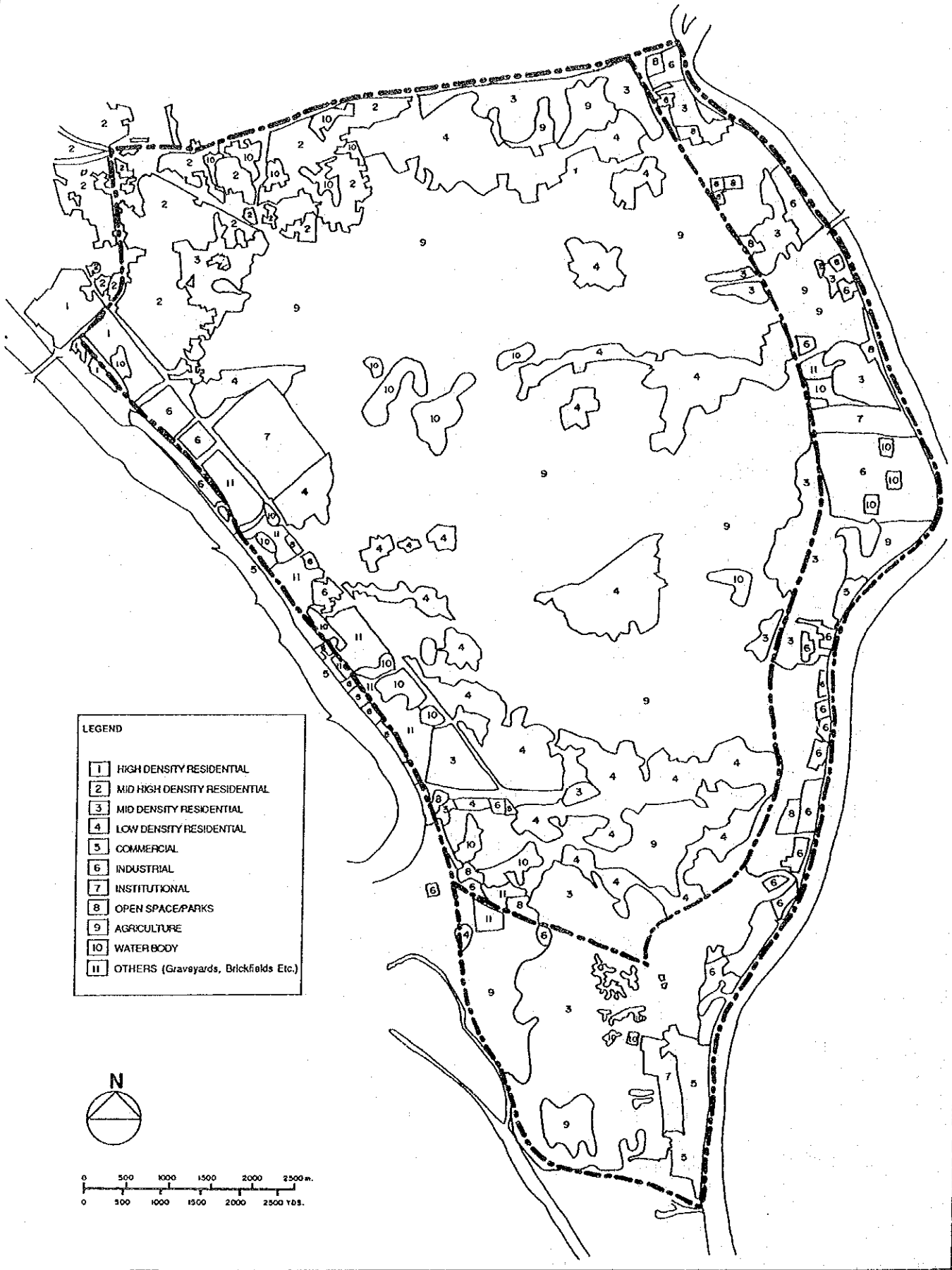

FIG. A.13 EXISTING LAND USE : DND/NARAYANGANJ WEST

GREATER DHAKA PROTECTION PROJECT (STUDY IN DHAKA METROPOLITAN AREA) OF BANGLADESH FLOOD ACTION PLAN NO.8A IN THE PEOPLE'S REPUBLIC OF BANGLADESH

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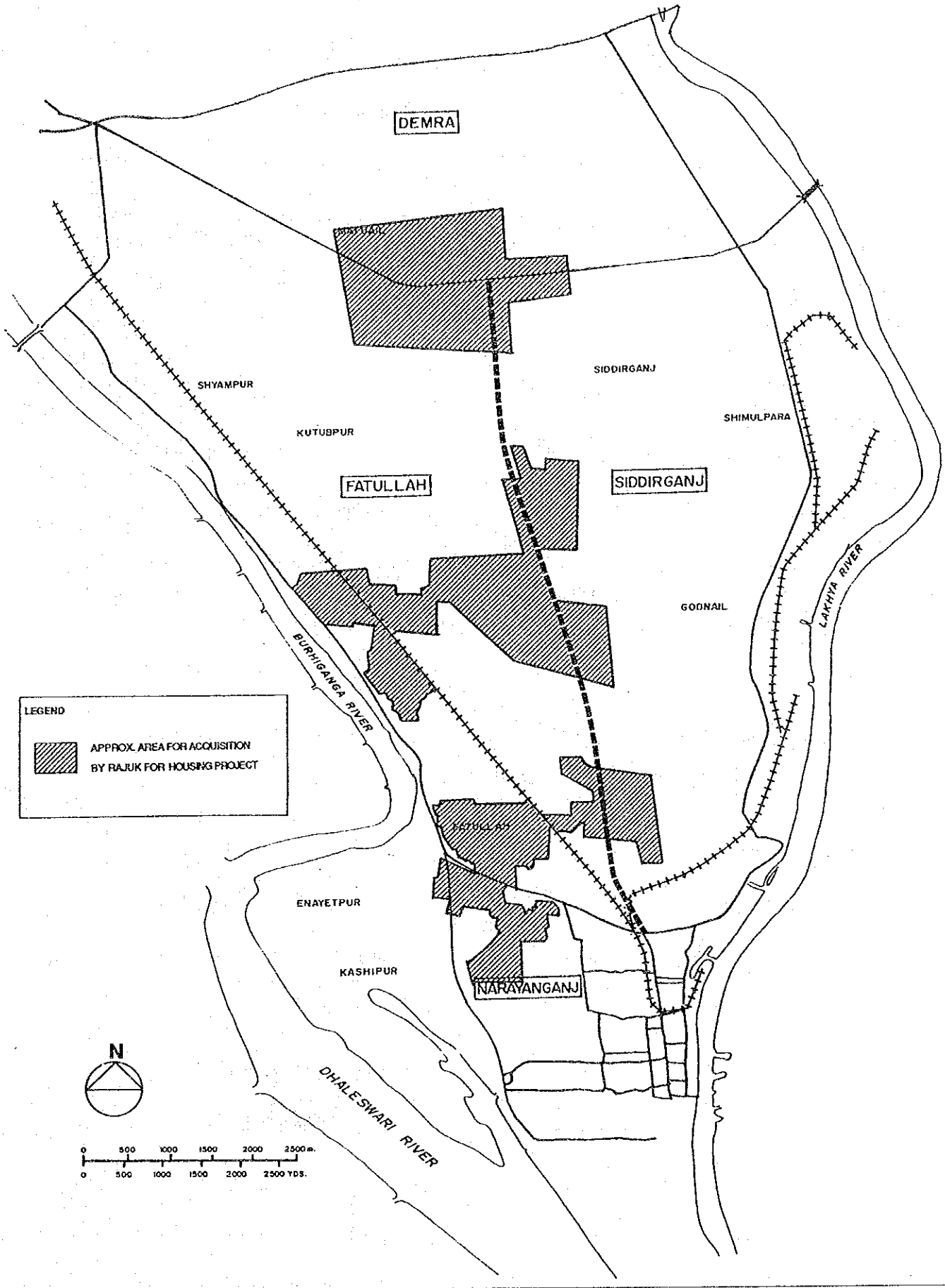

FIG. A.14 DEVELOPMENT COMMITMENTS : DND/NARAYANGANJ WEST

GREATER DHAKA PROTECTION PROJECT (STUDY IN DHAKA METROPOLITAN AREA) OF BANGLADESH FLOOD ACTION PLAN NO.8A IN THE PEOPLE'S REPUBLIC OF BANGLADESH

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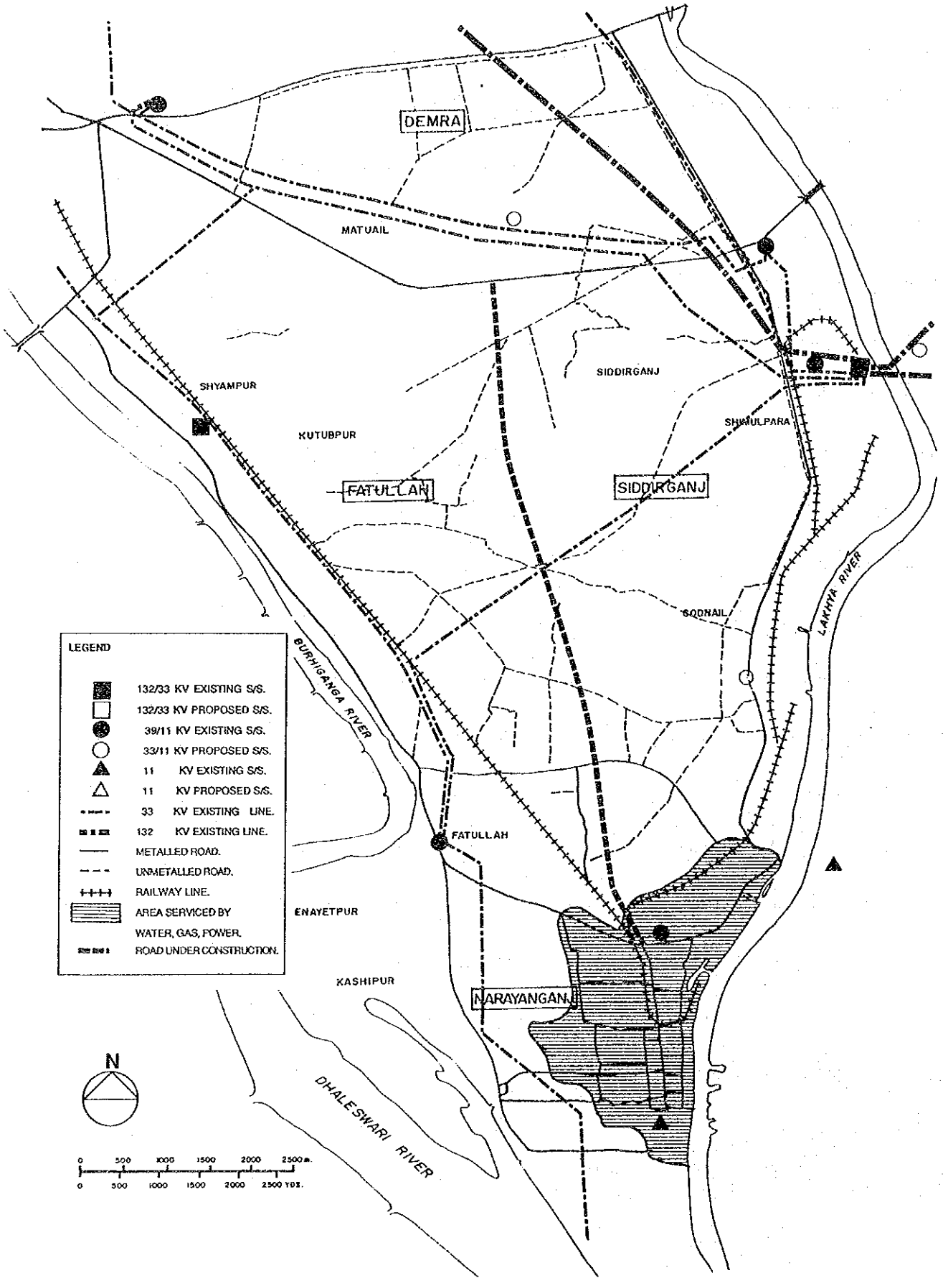

FIG. A.15 INFRASTRUCTURE : DND/NARAYANGANJ WEST

GREATER DHAKA PROTECTION PROJECT (STUDY IN DHAKA METROPOLITAN AREA) OF BANGLADESH FLOOD ACTION PLAN NO.8A IN THE PEOPLE'S REPUBLIC OF BANGLADESH

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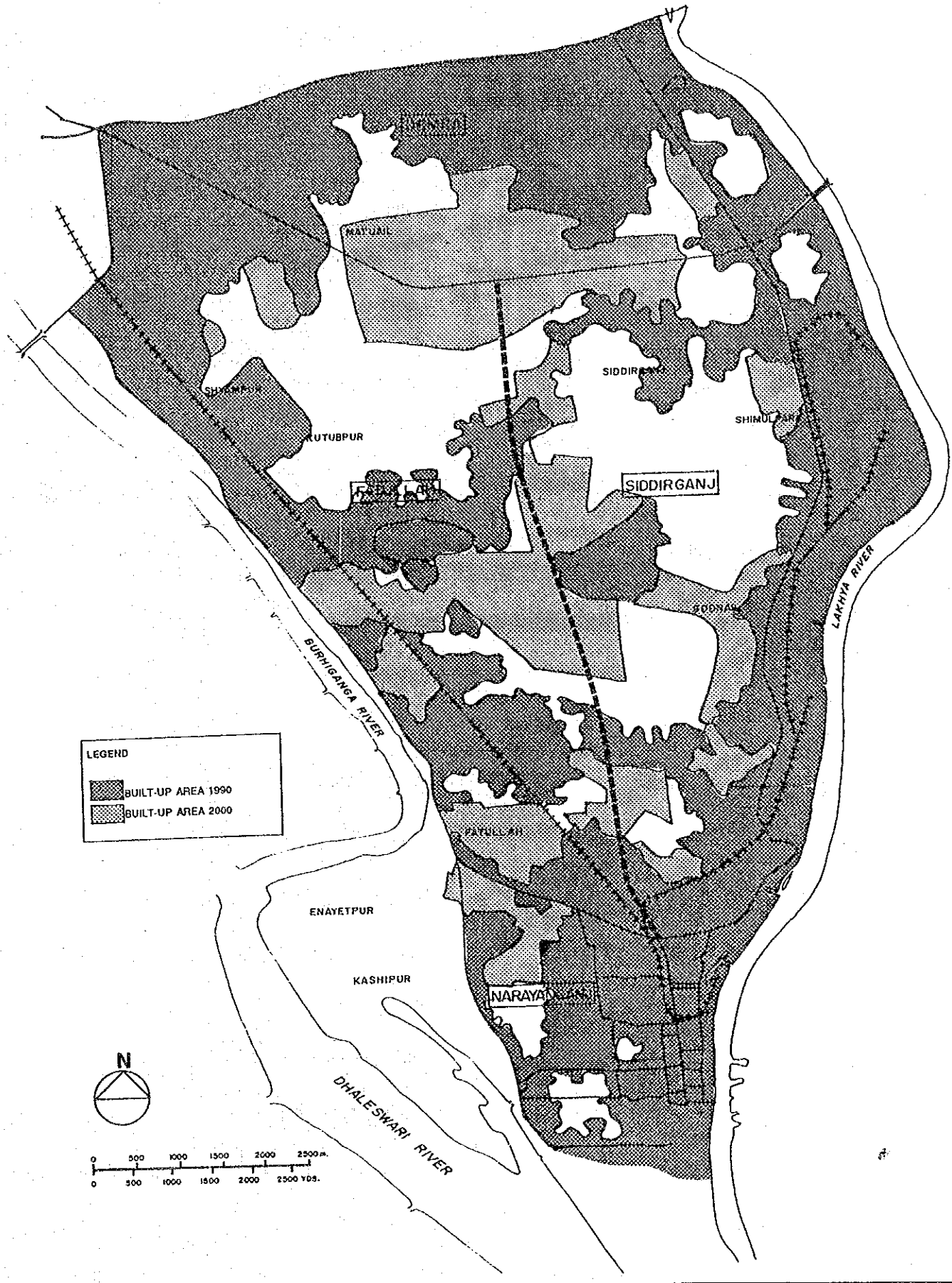

FIG. A.16 BUILT-UP AREA 1990/2000 : DND/NARAYANGANJ WEST

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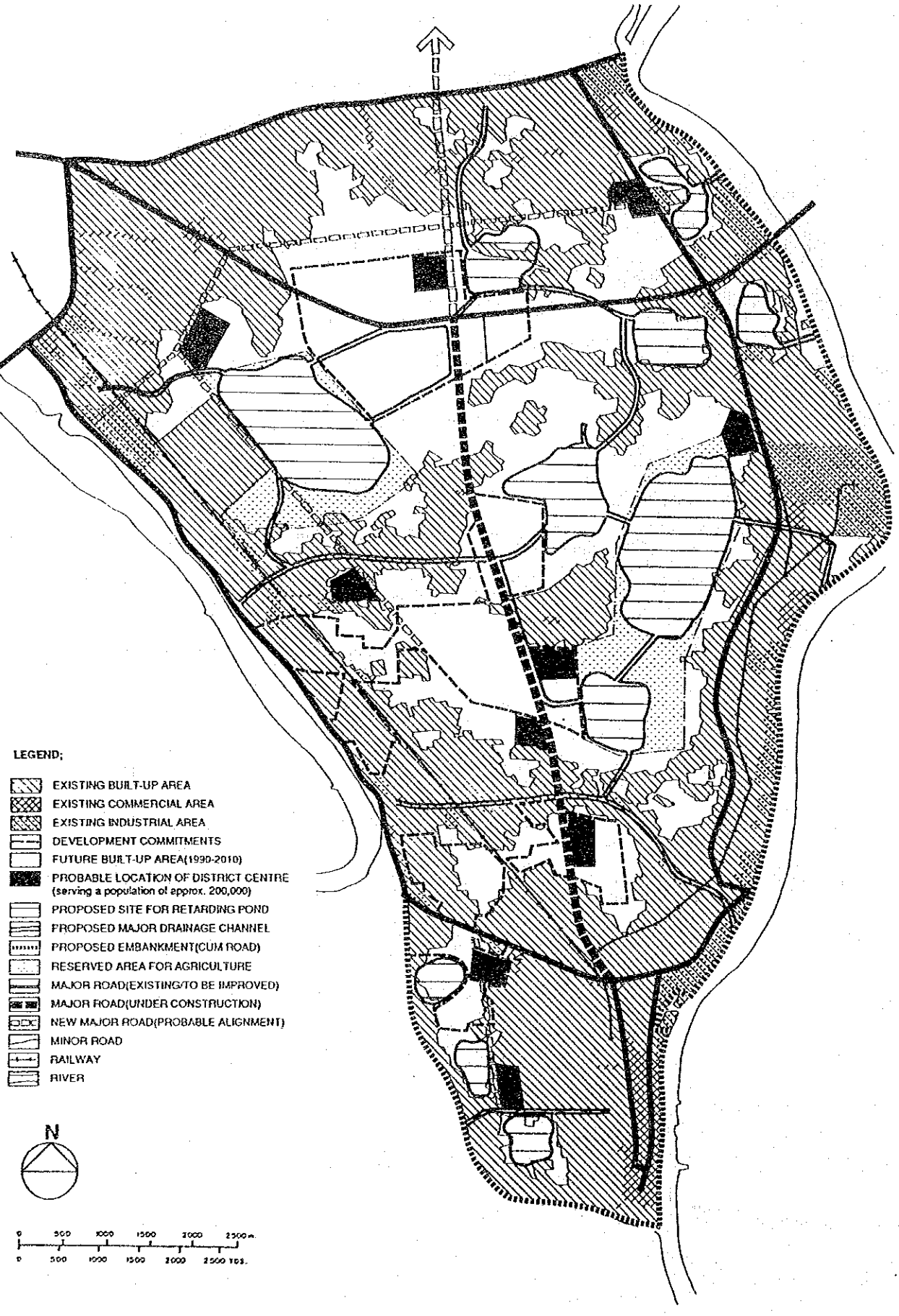

