
				86,270.45	8,874.97	(1,159.21)

Economic Rate of Return (E R R) = 18.06%

Official Exchange Rate US \$ 1 = TK. 36.50

Salvage Value

Land @ 100% = 3,517.58
Civil
Works @ 5% = 274.57

Total 3,792.15
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DHAKA INTEGRATED FLOOD PROTECTION PROJECT
SENSITIVITY ANALYSIS - 25% Decrease in benefits

Appendix - 8

CALCULATION OF ECONOMIC RATE OF RETURN

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(On the basis of increase in land value
and avoidance of flood damage)

Tk.in million

Year	FY	Net Benefits		Total Net Benefit	Net Benefit Discounted at 12%	
		L.C.	F.C.		L.C.	F.C.
0	1991-92	(2,741.46)	(100.27)	(2,841.73)		
1	1992-93	(3,125.85)	(169.63)	(3,295.48)		
2	1993-94	(4,151.72)	(123.67)	(4,275.39)		
3	1994-95	1,381.95	(210.15)	1,171.80		
4	1995-96	1,736.12	(215.16)	1,520.96		
5	1996-97	2,073.03	(236.88)	1,836.15		
6	1997-98	2,669.49	(192.18)	2,477.31		
7	1998-99	2,677.06	(196.36)	2,480.70		
8	1999-2000	1,963.20	(200.54)	1,762.66		
9	2000-2001	1,972.53	(204.69)	1,767.84		
10	2001-2002	3,447.06	(41.78)	3,405.28		
11	2002-2003	3,379.87	(83.56)	3,296.31		
12	2003-2004	3,470.17	(83.56)	3,386.61		
13	2004-2005	3,565.66	(83.56)	3,482.10		
14	2005-2006	3,666.62	(83.56)	3,583.06		
15	2006-2007	4,848.16	(83.56)	4,764.60		
16	2007-2008	4,961.08	(83.56)	4,877.52		
17	2008-2009	5,080.51	(83.56)	4,996.95		
18	2009-2010	5,206.85	(83.56)	5,123.29		
19	2010-2011	5,340.49	(83.56)	5,256.93		
20	2011-2012	5,418.60	(83.56)	5,335.04		
21	2012-2013	3,955.22	(83.56)	3,871.66		
22	2013-2014	7,905.65	(83.56)	7,822.09		
				61,806.26	7,447.93	(1,153.70)

Economic Rate of Return (E R R) = 18.92%

Official Exchange Rate US \$ 1 = TK. 36.50

Salvage Value

Land @ 100% = 3,517.58

Civil

Works @ 5% = 274.57

Total 3,792.15

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Aug-91

D I F P P - DHAKA WEST

 CALCULATION OF ECONOMIC RATE OF RETURN

 (On the basis of increase in land value)

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Tk. in million

Year	FY	Net Benefits		Total Net Benefit	Net Benefit Discounted at 12%	
		L.C.	F.C.		L.C.	F.C.
0	1991-92	(1,392.05)	(256.77)	(1,648.82)		
1	1992-93	(1,728.88)	(458.83)	(2,187.71)		
2	1993-94	(1,493.72)	(347.87)	(1,841.59)		
3	1994-95	4,395.23	(99.34)	4,295.89		
4	1995-96	3,386.89	(76.71)	3,310.18		
5	1996-97	3,367.63	(90.15)	3,277.48		
6	1997-98	3,454.87	(29.03)	3,425.84		
7	1998-99	3,454.87	(29.03)	3,425.84		
8	1999-2000	3,454.87	(29.03)	3,425.84		
9	2000-2001	3,407.05	(58.06)	3,348.99		
10	2001-2002	2,054.98	(58.06)	1,996.92		
11	2002-2003	2,054.98	(58.06)	1,996.92		
12	2003-2004	2,054.98	(58.06)	1,996.92		
13	2004-2005	2,054.98	(58.06)	1,996.92		
14	2005-2006	2,054.98	(58.06)	1,996.92		
15	2006-2007	2,054.98	(58.06)	1,996.92		
16	2007-2008	2,054.98	(58.06)	1,996.92		
17	2008-2009	2,054.98	(58.06)	1,996.92		
18	2009-2010	2,054.98	(58.06)	1,996.92		
19	2010-2011	2,054.98	(58.06)	1,996.92		
20	2011-2012	2,054.98	(58.06)	1,996.92		
21	2012-2013	2,054.98	(58.06)	1,996.92		
22	2013-2014	2,402.57	(58.06)	2,344.51		
				45,139.49	12,313.64	(1,169.07)

Economic Rate of Return (ERR) = 42.35%

Official Exchange Rate US \$ 1 = TK. 36.50

Salvage Value

Land @ 100% = 255.14
 Civil
 Works @ 5% = 92.45

 347.59
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D I F P P - DHAKA WEST

CALCULATION OF ECONOMIC RATE OF RETURN

(On the basis of increase in land value)
(with one year slippage)

Appendix - 8

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Tk. in million

Year	FY	Net Benefits		Total Net Benefit	Net Benefit Discounted at 12%	
		L.C.	F.C.		L.C.	F.C.
0	1991-92	(1,392.05)	(256.77)	(1,648.82)		
1	1992-93	(1,728.88)	(458.83)	(2,187.71)		
2	1993-94	(1,493.72)	(347.87)	(1,841.59)		
3	1994-95	2,313.71	(99.34)	2,214.37		
4	1995-96	3,386.89	(76.71)	3,310.18		
5	1996-97	3,367.63	(90.15)	3,277.48		
6	1997-98	3,454.87	(29.03)	3,425.84		
7	1998-99	3,454.87	(29.03)	3,425.84		
8	1999-2000	3,454.87	(29.03)	3,425.84		
9	2000-2001	3,407.05	(58.06)	3,348.99		
10	2001-2002	2,054.98	(58.06)	1,996.92		
11	2002-2003	2,054.98	(58.06)	1,996.92		
12	2003-2004	2,054.98	(58.06)	1,996.92		
13	2004-2005	2,054.98	(58.06)	1,996.92		
14	2005-2006	2,054.98	(58.06)	1,996.92		
15	2006-2007	2,054.98	(58.06)	1,996.92		
16	2007-2008	2,054.98	(58.06)	1,996.92		
17	2008-2009	2,054.98	(58.06)	1,996.92		
18	2009-2010	2,054.98	(58.06)	1,996.92		
19	2010-2011	2,054.98	(58.06)	1,996.92		
20	2011-2012	2,054.98	(58.06)	1,996.92		
21	2012-2013	2,054.98	(58.06)	1,996.92		
22	2013-2014	2,054.98	(58.06)	1,996.92		
23	2014-2015	2,402.57	(58.06)	2,344.51		
				45,054.89	11,123.44	(1,172.90)

Economic Rate of Return (ERR) = 36.57%

Official Exchange Rate US \$ 1 = TK. 36.50

Salvage Value

Land	@ 100% =	255.14
Civil Works	@ 5% =	92.45

		347.59
		=====

D I F P P - DHAKA WEST

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CALCULATION OF ECONOMIC RATE OF RETURN

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(On the basis of avoidance of flood damage)

Tk. in million

Year	FY	Net Benefits		Total Net Benefit	Net Benefit Discounted at 12%	
		L.C.	F.C.		L.C.	F.C.
0	1991-92	(1,392.05)	(256.77)	(1,648.82)		
1	1992-93	(1,728.88)	(458.83)	(2,187.71)		
2	1993-94	(1,493.72)	(347.87)	(1,841.59)		
3	1994-95	892.54	(99.34)	793.20		
4	1995-96	977.42	(76.71)	900.71		
5	1996-97	1,013.25	(90.15)	923.10		
6	1997-98	1,158.37	(29.03)	1,129.34		
7	1998-99	1,219.16	(29.03)	1,190.13		
8	1999-2000	1,283.02	(29.03)	1,253.99		
9	2000-2001	1,302.27	(58.06)	1,244.21		
10	2001-2002	1,372.73	(58.06)	1,314.67		
11	2002-2003	1,446.73	(58.06)	1,388.67		
12	2003-2004	1,524.47	(58.06)	1,466.41		
13	2004-2005	1,606.11	(58.06)	1,548.05		
14	2005-2006	1,691.89	(58.06)	1,633.83		
15	2006-2007	1,781.98	(58.06)	1,723.92		
16	2007-2008	1,876.61	(58.06)	1,818.55		
17	2008-2009	1,976.01	(58.06)	1,917.95		
18	2009-2010	2,080.42	(58.06)	2,022.36		
19	2010-2011	2,190.09	(58.06)	2,132.03		
20	2011-2012	2,190.09	(58.06)	2,132.03		
21	2012-2013	2,190.09	(58.06)	2,132.03		
22	2013-2014	2,537.68	(58.06)	2,479.62		
				25,466.68	3,462.77	(1,169.07)