FIG. A.17 | INDICATIVE LANDUSE MAP OF NARAYANGANJ DND/WEST, 2010

GREATER DHAKA PROTECTION PROJECT (STUDY IN DHAKA METROPOLITAN AREA) OF BANGLADESH FLOOD ACTION PLAN NO.8A IN THE PEOPLE'S REPUBLIC OF BANGLADESH

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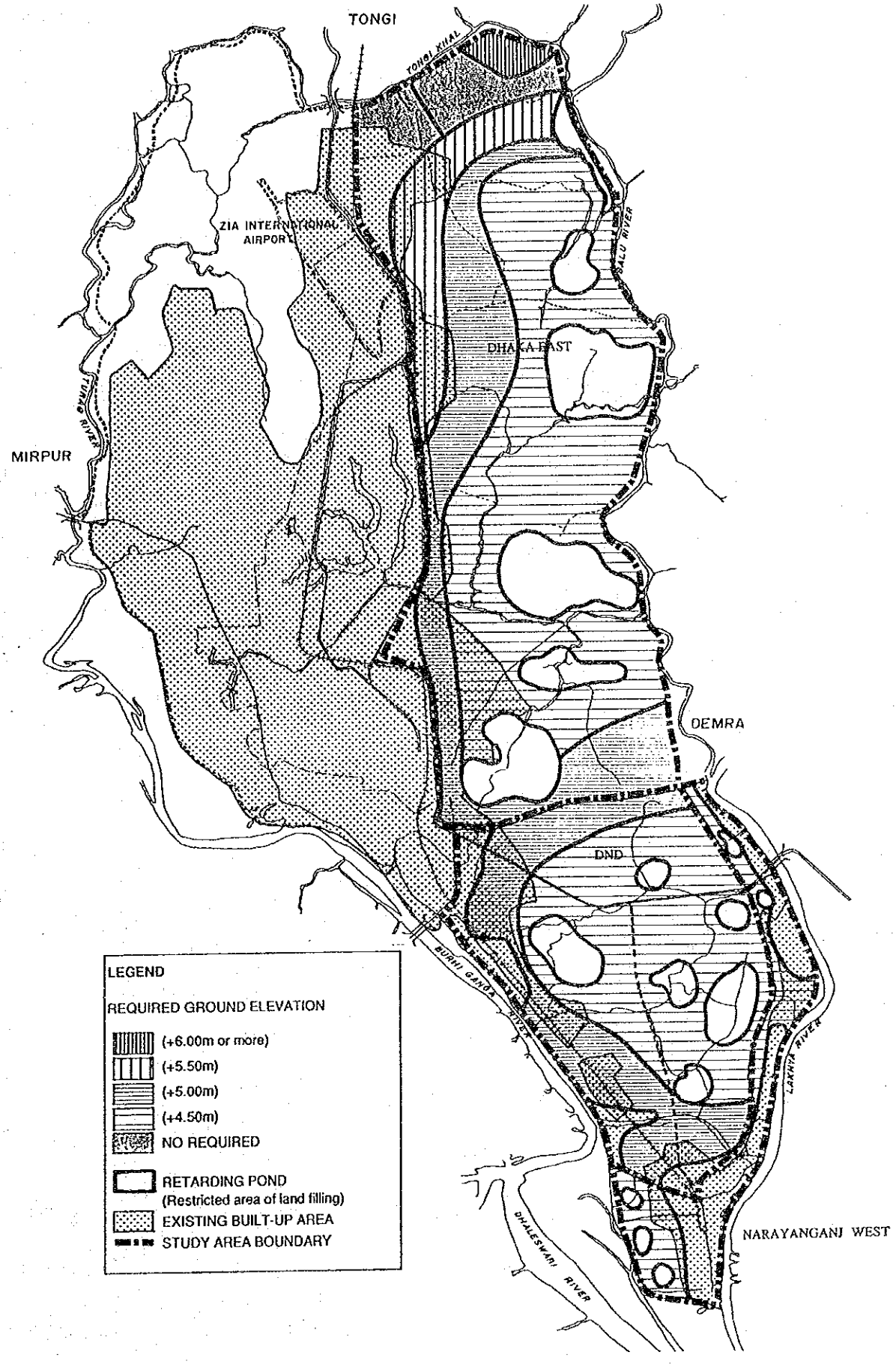

FIG. A.18 MINIMUM HEIGHTS FOR DEVELOPMENT

GREATER DHAKA PROTECTION PROJECT (STUDY IN DHAKA METROPOLITAN AREA) OF BANGLADESH FLOOD ACTION PLAN NO.8A IN THE PEOPLE'S REPUBLIC OF BANGLADESH

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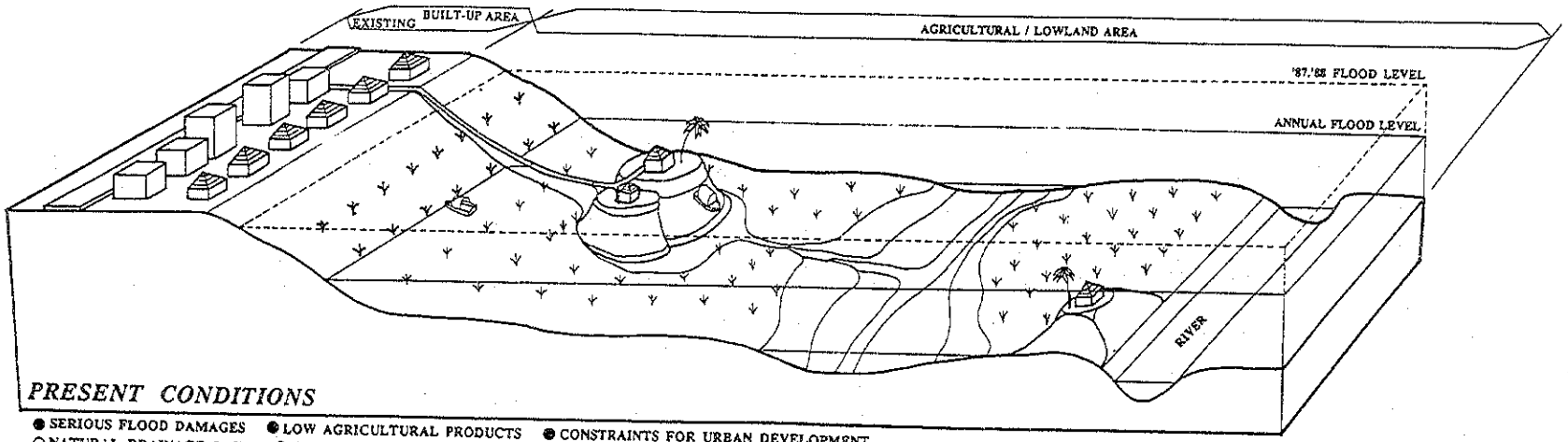
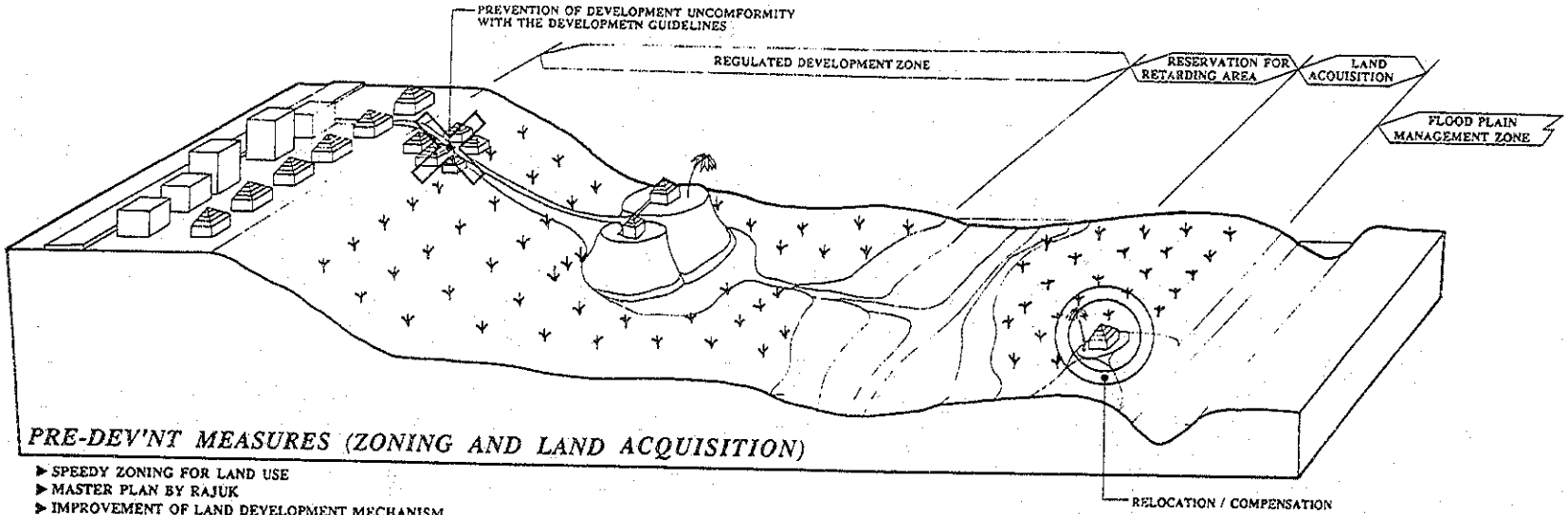


PRESENT CONDITIONS

● SERIOUS FLOOD DAMAGES ● LOW AGRICULTURAL PRODUCTS ● CONSTRAINTS FOR URBAN DEVELOPMENT
○ NATURAL DRAINAGE BASIN ○ OPENSPACE / GREEN ZONE ○ NAVIGATION AREA IN RAIN SEASON



PRE-DEV'NT MEASURES (ZONING AND LAND ACQUISITION)

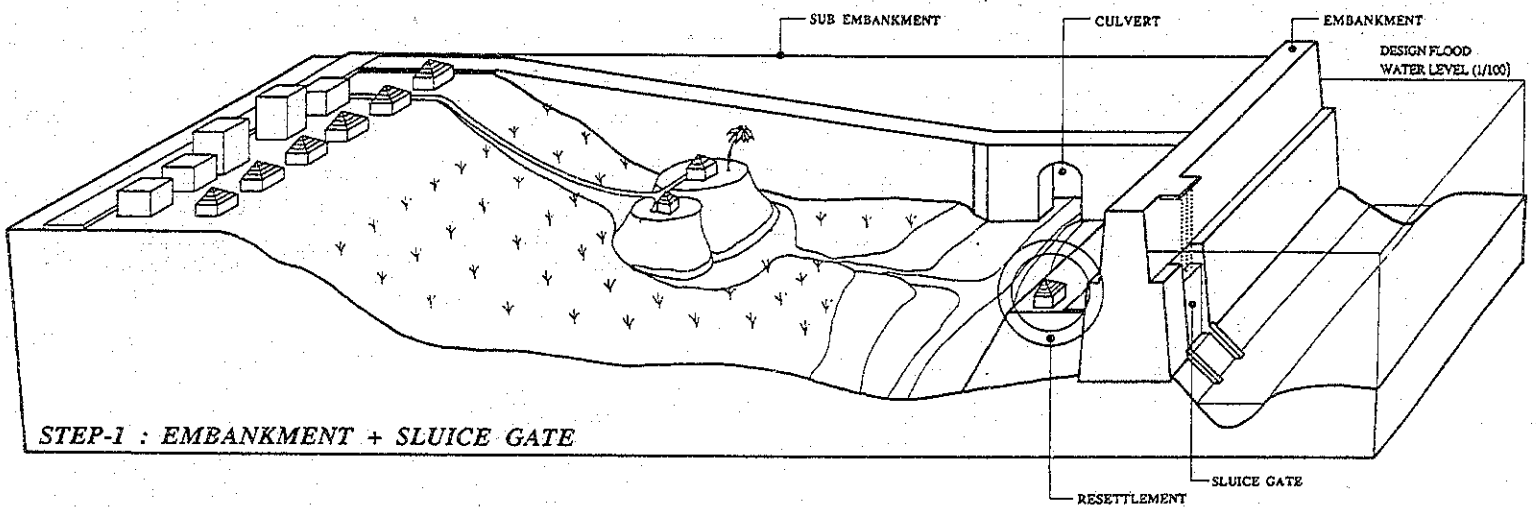
- SPEEDY ZONING FOR LAND USE
- MASTER PLAN BY RAJUK
- IMPROVEMENT OF LAND DEVELOPMENT MECHANISM
- DEVELOPMENT OF COST RECOVERY SYSTEM

A - 66

JICA

FIG. A.18(1) URBAN DEVELOPMENT STEP OF LOW LAND AREA-1

GREATER DHAKA PROTECTION PROJECT (STUDY IN DHAKA METROPOLITAN AREA) OF BANGLADESH FLOOD ACTION PLAN NO.8A IN THE PEOPLE'S REPUBLIC OF BANGLADESH



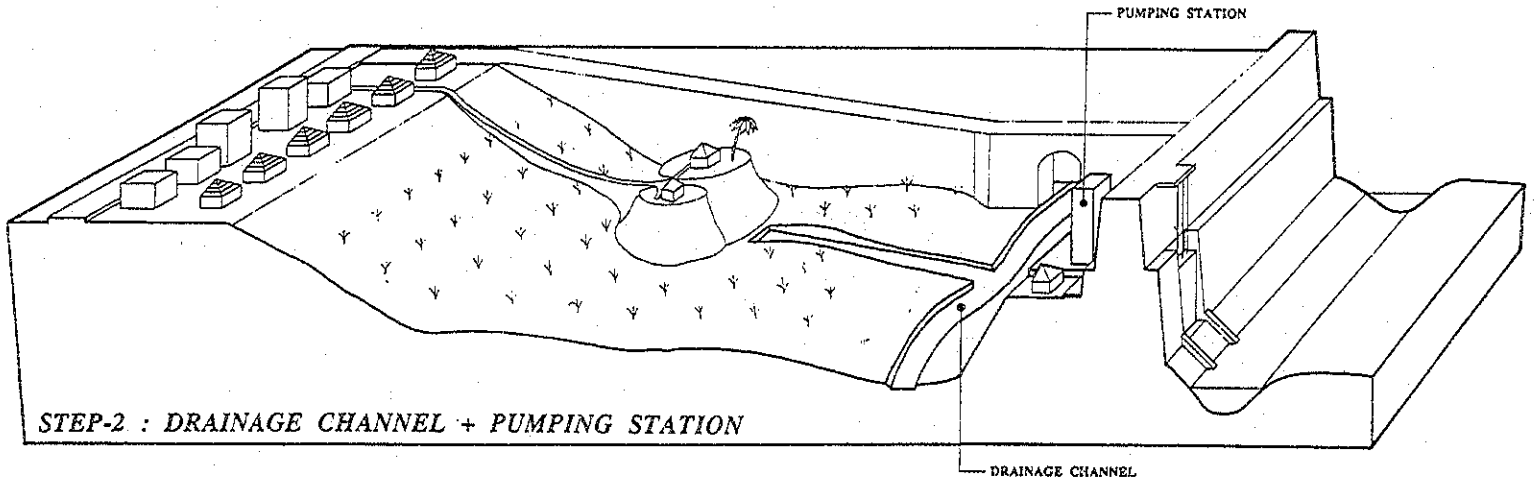


FIG. A.18(2)	URBAN DEVELOPMENT STEP OF LOW LAND AREA-2

GREATER DHAKA PROTECTION PROJECT (STUDY IN DHAKA METROPOLITAN AREA) OF BANGLADESH FLOOD ACTION PLAN NO.8A IN THE PEOPLE'S REPUBLIC OF BANGLADESH

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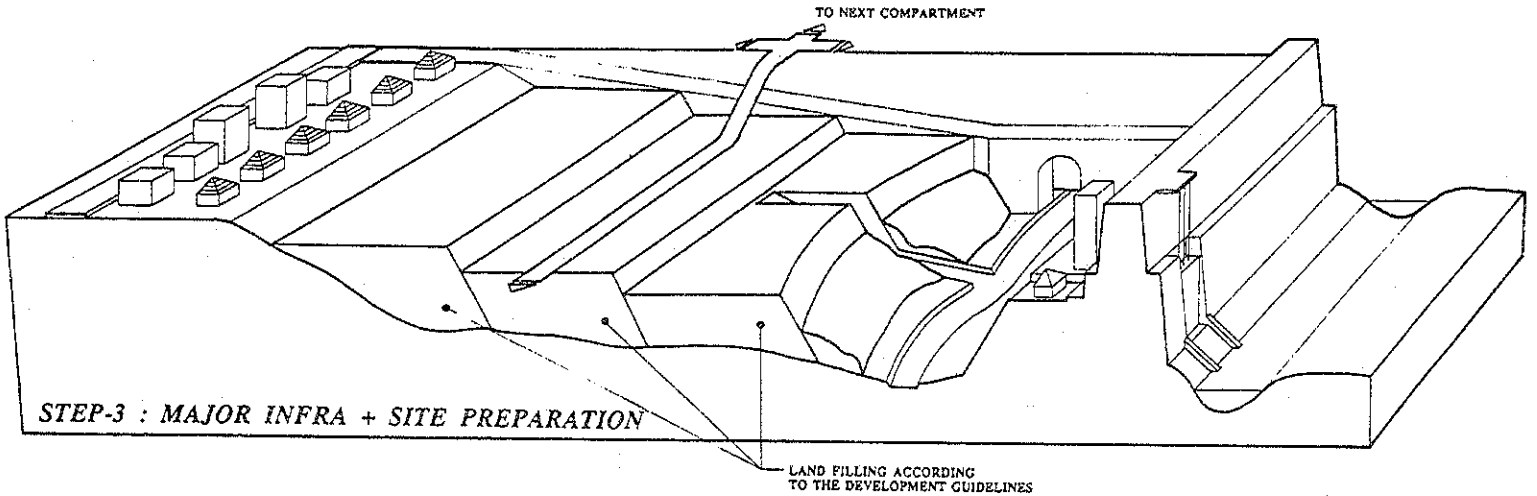

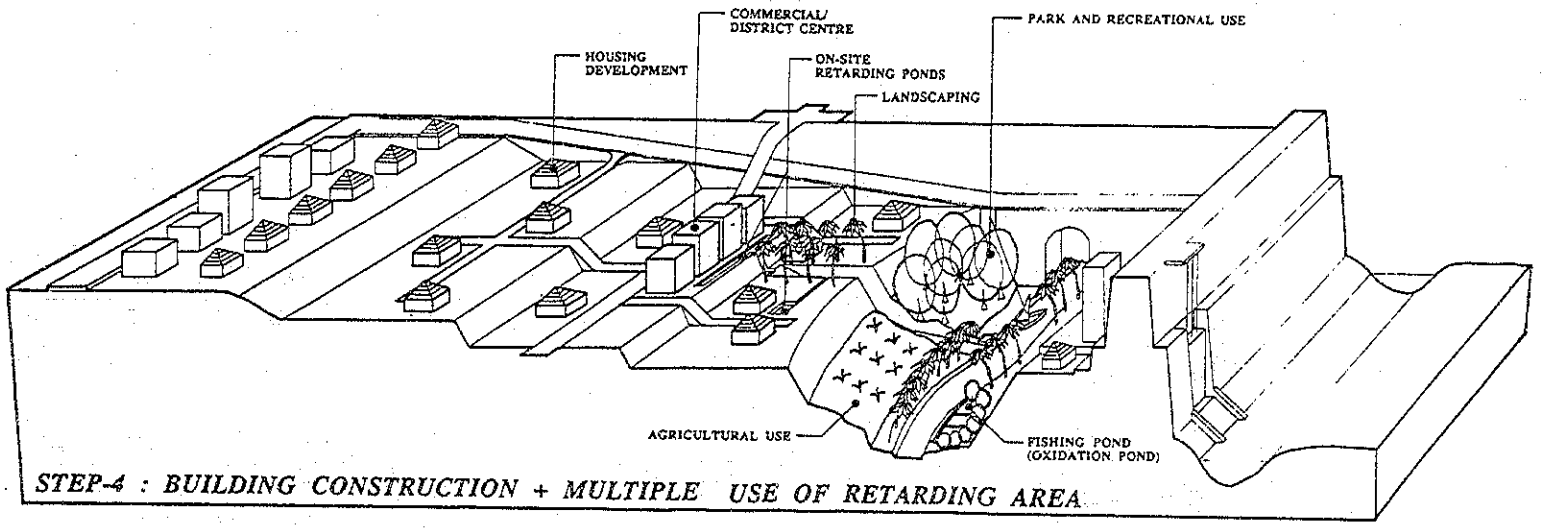

FIG. A.18(3)	URBAN DEVELOPMENT STEP OF LOW LAND AREA-3

GREATER DHAKA PROTECTION PROJECT (STUDY IN DHAKA METROPOLITAN AREA) OF BANGLADESH FLOOD ACTION PLAN NO.8A IN THE PEOPLE'S REPUBLIC OF BANGLADESH

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SUPPORTING REPORT B
FLOOD AND FLOOD DAMAGE

SUPPORTING REPORT B : FLOOD AND FLOOD DAMAGE

Table of Contents

List of Tables

Page

List of Figures

Annexes

SUPPORTING REPORT B : FLOOD AND FLOOD DAMAGE

1 Flood Condition

1.1 General

There are two types of floods, external and internal, in the study area. External floods are caused by overflow of surrounding rivers, while internal floods are caused by stormwater flooding due to insufficient drainage facilities in the built-up areas.

Most of floods within the study area have been derived from the surrounding rivers.

Major floods of the study area were recorded in 1954, 1955, 1958, 1970, 1974, 1980, 1984, 1987 and 1988 since the water level observation was initiated at Mill Barak in Dhaka in 1945.

During the 1988 flood, a large part of the built-up area, which is usually flood free, was submerged by flooding from the surrounding rivers. Most parts of Greater Dhaka East were submerged.

The study area experienced severe floods consecutively in 1987 and 1988. The 1987 flood was assessed as the medium-size flood of a 10-year return period, while the 1988 flood was the largest one recorded and estimated as the flood of a 70-year flood return period.

During the Phase I (Preliminary Review Stage) and the Phase II (A Master Plan Study Stage), a questionnaire survey on "external and internal floods" in the study area of 850 km^2 was carried out. The survey on external floods was executed on the last three floods of the 1987 flood, the 1988 flood and the 1990 flood. The 1990 flood was considered as an "annual flood". The survey on internal floods were done on the annual flood and the worst one.

For this feasibility study stage, supplementary flood surveys have been carried out for the F/S area including a related area of Dhaka City. The survey areas are Greater Dhaka East and a part of Dhaka City, which belongs to the drainage area of the Balu River, Narayanganj DND and West.

The supplementary surveys consist of the followings :

(1) Review of the flood depth and duration survey data in the Master Plan Study according to the land use of each administrative unit, and

(2) Collection of supplementary data and information on flood damages to public utilities and traffic, from RHD, DCC, Bangladesh Railways, Power Development Board, etc.

Concerning the internal flood conditions of zones No. 1 to 53 in the Dhaka Sub-Area, the survey results of the 1987 JICA Study were referred to.

1.2 Greater Dhaka East

The survey area covers Greater Dhaka East (118.62 km^2) and a part of Greater Dhaka West (47.74 km^2), mostly built-up, which drains off eastwards to the Balu River.

The survey area consists of 39 zones based on the administrative division of wards and unions. (Refer to Fig. B.1).

1.2.1 External Flood

1) Annual Flood

(1) Flood Area

The total flood area by the annual external flood is estimated at 7,850 ha, or 47% of the survey area. There is no flooding in the built-up area.

Most of the agricultural area in Greater Dhaka East is submerged during the flood season, and rural villages or settlements there are likely to be isolated, but still flood free because their house lots are built a little higher than the annual flood stage. (Refer to Fig. B.3).

(2) Flood Depth and Duration

There are only limited cases of flooding by the annual flood. However, it does not mean that the study area is free from the annual flood. The flood depth and duration were surveyed only for houses and assets, which are mostly located on high plots that are safe from annual external floods. However, most of rural villages and settlements are isolated because of inundation.

2) 1987 Flood

(1) Flood Area

The flood area by the 1987 flood is estimated at 10,716 ha, or 64% of the survey area.

Within the flood area, the built-up area is estimated at 1,121 ha, or 17% of the total built-up area. (Refer to Fig. B.4).

(2) Flood Depth and Duration

During the 1987 flood, the maximum flood depth and duration in the survey area were 0.91m and 22 days respectively, and the average depth and duration were 0.27 m and 7.47 days respectively. (Refer to Table B.2 and Fig. B.6).

The flood map, Fig. B.4 shows the flood depth and the flood duration at houses and the flood depth around settlements. Flooded depth around settlement areas were from 0.4 m to 4.0m.

3) 1988 Flood

(1) Flood Area

The 1988 flood is the most severe flood that has ever hit the study area. The flood area is estimated at 13,173 ha, or 79% of the survey area. The built-up area of 3,285 ha, or 49% of the total built-up area was affected and shown in Table B.6.1. and Fig. B.5.

(2) Flood Depth and Duration

The 1988 flood recorded the maximum flood depth and duration of 2.13 m and 65 days respectively in the survey area. The average flood depth and duration are estimated at 0.72 m depth and 19.66 days respectively. (Refer to Table B.2 and Fig. B.6).

The flood map, Fig. B.5 shows flood depth and duration by the 1988 flood. The flooded depth around rural settlements is estimated at 0.3 m to 4.6 m.

1.2.2 Internal Flood

1) Annual Flood

(1) Flood Area

The internal flood area is estimated at 417 ha, or 3% of the survey area.

The internal flood area lies mostly in the highly built-up areas. (Refer to Table B.1.1, Fig. B.7).

(2) Flood Depth and Duration

The maximum flood depth and duration are 0.61 m depth and 4 days respectively. Also, the average flood depth and duration are 0.37 m depth and 0.44 days respectively. (Refer to Table B.2 and Fig. B.8).

2) Worst Flood

(1) Flood Area

The internal flood area by the worst flood is estimated at 417 ha, or 3% of the survey area.

The internal inundation areas are mostly distributed in the highly built-up areas. (Refer to Table B.1.1, Fig. B.7 and Fig. B.8).

(2) Flood Depth and Duration

The maximum flood depth and duration in the worst internal flood are estimated 0.91 m depth and 6.0 days, respectively. On the other hand, the average depth and duration of inundation are estimated at 0.54 m and 1.19 days, respectively. (Refer to Table B.2. and Fig. B.8)

1.3 Narayanganj DND and West

1.3.1 DND

DND area consists of 14 zones based on administrative divisions of wards and unions. (Refer to Fig. B.2).

1) External Flood

(1) Annual Flood

DND area is free from flood due to the existing embankment. (Refer to Tables B.3.1, B.3.2 and Fig. B.3).

(2) 1987 Flood

DND area was not affected by the 1987 flood.

(3) 1988 flood

DND area was marginally safe from the 1988 flood by the flood fighting measures during the flood, reinforcing the embankment by sand bags, because the flood level exceeded partly the top of embankment. (Refer to Tables B.3.1, B.3.2, Figs. B.5 and B.6).

2) Internal Flood

(1) Annual Flood

The internal flood area is estimated at 410 ha, or 7% of DND area. (Refer to Table B.3.1, Figs. B.7 and B.8).

The maximum flood depth and duration of inundation are 0.15 m depth and 2.0 days, respectively. Also, the average flood depth and duration are 0.13 m and 2.0 days, respectively. (Refer to Table B.4 and Fig. B.8).

(2) Worst Flood

The internal flood area is estimated at 410 ha, or 7% of DND area. (Refer to Table B.3.1, Figs. B.7 and B.8).

The maximum depth and duration of inundation by the worst flood were estimated at 0.76 m depth and 7.0 days, respectively. On the other hand, the average flood depth and duration are estimated at 0.28 m and 2.74 days respectively. (Refer to Table B.4 and Fig. B.8).

1.3.2 Narayanganj West

The study area consists of 14 zones based on administrative divisions of wards and unions. (Refer to Fig. B.2).

1) External Flood

(1) Annual Flood

The total flood area in the annual external flood is estimated at111 ha, or 6% of Narayanganj West area. However, there is no flooding in the built-up area. (Refer to Table B.5.1 Figs. B.3 and B.6).

There are only few cases of flooding due to the annual flood. However, it does not mean that the area is free from annual external flood. The flood depth and duration was surveyed on rural settlements, which are mostly located on high plots that are not affected by the annual floods. (Refer to Table B.5 and Fig. B.6).

(2) 1987 Flood

The flood area by the 1987 flood is estimated at 606 ha, or 33% of Narayanganj West area.

The built-up area affected by the flood is 379 ha, or 29% of the total built-up area. (Refer to Table B.5.1, Figs. B.4 and B.6).

The maximum flood depth and duration in the Narayanganj West area are estimated at 0.61 m depth and 15.0 days respectively, and the average depth and duration are 0.27 m and 8.11 days, respectively. (Refer to Table B.6 and Fig. B.6).

Fig. B.4 shows the flood depth and duration at houses of residence and the depth around settlements.

(3) 1988 Flood

The flood area is estimated at 1863 ha. The built-up area affected by the flood is 1312 ha, which is the whole of the built-up area. (Refer to Table B.5.1, Figs. B.5 and B.6).

The 1988 flood recorded the maximum flood depth and duration of 1.63 m and 40.0 days respectively. The average flood depth and duration are estimated at 0.84 m depth and 21.69 days respectively. (Refer to Table B.6 and Fig. B.6).

Fig. B.5 shows flood depth and duration. Flood depth around settlements is estimated at 0.8 m to 2.6 m.

2) Internal Flood

(1) Annual Flood

The internal flood area is estimated at 87 ha, or 5% of Narayanganj West area. The internal flood areas are distributed mostly in the highly built-up areas. (Refer to Table B.5.1, Figs. B.7 and B.8).

The maximum flood depth and duration are estimated at 0.12 m depth and 0.08 days respectively, and the average flood depth and duration are 0.12 m and 0.08 days respectively. (Refer to Table B.6 and Fig. B.8).

(2) Worst Flood

The internal flood area is estimated at 87 ha, or 5% of Narayanganj West area. The internal inundation areas are located mostly in the highly built-up area. (Refer to Table B.5.1, Figs. B.7 and B.8).

The maximum depth and duration in the worst internal flood are estimated at 0.82 m depth and 2 days, respectively. On the other hand, the average flood depth and duration are estimated at 0.28 m depth and 0.79 days, respectively. (Refer to Table B.6 and Fig. B.8).

2. Flood Damage

Flood damages are estimated for Greater Dhaka East, Narayanganj DND and Narayanganj West areas. The Greater Dhaka East area is divided into 4 compartments incorporating parts of drainage areas belonging to the Greater Dhaka West area as shown in Fig. B.12. Flood damages are also estimated for each of the above 4 compartments.

The 4 compartments are named Dhaka East - 1, -2, -3, and -4, or DC-1, -2, -3, and -4 starting the number from the northernmost compartments.

Flood damages are calculated for both the external and internal floods. The external floods are classified into the annual, the 1987-scale and the 1988-scale floods, while the internal floods are classified into the annual and the worst floods. The most recent typical annual external flood occurred in 1990. The worst internal flood was experienced in 1986.

Flood damages take the form of direct damages to houses, shops, industries and institutions, income / profit losses for households, shops and factories, traffic damages, direct damages to infrastructures and profit losses for public enterprises.

Direct damages to houses, shops, industries and institutions as well as income / profit losses for households, shops and factories are estimated based on the area, depth and duration of inundation and the unit value and number of the above-mentioned properties.

Traffic damages are worked out based on lower sales, higher operating cost and greater time cost per vehicle during floods and the volume of traffic.

Direct damages to infrastructures such as roads, bridges, railways, electric supply, water supply, gas supply and telecommunication facilities are estimated based on the concepts of damages per unit quantity multiplied by the total quantity.

In estimating flood damages for the Narayanganj DND area, it was assumed that the raised roads and flood walls now surrounding the area will not function properly and be defective in the future unless overall reinforcements are done.

In estimating internal flood damages, the results of the "Study on Storm Water Drainage System Improvement Project in Dhaka City" in 1987 were referred to and utilized.

Flood damages are estimated for both 1990 and 2010. Flood damages for 2010 will be greater than those in 1990 because the unit value and number / quantity of properties, the volume of traffic and the quantity of infrastructures will be greater in 2010 than in 1990. Various kinds of flood damages are added together at a final stage and ultimately they are converted into "average annual flood damages".

2.1 Direct Damages to Properties and Income / Profit Losses of Economic Units

2.1.1 Concept / Methodology of Direct Damage Estimation

Damageable properties are classified into 5 categories, namely houses, shops, factories, institutions and cropped farm land.

Building properties and crops in the farm land will be damaged when they are immersed in flood water. The degree of the damage will get greater in proportion to the depth and duration of the immersion. The degree of the damage will be different depending on the categories of properties. Flood damages multiply in accordance with the unit value and number / quantity of inundated properties.

The unit value and number / quantity of properties by category are estimated for 1990 and 2010. The unit value and number/quantity of properties for 2010 are forecast based on the estimated growth of population and economy.

The number / quantity of properties in inundation areas is determined based on the land use and the inundation ratio. It is worked out by type of properties by zone by type / scale of floods and by year.

Using regressional equations determining the relationships between inundation depths/ durations and flood damage ratios per unit property, ultimately direct flood damages to properties are estimated.

(For more detailed explanation and information refer to 2.3 Methodology for Flood Damage Estimation (page E-12 to E-15) in Master Plan Supporting Report I.)

As a specific example the calculation steps leading to the estimation of the direct damages to houses by a 1987 - scale flood in Greater Dhaka East are explained in detail in Annex 1.

2.1.2 Concept / Methodology for Income / Profit Loss Estimation

Economic activities in an area will be affected when a flood hit the area. Wage earners will not be able to work and shops and factories will be forced to close due to inundation. The amount of those economic losses will be proportionate to the number of non-workable days and the latter will be closely connected with the depth and duration of inundations. The number of non-workable days may be different depending on the types of economic units. Economic losses multiply in accordance with the average income / profit and number of affected households, shops and factories.

The average yearly income / profit per household, shop and factory and the number of those economic units are estimated for 1990 and 2010. The average income / profit and number of economic units for 2010 are forecast based on the estimated growth of population and economy. The number of economic units in inundation areas is determined based on the land use and the inundation ratio. It is worked out by type of economic units by zone by type / scale of flood and by year.

Using regressional equations determining the relationships between inundation depths / durations and ratios of non-workable days per economic unit, ultimately income / profit losses for households, shops and factories are estimated. (For more detailed explanation and information refer to 2.3 Methodology for Flood Damage Estimation in Master Plan Supporting Report I.)

As a specific example the calculation steps leading to the estimation of the income losses to households by a 1987 - scale flood in Greater Dhaka East are explained in detail in Annex 1.

2.1.3 Estimated Damages and Losses

1) No. of Properties in the Study Area

The total number of houses, businesses, industries and institutions in the Greater Dhaka East area in 1990 is estimated at 341,673, 13,851, 1,499 and 19,497, respectively. The majority of those properties concentrate in the two compartments of DC-3 and DC-4 as shown in Table B.7.

The total number of the four types of properties in the above order in the Narayanganj DND area in 1990 is estimated at 87,634, 2,408, 1,226 and 3,544, respectively. Likewise, the total number of the four types of properties in the same order in the Narayanganj West area in the same year is estimated at 81,762, 3,465, 1,013 and 2,461, respectively.

In the target year of 2010, the total number of houses, businesses, industries and institutions in the Greater Dhaka East area is projected to increase to 716,785, 23,306, 2,270 and 36,079, respectively.

It is to be noted that properties will in 2010 still concentrate in the two southern compartments, but the growth rate is higher in the two northern compartments.

In 2010 the total number of the four types of properties in the above order in the Narayanganj DND area is projected to increase to 256,643, 6,410, 3,873 and 11,656, respectively. Similarly, the total number of the four types of properties in the same order in the Narayanganj West area in the same year is projected to increase to 160,891, 6,021, 2,245 and 4,509, respectively.

It is to be noted that the growth rate of properties is greater in the Narayanganj DND area than in the Narayanganj West area. (Refer to Table B.7).

2) No. of Properties in Inundation Areas

(1) Year 1990

The annual external flood in 1990 did not inundate any properties in the Study Area. Supposing the 1987-scale flood had hit the Greater Dhaka East area in 1990, 61,376 houses, 1,658 businesses, 319 industries and 3,057 institutions would have been inundated. It is to be noted that the inundation of properties would have been witnessed mostly in the two southern compartments.

The 1987-scale flood would in 1990 have inundated 25,414 houses, 698 businesses, 356 industries and 1,028 institutions in the Narayanganj DND area. Likewise, the same flood would have inundated 23,043 houses, 688 businesses, 218 industries and 346 institutions in the Narayanganj West area.

Supposing the 1988-scale flood had hit the Greater Dhaka East area in 1990, 165,978 houses, 5,102 businesses, 486 industries and 7,287 institutions would have been inundated. The same flood would have inundated 87,634 houses, 2,408 businesses, 1,226 industries and 3,544 institutions in the Narayanganj DND area. Similarly, the same flood would have inundated 64,679 houses, 3,068 businesses, 705 industries and 1,500 institutions in the Narayanganj West area (Refer to Table B.9.).

(2) Year 2010

Supposing the annual external flood hit the Greater Dhaka East area in 2010, 164,951 houses, 3,254 businesses, 20 industries and 5,006 institutions would be inundated. It is to be noted that the number of properties to be inundated are not too much different among the 4 compartments.

The annual external flood would in 2010 inundate 7,699 houses, 192 businesses, 116 industries and 350 institutions in the Narayanganj DND area. Likewise, the same flood would inundate 6,517 houses, 329 businesses, 47 industries and 127 institutions in the Narayanganj West area.

Supposing the 1987-scale flood hit the Greater Dhaka East area in 2010, 303,957 houses, 6,096 businesses, 502 industries and 10,028 institutions would be inundated. The same flood would inundate 69,294 houses, 1,731 businesses, 1,046 industries and 3,148 institutions in the Narayanganj DND area. Likewise, the same flood would inundate 47,550 houses, 1,706 businesses, 398 industries and 878 institutions in the Narayanganj West area.

Supposing the 1988-scale flood hit the Greater Dhaka East area in 2010, 465,002 houses, 11,714 businesses, 751 industries and 17,308 institutions would be inundated. The same flood would inundate 256,643 houses, 6,410 businesses, 3,873 industries and 11,659 institutions in the Narayanganj DND area. Similarly, the same flood would inundate 148,026 houses, 5,118 businesses, 5,082 industries and 4,067 institutions in the Narayanganj West area. (Refer to Table B. 10.)

3) Estimated Damages and Losses

Direct damages to properties and income/profit losses of economic units were combinedly broadly classified as residential, commercial, industrial, institutional and agricultural damages.