Economic Rate of Return (ERR) = 17.22%

Official Exchange Rate US \$ 1 = TK. 36.50

Salvage Value

Land @ 100% = 255.14
 Civil Works @ 5% = 92.45

 347.59
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D I F P P - DHAKA WEST

Appendix - 8

CALCULATION OF ECONOMIC RATE OF RETURN

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(On the basis of avoidance of flood damage)
(With one year slippage)

Tk. in million

Year	FY	Net Benefits		Total Net Benefit	Net Benefit Discounted at 12%	
		L.C.	F.C.		L.C.	F.C.
0	1991-92	(1,392.05)	(256.77)	(1,648.82)		
1	1992-93	(1,728.88)	(458.83)	(2,187.71)		
2	1993-94	(1,493.72)	(347.87)	(1,841.59)		
3	1994-95	(1,188.98)	(99.34)	(1,288.32)		
4	1995-96	977.42	(76.71)	900.71		
5	1996-97	1,013.25	(90.15)	923.10		
6	1997-98	1,158.37	(29.03)	1,129.34		
7	1998-99	1,219.16	(29.03)	1,190.13		
8	1999-2000	1,283.02	(29.03)	1,253.99		
9	2000-2001	1,302.27	(58.06)	1,244.21		
10	2001-2002	1,372.73	(58.06)	1,314.67		
11	2002-2003	1,446.73	(58.06)	1,388.67		
12	2003-2004	1,524.47	(58.06)	1,466.41		
13	2004-2005	1,606.11	(58.06)	1,548.05		
14	2005-2006	1,691.89	(58.06)	1,633.83		
15	2006-2007	1,781.98	(58.06)	1,723.92		
16	2007-2008	1,876.61	(58.06)	1,818.55		
17	2008-2009	1,976.01	(58.06)	1,917.95		
18	2009-2010	2,080.42	(58.06)	2,022.36		
19	2010-2011	2,190.09	(58.06)	2,132.03		
20	2011-2012	2,190.09	(58.06)	2,132.03		
21	2012-2013	2,190.09	(58.06)	2,132.03		
22	2013-2014	2,190.09	(58.06)	2,132.03		
23	2014-2015	2,537.68	(58.06)	2,479.62		
				25,517.19	2,281.46	(1,172.90)

Economic Rate of Return (ERR) = 14.15%

Official Exchange Rate US \$ 1 = TK. 36.50

Salvage Value

Land @ 100% = 255.14
Civil Works @ 5% = 92.45

347.59



D I F P P - DHAKA WEST

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CALCULATION OF ECONOMIC RATE OF RETURN

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(On the basis of increase in land value
and avoidance of flood damage)

TK. in million

Year	FY	Net Benefits		Total Net Benefit	Net Benefit Discounted at 12%	
		L.C.	F.C.		L.C.	F.C.
0	1991-92	(1,392.05)	(256.77)	(1,648.82)		
1	1992-93	(1,728.88)	(458.83)	(2,187.71)		
2	1993-94	(1,493.72)	(347.87)	(1,841.59)		
3	1994-95	4,395.23	(99.34)	4,295.89		
4	1995-96	4,480.11	(76.71)	4,403.40		
5	1996-97	4,515.94	(90.15)	4,425.79		
6	1997-98	4,661.06	(29.03)	4,632.03		
7	1998-99	4,721.85	(29.03)	4,692.82		
8	1999-2000	4,785.71	(29.03)	4,756.68		
9	2000-2001	4,804.96	(58.06)	4,746.90		
10	2001-2002	3,523.35	(58.06)	3,465.29		
11	2002-2003	3,597.35	(58.06)	3,539.29		
12	2003-2004	3,675.09	(58.06)	3,617.03		
13	2004-2005	3,756.73	(58.06)	3,698.67		
14	2005-2006	3,842.51	(58.06)	3,784.45		
15	2006-2007	3,932.60	(58.06)	3,874.54		
16	2007-2008	4,027.23	(58.06)	3,969.17		
17	2008-2009	4,126.63	(58.06)	4,068.57		
18	2009-2010	4,231.04	(58.06)	4,172.98		
19	2010-2011	4,340.71	(58.06)	4,282.65		
20	2011-2012	4,340.71	(58.06)	4,282.65		
21	2012-2013	4,340.71	(58.06)	4,282.65		
22	2013-2014	4,688.30	(58.06)	4,630.24		
				77,943.57	19,289	(1,169)

Economic Rate of Return (ERR) = 49.79%

Official Exchange Rate US \$ 1 = TK. 36.50

Salvage Value

Land	@ 100% =	255.14
Civil Works	@ 5% =	92.45
		347.59

D I F P P - DHAKA WEST

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CALCULATION OF ECONOMIC RATE OF RETURN

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(On the basis of increase in land value
and avoidance of flood damage)
(With one year slippage)

Tk. in million

Year	FY	Net Benefits		Total Net Benefit	Net Benefit Discounted at 12%	
		L.C.	F.C.		L.C.	F.C.
0	1991-92	(1,392.05)	(256.77)	(1,648.82)		
1	1992-93	(1,728.88)	(458.83)	(2,187.71)		
2	1993-94	(1,493.72)	(347.87)	(1,841.59)		
3	1994-95	(4,691.67)	(99.34)	(4,791.01)		
4	1995-96	4,480.11	(76.71)	4,403.40		
5	1996-97	4,515.94	(90.15)	4,425.79		
6	1997-98	4,661.06	(29.03)	4,632.03		
7	1998-99	4,721.85	(29.03)	4,692.82		
8	1999-2000	4,785.71	(29.03)	4,756.68		
9	2000-2001	4,804.96	(58.06)	4,746.90		
10	2001-2002	3,523.35	(58.06)	3,465.29		
11	2002-2003	3,597.35	(58.06)	3,539.29		
12	2003-2004	3,675.09	(58.06)	3,617.03		
13	2004-2005	3,756.73	(58.06)	3,698.67		
14	2005-2006	3,842.51	(58.06)	3,784.45		
15	2006-2007	3,932.60	(58.06)	3,874.54		
16	2007-2008	4,027.23	(58.06)	3,969.17		
17	2008-2009	4,126.63	(58.06)	4,068.57		
18	2009-2010	4,231.04	(58.06)	4,172.98		
19	2010-2011	4,340.71	(58.06)	4,282.65		
20	2011-2012	4,340.71	(58.06)	4,282.65		
21	2012-2013	4,340.71	(58.06)	4,282.65		
22	2013-2014	4,340.71	(58.06)	4,282.65		
23	2014-2015	4,688.30	(58.06)	4,630.24		
				73,139.32	13,797.15	(1,172.90)

Economic Rate of Return (ERR) = 30.02%

Official Exchange Rate US \$ 1 = TK. 36.50

Salvage Value

Land @ 100% = 255.14
Civil
Works @ 5% = 92.45

347.59
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DIFPP-DHAKA WEST (SENSITIVITY ANALYSIS)

Appendix - 8

(25% decrease in benefits)

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CALCULATION OF ECONOMIC RATE OF RETURN

Tk. in million

(On the basis of increase in land value and avoidance of flood damage)