Residential damages consist of damages to buildings, damages to household effects and income losses. Commercial and industrial damages consist of damages to buildings, damages to equipment & inventories and profit losses. Institutional and agricultural damages mean damages to buildings and damages to agricultural crops, respectively.

(1) Year 1990

There were no annual external flood damages in 1990 in the Study Area. Supposing the 1987-scale flood had hit the Greater Dhaka East area in 1990, damages and losses amounting to Tk. 493.0 million would have been incurred, of which 54.8% and 45.0% would have been accounted for by residential and agricultural damages, respectively. Most of residential damages would have been witnessed in the two southern compartments and agricultural damages would have been observed all over the area. (Refer to Table B.11).

The 1987-scale flood would in 1990 have inflicted damages in the Narayanganj DND area amounting to Tk. 142.9 million, of which 82.0% and 17.7% would have been accounted for by residential and agricultural damages, respectively. Likewise, the same flood would have inflicted damages in the Narayanganj West area amounting to Tk. 75.5 million, of which 82.6% and 17.0% would have been accounted for by residential and agricultural damages, respectively.

Supposing the 1988-scale flood had hit the Greater Dhaka East area in 1990, damages and losses amounting to Tk. 3,086.0 million would have been incurred. Out of them, 76.9%, 14.4% and 8.7% would have been accounted for by residential, commercial / industrial / institutional and agricultural damages, respectively. The same flood would have inflicted damages in the Narayanganj DND area amounting to Tk. 1,864.1 million, of which 72.0%, 23.3% and 4.7% would have been accounted for by residential, commercial / industrial / institutional and agricultural damages, respectively. Similarly, the same flood would have inflicted damages in the Narayanganj West area amounting to Tk. 1,310.8 million, of which 77.5%, 20.9% and 1.6% would have been accounted for by residential, commercial / industrial / institutional and agricultural damages, respectively. (Refer to Table B.12).

The annual internal flood in 1990 brought on the damages to house buildings and household articles in the Greater Dhaka East area amounting to Tk. 121.0 million. Most of the damages were witnessed in the two southern compartments. The same flood brought on the damages to houses amounting to Tk. 27.3 million and Tk. 0.8 million in the Narayanganj DND and West areas, respectively. (Refer to Table B.16).

The worst internal flood in 1990 would have brought on the damages to house buildings and household articles in the Greater Dhaka East area amounting to Tk. 257.3 million. The same flood would have brought on the damages to houses amounting to Tk. 43.4 million and Tk. 9.9 million in the Narayanganj DND and West areas, respectively.

(2) Year 2010

Supposing the annual external flood hit the Greater Dhaka East area in 2010, damages and losses amounting to Tk. 157.6 million would be suffered, most of which would be in the form of income losses of households. The same flood would cause damages amounting to Tk. 7.1 million and Tk. 6.1 million in the Narayanganj DND and West areas, respectively. (Refer to Table B. 13).

If the 1987-scale flood hit the Greater Dhaka East area in 2010, damages and losses amounting to Tk. 2,884.6 million would be suffered, of which 99.2% would be borne by the residential sector. The same flood would cause damages amounting to Tk. 518.8 million and Tk. 229.4 million in the Narayanganj DND and West areas, respectively. Most of them would be borne by the residential sector. (Refer to Table B. 14).

If the 1988-scale flood hit the Greater Dhaka East area in 2010, damages and losses amounting to Tk. 12,995.7 million would be suffered, of which 88.2%, 11.6% and 0.2% would be borne by the residential, commercial / industrial / institutional and agricultural sectors, respectively. (Refer to Table B.15).

The 1988-scale flood would in 2010 cause damages in the Narayanganj DND area amounting to Tk. 8,530.8 million, of which 74.3% and 25.6% would be borne by the residential and commercial / industrial / institutional sectors, respectively. The same flood would cause damages in the Narayanganj West area amounting to Tk. 5,678.1 million, of which 63.7% and 36.3% would be borne by the residential and commercial / industrial / institutional sectors, respectively.

If the annual internal flood hit the Greater Dhaka East area in 2010, the damages to house buildings and household articles would amount to Tk. 185.9 million. The same flood would bring on the damages to houses amounting to Tk. 109.1 million and Tk. 2.0 million in the Narayanganj DND and West areas, respectively. (Refer to Table B. 16).

If the worst internal flood experienced in 1986 hit the Greater Dhaka East area in 2010, the damages to house buildings and household articles would amount to Tk. 389.9 million. The same flood would bring on the damages to houses amounting to Tk. 171.0 million and Tk. 24.4 million in the Narayanganj DND and West areas, respectively.

2.2 Traffic Damages

2.2.1 Concept / Methodology

In the circumstances where one witnesses inundation everywhere due to floods, vehicle and human traffic is slowed, hampered or stopped.

In the peak of a flood sometimes vehicles will be unable to be operated for days. At the beginning and the latter part of a flood vehicles will be operated, but slowly and in a haphazard way.

In the non-operatable days commercial vehicles will lose sales and profit in proportion to the length of those days.

In the slow-operating days it will take more time for a vehicle to reach a destination because the driver will have to slow down its speed or he will be forced to take a roundabout route. Slower speed will mean less operating distance. Less operating distance will in turn mean less sales for commercial vehicles. Slower speed will also mean consumption of more oil per hour.

All of these things will mean additional cost and/or less profit to vehicle owners and/or passengers.

To know the extent of traffic damages, firstly one must know the number of both non-operating and slow-operating days by type/scale of floods and by type of vehicles.

The types of vehicles were classified into rickshaw, auto-rickshaw, motor cycle, car, jeep, micro bus, mini bus, bus, mini truck, pick-up van and truck.

Secondly, one must know average sales, average oil cost and average incremental operating hours per day per vehicle by type of vehicles in both the normal time and the slow-operating flood time. Thirdly, one must know average number of passengers per vehicle by type of vehicles.

Multiplying the number of non-operating days by the average profit per day per vehicle in normal time, one gets profit losses per vehicle due to non-operation. The multiplication will be done by type/ scale of floods and by type of vehicles.

Comparing the average sales minus oil cost per day per vehicle in normal time and in flood time, one gets profit losses in slow-operating flood time. Time will be converted into financial terms. Then, multiplying the average incremental operating hours per day per vehicle by the average number of passengers per vehicle, one gets incremental time cost per day per vehicle in the slow-operating flood time. The calculation will be done by type of vehicles.

Profit losses and incremental time cost per day per vehicle in the slow-operating flood time are multiplied by the number of slow-operating days. The multiplication will be done by type / scale of floods and by type of vehicles.

Going through the above procedure, one gets traffic damages per vehicle by type of vehicles by type / scale of floods. When one multiply traffic damages per vehicle by the number of vehicles, one will get the total amount of damages.

The number of vehicles is estimated by type of vehicles, by area and by year. The number of vehicles for each area was estimated based on the results of traffic survey and the estimated number of properties in each area. The number of vehicles for 2010 was forecast based on the projected population and economy.

2.2.2 Traffic and Traffic Damage Surveys

1) Traffic Survey

Traffic survey was conducted to know the volume of vehicle traffic at major flood vulnerable points in the Greater Dhaka East and Narayanganj areas.

20 traffic points which are susceptible to internal floods were selected, of which 16 belong to the Greater Dhaka East area and 4 to the Narayanganj West area. Also, 8 traffic survey points which were inundated in the 1988 external flood were picked up, of which 2 are in the Greater Dhaka East area, 5 in the Narayanganj DND area and 1 in the Narayanganj West area. (Refer to Figs. B.9, B.10 and B.11). Survey time was basically from 7 am to 8 pm. Vehicles were classified into 8 types,namely rickshaw, auto-rickshaw, motor cycle, car/jeep, micro bus, bus/mini bus, mini truck/pick-up and truck.

According to the survey results, total traffic in the above 28 survey points comes to 580,839 rickshaws, 111,622 auto-rickshaws, 41,189 motor cycles, 125,320 cars/jeeps, 24,858 micro buses, 39,373 buses/mini buses, 7,429 mini trucks/pick-ups and 17,409 trucks. Out of it, about 75% belongs to the Greater Dhaka East & related areas and about 25% to the Narayanganj areas. (Refer to Table B.17).

2) Traffic Damage Survey

Traffic damage survey was conducted along with traffic survey to know about the average sales, oil cost, incremental time cost, etc. per vehicle by type of vehicles for each type/scale of floods. The number of samples were 30 for each type of vehicles. The survey was conducted mostly in the Greater Dhaka East and related areas.

The survey took the form of the sampling questionnaire survey.

The questionnaire consisted of questions regarding the type of vehicles, the number of days affected by flood in terms of non-operating days and slow-operating days in each type/scale of floods, the average operating km per day per vehicle in normal time as well as in time of flood (in slow-operating days), the average oil consumption per day per vehicle in normal time as well as in time of flood (in slow-operating days), etc.

2.2.3 Estimated Traffic Damages

1) Impacts of Floods on Vehicle Traffic

It was revealed as a result of traffic damage survey that in the 1987 flood buses and trucks could not operate for 10.4 days on average and all types of vehicles except rickshaws were forced to operate slowly for 18.6 days on average. In the 1988 flood vehicles could not operate for 20.1 days on average and also they were forced to operate slowly for 38.9 days on average. Likewise, in the 1986 flood which was the worst internal flood vehicles could not operate for 1.3 days on average and also they operated slowly for 12.9 days on average.

Operating distance per day per vehicle is on average 131.0 km in normal time, while it is 104.7 km in the slow-operating flood time. Operating speed is on average 41.5 km per hour in normal time, while it is 30.7 km per hour in flood time.

Oil consumption per day per vehicle excepting rickshaws is on average 30.8 liter in normal time, while it is 29.2 liter in the slow-operating flood time. Sales per day per

commercial vehicle is on average Tk. 1,511 in normal time, while it is Tk. 1,266 in flood time.

It is to be noted that operating hours per day per vehicle on average increases from 3.16 hours in normal time to 3.41 hours in flood time, oil consumption per km per vehicle increases from 0.235 liter in normal time to 0.279 liter in flood time and sales per km per commercial vehicle increases from Tk. 11.5 in normal time to Tk. 12.1 in flood time. It is also to be noted that the rate of increase in oil consumption is higher than the rate of increase in sales in flood time.

(Refer to Table B.18).

2) Traffic Damages per Vehicle

In the 1987 flood traffic damages per commercial vehicle are estimated to have been Tk. 9,379 on average. The damages to buses were the highest with Tk. 19,866 per vehicle, followed by the damages to mini buses with Tk. 16,916 per vehicle. Rickshaws earned more profits than in normal time.

In the 1988 flood traffic damages per commercial vehicle were Tk. 23,438 on average. The damages to buses were the highest with Tk. 58,211 per vehicle, followed by mini buses with Tk. 36,081 per vehicle. Rickshaws earned the profits of Tk. 150 per vehicle.

In the 1986 flood which was the worst internal flood traffic damages per commercial vehicle were Tk. 4,271 on average. The damages to buses were the highest with Tk. 12,509 per vehicle, followed by mini buses with Tk. 7,101 per vehicle. Rickshaws got profits instead of damages.

(Refer to Table B.20).

3) Number of Vehicles

(1) Year 1990

It is estimated that there were 58,277 rickshaws, 4,194 auto-rickshaws, 23,797 motor cycles, 6,727 cars, 1,061 jeeps, 2,400 micro buses, 1,780 mini buses, 790 buses, 455 mini trucks, 684 pick-up vans and 2,411 trucks in 1990 in the Greater Dhaka East area. Most of vehicles belonged to the two southern compartments.

In the Narayanganj DND area it is estimated that there were 15,238 rickshaws, 1,080 auto-rickshaws, 6,236 motor cycles, 1,763 cars, 227 jeeps, 513 micro buses, 466 mini buses, 207 buses, 111 mini trucks, 166 pick-up vans and 586 trucks in 1990. Similarly, in the Narayanganj West area there were 14,217 rickshaws, 1,011 auto-rickshaws, 5,818 motor cycles, 1,645 cars, 219 jeeps, 496 micro buses, 435 mini buses, 193 buses, 137 mini trucks, 205 pick-up vans and 723 trucks.

Summing up, it is estimated that there were 102,576 vehicles in the Greater Dhaka East area in 1990, of which 56.8% were accounted for by rickshaws. In the Narayanganj DND area there were 26,593 vehicles, of which 57.3% were rickshaws. Likewise, in the Narayanganj West area there were 25,099 vehicles, of which 56.6% were rickshaws. (Refer to table B.21).

(2) Year 2010

It is projected that in 2010 there will be 190,135 rickshaws, 13,498 auto-rickshaws, 77,670 motor cycles, 21,957 cars, 2,940 jeeps, 6,652 micro buses, 5,809 mini buses, 2,577 buses, 1,167 mini trucks, 1,752 pick-up vans and 6,181 trucks in the Greater Dhaka East area. Compartment wise, the two southern compartments will dominate in the number of vehicles, but the growth rate of vehicles in the two northern compartments will be higher.

In the Narayanganj DND area it is projected that in 2010 there will be 71,910 rickshaws, 5,115 auto-rickshaws, 29,428 motor cycles, 8,319 cars, 1,117 jeeps, 2,526 micro buses, 2,201 mini buses, 976 buses, 505 mini trucks, 758 pick-up vans and 2,674 trucks. Likewise, in the Narayanganj West area there will be 45,081 rickshaws, 3,189 auto rickshaws, 18,448 motor cycles, 5,215 cars, 650 jeeps, 1,471 micro buses, 1,380 mini buses, 612 buses, 406 mini truck, 609 pick-up vans and 2,150 trucks.

Summing up, it is estimated that in 2010 there will be 330,338, 125,529 and 79,211 vehicles in the Greater Dhaka East, Narayanganj DND and Narayanganj West areas, respectively. (Refer to Table B.22).

(3) Estimated Traffic Damages

a. 1987-scale Flood

Supposing the 1987-scale flood had hit the Greater Dhaka East area in 1990, traffic damages amounting to Tk.86.5 million would have been incurred, most of which would have occurred in the two southern compartments. The same flood would have inflicted traffic damages in the Narayanganj DND and West areas amounting to Tk. 22.0 million and Tk. 23.2 million, respectively.

Supposing the 1987-scale flood hit the Greater Dhaka East area in 2010, traffic damages amounting to Tk. 256.5 million would be incurred. The same flood would inflict traffic damages in the Narayanganj DND and West areas amounting to Tk. 102.2 million and Tk. 71.4 million, respectively. (Refer to Table B.23.)

b. 1988-scale Flood

Supposing the 1988-scale flood had hit the Greater Dhaka East area in 1990, traffic damages amounting to Tk.187.3 million would have been incurred, most of which would have occurred in the two southern compartments. The same flood would have inflicted traffic damages in the Narayanganj DND and West areas amounting to Tk. 47.4 million and Tk. 50.5 million, respectively.

Supposing the 1988-scale flood hit the Greater Dhaka East area in 2010, traffic damages amounting to Tk. 551.1 million would be incurred. The same flood would inflict traffic damages in the Narayanganj DND and West areas amounting to Tk. 220.5 million and Tk. 155.1 million, respectively. (Refer to Table B.24.)

c. Worst Internal Flood

Supposing the 1986-scale flood which is the worst internal flood had hit the Greater Dhaka East area in 1990, traffic damages amounting to Tk.36.5 million would have been incurred. The same flood would have inflicted traffic damages in the Narayanganj DND and West areas amounting to Tk. 10.1 million and Tk. 10.3 million, respectively.

Supposing the 1986-scale hit the Greater Dhaka East area in 2010, traffic damages amounting to Tk. 119.8 million would be incurred. The same flood would inflict traffic damages in the Narayanganj DND and West areas amounting to Tk. 47.0 million and Tk. 32.0 million, respectively. (Refer to Table B.25.)

2.3 Direct Damages to Infrastructure and Profit Losses for Public Enterprises

The JICA Study Team conducted interview surveys visiting the officials concerned in RHD, DCC, Dhaka District Council, NMC, Bangladesh Railways, Power Development Board, T&T, DWASA, NWASA, Titas Gas, CAA and other related agencies.

The study team wanted to gather information and data on the direct damages to infrastructures such as roads, bridges, railways, electricity supply facilities, telecommunication facilities, water supply facilities, sewerage facilities, gas supply facilities and the airport in each of the 5 types/scales of floods for each of the 3 areas. Also, the study team wanted to collect information and data on profit losses for public enterprises such as Bangladesh Railways, Power Development Board, T&T, DWASA, NWASA, Titas Gas and CAA.

2.3.1 Concept / Methodology of Damage Estimation

The basic approach to the estimation of direct damages to infrastructures was the establishment of total quantity (length or number), construction cost per unit quantity and the ratio of repair cost to construction cost for each type of infrastructures. By combining these three factors direct damages to infrastructure will be arrived at.

The direct damages to infrastructures and profit losses for public enterprises for 2010 were forecast based on the projected number of properties such as houses, shops, factories and institutions.

2.3.2 Estimated Damages and Losses

1) Direct Damages to Infrastructures

Direct damages to infrastructures in the Greater Dhaka East area was found to total Tk. 41.5 million in the annual external flood, Tk. 68.7 million in the 1987 flood, Tk. 458.1 million in the 1988 flood, Tk. 22.6 million in the annual internal flood and Tk. 58.1 million in the worst internal flood. Damages were concentrated in the two southern compartments.

Direct damages to infrastructures in the Narayanganj DND area totaled Tk. 1.4 million, Tk. 1.4 million, Tk. 22.4 million, Tk. 7.8 million, Tk. 10.3 million in the annual external, the 1987, the 1988, the annual internal and the worst internal floods, respectively.

Likewise, direct damages to infrastructures in the Narayanganj West area summed up to Tk. 5.5 million for the annual external flood, Tk. 17.5 million for the 1987 flood, Tk. 134.2 million for the 1988 flood, Tk. 19.1 million for the annual internal flood and Tk. 31.9 million for the worst internal flood. (Refer to Table B.26).

Supposing the annual external flood hit the Greater Dhaka East area in 2010, direct damages to infrastructures amounting to Tk.133.7 million would be incurred. Likewise, the 1987-scale, the 1988-scale, the annual internal and the worst internal floods would inflict damages amounting to Tk. 221.1 million, Tk. 1,474.5 million, Tk. 72.9 million and Tk. 186.9 million, respectively. Damages will still predominate in the two southern comportments, but the growth of damages in the two northern compartments will be conspicuous.

Supposing the annual external flood hit the Narayanganj DND area in 2010, direct damages to infrastructures amounting to Tk.6.6 million would be incurred. Likewise, the 1987-scale, the 1988-scale, the annual internal and the worst internal floods would inflict damages amounting to Tk. 6.6 million, Tk. 106.0 million, Tk. 36.9 million and Tk. 48.8 million, respectively.

Supposing the annual external flood hit the Narayanganj West area in 2010, direct damages to infrastructures amounting to Tk.17.4 million would be incurred. Likewise, the 1987-scale, the 1988-scale, the annual internal and the worst internal floods would inflict damages amounting to Tk. 55.3 million, Tk. 422.8 million, Tk. 60.3 million and Tk. 100.7 million, respectively. (Refer to Table B.28).

2) Profit Losses for Public Enterprises

It was found out that profit losses for public enterprises are not marked compared to direct damages to infrastructures.

The 1987 and 1988 floods are estimated to have caused profit losses amounting to Tk. 6.2 million and Tk. 43.0 million respectively for public enterprises in the Greater Dhaka East area. Likewise, the two floods caused profit losses amounting Tk. 1.1. million and Tk. 8.0 million respectively for public enterprises in the Narayanganj West area.

Supposing the annual external flood hit the Greater Dhaka East area in 2010, profit losses amounting to Tk. 1.5 million would be suffered by public enterprises. Likewise, the 1987-scale, 1988-scale, the annual internal and the worst internal floods would

bring on profit losses amounting to Tk. 20.3 million, Tk. 138.6 million, Tk. 1.0 million and Tk. 1.8 million respectively to public enterprises in the area. Also, the 1987-scale and 1988-scale floods in 2010 would bring on profit losses amounting to Tk. 3.6 million and Tk. 25.3 million respectively to public enterprises in the Narayanganj West area. (Refer to Table B.29).

2.4 Summary of Flood Damages

2.4.1 Summary of Flood Damages by Type / Scale of Floods

Direct damages to properties, income / profit losses of economic units, traffic damages, direct damages to infrastructures and profit losses for public enterprises are added together by area, by type / scale of floods and by year. In doing so, 10% addition is done to the results of the above summation to rake up unaccounted-for damages.

The 10% addition is explained and substantiated in Annex 2.

The below table summarizes flood damages worked out in the above mentioned way.

(Unit : Tk. Million)

Area	External Flood			Internal Flood	
	Annual	1987-Scale	1988-Scale	Annual	Worst
1. 1990					
DC - 1	2.8	89.8	293.5	1.8	6.7
DC - 2	1.3	53.6	233.8	0.7	2.8
DC - 3	21.3	219.6	1,263.4	66.6	167.0
DC - 4	20.8	357.1	2,361.2	89.3	214.6
Dhaka East	46.2	720.1	4,151.9	158.4	391.1
Narayanganj DND	1.5	182.9	2,127.4	38.6	70.2
Narayanganj West	6.1	129.0	1,653.6	21.9	57.3
Total	53.8	1,032.0	7,932.9	218.9	518.6

2. 2010

DC - 1	75.8	1,415.9	3,516.7	10.0	38.5
DC - 2	33.8	322.9	1,425.3	5.1	21.0
DC - 3	100.0	863.1	4,746.4	128.9	345.5
DC - 4	112.5	1,118.9	6,988.0	141.8	363.2
Dhaka East	322.1	3,720.8	16,676.4	285.8	768.2
Narayanganj DND	15.1	690.4	9,743.6	160.6	293.5
Narayanganj West	25.9	395.7	6,909.4	68.5	172.8
Total	363.1	4,806.9	33,329.4	514.9	1,234.5

(For more details refer to Tables B.30 and B.31.)

2.4.2 Average Annual Flood Damages

Based on the figures tabulated in the preceding section, average annual flood damages are calculated. (The methodology for the calculation of average annual flood damages is explained in 2.3.5 Estimation of Average Annual Flood Damages in Master Plan Supporting Report I).

The results are shown in the below table.

(Unit : Tk. Million)

Area	1990	2010
DC - 1	43.2	648.4
DC - 2	26.4	176.7
DC - 3	195.1	628.5
DC - 4	293.0	791.3
Greater Dhaka East	557.7	2,244.9
Narayanganj DND	153.4	639.9
Narayanganj West	113.4	395.3
Total	824.5	3,280.1

As a specific example the calculation steps leading to the estimation of average annual flood damages for Greater Dhaka East are explained in detail in Annex 3.

The above-tabulated flood damages are expected in the "without" situation. In other words, the benefits of the same amount can be expected in the "with" situation. (The average annual flood damages broken down into external and internal flood damages are shown in Table B.32).

TABLE B.1(1) FLOOD AREA AND LAND USE AT DHAKA EAST/ DRAINAGE RELATED AREA (BUILT UP)

Name of Zone	Total Area	Total B/U Area in 1990	Total B/U Area in 2010	External Flood																		Internal Flood	
				Annual Flood						1987 Flood						1988 Flood							
				Total Flood Area	Ratio of Flood Area	Flood Area in B/U in 1990	R. of B/U in Flood Area in 1990	Flood Area in B/U in 2010	R. of B/U in Flood Area in 2010	Total Flood Area	Ratio of Flood Area	Flood Area in B/U in 1990	R. of B/U in Flood Area in 1990	Flood Area in B/U in 2010	R. of B/U in Flood Area in 2010	Total Flood Area	Ratio of Flood Area	Flood Area in B/U in 1990	R. of B/U in Flood Area in 1990	Flood Area in B/U in 2010	R. of B/U in Flood Area in 2010	Total Flood Area	Ratio of Flood Area
	(ha.) (a)	(ha.) (b)	(ha.) (c)	(ha.) (d)	(%) =(d)/(a)	(ha.) (e)	(%) =(e)/(b)	(ha.) (f)	(%) =(f)/(c)	(ha.) (g)	(%) =(g)/(a)	(ha.) (h)	(%) =(h)/(b)	(ha.) (i)	(%) =(i)/(c)	(ha.) (j)	(%) =(j)/(a)	(ha.) (k)	(%) =(k)/(b)	(ha.) (l)	(%) =(l)/(c)	(ha.) (m)	(%) =(m)/(a)
Ward 4	96	94	96	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11	11
Ward 7	199	185	185	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	13	6
Ward 8	83	83	79	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	27	33
Ward 9	72	72	72	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15	21
Ward 11	12	12	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	12
Ward 13	31	31	31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	13	42
Ward 27	14	14	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	64
Ward 28	20	20	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Ward 29	46	46	46	0	0	0	0	0	0	0	0	0	0	0	0	23	51	23	51	23	51	12	26
Ward 34	151	103	134	48	32	0	0	31	23	98	65	50	49	81	61	145	96	97	94	128	96	1	1
Ward 35	103	98	103	0	0	0	0	0	0	0	0	0	0	0	0	43	42	38	39	43	42	20	19
Ward 36	190	164	190	26	14	0	0	26	14	41	22	15	9	41	22	172	90	146	89	172	90	0	0
Ward 37	76	76	76	0	0	0	0	0	0	0	0	0	0	0	0	64	84	64	84	64	84	15	20
Ward 38	105	98	105	6	6	0	0	6	6	16	15	9	9	16	15	105	100	98	100	105	100	0	0
Ward 39	185	155	184	31	17	0	0	30	16	130	70	99	64	129	70	185	100	155	100	184	100	0	0
Ward 40	439	295	434	143	33	0	0	139	32	230	52	86	29	225	52	325	74	181	62	321	74	13	3
Ward 41	96	96	96	0	0	0	0	0	0	0	0	0	0	0	0	71	74	71	74	71	74	38	39
Ward 42	80	80	80	0	0	0	0	0	0	0	0	0	0	0	0	32	40	32	40	32	40	18	22
Ward 43	128	128	128	0	0	0	0	0	0	0	0	0	0	0	0	30	24	30	24	30	24	48	37
Ward 44	230	230	230	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	37	16
Ward 45	194	194	194	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	55	28
Ward 46	161	161	161	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	5
Ward 47	156	140	152	11	7	0	0	7	5	27	17	11	8	23	15	48	31	33	23	44	29	15	10
Ward 48	326	314	315	12	4	0	0	1	0	99	30	88	28	88	28	140	43	128	41	129	41	0	0
Ward 49	131	131	128	0	0	0	0	0	0	10	7	10	7	6	5	19	15	19	15	16	13	8	6
Ward 50	93	93	93	0	0	0	0	0	0	1	2	1	2	1	2	4	5	4	5	4	5	20	22
Ward 51	672	639	649	33	5	0	0	10	2	210	31	177	28	188	29	480	72	447	70	458	71	0	0
Ward 52	186	150	179	36	19	0	0	29	16	128	69	92	61	121	68	186	100	150	100	179	100	0	0
Ward 53	193	169	190	24	12	0	0	21	11	95	49	71	42	92	48	121	63	97	58	118	62	0	0
Uttar Khan	1811	188	1422	850	47	0	0	461	32	1460	81	0	0	1072	75	1562	86	0	0	1173	82	0	0
D. Khan Cant	288	184	288	18	6	0	0	18	6	28	10	0	0	28	10	115	40	11	6	115	40	0	0
D. Khan Gulshan	1448	344	1440	878	61	0	0	870	60	1245	86	142	41	1237	86	1353	93	249	72	1345	93	0	0
Cantonment 1	825	794	825	5	1	0	0	5	1	70	8	39	5	70	8	293	36	262	33	293	36	8	1
Cantonment 3	1118	518	1101	429	38	0	0	412	37	568	51	0	0	552	50	1016	91	416	80	999	91	0	0
Beraid U. Gulshan	1872	67	463	1644	88	0	0	235	51	1842	98	37	55	433	94	1872	100	67	100	463	100	0	0
Gulshan 57	2145	174	1490	1511	70	0	0	856	57	1959	91	0	0	1304	88	2145	100	174	100	1490	100	0	0
Beraid Demra	578	61	310	517	90	0	0	249	80	578	100	61	100	310	100	578	100	61	100	310	100	4	1
Demra	1236	196	986	1007	82	0	0	757	77	1174	95	134	68	924	94	1236	100	196	100	986	100	11	1
DE-Matuail	850	79	541	621	73	0	0	312	58	706	83	0	0	397	73	808	95	36	46	499	92	0	0
Summary	16636	6672	13241	7850	47	0	0	4475	34	10716	64	1121	17	7337	55	13173	79	3285	49	9794	74	417	3

TABLE B.1(2) FLOOD AREA AND LAD USE AT DHAKA EAST/DRAINAGE RELATED AREA (AGRICULTURAL LAND)

Name of Zone	Total Area	Total Agricul. Area in 1990	Total Agricul. Area in 2010	Annual Flood						External Flood											
										1987 Flood						1988 Flood					
				Total Flood Area	Ratio of Flood Area	Flood Area in Agri. in 1990	R. of Agri. in Flood Area in 1990	Flood Area in Agri. in 2010	R. of Agri. in Flood Area in 2010	Total Flood Area	Ratio of Flood Area	Flood Area in B/U in 1990	R. of Agri. in Flood Area in 1990	Flood Area in B/U in 2010	R. of Agri. in Flood Area in 2010	Total Flood Area	Ratio of Flood Area	Flood Area in B/U in 1990	R. of Agri. in Flood Area in 1990	Flood Area in B/U in 2010	R. of Agri. in Flood Area in 2010
	(ha.) (a)	(ha.) (b)	(ha.) (c)	(ha.) (d)	(%) =(d)/(a)	(ha.) (e)	(%) =(e)/(b)	(ha.) (f)	(%) =(f)/(c)	(ha.) (g)	(%) =(g)/(a)	(ha.) (h)	(%) =(h)/(b)	(ha.) (i)	(%) =(i)/(c)	(ha.) (j)	(%) =(j)/(a)	(ha.) (k)	(%) =(k)/(b)	(ha.) (l)	(%) =(l)/(c)
Ward 4	96	1	0	0	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-
Ward 7	199	0	0	0	0	0	-	0	-	0	0	0	-	0	-	0	0	0	-	0	-
Ward 8	83	0	0	0	0	0	-	0	-	0	0	0	-	0	-	0	0	0	-	0	-
Ward 9	72	0	0	0	0	0	-	0	-	0	0	0	-	0	-	0	0	0	-	0	-
Ward 11	12	0	0	0	0	0	-	0	-	0	0	0	-	0	-	0	0	0	-	0	-
Ward 13	31	0	0	0	0	0	-	0	-	0	0	0	-	0	-	0	0	0	-	0	-
Ward 27	14	0	0	0	0	0	-	0	-	0	0	0	-	0	-	0	0	0	-	0	-
Ward 28	20	0	0	0	0	0	-	0	-	0	0	0	-	0	-	0	0	0	-	0	-
Ward 29	46	0	0	0	0	0	-	0	-	0	0	0	-	0	-	0	0	0	-	0	-
Ward 34	151	23	0	48	32	23	100	0	-	98	65	23	100	0	-	145	96	23	100	0	-
Ward 35	103	3	0	0	0	0	0	0	-	0	0	0	0	0	-	43	42	3	100	0	-
Ward 36	190	9	0	26	14	9	100	0	-	41	22	9	100	0	-	172	90	9	100	0	-
Ward 37	76	0	0	0	0	0	-	0	-	0	0	0	-	0	-	64	84	0	-	0	-
Ward 38	105	0	0	6	6	0	-	0	-	16	15	0	-	0	-	105	100	0	-	0	-
Ward 39	185	30	0	31	17	30	100	0	-	130	70	30	100	0	-	185	100	30	100	0	-
Ward 40	439	74	0	143	33	74	100	0	-	230	52	74	100	0	-	325	74	74	100	0	-
Ward 41	96	0	0	0	0	0	-	0	-	0	0	0	-	0	-	71	74	0	-	0	-
Ward 42	80	0	0	0	0	0	-	0	-	0	0	0	-	0	-	32	40	0	-	0	-
Ward 43	128	0	0	0	0	0	-	0	-	0	0	0	-	0	-	30	24	0	-	0	-
Ward 44	230	0	0	0	0	0	-	0	-	0	0	0	-	0	-	0	0	0	-	0	-
Ward 45	194	0	0	0	0	0	-	0	-	0	0	0	-	0	-	0	0	0	-	0	-
Ward 46	161	0	0	0	0	0	-	0	-	0	0	0	-	0	-	0	0	0	-	0	-
Ward 47	156	0	0	11	7	0	-	0	-	27	17	0	-	0	-	48	31	0	-	0	-
Ward 48	326	0	0	12	4	0	-	0	-	99	30	0	-	0	-	140	43	0	-	0	-
Ward 49	131	0	0	0	0	0	-	0	-	10	7	0	-	0	-	19	15	0	-	0	-
Ward 50	93	0	0	0	0	0	-	0	-	1	2	0	-	0	-	4	5	0	-	0	-
Ward 51	672	0	0	33	5	0	-	0	-	210	31	0	-	0	-	480	72	0	-	0	-
Ward 52	186	0	0	36	19	0	-	0	-	128	69	0	-	0	-	186	100	0	-	0	-
Ward 53	193	0	0	24	12	0	-	0	-	95	49	0	-	0	-	121	63	0	-	0	-
Uttar Khan	1811	1585	240	850	47	812	51	240	100	1460	81	1422	90	240	100	1562	86	1524	96	240	100
D. Khan Cant	288	14	0	18	6	0	0	0	-	28	10	0	0	0	-	115	40	14	100	0	-
D. Khan Gulshan	1448	1095	0	878	61	869	79	0	-	1245	86	1095	100	0	-	1353	93	1095	100	0	-
Cantonment 1	825	4	0	5	1	0	0	0	-	70	8	4	100	0	-	293	36	4	100	0	-
Cantonment 3	1118	583	0	429	38	412	71	0	-	568	51	552	95	0	-	1016	91	583	100	0	-
Beraid U. Gulshan	1872	1806	720	1644	88	1644	91	720	100	1842	98	1806	100	720	100	1872	100	1806	100	720	100
Gulshan 57	2145	1666	350	1511	70	1206	72	350	100	1959	91	1655	99	350	100	2145	100	1666	100	350	100
Beraid Demra	578	348	0	517	90	348	100	0	-	578	100	348	100	0	-	578	100	348	100	0	-
Demra	1236	1035	0	1007	82	1002	97	0	-	1174	95	1035	100	0	-	1236	100	1035	100	0	-
DE-Matuail	850	758	0	621	73	607	80	0	-	706	83	692	91	0	-	808	95	758	100	0	-
Sumary	16636	9034	1310	7850	47	7036	78	1310	100	10716	64	8744	97	1310	100	13173	79	8972	99	1310	100

TABLE B.2 FLOOD CONDITION OF DHAKA EAST/DRAINAGE RELATED AREA

Name of Zone	External Flood																		Internal Flood									
	Annual Flood						1987 Flood						1988 Flood						Annual Flood						Worst Flood			
	Depth (meter)			Duration (day)			Depth (meter)			Duration (day)			Depth (meter)			Duration (day)			Depth (meter)			Duration (day)			Depth (meter)			Duration (day)	
	Max.	Ave.	Min.	Max.	Ave.	Min.	Max.	Ave.	Min.	Max.	Ave.	Min.	Max.	Ave.	Min.	Max.	Ave.	Min.	Max.	Ave.	Min.	Max.	Ave.	Min.	Max.	Ave.	Min.	Max.	Ave.	Min.
Ward 4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ward 7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.64	0.64	0.00	16.00	16.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ward 8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.85	0.73	0.00	18.00	17.00	0.00	0.61	0.37	0.00	4.00	0.62	0.00	0.91	0.52	0.00	4.00	0.77	0.00
Ward 9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ward 11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ward 13	0.00	0.00	0.00	0.00	0.00	0.00	0.15	0.15	0.00	4.00	4.00	0.00	0.76	0.76	0.00	20.00	20.00	0.00	0.08	0.08	0.00	0.15	0.15	0.00	0.23	0.23	0.00	0.50	0.50	0.00
Ward 27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ward 28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ward 29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.72	0.56	0.27	26.00	18.66	9.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ward 34	0.00	0.00	0.00	0.00	0.00	0.00	0.61	0.54	0.00	16.00	11.50	0.00	1.22	0.88	0.46	34.00	23.66	12.00	0.00	0.00	0.00	0.00	0.00	0.00	0.15	0.15	0.00	0.10	0.10	0.00
Ward 35	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.84	0.84	0.84	29.00	29.00	29.00	0.61	0.37	0.00	3.00	0.37	0.00	0.91	0.47	0.00	5.00	1.03	0.00
Ward 36	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.08	0.00	2.00	2.00	0.00	1.19	0.76	0.00	35.00	23.33	0.00	0.61	0.33	0.00	0.50	0.15	0.00	0.91	0.48	0.00	2.00	0.55	0.00
Ward 37	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.46	0.29	0.15	14.00	10.29	6.00	0.61	0.56	0.30	0.50	0.32	0.21	0.91	0.76	0.61	6.00	2.50	0.50
Ward 38	0.00	0.00	0.00	0.00	0.00	0.00	0.18	0.17	0.00	6.00	6.00	0.00	1.19	1.08	1.01	36.00	30.00	20.00	0.30	0.30	0.30	2.00	0.72	0.13	0.61	0.49	0.30	6.00	2.60	1.00
Ward 39	0.00	0.00	0.00	0.00	0.00	0.00	0.12	0.12	0.00	5.00	5.00	0.00	1.10	0.88	0.40	34.00	27.29	12.00	0.30	0.30	0.30	2.00	0.58	0.08	0.91	0.51	0.30	5.00	2.08	0.42
Ward 40	0.00	0.00	0.00	0.00	0.00	0.00	0.12	0.12	0.00	5.00	5.00	0.00	1.13	0.60	0.00	36.00	18.42	0.00	0.61	0.36	0.00	3.00	0.40	0.00	0.91	0.57	0.00	4.00	0.96	0.00
Ward 41	0.00	0.00	0.00	0.00	0.00	0.00	0.53	0.53	0.00	18.00	18.00	0.00	1.52	0.57	0.00	45.00	17.60	0.00	0.61	0.37	0.00	1.00	0.37	0.00	0.91	0.61	0.00	3.00	1.03	0.00
Ward 42	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.08	0.00	1.00	1.00	0.00	0.64	0.44	0.00	15.00	10.67	0.00	0.61	0.44	0.30	0.63	0.38	0.21	0.91	0.70	0.30	2.00	1.02	0.50
Ward 43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.76	0.61	0.00	27.00	21.00	0.00	0.61	0.47	0.00	3.00	0.46	0.00	0.91	0.72	0.00	5.00	0.82	0.00
Ward 44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.61	0.45	0.00	3.00	0.64	0.00	0.91	0.67	0.00	5.00	1.44	0.00
Ward 45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.61	0.45	0.00	3.00	0.84	0.00	0.91	0.69	0.00	4.00	1.86	0.00
Ward 46	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.61	0.61	0.00	15.00	15.00	0.00	0.61	0.44	0.30	0.50	0.30	0.17	0.91	0.61	0.30	2.00	0.69	0.25
Ward 47	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.08	0.00	2.00	2.00	0.00	0.94	0.85	0.00	18.00	16.50	0.00	0.61	0.38	0.00	2.00	0.50	0.00	0.91	0.58	0.00	3.00	1.17	0.00
Ward 48	0.00	0.00	0.00	0.00	0.00	0.00	0.91	0.54	0.00	15.00	11.17	0.00	1.80	0.83	0.00	32.00	18.91	0.00	0.61	0.46	0.30	0.63	0.52	0.42	0.91	0.76	0.61	2.00	2.00	2.00
Ward 49	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.76	0.62	0.00	17.00	14.00	0.00	0.61	0.37	0.00	0.63	0.37	0.00	0.91	0.53	0.00	4.00	1.27	0.00
Ward 50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.82	0.81	0.00	20.00	20.00	0.00	0.61	0.42	0.00	0.63	0.40	0.00	0.91	0.62	0.00	2.00	1.18	0.00
Ward 51	0.00	0.00	0.00	0.00	0.00	0.00	0.46	0.46	0.00	10.00	10.00	0.00	0.99	0.58	0.00	30.00	19.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ward 52	0.00	0.00	0.00	0.00	0.00	0.00	0.15	0.15	0.00	4.00	4.00	0.00	0.76	0.60	0.00	25.00	17.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ward 53	0.00	0.00	0.00	0.00	0.00	0.00	0.15	0.15	0.00	5.00	5.00	0.00	0.90	0.37	0.00	22.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Uttar Khan	0.00	0.00	0.00	0.00	0.00	0.00	0.66	0.41	0.00	18.00	11.94	0.00	1.93	1.04	0.00	35.00	22.88	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
D. Khan Cant	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.07	0.60	0.00	28.00	16.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.26	0.26	0.00	1.00	1.00	0.00
D. Khan Gulshan	0.00	0.00	0.00	0.00	0.00	0.00	0.69	0.34	0.00	22.00	9.90	0.00	1.74	0.66	0.00	40.00	19.82	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cantonment 1	0.00	0.00	0.00	0.00	0.00	0.00	0.64	0.39	0.00	12.00	7.70	0.00	1.83	0.89	0.00	35.00	19.30	0.00	0.11	0.11	0.00	0.20	0.20	0.00	0.46	0.46	0.00	0.40	0.40	0.00
Cantonment 3	0.00	0.00	0.00	0.00	0.00	0.00	0.43	0.28	0.00	15.00	9.00	0.00	1.40	0.81	0.00	65.00	24.39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Beraid U. Gulshan	0.00	0.00	0.00	0.00	0.00	0.00	0.20	0.20	0.00	7.00	7.00	0.00	1.25	0.70	0.00	39.00	19.71	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Gulshan 57	0.00	0.00	0.00	0.00	0.00	0.00	0.38	0.24	0.00	12.00	7.77	0.00	1.19	0.78	0.00	38.00	21.97	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Beraid Demra	0.00	0.00	0.00	0.00	0.00	0.00	0.24	0.24	0.00	7.00	7.00	0.00	0.99	0.74	0.30	23.00	16.57	8.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Demra	0.00	0.00	0.00	0.00	0.00	0.00	0.38	0.29	0.00	13.00	9.75	0.00	1.52	0.92	0.29	42.00	26.84	12.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DE-Matuail	0.00	0.00	0.00	0.00	0.00	0.00	0.76	0.41	0.00	12.00	9.67	0.00	2.13	0.86	0.00	36.00	27.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SUMMARY	0.00	0.00	0.00	0.00	0.00	0.00	0.91	0.27	0.00	22.00	7.47	0.00	2.13	0.72	0.00	65.00	19.66	0.00	0.61	0.37	0.00	4.00	0.44	0.00	0.91	0.54	0.00	6.00	1.19	0.00