Year	FY	Net Benefits		Total Net Benefit	Net Benefit Discounted at 12%	
		L.C.	F.C.		L.C.	F.C.
0	1991-92	(1,392.05)	(256.77)	(1,648.82)		
1	1992-93	(1,728.88)	(458.83)	(2,187.71)		
2	1993-94	(1,493.72)	(347.87)	(1,841.59)		
3	1994-95	3,259.37	(99.34)	3,160.03		
4	1995-96	3,331.13	(76.71)	3,254.42		
5	1996-97	3,353.19	(90.15)	3,263.04		
6	1997-98	3,483.84	(29.03)	3,454.81		
7	1998-99	3,529.43	(29.03)	3,500.40		
8	1999-2000	3,577.33	(29.03)	3,548.30		
9	2000-2001	3,579.81	(58.06)	3,521.75		
10	2001-2002	2,618.60	(58.06)	2,560.54		
11	2002-2003	2,674.10	(58.06)	2,616.04		
12	2003-2004	2,732.41	(58.06)	2,674.35		
13	2004-2005	2,793.64	(58.06)	2,735.58		
14	2005-2006	2,857.97	(58.06)	2,799.91		
15	2006-2007	2,925.54	(58.06)	2,867.48		
16	2007-2008	2,996.51	(58.06)	2,938.45		
17	2008-2009	3,071.06	(58.06)	3,013.00		
18	2009-2010	3,149.37	(58.06)	3,091.31		
19	2010-2011	3,231.62	(58.06)	3,173.56		
20	2011-2012	3,231.62	(58.06)	3,173.56		
21	2012-2013	3,231.62	(58.06)	3,173.56		
22	2013-2014	3,579.21	(58.06)	3,521.15		
				56,363.12	13,423	(1,169)

Economic Rate of Return (ERR) = 39.85%

Official Exchange Rate US \$ 1 = TK. 36.50

Salvage Value

Land	@ 100% =	255.14
Civil Works	@ 5% =	92.45
		347.59

DIFPP (DHAKA WEST) - SENSITIVITY ANALYSIS
(Based on 10% decrease in benefits)

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CALCULATION OF ECONOMIC RATE OF RETURN

Tk.in million

(On the basis of increase in land value
and avoidance of flood damage)

Year	FY	Net Benefits		Total Net Benefit	Net Benefit Discounted at 12%	
		L.C.	F.C.		L.C.	F.C.
0	1991-92	(1,481.85)	(256.77)	(1,738.62)		
1	1992-93	(1,823.21)	(458.83)	(2,282.04)		
2	1993-94	(1,592.80)	(347.87)	(1,940.67)		
3	1994-95	3,940.89	(99.34)	3,841.55		
4	1995-96	4,020.52	(76.71)	3,943.81		
5	1996-97	4,050.84	(90.15)	3,960.69		
6	1997-98	4,190.17	(29.03)	4,161.14		
7	1998-99	4,244.88	(29.03)	4,215.85		
8	1999-2000	4,302.36	(29.03)	4,273.33		
9	2000-2001	4,314.90	(58.06)	4,256.84		
10	2001-2002	3,161.45	(58.06)	3,103.39		
11	2002-2003	3,228.05	(58.06)	3,169.99		
12	2003-2004	3,298.02	(58.06)	3,239.96		
13	2004-2005	3,371.49	(58.06)	3,313.43		
14	2005-2006	3,448.70	(58.06)	3,390.64		
15	2006-2007	3,529.78	(58.06)	3,471.72		
16	2007-2008	3,614.94	(58.06)	3,556.88		
17	2008-2009	3,704.40	(58.06)	3,646.34		
18	2009-2010	3,798.37	(58.06)	3,740.31		
19	2010-2011	3,897.08	(58.06)	3,839.02		
20	2011-2012	3,897.08	(58.06)	3,839.02		
21	2012-2013	3,897.08	(58.06)	3,839.02		
22	2013-2014	4,244.67	(58.06)	4,186.61		
				69,028.21	16,717	(1,169)

Economic Rate of Return (ERR) = 44.35%

Official Exchange Rate US \$ 1 = TK. 36.50

Salvage Value

Land @ 100% = 255.14
Civil Works @ 5% = 92.45

347.59
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DIFPP (DHAKA WEST) - SENSITIVITY ANALYSIS
(Based on 10% increase in Project cost)

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CALCULATION OF ECONOMIC RATE OF RETURN

Tk.in million

(On the basis of increase in land value
and avoidance of flood damage)

Year	FY	Net Benefits		Total	Net Benefit Discounted	
		L.C.	F.C.	Net Benefit	at 12%	
					L.C.	F.C.
0	1991-92	(1,441.45)	(282.45)	(1,723.90)		
1	1992-93	(1,806.21)	(504.07)	(2,310.28)		
2	1993-94	(1,540.84)	(380.88)	(1,921.72)		
3	1994-95	4,384.75	(106.68)	4,278.07		
4	1995-96	4,473.14	(81.60)	4,391.54		
5	1996-97	4,507.22	(96.26)	4,410.96		
6	1997-98	4,661.06	(29.03)	4,632.03		
7	1998-99	4,721.85	(29.03)	4,692.82		
8	1999-2000	4,785.71	(29.03)	4,756.68		
9	2000-2001	4,804.96	(58.06)	4,746.90		
10	2001-2002	3,523.35	(58.06)	3,465.29		
11	2002-2003	3,597.35	(58.06)	3,539.29		
12	2003-2004	3,675.09	(58.06)	3,617.03		
13	2004-2005	3,756.73	(58.06)	3,698.67		
14	2005-2006	3,842.51	(58.06)	3,784.45		
15	2006-2007	3,932.60	(58.06)	3,874.54		
16	2007-2008	4,027.23	(58.06)	3,969.17		
17	2008-2009	4,126.63	(58.06)	4,068.57		
18	2009-2010	4,231.04	(58.06)	4,172.98		
19	2010-2011	4,340.71	(58.06)	4,282.65		
20	2011-2012	4,340.71	(58.06)	4,282.65		
21	2012-2013	4,340.71	(58.06)	4,282.65		
22	2013-2014	4,688.30	(58.06)	4,630.24		
				77,621.28	19,134	(1,262)

Economic Rate of Return (ERR) = 48.02%

Official Exchange Rate US \$ 1 = TK. 36.50

Salvage Value

Land @ 100% = 255.14
Civil Works @ 5% = 92.45

347.59
=====

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DIFPP (DHAKA WEST) - SENSITIVITY ANALYSIS
(Based on 10% increase in project
cost and 10% decrease in benefits)
CALCULATION OF ECONOMIC RATE OF RETURN

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Tk.in million

(On the basis of increase in land value
and avoidance of flood damage)

Year	FY	Net Benefits		Total Net Benefit	Net Benefit Discounted at 12%	
		L.C.	F.C.		L.C.	F.C.
0	1991-92	(1,531.26)	(282.45)	(1,813.71)		
1	1992-93	(1,900.53)	(504.07)	(2,404.60)		
2	1993-94	(1,639.92)	(380.88)	(2,020.80)		
3	1994-95	3,930.41	(106.68)	3,823.73		
4	1995-96	4,013.55	(81.60)	3,931.95		
5	1996-97	4,042.12	(96.26)	3,945.86		
6	1997-98	4,190.17	(29.03)	4,161.14		
7	1998-99	4,244.88	(29.03)	4,215.85		
8	1999-2000	4,302.36	(29.03)	4,273.33		
9	2000-2001	4,314.90	(58.06)	4,256.84		
10	2001-2002	3,161.45	(58.06)	3,103.39		
11	2002-2003	3,228.05	(58.06)	3,169.99		
12	2003-2004	3,298.02	(58.06)	3,239.96		
13	2004-2005	3,371.49	(58.06)	3,313.43		
14	2005-2006	3,448.70	(58.06)	3,390.64		
15	2006-2007	3,529.78	(58.06)	3,471.72		
16	2007-2008	3,614.94	(58.06)	3,556.88		
17	2008-2009	3,704.40	(58.06)	3,646.34		
18	2009-2010	3,798.37	(58.06)	3,740.31		
19	2010-2011	3,897.08	(58.06)	3,839.02		
20	2011-2012	3,897.08	(58.06)	3,839.02		
21	2012-2013	3,897.08	(58.06)	3,839.02		
22	2013-2014	4,244.67	(58.06)	4,186.61		
				68,705.92	16,562	(1,262)

Economic Rate of Return (ERR) = 42.79%

Official Exchange Rate US \$ 1 = TK. 36.50

Salvage Value

Land @ 100% = 255.14
Civil Works @ 5% = 92.45

347.59
=====

DIFPP (DHAKA WEST) - SENSITIVITY ANALYSIS
 (Based on 10% increase in project cost,
 10% decrease in benefits and delay in
 realization of benefits by one year)
 CALCULATION OF ECONOMIC RATE OF RETURN