TABLE B.3.1 FLOOD AREA AND LAND USE AT DND(BUILT UP AREA)

Name of Zone	Total Area	Total B/U Area in 1990	Total B/U Area in 2010	External Flood																		Internal Flood	
				Annual Flood						1987 Flood						1988 Flood							
				Total Flood Area	Ratio of Flood Area	Flood Area in B/U in 1990	R. of B/U in Flood Area in 1990	Flood Area in B/U in 2010	R. of B/U in Flood Area in 2010	Total Flood Area	Ratio of Flood Area	Flood Area in B/U in 1990	R. of B/U in Flood Area in 1990	Flood Area in B/U in 2010	R. of B/U in Flood Area in 2010	Total Flood Area	Ratio of Flood Area	Flood Area in B/U in 1990	R. of B/U in Flood Area in 1990	Flood Area in B/U in 2010	R. of B/U in Flood Area in 2010	Total Flood Area	Ratio of Flood Area
	(ha.) (a)	(ha.) (b)	(ha.) (c)	(ha.) (d)	(%) =(d)/(a)	(ha.) (e)	(%) =(e)/(b)	(ha.) (f)	(%) =(f)/(c)	(ha.) (g)	(%) =(g)/(a)	(ha.) (h)	(%) =(h)/(b)	(ha.) (i)	(%) =(i)/(c)	(ha.) (j)	(%) =(j)/(a)	(ha.) (k)	(%) =(k)/(b)	(ha.) (l)	(%) =(l)/(c)	(ha.) (m)	(%) =(m)/(a)
Ward 31	8	8	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ward 32	162	162	155	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	6
Ward 33	52	47	50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DND-Matuail	1479	581	1282	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	1
Shyampur	397	142	361	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11	3
DND-Siddirganj	564	129	406	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DND-Simulpara	198	150	114	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	5
Kutubpur	1243	310	844	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	109	9
DND-Godnail	826	238	317	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	146	18
Fatullah	478	253	467	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	57	12
DND-Enayetnagar	22	12	22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	14
DND-N'ganj 1	44	15	42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	33	74
DND-N'ganj 2	49	34	49	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	4
DND-N'ganj 3	156	93	154	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	22	14
Summary	5679	2174	4270	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	410	7

TABLE B.3.2 FLOOD AREA AND LAND USE AT DND (AGRICULTURAL AREA)

Name of Zone	Total Area	Total Agricul. Area in 1990	Total Agricul. Area in 2010	External Flood																	
				Annual Flood						1987 Flood						1988 Flood					
				Total Flood Area	Ratio of Flood Area	Flood Area in Agri. in 1990	R. of Agri. in Flood Area in 1990	Flood Area in Agri. in 2010	R. of Agri. in Flood Area in 2010	Total Flood Area	Ratio of Flood Area	Flood Area in B/U in 1990	R. of Agri. in Flood Area in 1990	Flood Area in B/U in 2010	R. of Agri. in Flood Area in 2010	Total Flood Area	Ratio of Flood Area	Flood Area in B/U in 1990	R. of Agri. in Flood Area in 1990	Flood Area in B/U in 2010	R. of Agri. in Flood Area in 2010
	(ha.) (a)	(ha.) (b)	(ha.) (c)	(ha.) (d)	(%) =(d)/(a)	(ha.) (e)	(%) =(e)/(b)	(ha.) (f)	(%) =(f)/(c)	(ha.) (g)	(%) =(g)/(a)	(ha.) (h)	(%) =(h)/(b)	(ha.) (i)	(%) =(i)/(c)	(ha.) (j)	(%) =(j)/(a)	(ha.) (k)	(%) =(k)/(b)	(ha.) (l)	(%) =(l)/(c)
Ward 31	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ward 32	162	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ward 33	52	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DND-Matuail	1479	886	78	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Shyampur	397	129	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DND-Siddirganj	564	428	31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DND-Simulpara	198	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Kutubpur	1243	869	188	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DND-Godnail	826	584	235	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fatullah	478	159	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DND-Enayetnagar	22	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DND-N'ganj 1	44	27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DND-N'ganj 2	49	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DND-N'ganj 3	156	63	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Summary	5679	3173	532	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

TABLE B.4 FLOOD CONDITION OF DND

Name of Zone	External Flood																		Internal Flood									
	Annual Flood						1987 Flood						1988 Flood						Annual Flood						Worst Flood			
	Depth (meter)			Duration (day)			Depth (meter)			Duration (day)			Depth (meter)			Duration (day)			Depth (meter)			Duration (day)			Depth (meter)			Duration (day)	
	Max.	Ave.	Min.	Max.	Ave.	Min.	Max.	Ave.	Min.	Max.	Ave.	Min.	Max.	Ave.	Min.	Max.	Ave.	Min.	Max.	Ave.	Min.	Max.	Ave.	Min.	Max.	Ave.	Min.	Max.	Ave.	Min.
Ward 31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ward 32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.46	0.31	0.00	0.30	0.21	0.00
Ward 33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DND-Matuail	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.29	0.23	0.00	0.35	0.24	0.00
Shyampur	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.43	0.43	0.00	0.30	0.30	0.00
DND-Siddirganj	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.15	0.13	0.00	2.00	2.00	0.00	0.26	0.24	0.21	7.00	6.39	6.00
DND-Simulpara	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.23	0.23	0.00	7.00	7.00	0.00
Kutubpur	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.26	0.23	0.00	7.00	6.67	0.00
DND-Godnail	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.25	0.19	0.00	7.00	4.63	0.00
Fatullah	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.41	0.29	0.00	3.00	0.90	0.00
DND-Enayetnagar	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DND-N'ganj 1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DND-N'ganj 2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.09	0.00	0.25	0.22	0.00
DND-N'ganj 3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.76	0.51	0.00	1.00	0.81	0.00
SUMMARY	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.15	0.13	0.00	2.00	2.00	0.00	0.76	0.28	0.00	7.00	2.74	0.00

TABLE B.5(1) FLOOD AREA AND LAND USE AT NARAYANGANJ WEST(BUILT UP)

Name of Zone	Total Area	Total B/U Area in 1990	Total B/U Area in 2010	External Flood																		Internal Flood	
				Annual Flood						1987 Flood						1988 Flood							
				Total Flood Area	Ratio of Flood Area	Flood Area in B/U in 1990	R. of B/U in Flood Area in 1990	Flood Area in B/U in 2010	R. of B/U in Flood Area in 2010	Total Flood Area	Ratio of Flood Area	Flood Area in B/U in 1990	R. of B/U in Flood Area in 1990	Flood Area in B/U in 2010	R. of B/U in Flood Area in 2010	Total Flood Area	Ratio of Flood Area	Flood Area in B/U in 1990	R. of B/U in Flood Area in 1990	Flood Area in B/U in 2010	R. of B/U in Flood Area in 2010	Total Flood Area	Ratio of Flood Area
	(ha.) (a)	(ha.) (b)	(ha.) (c)	(ha.) (d)	(%) =(d)/(a)	(ha.) (e)	(%) =(e)/(b)	(ha.) (f)	(%) =(f)/(c)	(ha.) (g)	(%) =(g)/(a)	(ha.) (h)	(%) =(h)/(b)	(ha.) (i)	(%) =(i)/(c)	(ha.) (j)	(%) =(j)/(a)	(ha.) (k)	(%) =(k)/(b)	(ha.) (l)	(%) =(l)/(c)	(ha.) (m)	(%) =(m)/(a)
NW-Matuail	136	118	123	0	0	0	0	0	0	7	5	0	0	0	0	136	100	118	100	123	100	0	0
NW-Siddirganj	183	49	177	0	0	0	0	0	0	12	7	0	0	6	4	183	100	49	100	177	100	0	0
NW-Simulpara	411	266	400	0	0	0	0	0	0	50	12	0	0	40	10	411	100	266	100	400	100	23	6
NW-Godnail	164	68	161	0	0	0	0	0	0	9	5	0	0	6	4	164	100	68	100	161	100	16	10
NW-Enayetnagar	33	32	5	1	2	0	0	0	0	26	80	26	80	0	0	33	100	32	100	5	100	0	0
Kashipur	140	110	91	30	21	0	0	0	0	140	100	110	100	91	100	140	100	110	100	91	100	0	0
NW-N'ganj 1	85	68	83	0	0	0	0	0	0	36	42	19	28	34	41	85	100	68	100	83	100	0	0
NW-N'ganj 2	86	86	85	0	0	0	0	0	0	47	54	46	54	45	53	86	100	86	100	85	100	2	3
NW-N'ganj 3	78	58	76	0	0	0	0	0	0	10	13	0	0	9	11	78	100	58	100	76	100	1	1
N'ganj 4	184	157	178	27	15	0	0	22	12	104	56	76	49	98	55	184	100	157	100	178	100	6	4
N'ganj 5	100	86	96	10	10	0	0	6	6	23	23	9	10	19	20	100	100	86	100	96	100	23	23
N'ganj 6	55	47	51	0	0	0	0	0	0	18	32	10	20	14	28	55	100	47	100	51	100	0	0
N'ganj 7	124	94	110	30	24	0	0	16	14	76	61	45	48	61	56	124	100	94	100	110	100	3	2
N'ganj 8	85	73	82	12	14	0	0	10	12	49	58	37	51	47	57	85	100	73	100	82	100	12	14
Summary	1863	1312	1720	111	6	0	0	53	3	606	33	379	29	471	27	1863	100	1312	100	1720	100	87	5

TABLE B.5(2) FLOOD AREA AND LAND USE AT NARAYANGANJ WEST(AGRICULTURE AREA)

Name of Zone	Total Area	Total Agricul. Area in 1990	Total Agricul. Area in 2010	External Flood																	
				Annual Flood						1987 Flood						1988 Flood					
				Total Flood Area	Ratio of Flood Area	Flood Area in Agri. in 1990	R. of Agri. in Flood Area in 1990	Flood Area in Agri. in 2010	R. of Agri. in Flood Area in 2010	Total Flood Area	Ratio of Flood Area	Flood Area in B/U in 1990	R. of Agri. in Flood Area in 1990	Flood Area in B/U in 2010	R. of Agri. in Flood Area in 2010	Total Flood Area	Ratio of Flood Area	Flood Area in B/U in 1990	R. of Agri. in Flood Area in 1990	Flood Area in B/U in 2010	R. of Agri. in Flood Area in 2010
	(ha.) (a)	(ha.) (b)	(ha.) (c)	(ha.) (d)	(%) =(d)/(a)	(ha.) (e)	(%) =(e)/(b)	(ha.) (f)	(%) =(f)/(c)	(ha.) (g)	(%) =(g)/(a)	(ha.) (h)	(%) =(h)/(b)	(ha.) (i)	(%) =(i)/(c)	(ha.) (j)	(%) =(j)/(a)	(ha.) (k)	(%) =(k)/(b)	(ha.) (l)	(%) =(l)/(c)
NW-Matuail	136	17	6	0	0	0	0	0	0	7	5	6	34	0	0	136	100	17	100	6	100
NW-Siddirganj	183	132	1	0	0	0	0	0	0	12	7	10	8	1	100	183	100	132	100	1	100
NW-Simulpara	411	75	0	0	0	0	0	0	0	50	12	0	0	0	100	411	100	75	100	0	100
NW-Godnail	164	95	1	0	0	0	0	0	0	9	5	8	9	1	100	164	100	95	100	1	100
NW-Enayetnagar	33	0	0	1	2	0	100	0	-	26	80	0	100	0	-	33	100	0	100	0	-
Kashipur	140	27	1	30	21	27	100	0	0	140	100	27	100	1	100	140	100	27	100	1	100
NW-N'ganj 1	85	10	0	0	0	0	0	0	-	36	42	10	100	0	-	85	100	10	100	0	-
NW-N'ganj 2	86	0	0	0	0	0	100	0	-	47	54	0	100	0	-	86	100	0	100	0	-
NW-N'ganj 3	78	20	0	0	0	0	0	0	-	10	13	10	50	0	-	78	100	20	100	0	-
N'ganj 4	184	26	0	27	15	26	100	0	-	104	56	26	100	0	-	184	100	26	100	0	-
N'ganj 5	100	14	0	10	10	10	73	0	-	23	23	14	100	0	-	100	100	14	100	0	-
N'ganj 6	55	8	0	0	0	0	0	0	-	18	32	8	100	0	-	55	100	8	100	0	-
N'ganj 7	124	28	0	30	24	28	100	0	-	76	61	28	100	0	-	124	100	28	100	0	-
N'ganj 8	85	12	0	12	14	12	100	0	100	49	58	12	100	0	100	85	100	12	100	0	100
									-						-						-
Summary	1863	464	8	111	6	104	22	0	0	606	33	160	34	2	26	1863	100	464	100	8	100

TABLE B.6 FLOOD CONDITION OF NARAYANGANJ WEST

Name of Zone	External Flood																		Internal Flood									
	Annual Flood						1987 Flood						1988 Flood						Annual Flood						Worst Flood			
	Depth (meter)			Duration (day)			Depth (meter)			Duration (day)			Depth (meter)			Duration (day)			Depth (meter)			Duration (day)			Depth (meter)			Duration (day)	
	Max.	Ave.	Min.	Max.	Ave.	Min.	Max.	Ave.	Min.	Max.	Ave.	Min.	Max.	Ave.	Min.	Max.	Ave.	Min.	Max.	Ave.	Min.	Max.	Ave.	Min.	Max.	Ave.	Min.	Max.	Ave.	Min.
NW-Matuail	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.88	0.77	0.00	22.00	18.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NW-Siddirganj	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.94	0.81	0.73	23.00	19.30	18.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NW-Simulpara	0.00	0.00	0.00	0.00	0.00	0.00	0.46	0.30	0.00	15.00	13.50	0.00	1.22	0.72	0.15	31.00	20.50	6.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NW-Godnail	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.14	0.67	0.15	20.00	13.80	6.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NW-Enayetnagar	0.00	0.00	0.00	0.00	0.00	0.00	0.30	0.30	0.00	7.00	7.00	0.00	1.31	0.92	0.00	30.00	21.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Kashipur	0.00	0.00	0.00	0.00	0.00	0.00	0.58	0.40	0.00	13.00	9.10	0.00	1.63	0.91	0.15	32.00	18.40	3.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NW-N'ganj 1	0.00	0.00	0.00	0.00	0.00	0.00	0.15	0.11	0.00	6.00	5.00	0.00	0.99	0.78	0.64	30.00	24.00	15.00	0.00	0.00	0.00	0.00	0.00	0.00	0.15	0.15	0.00	1.00	1.00	0.00
NW-N'ganj 2	0.00	0.00	0.00	0.00	0.00	0.00	0.20	0.20	0.00	7.00	7.00	0.00	1.07	1.07	0.00	30.00	30.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.24	0.18	0.00	1.00	1.00	0.00
NW-N'ganj 3	0.00	0.00	0.00	0.00	0.00	0.00	0.46	0.46	0.00	15.00	15.00	0.00	1.07	0.74	0.23	35.00	22.50	7.00	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.08	0.00	0.25	0.25	0.00
N'ganj 4	0.00	0.00	0.00	0.00	0.00	0.00	0.23	0.21	0.00	8.00	6.33	0.00	1.14	0.67	0.00	40.00	19.57	0.00	0.12	0.12	0.00	0.08	0.08	0.00	0.82	0.45	0.00	0.83	0.47	0.00
N'ganj 5	0.00	0.00	0.00	0.00	0.00	0.00	0.38	0.25	0.00	12.00	7.25	0.00	1.14	0.88	0.58	35.00	22.43	15.00	0.00	0.00	0.00	0.00	0.00	0.00	0.30	0.30	0.00	0.50	0.50	0.00
N'ganj 6	0.00	0.00	0.00	0.00	0.00	0.00	0.61	0.34	0.00	14.00	8.67	0.00	1.60	1.14	0.91	30.00	25.75	21.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
N'ganj 7	0.00	0.00	0.00	0.00	0.00	0.00	0.61	0.24	0.00	14.00	6.33	0.00	1.58	1.01	0.46	35.00	23.71	18.00	0.00	0.00	0.00	0.00	0.00	0.00	0.61	0.61	0.00	2.00	2.00	0.00
N'ganj 8	0.00	0.00	0.00	0.00	0.00	0.00	0.34	0.20	0.00	7.00	4.00	0.00	1.10	0.61	0.00	30.00	23.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.38	0.21	0.00	0.50	0.28	0.00
SUMMARY	0.00	0.00	0.00	0.00	0.00	0.00	0.61	0.27	0.00	15.00	8.11	0.00	1.63	0.84	0.00	40.00	21.69	0.00	0.12	0.12	0.00	0.08	0.08	0.00	0.82	0.28	0.00	2.00	0.79	0.00

Table B.7 No. of Properties by Area by Type of Properties by Year

1. 1990

(Unit : Number)

Name of Areas	Houses	Businesses	Industries	Institutions
Dhaka East - 1	27,976	1,026	0	1,565
Dhaka East - 2	10,210	75	0	81
Dhaka East - 3	151,019	6,366	1,217	10,381
Dhaka East - 4	152,468	6,384	282	7,470
Dhaka East (Sub-Total)	341,673	13,851	1,499	19,497
Narayanganj DND	87,634	2,408	1,226	3,544
Narayanganj West	81,762	3,465	1,013	2,461
TOTAL	511,069	19,724	3,738	25,502

2. 2010

(Unit : Number)

Name of Areas	Houses	Businesses	Industries	Institutions
Dhaka East - 1	130,785	2,736	0	2,600
Dhaka East - 2	43,650	479	0	418
Dhaka East - 3	286,965	10,571	1,830	18,303
Dhaka East - 4	255,385	9,520	440	14,758
Dhaka East (Sub-Total)	716,785	23,306	2,270	36,079
Narayanganj DND	256,643	6,410	3,873	11,656
Narayanganj West	160,891	6,021	2,245	4,509
TOTAL	1,134,319	35,737	8,388	52,244

Note : No. is on household basis.
Source : Population Census 1981 and JICA

Table B.8 Farm Houses by Area in 1990 and 2010

(Unit : Number)

Name of Areas	1990	2010
Dhaka East - 1	9,683	593
Dhaka East - 2	8,271	2,642
Dhaka East - 3	6,262	0
Dhaka East - 4	21,179	0
Dhaka East (Sub-Total)	45,395	3,235
Narayanganj DND	14,492	1,868
Narayanganj West	3,459	26
TOTAL	63,346	5,129

Source : Upazila Statistics of Bangladesh 1988 and JICA.

Table B.9 No. of Properties in Inundation Areas by Area by Type of Properties in 1990

(Unit : Number)

Name of Areas	Houses	Businesses	Industries	Institutions
1. Annual Flood				
Dhaka East - 1	0	0	0	0
Dhaka East - 2	0	0	0	0
Dhaka East - 3	0	0	0	0
Dhaka East - 4	0	0	0	0
Dhaka East (Sub-Total)	0	0	0	0
Narayanganj DND	0	0	0	0
Narayanganj West	0	0	0	0
TOTAL	0	0	0	0
2. 1987 - Scale Flood				
Dhaka East - 1	4,031	108	0	44
Dhaka East - 2	1,012	1	0	2
Dhaka East - 3	24,731	771	313	1,463
Dhaka East - 4	31,602	778	6	1,548
Dhaka East (Sub-Total)	61,376	1,658	319	3,057
Narayanganj DND	25,414	698	356	1,028
Narayanganj West	23,043	688	218	346
TOTAL	109,833	3,044	893	4,431
3. 1988 - Scale Flood				
Dhaka East - 1	11,002	357	0	325
Dhaka East - 2	9,831	63	0	73
Dhaka East - 3	48,812	1,605	458	2,872
Dhaka East - 4	96,333	3,077	28	4,017
Dhaka East (Sub-Total)	165,978	5,102	486	7,287
Narayanganj DND	87,634	2,408	1,226	3,544
Narayanganj West	64,679	3,068	705	1,500
TOTAL	318,291	10,578	2,417	12,331

Note : No. is on household basis.
Source : Population Census 1981 and JICA.

Table B.10 No. of Properties in Inundation Areas by Area by Type of Properties in 2010

(Unit : Number)

Name of Zones	Houses	Businesses	Industries	Institutions
1. Annual Flood				
Dhaka East - 1	52,593	1,010	0	333
Dhaka East - 2	21,573	186	0	180
Dhaka East - 3	35,187	544	1	594
Dhaka East - 4	55,598	1,514	19	3,899
Dhaka East (Sub-Total)	164,951	3,254	20	5,006
Narayanganj DND	7,699	192	116	350
Narayanganj West	6,517	329	47	127
TOTAL	179,167	3,775	183	5,483
2. 1987 - Scale Flood				
Dhaka East - 1	90,600	1,462	0	532
Dhaka East - 2	33,991	257	0	261
Dhaka East - 3	84,086	1,814	471	3,070
Dhaka East - 4	95,280	2,563	31	6,165
Dhaka East (Sub-Total)	303,957	6,096	502	10,028
Narayanganj DND	69,294	1,731	1,046	3,148
Narayanganj West	47,550	1,706	398	878
TOTAL	420,801	9,533	1,946	14,054
3. 1988 - Scale Flood				
Dhaka East - 1	106,827	1,987	0	1,268
Dhaka East - 2	42,450	440	0	392
Dhaka East - 3	130,085	3,468	690	5,780
Dhaka East - 4	185,640	5,819	61	9,868
Dhaka East (Sub-Total)	465,002	11,714	751	17,308
Narayanganj DND	256,643	6,410	3,873	11,659
Narayanganj West	148,026	5,118	5,082	4,067
TOTAL	869,671	23,242	9,706	33,034

Note : No. is on household basis.
Source : Population Census 1981 and JICA.

Table B.11 1987 - Scale Flood Damages by Area by Type of Properties in 1990

Bd = Building(s), H.E = Household Effects, Ic = Income, E & I = Equipment and Inventories, Pf = Profit, Cp = Crops

(Unit : Tk. Million)

Name of Areas	Residential			Commercial			Industrial			Institutional	Agricultural
	Bd	H.E	Ic	Bd	E & I	Pf	Bd	E & I	Pf	Bd	Cp
Dhaka East - 1	20.2	0.3	5.2	0.0	0.0	0.1	0.0	0.0	0.0	0.0	46.7
Dhaka East - 2	2.1	0.0	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	41.7
Dhaka East - 3	65.0	3.2	26.7	0.0	0.0	0.4	0.0	0.0	0.0	0.0	28.7
Dhaka East - 4	105.2	4.7	36.7	0.0	0.0	0.4	0.0	0.0	0.0	0.0	104.6
Dhaka East (Sub-Total)	192.5	8.2	69.7	0.0	0.0	0.9	0.0	0.0	0.0	0.0	221.7
Narayanganj DND	87.0	0.0	30.2	0.0	0.0	0.4	0.0	0.0	0.0	0.0	25.3
Narayanganj West	40.4	0.9	21.1	0.0	0.0	0.3	0.0	0.0	0.0	0.0	12.8
TOTAL	319.9	9.1	121.0	0.0	0.0	1.6	0.0	0.0	0.0	0.0	259.8

Source : JICA

Table B.12 1988 - Scale Flood Damages by Area by Type of Properties in 1990

Bd = Building(s), H.E = Household Effects, Ic = Income, E & I = Equipment and Inventories, Pf = Profit, Cp = Crops

(Unit : Tk. Million)

Name of Areas	Residential			Commercial			Industrial			Institutional	Agricultural
	Bd	H.E	Ic	Bd	E & I	Pf	Bd	E & I	Pf	Bd	Cp
Dhaka East - 1	91.0	45.9	14.0	2.5	5.8	0.5	0.0	0.0	0.0	9.6	57.6
Dhaka East - 2	87.7	42.7	13.3	0.5	1.0	0.1	0.0	0.0	0.0	2.3	47.3
Dhaka East - 3	348.1	187.4	53.2	9.8	24.9	2.0	18.9	62.9	9.9	77.8	34.2
Dhaka East - 4	914.2	434.9	140.0	23.6	50.6	5.0	1.2	4.1	0.6	130.3	130.6
Dhaka East (Sub-Total)	1,441.0	710.9	220.5	36.4	82.3	7.6	20.1	67.0	10.5	220.0	269.7
Narayanganj DND	838.3	386.5	117.6	17.7	40.1	3.7	54.7	180.5	26.8	110.7	87.5
Narayanganj West	639.7	288.7	87.5	24.1	53.6	5.0	29.6	98.5	15.2	48.0	20.9
TOTAL	2,919.0	1,386.1	425.6	78.2	176.0	16.3	104.4	346.0	52.5	378.7	378.1

Source : JICA

Table B.13 Annual Flood Damages by Area by Type of Properties in 2010

Bd = Building(s), H.E = Household Effects, Ic = Income, E & I = Equipment and Inventories, Pf = Profit, Cp = Crops

(Unit : Tk. Million)

Name of Areas	Residential			Commercial			Industrial			Institutional	Agricultural
	Bd	H.E	Ic	Bd	E & I	Pf	Bd	E & I	Pf	Bd	Cp
Dhaka East - 1	0.0	0.0	52.2	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0
Dhaka East - 2	0.0	0.0	21.4	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0
Dhaka East - 3	0.0	0.0	31.8	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0
Dhaka East - 4	0.0	0.0	50.3	0.0	0.0	0.9	0.0	0.0	0.0	0.0	0.0
Dhaka East (Sub-Total)	0.0	0.0	155.7	0.0	0.0	1.9	0.0	0.0	0.0	0.0	0.0
Narayanganj DND	0.0	0.0	7.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0
Narayanganj West	0.0	0.0	5.9	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0
TOTAL	0.0	0.0	168.6	0.0	0.0	2.2	0.0	0.0	0.0	0.0	0.0

Source : JICA

Table B.14 1987 - Scale Flood Damages by Area by Type of Properties in 2010

Bd = Building(s), H.E = Household Effects, Ic = Income, E & I = Equipment and Inventories, Pf = Profit, Cp = Crops

(Unit : Tk. Million)

Name of Areas	Residential			Commercial			Industrial			Institutional	Agricultural
	Bd	H.E	Ic	Bd	E & I	Pf	Bd	E & I	Pf	Bd	Cp
Dhaka East - 1	984.2	27.3	217.7	0.0	0.0	1.5	0.0	0.0	0.0	0.0	3.1
Dhaka East - 2	180.3	0.0	69.8	0.0	0.0	0.3	0.0	0.0	0.0	0.0	13.5
Dhaka East - 3	399.1	9.0	152.8	0.0	0.0	1.5	0.0	0.0	0.0	0.0	0.0
Dhaka East - 4	616.2	20.9	185.2	0.0	0.0	2.2	0.0	0.0	0.0	0.0	0.0
Dhaka East (Sub-Total)	2,179.8	57.2	625.5	0.0	0.0	5.5	0.0	0.0	0.0	0.0	16.6
Narayanganj DND	382.3	0.0	132.5	0.0	0.0	1.5	0.0	0.0	0.0	0.0	2.5
Narayanganj West	150.9	3.7	73.5	0.0	0.0	1.3	0.0	0.0	0.0	0.0	0.0
TOTAL	2,713.0	60.9	831.5	0.0	0.0	8.3	0.0	0.0	0.0	0.0	19.1

Source : JICA

Table B.15 1988 - Scale Flood Damages by Area by Type of Properties in 2010

Bd = Building(s), H.E = Household Effects, Ic = Income, E & I = Equipment and Inventories, Pf = Profit, Cp = Crops

(Unit : Tk. Million)

Name of Areas	Residential			Commercial			Industrial			Institutional	Agricultural
	Bd	H.E	Ic	Bd	E & I	Pf	Bd	E & I	Pf	Bd	Cp
Dhaka East - 1	1,736.0	817.7	246.9	24.1	55.5	5.0	0.0	0.0	0.0	63.1	3.6
Dhaka East - 2	671.6	326.9	102.4	6.1	12.9	1.3	0.0	0.0	0.0	22.6	16.0
Dhaka East - 3	1,648.9	849.4	252.7	36.0	87.6	7.5	45.9	152.6	24.1	258.4	0.0
Dhaka East - 4	2,901.2	1,369.3	445.4	73.5	155.2	15.4	4.5	15.2	2.1	539.1	0.0
Dhaka East (Sub-Total)	6,957.7	3,363.3	1,047.4	139.7	311.2	29.2	50.4	167.8	26.2	883.2	19.6
Narayanganj DND	3,956.1	1,824.2	554.9	75.7	172.1	15.8	278.4	918.9	136.6	586.8	11.3
Narayanganj West	2,267.7	1,039.5	309.4	63.5	142.2	13.2	341.0	1,119.6	182.0	199.8	0.2
TOTAL	13,181.5	6,227.0	1,911.7	278.9	625.5	58.2	669.8	2,206.3	344.8	1,669.8	31.1

Source : JICA

Table B.16 Internal Flood Damages to Houses and Household Articles by Area by Year by Scale of Floods

(Unit : Tk. Million)

Name of Areas	Annual Flood	Worst Flood
1. 1990		
Dhaka East - 1	0.2	0.4
Dhaka East - 2	0.0	0.0
Dhaka East - 3	49.9	106.2
Dhaka East - 4	70.9	150.7
Dhaka East (Sub-Total)	121.0	257.3
Narayanganj DND	27.3	43.4
Narayanganj West	0.8	9.9
Total	149.1	310.6
2. 2010		
Dhaka East - 1	0.0	0.1
Dhaka East - 2	0.0	0.0
Dhaka East - 3	85.0	178.2
Dhaka East - 4	100.9	211.6
Dhaka East (Sub-Total)	185.9	389.9
Narayanganj DND	109.1	171.0
Narayanganj West	2.0	24.4
Total	297.0	585.3

Source : JICA

Table B.17 Summary of Traffic Survey Results

Unit : Number

Location	Rickshaw	Auto Rickshaw	Motor Cycle	Car / Jeep	Micro Bus	Bus/ Mini Bus	Mini Truck/ Pick-up	Truck
Dha1	53300	8120	3118	9160	2270	3923	769	869
Dha2	1199	3214	995	404	125	1385	77	46
Dha3	26116	3573	1003	2412	471	1397	170	19
Dha4	29270	4939	3603	6693	957	3304	227	418
Dha5	310	186	2630	4289	1087	277	197	93
Dha6	26720	3686	1071	1565	465	317	231	245
Dha7	35840	9215	2338	3603	695	2006	213	140
Dha8	12966	1489	1037	2194	450	173	120	123
Dha9	43480	5783	2134	2665	607	161	128	78
Dha10	38775	8574	4225	8064	1783	1314	470	107
Dha11	30630	2130	1710	5119	993	76	222	142
Dha12	54060	4287	1802	5528	741	3078	273	170
Dha13	39460	8698	2813	13205	1680	192	253	90
Dha14	36490	5153	1223	3759	754	85	142	142
Dha15	11460	5428	1525	7492	1119	1507	222	601
Dha16	0	14123	2532	21472	2896	1802	762	643
Nar-1	23750	325	575	864	328	2127	146	707
Nar-2	22210	338	209	381	77	1673	64	102
Nar-3	7242	103	114	176	59	3	43	37
Nar-4	1231	2	30	41	2	0	17	215
Airport	0	5103	1668	6131	2131	3404	697	807
Mirpur Road	20340	5635	1986	14365	3043	1927	482	466
Jatra-1	3290	2245	292	244	102	541	66	273
Jatra-2	12790	1473	585	1527	723	2648	429	2666
Jatra-3	15130	4565	732	1405	393	2258	345	2743
China Bridge	6600	1871	527	1009	298	1655	212	3318
DND Pump	2790	828	326	573	193	779	224	1094
Narayanganj	25390	536	386	980	416	1361	228	1055
Total	580839	111622	41189	125320	24858	39373	7429	17409
Total Dha, Nar	494509	89366	34687	99086	17559	24800	4746	4987
Total-Dhaka	440076	88598	33759	97624	17093	20997	4476	3926
Total Dha10, Nar-1	62525	8899	4800	8928	2111	3441	616	814

Note : Survey time was from 7 am to 8 pm.

Table B.18 Results of Traffic Damage Survey

Type of Vehicles	Average No. of Flood Affected Days/Vehicle								Average Operating Kilometers/ Day/Vehicle		Average Speed (km / hour)		Average Oil Consumption /Day/Vehicle (liter)		Average Sales per Day per Vehicle (Tk.)	
	1987		1988		1986		1990									
	Non-Operating	Slow Operating	Non-Operating	Slow Operating	Non-Operating	Slow Operating	Non-Operating	Slow Operating	Normal Time	Flood Time	Normal Time	Flood Time	Normal Time	Flood Time	Normal Time	Flood Time
Rickshaw	0.0	1.2	3.4	15.5	3.9	8.7	0.0	0.0	64.0	43.3	11.7	8.4	0.0	0.0	118.5	175.0
Auto-Rickshaw	1.5	11.9	18.0	32.2	2.6	8.7	0.0	0.0	130.7	98.5	29.0	21.0	15.7	16.4	612.5	535.0
Motor Cycle	0.0	8.4	13.1	27.6	2.4	14.4	0.0	0.0	91.0	67.5	39.0	30.8	5.9	4.8	-	-
Car	0.0	14.3	19.0	37.5	0.0	9.5	0.0	0.0	131.5	105.5	65.5	48.5	22.3	21.5	-	-
Jeep	0.0	15.5	13.5	37.5	0.0	8.2	0.0	0.0	110.0	84.5	53.1	40.5	26.5	22.9	-	-
Micro Bus	0.0	18.2	14.6	38.5	0.0	11.4	0.0	0.0	104.5	84.0	57.0	44.5	19.1	18.6	-	-
Mini Bus	9.9	25.5	25.2	48.5	0.0	16.7	0.0	0.0	207.7	166.0	46.5	33.9	42.1	37.4	2,045.0	1,565.0
Bus	6.2	21.0	26.0	47.0	3.0	14.9	0.0	0.0	257.9	251.6	58.0	44.5	79.0	86.6	3,780.0	3,325.0
Mini Truck	9.1	19.2	26.3	40.5	0.0	10.5	0.0	0.0	86.0	66.0	29.5	20.7	22.5	20.0	942.0	750.0
Pick-up Van	13.4	22.0	27.5	49.0	0.7	11.1	0.0	0.0	105.0	67.0	32.8	20.6	27.6	21.6	1,115.0	730.0
Truck	13.2	29.5	34.5	54.5	1.5	28.0	0.0	0.0	153.2	117.5	34.3	24.6	47.4	42.1	1,965.0	1,785.0

Source : JICA

Table B.19 Profit Loss and Incremental Time Cost in Flood Time per Day per Vehicle

Type of Vehicles	Average Oil Cost /Day/Vehicle * (Tk)		Average Sales minus Oil Cost/Day/Vehicle (Tk)		Profit Loss in Flood Time /Day/Vehicle (Tk)	Average Operating Hours/ Day/Vehicle		Average Incremental Operating Hours in Flood Time/Day/ Vehicle	Average Number of Passengers	Incremental Time Cost in Flood Time /Day/ Vehicle (Tk)
	Normal Time	Flood Time	Normal Time	Flood Time		Normal Time	Flood Time			
Rickshaw	-	-	-	-	-17	5.466	5.149	-0.317	2	-0.463
Auto-Rickshaw	200	229	393	306	87	4.507	4.690	0.183	4	0.534
Motor Cycle	83	67	-	-	-	2.333	2.195	-0.138	0	0.000
Car	332	322	-	-	-	2.008	2.175	0.167	2	0.244
Jeep	395	341	-	-	-	2.072	2.086	0.014	3	0.031
Micro Bus	268	260	-	-	-	1.833	1.888	0.055	6	0.241
Mini Bus	590	523	1,455	1,042	413	4.467	4.897	0.430	40	12.556
Bus	1,105	1,212	2,675	2,113	562	4.447	5.654	1.207	56	49.342
Mini Truck	315	279	627	471	156	2.915	3.188	0.273	-	-
Pick-up Van	387	302	728	428	300	3.201	3.252	0.051	-	-
Truck	663	589	1,302	1,196	106	4.466	4.776	0.310	-	-

Notes : * : Oil cost/liter ..... octan = Tk. 14.95, diesel = Tk. 14.00, petrol = Tk. 14.00

*2 : Profit ratio to sales is assumed as 30%.