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Tk. in million

(On the basis of increase in land value
 and avoidance of flood damage)

Year	FY	Net Benefits		Total	Net Benefit Discounted	
		L.C.	F.C.	Net Benefit	L.C.	F.C.
0	1991-92	(1,531.26)	(282.45)	(1,813.71)		
1	1992-93	(1,900.53)	(504.07)	(2,404.60)		
2	1993-94	(1,639.92)	(380.88)	(2,020.80)		
3	1994-95	(1,095.38)	(106.68)	(1,202.06)		
4	1995-96	4,013.55	(81.60)	3,931.95		
5	1996-97	4,042.12	(96.26)	3,945.86		
6	1997-98	4,190.17	(29.03)	4,161.14		
7	1998-99	4,244.88	(29.03)	4,215.85		
8	1999-2000	4,302.36	(29.03)	4,273.33		
9	2000-2001	4,314.90	(58.06)	4,256.84		
10	2001-2002	3,161.45	(58.06)	3,103.39		
11	2002-2003	3,228.05	(58.06)	3,169.99		
12	2003-2004	3,298.02	(58.06)	3,239.96		
13	2004-2005	3,371.49	(58.06)	3,313.43		
14	2005-2006	3,448.70	(58.06)	3,390.64		
15	2006-2007	3,529.78	(58.06)	3,471.72		
16	2007-2008	3,614.94	(58.06)	3,556.88		
17	2008-2009	3,704.40	(58.06)	3,646.34		
18	2009-2010	3,798.37	(58.06)	3,740.31		
19	2010-2011	3,897.08	(58.06)	3,839.02		
20	2011-2012	3,897.08	(58.06)	3,839.02		
21	2012-2013	3,897.08	(58.06)	3,839.02		
22	2013-2014	4,244.67	(58.06)	4,186.61		
				63,680.13	13,368	(1,262)

Economic Rate of Return (ERR) = 31.97%

Official Exchange Rate US \$ 1 = TK. 36.50

Salvage Value

Land @ 100% = 255.14
 Civil Works @ 5% = 92.45

 347.59
 =====

IFPP : PART - C : SLUM IMPROVEMENT

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CULATION OF ECONOMIC RATE OF RETURN

Tk. in million

Year	Net Benefits		Total Net Benefit	Net Benefit Discounted at 12%	
	L.C.	F.C.		L.C.	F.C.
0	(2.69)	(1.21)	(3.90)		
1	(8.28)	(3.20)	(11.48)		
2	(10.30)	(4.00)	(14.30)		
3	(6.30)	(3.46)	(9.76)		
4	(2.77)	(3.32)	(6.09)		
5	(2.10)	(4.02)	(6.12)		
6	7.76	(0.38)	7.38		
7	8.14	(0.38)	7.76		
8	8.62	(0.38)	8.24		
9	8.62	(0.38)	8.24		
10	8.62	(0.38)	8.24		
11	8.62	(0.38)	8.24		
12	8.62	(0.38)	8.24		
13	8.62	(0.38)	8.24		
14	8.62	(0.38)	8.24		
15	8.62	(0.38)	8.24		
16	8.62	(0.38)	8.24		
17	8.62	(0.38)	8.24		
18	8.62	(0.38)	8.24		
19	8.62	(0.38)	8.24		
20	8.62	(0.38)	8.24		
21	8.62	(0.38)	8.24		
22	8.62	(0.38)	8.24		
			87.09	7.54	(13.97)

Rate of Return (ERR) = 9.69%

Exchange Rate US \$ 1 = TK. 36.50

alue

@ 100% = 0.00

@ 5% = 0.00

0.00

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DIFPP:PART-C :ENVIRONMENTAL IMPROVEMENT-SOLID WASTE

FINANCIAL INTERNAL RATE OF RETURN

1991 CONSTANT PRICES - INCREMENTAL VALUES

Tk. in million

Year	Capital cost	Incremental O & M	Recurring O & M	Total cost	Benefits	Net Benefit
0	5.83	0	0.00	5.83	0.00	(5.83)
1	50.05	2.22	0.00	52.27	7.68	(44.59)
2	44.99	9.72	0.00	54.71	15.38	(39.33)
3	48.37	16.27	0.00	64.64	35.25	(29.39)
4	9.62	21.56	0.00	31.18	43.39	12.21
5	9.32	21.63	0.00	30.95	51.51	20.56
6	0	0	23.55	23.55	59.63	36.08
7	0	0	23.55	23.55	67.77	44.22
8	0	0	23.55	23.55	77.09	53.54
9	0	0	23.55	23.55	81.61	58.06
10	0	0	23.55	23.55	86.10	62.55
11	0	0	23.55	23.55	89.40	65.85

233.93

Financial Internal rate of Return (FIRR) =

18.58%

DIFPP:PART-C :ENVIRONMENTAL IMPROVEMENT-SOLID WASTE

SENSITIVITY ANALYSIS
(Based on 10% decrease in Benefits)

FINANCIAL INTERNAL RATE OF RETURN

Tk. in million

1991 CONSTANT PRICES - INCREMENTAL VALUES

Year	Capital cost	Incremental O & M	Recurring O & M	Total cost	Benefits	Net Benefit
0	5.83	0	0.00	5.83	0.00	(5.83)
1	50.05	2.22	0.00	52.27	6.91	(45.36)
2	44.99	9.72	0.00	54.71	13.84	(40.87)
3	48.37	16.27	0.00	64.64	31.73	(32.92)
4	9.62	21.56	0.00	31.18	39.05	7.87
5	9.32	21.63	0.00	30.95	46.36	15.41
6	0	0	23.55	23.55	53.67	30.12
7	0	0	23.55	23.55	60.99	37.44
8	0	0	23.55	23.55	69.38	45.83
9	0	0	23.55	23.55	73.45	49.90
10	0	0	23.55	23.55	77.49	53.94
11	0	0	23.55	23.55	80.46	56.91

172.45

Financial Internal rate of Return (FIRR) = 14.27%

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DIFPP:PART-C :ENVIRONMENTAL IMPROVEMENT-SOLID WASTE

SENSITIVITY ANALYSIS
(Based on 10% increase in Project cost)

FINANCIAL INTERNAL RATE OF RETURN

Tk.in million

1991 CONSTANT PRICES - INCREMENTAL VALUES

Year	Capital cost	Incremental O & M	Recurring O & M	Total cost	Benefits	Net Benefit
0	6.41	0	0.00	6.41	0.00	(6.41)
1	55.06	2.44	0.00	57.50	7.68	(49.82)
2	49.49	10.69	0.00	60.18	15.38	(44.80)
3	53.21	17.90	0.00	71.10	35.25	(35.85)
4	10.58	23.72	0.00	34.30	43.39	9.09
5	10.25	23.79	0.00	34.05	51.51	17.46
6	0.00	0	25.91	25.91	59.63	33.73
7	0.00	0	25.91	25.91	67.77	41.87
8	0.00	0	25.91	25.91	77.09	51.19
9	0.00	0	25.91	25.91	81.61	55.71
10	0.00	0	25.91	25.91	86.10	60.20
11	0.00	0	25.91	25.91	89.40	63.50

195.84

Financial Internal rate of Return (FIRR) =

14.67%



DIFPP:PART-C : ENVIRONMENTAL IMPROVEMENT-SOLID WASTE

SENSITIVITY ANALYSIS

(Based on 10% increase in project
cost and 10% decrease in Benefits)

Tk.in million

FINANCIAL INTERNAL RATE OF RETURN

1991 CONSTANT PRICES - INCREMENTAL VALUES

Year	Capital cost	Incremental O & M	Recurring O & M	Total cost	Benefits	Net Benefit
0	6.41	0	0.00	6.41	0.00	(6.41)
1	55.06	2.44	0.00	57.50	6.91	(50.59)
2	49.49	10.69	0.00	60.18	13.84	(46.34)
3	53.21	17.90	0.00	71.10	31.73	(39.38)
4	10.58	23.72	0.00	34.30	39.05	4.75
5	10.25	23.79	0.00	34.05	46.36	12.31
6	0	0	25.91	25.91	53.67	27.76
7	0	0	25.91	25.91	60.99	35.09
8	0	0	25.91	25.91	69.38	43.48
9	0	0	25.91	25.91	73.45	47.54
10	0	0	25.91	25.91	77.49	51.59
11	0	0	25.91	25.91	80.46	54.56
						134.36

Financial Internal rate of Return (FIRR) =

10.52%

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DIFPP:PART-C :ENVIRONMENTAL IMPROVEMENT-SOLID WASTE

SENSITIVITY ANALYSIS

(Based on delay in realization of benefits by one year)

Tk.in million

FINANCIAL INTERNAL RATE OF RETURN

1991 CONSTANT PRICES - INCREMENTAL VALUES

Year	Capital cost	Incremental O & M	Recurring O & M	Total cost	Benefits	Net Benefit
0	5.83	0	0.00	5.83	0.00	(5.83)
1	50.05	2.22	0.00	52.27	0.00	(44.59)
2	44.99	9.72	0.00	54.71	7.68	(39.33)
3	48.37	16.27	0.00	64.64	15.38	(29.39)
4	9.62	21.56	0.00	31.18	35.25	12.21
5	9.32	21.63	0.00	30.95	43.39	20.56
6	0	0	23.55	23.55	51.51	36.08
7	0	0	23.55	23.55	59.63	44.22
8	0	0	23.55	23.55	67.77	53.54
9	0	0	23.55	23.55	77.09	58.06
10	0	0	23.55	23.55	81.61	62.55
11	0	0	23.55	23.55	86.10	(23.55)
						144.53

Financial Internal rate of Return (FIRR) =

15.04%

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DIFPP : PART - C : ENVIRONMENTAL IMPROVEMENT-SOLID WASTE

SENSITIVITY ANALYSIS

(Based on 10% increase in project cost, 10% decrease in benefits and delay in realization of benefits by one year)

Tk.in million

FINANCIAL INTERNAL RATE OF RETURN

1991 CONSTANT PRICES - INCREMENTAL VALUES

Year	Capital cost	Incremental O & M	Recurring O & M	Total cost	Benefits	Net Benefit
0	6.41	0	0.00	6.41	0.00	(6.41)
1	55.06	2.44	0.00	57.50	0.00	(57.50)
2	49.49	10.69	0.00	60.18	6.91	(53.27)
3	53.21	17.90	0.00	71.10	13.84	(57.26)
4	10.58	23.72	0.00	34.30	31.73	(2.57)
5	10.25	23.79	0.00	34.05	39.05	5.01
6	0	0	25.91	25.91	46.36	20.45
7	0	0	25.91	25.91	53.67	27.76
8	0	0	25.91	25.91	60.99	35.09
9	0	0	25.91	25.91	69.38	43.48
10	0	0	25.91	25.91	73.45	47.54
11	0	0	25.91	25.91	77.49	51.59

53.90

Financial Internal rate of Return (FIRR) = 3.92%

DIFPP:PART-C : SANITATION, WATER SUPPLY AND DRAINAGE

FINANCIAL INTERNAL RATE OF RETURN

Tk. in million

1991 CONSTANT PRICES

Year	Capital cost	Incremental O & M	Recurring Cost	Total cost	Benefits	Net Benefit
0	30.38	0	0.00	30.38	0.00	(30.38)
1	69.98	0.48	0.00	70.46	1.27	(69.19)
2	29.38	3.85	0.00	33.23	14.91	(18.32)
3	16.29	4.75	0.00	21.04	29.03	7.99
4	17.53	5.08	0.00	22.61	42.51	19.90
5	17.46	5.4	0.00	22.86	56.02	33.16
6	0	0	8.77	8.77	68.68	59.91
7	0	0	8.77	8.77	68.21	59.44
8	0	0	8.77	8.77	68.21	59.44
9	0	0	8.77	8.77	68.21	59.44
10	0	0	8.77	8.77	67.94	59.17
11	0	0	8.77	8.77	67.94	59.17
12	0	0	8.77	8.77	67.94	59.17
13	0	0	8.77	8.77	67.94	59.17
14	0	0	8.77	8.77	67.94	59.17
15	0	0	8.77	8.77	67.94	59.17
16	0	0	8.77	8.77	67.94	59.17
17	0	0	8.77	8.77	67.94	59.17
18	0	0	8.77	8.77	67.94	59.17
19	0	0	8.77	8.77	67.94	59.17
20	0	0	8.77	8.77	67.94	59.17
				332.13	1,164.39	832.26

Financial Internal rate of Return (FIRR) =

25.14%

DIFPP:PART-C : SANITATION, WATER SUPPLY AND DRAINAGE

SENSITIVITY ANALYSIS
(Based on 10% decrease in Benefits)

Tk.in million

FINANCIAL INTERNAL RATE OF RETURN

1991 CONSTANT PRICES

Year	Capital cost	Incremental O & M	Recurring Cost	Total cost	Benefits	Net Benefit
0	30.38	0	0.00	30.38	0.00	(30.38)
1	69.98	0.48	0.00	70.46	1.14	(69.32)
2	29.38	3.85	0.00	33.23	13.42	(19.81)
3	16.29	4.75	0.00	21.04	26.13	5.09
4	17.53	5.08	0.00	22.61	38.26	15.65
5	17.46	5.4	0.00	22.86	50.42	27.56
6	0	0	8.77	8.77	61.81	53.04
7	0	0	8.77	8.77	61.39	52.62
8	0	0	8.77	8.77	61.39	52.62
9	0	0	8.77	8.77	61.39	52.62
10	0	0	8.77	8.77	61.15	52.38
11	0	0	8.77	8.77	61.15	52.38
12	0	0	8.77	8.77	61.15	52.38
13	0	0	8.77	8.77	61.15	52.38
14	0	0	8.77	8.77	61.15	52.38
15	0	0	8.77	8.77	61.15	52.38
16	0	0	8.77	8.77	61.15	52.38
17	0	0	8.77	8.77	61.15	52.38
18	0	0	8.77	8.77	61.15	52.38
19	0	0	8.77	8.77	61.15	52.38
20	0	0	8.77	8.77	61.15	52.38
				332.13	1,047.95	715.82

Financial Internal rate of Return (FIRR) =

22.54%

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DIFPP:PART-C : SANITATION, WATER SUPPLY AND DRAINAGE

SENSITIVITY ANALYSIS

(Based on 10% increase in Project Cost)

Tk. in million

FINANCIAL INTERNAL RATE OF RETURN

1991 CONSTANT PRICES

Year	Capital cost	Incremental O & M	Recurring Cost	Total cost	Benefits	Net Benefit
0	33.42	0	0.00	33.42	0.00	(33.42)
1	76.98	0.53	0.00	77.51	1.27	(76.24)
2	32.32	4.24	0.00	36.55	14.91	(21.64)
3	17.92	5.23	0.00	23.14	29.03	5.89
4	19.28	5.59	0.00	24.87	42.51	17.64
5	19.21	5.94	0.00	25.15	56.02	30.87
6	0	0	9.65	9.65	68.68	59.03
7	0	0	9.65	9.65	68.21	58.56
8	0	0	9.65	9.65	68.21	58.56
9	0	0	9.65	9.65	68.21	58.56
10	0	0	9.65	9.65	67.94	58.29
11	0	0	9.65	9.65	67.94	58.29
12	0	0	9.65	9.65	67.94	58.29
13	0	0	9.65	9.65	67.94	58.29
14	0	0	9.65	9.65	67.94	58.29
15	0	0	9.65	9.65	67.94	58.29
16	0	0	9.65	9.65	67.94	58.29
17	0	0	9.65	9.65	67.94	58.29
18	0	0	9.65	9.65	67.94	58.29
19	0	0	9.65	9.65	67.94	58.29
20	0	0	9.65	9.65	67.94	58.29
				365.34	1,164.39	799.05

Financial Internal rate of Return (FIRR) =

22.78%

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DIFPP:PART-C : SANITATION, WATER SUPPLY AND DRAINAGE

SENSITIVITY ANALYSIS
(Based on 10% increase in Project
cost and 10% decrease in Benefits)
FINANCIAL INTERNAL RATE OF RETURN

Tk. in million

1991 CONSTANT PRICES

Year	Capital cost	Incremental O & M	Recurring Cost	Total cost	Benefits	Net Benefit
0	33.42	0	0.00	33.42	0.00	(33.42)
1	76.98	0.53	0.00	77.51	1.14	(76.36)
2	32.32	4.24	0.00	36.55	13.42	(23.13)
3	17.92	5.23	0.00	23.14	26.13	2.98
4	19.28	5.59	0.00	24.87	38.26	13.39
5	19.21	5.94	0.00	25.15	50.42	25.27
6	0	0	9.65	9.65	61.81	52.17
7	0	0	9.65	9.65	61.39	51.74
8	0	0	9.65	9.65	61.39	51.74
9	0	0	9.65	9.65	61.39	51.74
10	0	0	9.65	9.65	61.15	51.50
11	0	0	9.65	9.65	61.15	51.50
12	0	0	9.65	9.65	61.15	51.50
13	0	0	9.65	9.65	61.15	51.50
14	0	0	9.65	9.65	61.15	51.50
15	0	0	9.65	9.65	61.15	51.50
16	0	0	9.65	9.65	61.15	51.50
17	0	0	9.65	9.65	61.15	51.50
18	0	0	9.65	9.65	61.15	51.50
19	0	0	9.65	9.65	61.15	51.50
20	0	0	9.65	9.65	61.15	51.50
				365.34	1,047.95	682.61

Financial Internal rate of Return (FIRR) =

20.30%

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DIFPP:PART-C : SANITATION, WATER SUPPLY AND DRAINAGE

SENSITIVITY ANALYSIS

(Based on delay in realization of benefits by one year)

Tk.in million

FINANCIAL INTERNAL RATE OF RETURN

1991 CONSTANT PRICES

Year	Capital cost	Incremental O & M	Recurring Cost	Total cost	Benefits	Net Benefit
0	30.38	0	0.00	30.38	0.00	(30.38)
1	69.98	0.48	0.00	70.46	0.00	(70.46)
2	29.38	3.85	0.00	33.23	1.27	(31.96)
3	16.29	4.75	0.00	21.04	14.91	(6.13)
4	17.53	5.08	0.00	22.61	29.03	6.42
5	17.46	5.4	0.00	22.86	42.51	19.65
6	0	0	8.77	8.77	56.02	47.25
7	0	0	8.77	8.77	68.68	59.91
8	0	0	8.77	8.77	68.21	59.44
9	0	0	8.77	8.77	68.21	59.44
10	0	0	8.77	8.77	68.21	59.44
11	0	0	8.77	8.77	67.94	59.17
12	0	0	8.77	8.77	67.94	59.17
13	0	0	8.77	8.77	67.94	59.17
14	0	0	8.77	8.77	67.94	59.17
15	0	0	8.77	8.77	67.94	59.17
16	0	0	8.77	8.77	67.94	59.17
17	0	0	8.77	8.77	67.94	59.17
18	0	0	8.77	8.77	67.94	59.17
19	0	0	8.77	8.77	67.94	59.17
20	0	0	8.77	8.77	67.94	59.17
				332.13	1,096.45	764.32

Financial Internal rate of Return (FIRR) =

20.44%

DIFPP:PART-C : SANITATION, WATER SUPPLY AND DRAINAGE

SENSITIVITY ANALYSIS

(Based on 10% increase in Project cost, 10% decrease in benefits and delay in realization of benefits by one year)

Tk. in million

FINANCIAL INTERNAL RATE OF RETURN

1991 CONSTANT PRICES

Year	Capital cost	Incremental O & M	Recurring Cost	Total cost	Benefits	Net Benefit
0	33.42	0	0.00	33.42	0.00	(33.42)
1	76.98	0.53	0.00	77.51	0.00	(77.51)
2	32.32	4.24	0.00	36.55	1.14	(35.41)
3	17.92	5.23	0.00	23.14	13.42	(9.73)
4	19.28	5.59	0.00	24.87	26.13	1.26
5	19.21	5.94	0.00	25.15	38.26	13.11
6	0	0	9.65	9.65	50.42	40.77
7	0	0	9.65	9.65	61.81	52.17
8	0	0	9.65	9.65	61.39	51.74
9	0	0	9.65	9.65	61.39	51.74
10	0	0	9.65	9.65	61.39	51.74
11	0	0	9.65	9.65	61.15	51.50
12	0	0	9.65	9.65	61.15	51.50
13	0	0	9.65	9.65	61.15	51.50
14	0	0	9.65	9.65	61.15	51.50
15	0	0	9.65	9.65	61.15	51.50
16	0	0	9.65	9.65	61.15	51.50
17	0	0	9.65	9.65	61.15	51.50
18	0	0	9.65	9.65	61.15	51.50
19	0	0	9.65	9.65	61.15	51.50
20	0	0	9.65	9.65	61.15	51.50
				365.34	986.81	621.46

Financial Internal rate of Return (FIRR) =

16.64%

RR

Assumptions used for Financial Projection of D.C.C.

1. Funds to be provided to DCC under Part C of the Project will be on lent basis of a mix of 50 percent grant and 50 percent loans. The loan portion will carry interest @12.5 percent p.a. and be repayable over a period of 20 years, including a grace period of 5 years.
2. Recurrent expenditures including minor works increase @6% p.a. over the inflation rate.

World Bank projection as a whole has generally been followed as a basis with certain modification as well as addition of project investment for the purpose of cash flow projection.

3. Actual receipt and payment position has been shown till 1990-91 and thereafter adjustment has been made in the Budget of 1991-92.
4. Property Tax (conservancy charge): The rate of Property Tax will increase horizontally due to extension of city limit and vertically due to increase in rental value as well as increase of 3% of conservancy rate from 3rd year of operation of the project as suggested by the World Bank.
5. Income from Public Toilets, Low cost latrines, Mobile Toilets and Stand Pipes/Tubewells and also Govt. duty realised on water has been considered.
6. Collection of arrear demand is about 50% paid one year late, 10% is paid two year late and then 5% constantly.
7. Collection of current demand has been made in consonance with World Bank Projection.
8. Market rent, other rents will increase substantially on completion of Nagar Bhavan.

DHAKA INTEGRATED FLOOD PROTECTION PROJECT

Appendix - 11

DHAKA CITY CORPORATION (D C C)

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PROJECT CASH FLOW STATEMENT

(Taka in '000)

SOURCES OF FUND	1987-88	1988-89	1989-90	1990-91	Actual Budget 1991-92	1991-92	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98	1998-99	1999-2000	2000-2001
A. REVENUE FROM OWN SOURCES															
1. PROPERTY BASED TAXES & RATES															
i) Taxes	130,778	141,858	217,874	305,742	389,000	307,800	282,495	320,970	375,718	440,048	515,635	604,451	708,808	831,429	975,508
a) Properties (holdings)															
b) Tax on transfer of immovable properties	70,213	78,847	114,362	173,845	201,600	201,600	236,860	278,334	327,042	384,275	451,523	530,540	623,384	732,476	860,659
c) Areal Collection	13,225	12,438	17,917	16,000	25,000	25,000	29,375	34,516	40,556	47,653	55,992	65,791	77,305	90,833	106,729
	47,340	50,573	85,595	115,897	162,400	81,200	16,240	8,120	8,120	8,120	8,120	8,120	8,120	8,120	8,120
ii) Rates	84,787	91,328	141,842	206,958	286,000	222,200	198,880	228,726	272,062	323,916	385,976	460,265	549,214	655,736	783,333
a) Lighting and Fire Rates	30,737	32,753	49,436	74,505	72,000	72,000	84,600	99,405	116,801	137,241	161,258	189,478	222,637	261,599	307,378
b) Conservancy	21,883	23,515	33,738	49,670	86,400	86,400	101,520	122,941	148,881	180,295	218,337	264,407	320,196	387,758	469,575
c) Areal Collection	32,167	35,060	58,668	82,783	127,600	63,800	12,760	6,380	6,380	6,380	6,380	6,380	6,380	6,380	6,380
iii) Other Taxes and Rates	45,327	47,453	53,470	63,010	66,600	66,600	78,255	91,950	108,041	126,948	149,164	175,268	205,939	241,979	284,325
Sub-total	260,892	280,639	413,186	575,710	741,600	596,600	559,630	641,645	755,821	890,912	1,050,775	1,239,983	1,463,961	1,729,144	2,043,166
2. FEES, TOLLS AND FINES															
a) Salami from Markets	254,833	150,826	79,960	50,000	155,097	155,097	182,239	214,131	251,604	295,634	347,370	408,160	479,588	563,516	662,131
b) Rent from Markets	18,012	28,256	41,464	50,000	60,000	60,000	70,500	82,838	97,334	114,368	134,382	157,899	185,531	217,999	256,149
c) Others	27,416	64,728	60,460	54,720	56,800	56,800	66,740	78,420	92,143	108,268	127,215	149,477	175,636	206,372	242,487
Sub-total	300,261	243,810	181,884	154,720	271,897	271,897	319,479	375,388	441,081	518,270	608,967	715,536	840,755	987,887	1,160,767
3. OWN PROPERTY SALES AND RENTALS															
a) Rent from Land, House, Flats & other properties	29,345	28,655	27,881	35,695	307,100	307,100	360,843	423,990	498,188	597,826	717,391	860,869	1,033,043	1,239,652	1,487,582
b) Low cost sanitation (proposed)	0	0	0	0	0	0	1,270	14,910	29,030	42,510	56,020	68,680	68,210	68,210	68,210
c) Hydrants to slum (proposed)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
d) Other Revenue	11,952	9,765	19,368	20,000	30,000	30,000	35,250	41,419	48,667	57,184	67,191	78,949	92,765	108,999	128,074
e) Sale of Property	0	34,963	710	50	0	0	0	0	0	0	0	0	0	0	0
Sub-total	41,297	73,383	47,959	55,745	337,100	337,100	397,363	480,319	575,885	697,520	840,602	1,008,499	1,194,018	1,416,861	1,683,866
4. MISCELLANEOUS REVENUE															
	29,936	49,318	48,285	45,109	42,850	42,850	50,349	59,160	69,513	81,677	95,971	112,766	132,500	155,688	182,933
TOTAL REVENUE OWN SOURCES	632,386	647,150	691,314	831,284	1,392,447	1,248,447	1,326,820	1,556,511	1,842,300	2,188,379	2,592,315	3,076,784	3,631,235	4,289,580	5,070,733

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DHAKA INTEGRATED FLOOD PROTECTION PROJECT

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DHAKA CITY CORPORATION (D C C)

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PROJECT CASH FLOW STATEMENT

(Taka in '000)

SOURCES OF FUND	A C T U A L				Actual Budget 1991-92	E S T I M A T E										B U D				E T	
	1987-88	1988-89	1989-90	1990-91		1991-92	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98	1998-99	1999-2000	2000-2001						
18. CAPITAL INFLOW																					
15. LOAN - OTHERS																					
LOAN - ADB	18,220	48,457	299,824	89,900	32,600	0	0	0	0	0	0	0	0	0	0	0	0	0			
LOAN - IDA	0	0	0	0	0	13,335	43,968	34,200	32,580	22,575	24,131	0	0	0	0	0	0	0			
DCC source	0	0	0	80,100	72,400	88,464	131,065	174,769	193,431	167,909	155,915	152,269	0	0	0	0	0	0			
Sub-total	18,220	48,457	299,824	170,000	105,000	116,619	223,898	246,979	262,220	215,574	206,865	152,269	0	0	0	0	0	0			
6. GRANTS																					
a) Salary Compensation	152	152	500	500	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
b) Octroi Compensation	25,460	24,992	24,835	25,500	50,000	29,963	35,206	41,367	48,606	57,112	67,107	78,851	92,650	108,863	127,914	127,914	127,914	127,914			
c) Development - Existing	2,500	200,000	10,000	26,600	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
d) Development - Proposed	0	0	0	0	0	44,873	99,862	114,233	118,374	82,163	65,324	26,949	4,650	0	0	0	0	0			
e) Other Grants & Compensation	1,370	1,370	22,500	0	500	0	0	0	0	0	0	0	0	0	0	0	0	0			
Sub-total	29,482	226,514	57,835	52,600	50,500	74,835	135,068	155,600	166,980	139,275	132,431	105,800	97,300	108,863	127,914	127,914	127,914	127,914			
TOTAL REVENUE SOURCE	680,086	922,121	1,048,973	1,053,884	1,548,947	1,439,901	1,685,786	1,959,090	2,271,499	2,543,227	2,935,611	3,334,853	3,728,535	4,398,443	5,198,647	5,198,647	5,198,647	5,198,647			
% increase over previous year		35.59%	13.76%	0.47%	46.98%	36.63%	8.83%	16.21%	15.95%	11.96%	15.43%	13.60%	11.81%	17.97%	18.19%	18.19%	18.19%	18.19%			

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DHAKA INTEGRATED FLOOD PROTECTION PROJECT

DHAKA CITY CORPORATION (DCC)

PROJECT CASH FLOW STATEMENT

(Taka in '000)

A P P L I C A T I O N O F F U N D	A C T U A L			E S T I M A T E D										B U D G E T		
	1987-88	1988-89	1989-90	1990-91	Actual Budget	1991-92	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98	1998-99	1999-2000	2000-2001	
A. EXPENDITURE																
1. Expenditure																
a) Salaries and Allowances	154,673	168,823	163,588	196,115	218,948	218,948	257,264	302,285	355,185	417,342	490,377	576,193	677,027	795,507	934,721	
b) Office Expenses	5,644	6,482	7,396	10,500	10,500	10,500	12,338	14,497	17,033	20,014	23,517	27,632	32,468	38,150	44,826	
c) Provision for Services	91,226	121,676	150,724	206,118	270,255	270,255	317,550	373,121	436,417	515,140	605,289	711,215	835,678	981,921	1,153,757	
Sub-total	251,543	296,981	321,708	412,733	499,703	499,703	587,151	689,902	810,635	952,497	1,119,183	1,315,041	1,545,173	1,815,578	2,133,304	
2. ADVANCE, LOAN & OTHERS	26,989	18,798	6,641	7,500	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	
3. REFUND OF SALARI	19,533	45,727	62,586	20,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	
4. DEBT CHARGES (FINANCIAL EXPENSES)																
a) Debt Charges Project	0	0	0	0	0	0	12,725	34,604	60,725	88,976	135,293	154,326	154,326	154,326	154,326	
b) Loan Repayment	12,145	0	12,410	144,400	222,500	222,500	109,100	206,200	0	0	0	0	0	0	0	
Sub-total :	12,145	0	12,410	144,400	222,500	222,500	121,825	186,804	266,925	88,976	135,293	154,326	154,326	154,326	154,326	
5. DEVELOPMENT & MAINTENANCE (EXISTING)	406,011	613,725	645,742	476,950	815,000	560,416	658,489	773,725	909,127	1,068,224	1,255,163	1,474,816	1,732,909	2,036,168	2,392,498	
6. DEVELOPMENT (PROJECT)	0	0	0	0	41,490	136,800	136,800	106,410	101,370	70,240	75,080	0	0	0	0	
7. OTHER	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
TOTAL EXPENDITURE	716,221	975,231	1,049,087	1,061,583	1,595,693	1,335,744	1,586,244	1,855,962	2,197,108	2,220,747	2,601,719	2,961,183	3,449,408	4,023,072	4,697,128	
± increase over previous year		36.16%	7.57%	1.19%	50.31%	25.83%	-0.47%	16.73%	3.95%	15.24%	17.16%	13.82%	16.49%	16.63%	16.75%	
NET CASH FLOW	(36,133)	(53,110)	(114)	(7,699)	(46,746)	104,157	97,542	105,128	344,391	322,480	333,892	373,670	279,127	375,371	501,519	
OPENING BALANCE	0	(36,133)	(89,243)	(89,357)	(97,056)	(143,802)	(39,645)	57,896	163,024	507,416	829,896	1,163,788	1,537,458	1,816,585	2,191,955	
CLOSING BALANCE	(36,133)	(89,243)	(89,357)	(97,056)	(143,802)	(39,645)	57,896	163,024	507,416	829,896	1,163,788	1,537,458	1,816,585	2,191,955	2,693,474	
Ratios																
Debits Service/Own Sources	1.92%	0.00%	1.80%	17.37%	15.97%	9.76%	14.23%	17.15%	4.83%	5.15%	5.21%	5.02%	4.25%	3.60%	3.04%	
Debits Service/Total Revenues	1.79%	0.00%	1.18%	13.70%	14.36%	8.46%	11.20%	13.62%	3.92%	4.33%	4.61%	4.63%	4.14%	3.51%	2.97%	
Local Revenue/Total Revenue	92.99%	70.18%	65.90%	78.88%	89.96%	86.70%	78.71%	79.45%	81.11%	86.05%	88.44%	92.26%	97.39%	97.52%	97.54%	
Property Based Taxes/Own Revenue	41.26%	43.37%	59.77%	65.26%	53.22%	47.79%	42.18%	41.22%	41.03%	40.71%	40.47%	40.30%	40.32%	40.31%	40.29%	

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TECHNICAL ASSISTANCE FOR FORMULATION OF
LAND DEVELOPMENT CONTROLS AND PROCEDURES
FOR DHAKA CITY

A. Outline Terms of Reference

1. The consultants primary responsibility will be to assist the Government of Bangladesh in developing appropriate land development requirements, policies, standards, regulations and control procedures in order: (i) to facilitate the orderly urban growth of Dhaka City, and (ii) to develop improved mechanisms for meeting the needs for upgrading public infrastructure and services occasioned by urban growth. In addition, the proposed technical assistance will assist the Government in developing new policies and strategies for optimum utilization of vacant or underutilized Government lands in Dhaka City.

2. Four international experts and five local experts will be engaged to provide the necessary support and advisory services, as outlined below.

A1. Municipal Manager/Land Development Advisor (International)

As the Team Leader of the consultants team, the Municipal Manager/Land Development Advisor will be responsible for the overall direction and co-ordination of the teams activities, for maintaining liaison with the Government agencies and with other concerned study teams, and for preparing periodic progress reports and interim discussion papers. Specific responsibilities include:

- (i) review existing land development related laws, regulation, procedures and practices in Dhaka City;
- (ii) assess the performance and adequacy of administration, application and enforcement of existing land development regulations;
- (iii) assist the Project Director in overall evaluation of the problems and needs in land development administration in Dhaka City;
- (iv) develop and recommend improved land development standards, building regulations and controls;
- (v) develop and recommend new land development/building approval procedures for developments in Dhaka City;
- (vi) recommend appropriate policies for modifying existing land development requirements, with particular consideration to the practicality, affordability and impacts of introducing new regulations for land developers to provide onsite and/or offsite public infrastructure and services such as roads, drains, drainage retention ponds, water supply systems, schools, health centers, parks, etc.;

- (vii) prepare draft legislation for any new development policies and fees recommended.

A2. Municipal Finance Expert (International)

- (i) review existing land development policies and land development taxation methods applied in Dhaka City;
- (ii) analyze the development requirements and the amount, sources, recipients and utilization of existing land taxes;
- (iii) analyze the impact of increased offsite service needs and costs to the public sector resulting from new land development and urban densification;
- (iv) recommend appropriate policies for modifying existing land development taxation, with particular consideration of the practicality, affordability and impacts of introducing new land development fees to assist in providing public infrastructure and services for development within Dhaka City;
- (v) assist in preparing draft legislation for any new development fees recommended.

A3. Urban Planning Advisor (International)

- (i) assist in determining the existing Government land ownership, uses and future projected uses in Dhaka City;
- (ii) review the existing land ownership, uses and projected needs;
- (iii) propose appropriate policies and strategies for rationalizing the use of vacant or underutilized Government lands;
- (iv) recommend alternative uses for vacant or underutilized Government lands, with particular consideration to potentials for disinvesting the lands, converting the lands for public use, converting the lands for use for low income residential use, and/or transferring/leasing/selling to squatters/settlers to provide long term security of tenure;
- (v) assist in developing and recommending improved land development standards, building regulations and controls;
- (vi) assist in developing and recommending new land development/building approval procedures for developments in Dhaka City;
- (vii) assist in analyzing the impact of increased offsite service needs and costs to the public sector resulting from new land development and urban densification;

(viii) assist in developing appropriate policies for modifying existing land development requirements, with particular consideration to the practicality, affordability and impacts of introducing new regulations for land developers to provide onsite and/or offsite public infrastructure and services such as roads, drains, drainage retention ponds, water supply systems, schools, health centers, parks, etc.;

(ix) assist in preparing draft legislation for any new development policies and standards recommended.

A4. Municipal Engineering Advisor (International)

(i) review existing land development standards, regulations and procedures within Dhaka City;

(ii) assist in developing and recommending improved land development standards, building regulations and controls, with particular consideration to introducing standards/guidelines for provision of adequate drainage facilities (including consideration of on-site retention where appropriate), sanitary disposal facilities for waste discharge, and minimum construction levels for roads, lots and buildings;

(iii) assist in developing and recommending new land development/building approval procedures for developments in Dhaka City;

(iv) assist in analyzing the impact of increased offsite service needs and costs to the public sector resulting from new land development and urban densification;

(v) assist in developing appropriate policies for modifying existing land development requirements, with particular consideration to: (a) the practicality, affordability and impacts of introducing new regulations for land developers to provide onsite and/or offsite public infrastructure and services such as roads, drains, drainage retention ponds, water supply systems, schools, health centers, parks, etc., and (b) to coordinating new road locations into an overall integrated plan for using roadways to compartmentalize Dhaka city for additional long term flood security;

(vi) assist in preparing draft legislation for any new development policies and standards recommended.

B1. Land Development Specialist (Domestic)

(i) As the Deputy Team Leader, assist the Team Leader in carrying out the above Terms of Reference with specific focus on identifying the local land development procedures, practices and constraints, and developing appropriate standards and procedures.

B2. Municipal Finance Management Consultant (Domestic)

- (i) Assist the Municipal Finance Expert in carrying out the above Terms of Reference, particularly in regards to the practices and procedures used in valuation of land development projects for assessing taxation levels, and in regards to the present practices used in pricing developed land for resale.

B3. Urban Planning Specialist (Domestic)

B4. Municipal Engineering Specialist (Domestic)

- (i) Assist the respective Advisors in carrying out the above Terms of Reference, particularly in regards to local practices and appropriate standards.

B5. Municipal Law Specialist (Domestic)

- (i) Assist the Team Leader and Advisors in developing draft legislation for any new development standards, policies, and/or fees recommended.

B. Staff Requirements

Position		Man-Months
<u>I. Professional Staff (to be engaged under the TA)</u>		
<u>A. International</u>		
1)	Municipal Manager/Land Use Specialist	6
2)	Municipal Finance Expert	4
3)	Urban Planning Advisor	3
4)	Municipal Engineering Advisor	3
	Sub-total, International	16
<u>B. Domestic</u>		
1)	Land Development Specialist	6
2)	Municipal Finance Management Consultant	6
3)	Urban Planning Specialist	6
4)	Municipal Engineering Specialist	6
5)	Municipal Law Specialist	4
	Sub-total, Domestic	28
<u>II. Counterpart Staff (to be provided by the Government)</u>		
a)	Project Director (Part Time)	6
b)	Municipal Administration Specialist	6
c)	Municipal Engineer	6
d)	Urban Planner	6
e)	Municipal Finance Expert	6
f)	Municipal Law Expert (Part Time)	6
g)	Electrical Engineer (Part Time)	6
h)	Property Valuation Expert (Part Time)	6
i)	Clerk/Secretary/Typist	18
	Sub-Total, Counterpart	66

C. Estimated Cost

Description		\$ '000 Equivalent
I. <u>Bank Financing</u>		
A. <u>Foreign Currency Cost</u>		
a)	Remuneration & Per Diem of International Consultants a/	296
b)	International Travel b/	25
c)	Communications and Reports	9
d)	Government Observer Participation	2
e)	Contingencies	50
	Sub-total, (A)	382
B. <u>Local Cost</u>		
a)	Remuneration of Local Consultants a/	98
b)	Technical and Support Staff c/	12
c)	Domestic Transportation	20
d)	Field Office Rent and Facilities	20
e)	Communications & Report/Document Preparation	10
f)	Land Use Surveys	5
g)	Contingencies	25
	Sub-total, (B)	190
II. <u>Govrnment Financing</u>		
a)	Remuneration of Counterpart Staff	9
b)	Operation and Maintenance of Vehicles	10
c)	Office Accomodation, Supplies and Equipment	5
	Total Government Financing	24
	Total, (I + II)	596

a/ Based on 16 man-months International (at \$15,000 per mm remuneration plus \$112 per day per diem) and 28 mm Domestic (at \$3,500 per mm).

b/ Five return trips at \$5,000 per trip.

c/ 24 man-months at \$500 per month.