*3 : Time value of a passenger is assumed as Tk. 0.73 /hour based on the estimated per capita GDP, Tk. 6,401 in the Region of Dhaka in 1990.

Source : JICA

Table B.20 Traffic Damages per Vehicle by Type of Vehicles by Scale of Flood

Type of Vehicles	1987 Flood				1988 Flood				1986 Flood			
	Profit Loss		Incremental Time Cost	Total	Profit Loss		Incremental Time Cost	Total	Profit Loss		Incremental Time Cost	Total
	by Non-Operation	by Slow Operation			by Non-Operation	by Slow Operation			by Non-Operation	by Slow Operation		
Rickshaw	-	-20	-1	-21	121	-264	-7	-150	139	-148	-4	-13
Auto-Rickshaw	276	1,033	6	1,315	3,308	2,796	17	6,121	478	755	5	1,238
Motor Cycle	-	-	0	0	-	-	0	0	-	-	0	0
Car	-	-	3	3	-	-	9	9	-	-	2	2
Jeep	-	-	0	0	-	-	1	1	-	-	0	0
Micro Bus	-	-	4	4	-	-	9	9	-	-	3	3
Mini Bus	6,074	10,522	320	16,916	15,460	20,012	609	36,081	-	6,891	210	7,101
Bus	7,031	11,799	1,036	19,866	29,484	26,408	2,319	58,211	3,402	8,372	735	12,509
Mini Truck	2,573	2,997	-	5,570	7,436	6,322	-	13,758	-	1,639	-	1,639
Pick-up Van	4,482	6,609	-	11,091	9,199	14,721	-	23,920	234	3,335	-	3,569
Truck	7,781	3,132	-	10,913	20,338	5,786	-	26,124	884	2,973	-	3,857

Notes : * : Profit ratio to sales is assumed as 30%.

Source : JICA

Table B.21 Number of Vehicles by Area by Type of Vehicles in 1990

(Unit : Number)

Type of Vehicles	Greater Dhaka East					Narayanganj DND	Narayanganj West	Total
	DC-1	DC-2	DC-3	DC-4	Sub-Total			
Rickshaw	3,606	1,775	26,259	26,637	58,277	15,238	14,217	87,732
Auto-Rickshaw	251	118	1,926	1,898	4,194	1,080	1,011	6,285
Motor Cycle	1,476	727	10,746	10,849	23,798	6,236	5,818	35,852
Car	417	205	3,038	3,067	6,727	1,763	1,645	10,135
Jeep	42	5	567	447	1,061	227	219	1,507
Micro Bus	95	11	1,284	1,010	2,400	513	496	3,409
Mini Bus	110	54	804	811	1,779	466	435	2,680
Bus	49	24	357	360	790	207	193	1,190
Mini Truck	19	2	231	203	455	111	137	703
Pick-up Van	28	3	347	305	683	166	205	1,054
Truck	99	12	1,224	1,076	2,411	586	723	3,720

Source : Statistical Yearbook of Bangladesh 1990 and JICA

Table B.22 Number of Vehicles by Area by Type of Vehicles in 2010

(Unit : Number)

Type of Vehicles	Greater Dhaka East					Narayanganj DND	Narayanganj West	Total
	DC-1	DC-2	DC-3	DC-4	Sub-Total			
Rickshaw	24,399	13,432	80,406	71,898	190,135	71,910	45,081	307,126
Auto-Rickshaw	1,624	898	5,833	5,143	13,498	5,115	3,189	21,802
Motor Cycle	9,985	5,497	32,905	29,283	77,670	29,428	18,448	125,546
Car	2,823	1,554	9,302	8,278	21,957	8,319	5,215	35,491
Jeep	69	50	1,563	1,258	2,940	1,117	650	4,707
Micro Bus	157	113	3,536	2,846	6,652	2,526	1,471	10,649
Mini Bus	747	411	2,461	2,190	5,809	2,201	1,380	9,390
Bus	331	182	1,092	972	2,577	976	612	4,165
Mini Truck	43	26	609	489	1,167	505	406	2,078
Pick-up Van	65	39	914	734	1,752	758	609	3,119
Truck	229	137	3,225	2,590	6,181	2,674	2,150	11,005

Source : Statistical Yearbook of Bangladesh 1990 and JICA

Table B.23 Traffic Damages by Area by Year in 1987 - Scale Flood

(Unit : Tk. Million)

Type of Vehicles	1990								2010							
	Greater Dhaka East					Narayanganj		Total	Greater Dhaka East					Narayanganj		Total
	DC-1	DC-2	DC-3	DC-4	Sub-Total	DND	West		DC-1	DC-2	DC-3	DC-4	Sub-Total	DND	West	
Rickshaw	-0.1	0.0	-0.6	-0.6	-1.3	-0.3	-0.3	-1.9	-0.5	-0.3	-1.7	-1.5	-4.0	-1.5	-0.9	-6.4
Auto-Rickshaw	0.3	0.2	2.5	2.5	5.5	1.4	1.3	8.2	2.1	1.2	7.7	6.8	17.8	6.7	4.2	28.7
Motor Cycle	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Car	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Jeep	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Micro Bus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mini Bus	1.9	0.9	13.7	13.8	30.3	8.0	7.4	45.7	12.6	7.0	41.6	37.1	98.3	37.2	23.3	158.8
Bus	1.0	0.5	7.1	7.2	15.8	4.1	3.8	23.7	6.6	3.6	21.7	19.3	51.2	19.4	12.2	82.8
Mini Truck	0.1	0.0	1.3	1.1	2.5	0.6	0.8	3.9	0.2	0.1	3.4	2.7	6.4	2.8	2.3	11.5
Pick-up Van	0.3	0.0	3.8	3.4	7.5	1.8	2.3	11.6	0.7	0.4	10.1	8.1	19.3	8.4	6.8	34.5
Truck	1.1	0.1	13.4	11.7	26.3	6.4	7.9	40.6	2.5	1.5	35.2	28.3	67.5	29.2	23.5	120.2
Total	4.6	1.7	41.2	39.1	86.6	22.0	23.2	131.8	24.2	13.5	118.0	100.8	256.5	102.2	71.4	430.1

Source : JICA

Table B.24 Traffic Damages by Area by Year in 1988 - Scale Flood

(Unit : Tk. Million)

Type of Vehicles	1990								2010							
	Greater Dhaka East					Narayanganj		Total	Greater Dhaka East					Narayanganj		Total
	DC-1	DC-2	DC-3	DC-4	Sub-Total	DND	West		DC-1	DC-2	DC-3	DC-4	Sub-Total	DND	West	
Rickshaw	-0.5	-0.3	-3.9	-4.0	-8.7	-2.3	-2.1	-13.1	-3.7	-2.0	-12.1	-10.8	-28.6	-10.8	-6.8	-46.2
Auto-Rickshaw	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.1	0.1	0.4
Motor Cycle	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Car	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.1	0.0	0.3
Jeep	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Micro Bus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mini Bus	3.9	2.0	29.0	29.3	64.2	16.9	15.7	96.8	26.9	14.8	88.8	79.0	209.5	79.4	49.8	338.7
Bus	2.8	1.4	20.8	21.0	46.0	12.0	11.2	69.2	19.3	10.6	63.6	56.6	150.1	56.8	35.6	242.5
Mini Truck	0.3	0.0	3.2	2.8	6.3	1.5	1.9	9.7	0.6	0.4	8.4	6.7	16.1	6.9	5.6	28.6
Pick-up Van	0.7	0.1	8.3	7.3	16.4	4.0	4.9	25.3	1.6	0.9	21.9	17.6	42.0	18.1	14.6	74.7
Truck	2.6	0.3	32.0	28.1	63.0	15.3	18.9	97.2	6.0	3.6	84.3	67.7	161.6	69.9	56.2	287.7
Total	9.8	3.5	89.4	84.5	187.2	47.4	50.5	285.1	50.7	28.3	255.1	217.0	551.1	220.5	155.1	926.7

Source : JICA

Table B.25 Traffic Damages by Area by Year in 1986 - Scale Flood

(Unit : Tk. Million)

Type Vehicles	1990								2010							
	Greater Dhaka East					Narayanganj		Total	Greater Dhaka East					Narayanganj		Total
	DC-1	DC-2	DC-3	DC-4	Sub-Total	DND	West		DC-1	DC-2	DC-3	DC-4	Sub-Total	DND	West	
Rickshaw	0.0	0.0	-0.3	-0.3	-0.6	-0.2	-0.2	-1.0	-0.3	-0.2	-1.0	-0.9	-2.4	-0.9	-0.6	-3.9
Auto-Rickshaw	0.3	0.1	2.4	2.4	5.2	1.3	1.3	7.8	2.0	1.1	7.2	6.4	16.7	6.3	3.9	26.9
Motor Cycle	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Car	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Jeep	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Micro Bus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mini Bus	0.8	0.5	5.7	5.7	12.7	3.3	3.1	19.1	5.3	2.9	17.5	15.6	41.3	15.6	9.8	66.7
Bus	0.6	0.3	4.5	4.5	9.9	2.6	2.4	14.9	4.1	2.3	13.7	12.2	32.3	12.2	7.7	52.2
Mini Truck	0.0	0.0	0.4	0.3	0.7	0.2	0.2	1.1	0.1	0.0	1.0	0.8	1.9	0.8	0.7	3.4
Pick-up Van	0.1	0.0	1.2	1.1	2.4	0.6	0.7	3.7	0.2	0.1	3.3	2.6	6.2	2.7	2.2	11.1
Truck	0.4	0.0	4.7	4.1	9.2	2.3	2.8	14.3	0.9	0.5	12.4	10.0	23.8	10.3	8.3	42.4
Total	2.2	0.9	18.6	17.8	39.5	10.1	10.3	59.9	12.3	6.9	54.0	46.6	119.8	47.0	32.0	198.8

Source : JICA

TABLE B.26(1) DIRECT DAMAGES TO INFRASTRUCTURES (1/2)

1. Greater Dhaka East

(Unit : Tk Million)

Infrastructure	External Flood			Internal Flood	
	Annual	1987	1988	Annual	Worst
Road / Bridge	14.1	39.8	171.3	6.1	9.8
Railway	0.0	0.0	0.0	0.0	0.0
Electricity	0.2	0.7	2.3	0.3	0.5
Telecom.	26.2	26.2	147.0	15.2	45.8
Water Supply	0.0	0.0	4.9	0.0	0.0
Sewer. / Drain.	1.0	2.0	7.7	1.0	2.0
Gas	0.0	0.0	44.9	0.0	0.0
Airport	0.0	0.0	80.0	0.0	0.0
Total :	41.5	68.7	458.1	22.6	58.1

2. DND

(Unit : Tk Million)

Infrastructure	External Flood			Internal Flood	
	Annual	1987	1988	Annual	Worst
Road / Bridge	0.0	0.0	13.2	6.0	7.6
Railway	0.0	0.0	0.0	0.0	0.0
Electricity	0.0	0.0	0.0	0.0	0.0
Telecom.	1.4	1.4	9.2	1.8	2.7
Water Supply	0.0	0.0	0.0	0.0	0.0
Sewer. / Drain.	0.0	0.0	0.0	0.0	0.0
Gas	0.0	0.0	0.0	0.0	0.0
Airport	0.0	0.0	0.0	0.0	0.0
Total :	1.4	1.4	22.4	7.8	10.3

TABLE B.26(2) DIRECT DAMAGES TO INFRASTRUCTURES (2/2)

3. Narayanganj West

(Unit : Tk Million)

Infrastructure	External Flood			Internal Flood	
	Annual	1987	1988	Annual	Worst
Road / Bridge	3.2	15.4	101.7	15.4	25.6
Railway	0.0	0.0	0.0	0.0	0.0
Electricity	0.0	0.0	1.4	0.0	0.0
Telecom.	2.3	2.1	25.4	3.7	6.3
Water Supply	0.0	0.0	0.0	0.0	0.0
Sewer. / Drain.	0.0	0.0	0.0	0.0	0.0
Gas	0.0	0.0	5.5	0.0	0.0
Airport	0.0	0.0	0.0	0.0	0.0
Total :	5.5	17.5	134.0	19.1	31.9

TABLE B.27 SALES LOSSES FOR PUBLIC ENTERPRISES

(Unit : Tk Million)

Area	Enterprises	External Flood			Internal Flood	
		Annual	1987	1988	Annual	Worst
Greater Dhaka East	PDB	1.5	2.0	3.0	0.6	1.0
	T & T	0.2	0.2	3.8	0.5	1.0
	Titas Gas	0.0	18.5	128.8	0.0	0.0
	CAA	0.0	0.0	7.7	0.0	0.0
	Total :	1.7	20.7	143.3	1.1	2.0
DND	T & T	0.0	0.0	0.3	0.0	0.1
Narayanganj West	T & T	0.1	0.0	0.7	0.1	0.1
	Titas Gas	0.0	3.8	25.8	0.0	0.0
	Total :	0.1	3.8	26.5	0.1	0.1

Table B.28 Direct Damages to Infrastructures by Area by Year

(Unit : Tk. Million)

Year	Area	External Flood			Internal Flood	
		Annual	1987-Scale	1988-Scale	Annual	Worst
1990	Dhaka East - 1	2.5	4.1	27.5	1.4	3.5
	Dhaka East - 2	1.2	1.9	12.9	0.6	1.6
	Dhaka East - 3	19.1	31.6	210.3	10.4	26.7
	Dhaka East - 4	18.7	31.1	207.4	10.2	26.3
	Dhaka East (Sub-Total)	41.5	68.7	458.1	22.6	58.1
	Narayanganj DND	1.4	1.4	22.4	7.8	10.3
	Narayanganj West	5.5	17.5	134.0	19.1	31.9
	Total	48.4	87.6	614.5	49.5	100.3
2010	Dhaka East - 1	16.1	26.6	177.6	9.1	22.6
	Dhaka East - 2	9.2	14.5	98.0	4.6	12.2
	Dhaka East - 3	57.8	95.7	637.0	31.6	80.9
	Dhaka East - 4	50.6	84.3	561.9	27.6	71.2
	Dhaka East (Sub-Total)	133.7	221.1	1474.5	72.9	186.9
	Narayanganj DND	6.6	6.6	106.0	36.9	48.8
	Narayanganj West	17.4	55.3	422.8	60.3	100.7
	Total	157.7	283.0	2003.3	170.1	336.4

Source : JICA

Table B.29 Profit Losses for Public Enterprises by Area by Year

(Unit : Tk. Million)

Year	Area	External Flood			Internal Flood	
		Annual	1987-Scale	1988-Scale	Annual	Worst
1990	Dhaka East - 1	0.0	0.4	2.6	0.0	0.0
	Dhaka East - 2	0.0	0.2	1.2	0.0	0.0
	Dhaka East - 3	0.3	2.8	19.7	0.2	0.3
	Dhaka East - 4	0.2	2.8	19.5	0.1	0.3
	Dhaka East (Sub-Total)	0.5	6.2	43.0	0.3	0.6
	Narayanganj DND	0.0	0.0	0.1	0.0	0.0
	Narayanganj West	0.0	1.1	8.0	0.0	0.0
	Total	0.5	7.3	51.1	0.3	0.6
2010	Dhaka East - 1	0.0	2.6	16.8	0.0	0.0
	Dhaka East - 2	0.0	1.6	9.2	0.0	0.0
	Dhaka East - 3	1.0	8.5	59.7	0.6	1.0
	Dhaka East - 4	0.5	7.6	52.9	0.4	0.8
	Dhaka East (Sub-Total)	1.5	20.3	138.6	1.0	1.8
	Narayanganj DND	0.0	0.0	0.5	0.0	0.0
	Narayanganj West	0.0	3.6	25.3	0.0	0.0
	Total	1.5	23.9	164.4	1.0	1.8

Source : JICA

Table B.30 Summary of Flood Damages by External Floods

Prop. = Property damages, Tra. = Traffic damages, Inf. = Infrastructure damages, Prof. = Profit loss for public enterprises, Oth. = Other damages

(Unit : Tk. Million)

Area	Annual Flood						1987-Scale Flood						1988-Scale Flood					
	Prop.	Tra.	Inf.	Prof.	Oth.	Total	Prop.	Tra.	Inf.	Prof.	Oth.	Total	Prop.	Tra.	Inf.	Prof.	Oth.	Total
1. 1990																		
DC - 1	0.0	0.0	2.5	0.0	0.3	2.8	72.5	4.6	4.1	0.4	8.2	89.8	226.9	9.8	27.5	2.6	26.7	293.5
DC - 2	0.0	0.0	1.2	0.0	0.1	1.3	44.9	1.7	1.9	0.2	4.9	53.6	194.9	3.5	12.9	1.2	21.3	233.8
DC - 3	0.0	0.0	19.1	0.3	1.9	21.3	124.0	41.2	31.6	2.8	20.0	219.6	829.1	89.4	210.3	19.7	114.9	1,263.4
DC - 4	0.0	0.0	18.7	0.2	1.9	20.8	251.6	39.1	31.1	2.8	32.5	357.1	1,835.1	84.5	207.4	19.5	214.7	2,361.2
Dhaka East	0.0	0.0	41.5	0.5	4.2	46.2	493.0	86.6	68.7	6.2	65.6	720.1	3,086.0	187.2	458.1	43.0	377.6	4,151.9
Nara. DND	0.0	0.0	1.4	0.0	0.1	1.5	142.9	22.0	1.4	0.0	16.6	182.9	1,864.1	47.4	22.4	0.1	193.4	2,127.4
Nara. West	0.0	0.0	5.5	0.0	0.6	6.1	75.5	23.2	17.5	1.1	11.7	129.0	1,310.8	50.5	134.0	8.0	150.3	1,653.6
Total	0.0	0.0	48.4	0.5	4.9	53.8	711.4	131.8	87.6	7.3	93.9	1,032.0	6,260.9	285.1	614.5	51.1	721.3	7,932.9
1. 2010																		
DC - 1	52.8	0.0	16.1	0.0	6.9	75.8	1,233.8	24.2	26.6	2.6	128.7	1,415.9	2,951.9	50.7	177.6	16.8	319.7	3,516.7
DC - 2	21.5	0.0	9.2	0.0	3.1	33.8	263.9	13.5	14.5	1.6	29.4	322.9	1,159.8	28.3	98.4	9.2	129.6	1,425.3
DC - 3	32.1	0.0	57.8	1.0	9.1	100.0	562.4	118.0	95.7	8.5	78.5	863.1	3,363.1	255.1	637.0	59.7	431.5	4,746.4
DC - 4	51.2	0.0	50.6	0.5	10.2	112.5	824.5	100.8	84.3	7.6	101.7	1,118.9	5,520.9	217.0	561.9	52.9	635.3	6,988.0
Dhaka East	157.6	0.0	133.7	1.5	29.3	322.1	2,884.6	256.5	221.1	20.3	338.3	3,720.8	12,995.7	551.1	1,474.9	138.6	1,516.1	16,676.4
Nara. DND	7.1	0.0	6.6	0.0	1.4	15.1	518.8	102.2	6.6	0.0	62.8	690.4	8,530.8	220.5	106.0	0.5	885.8	9,743.6
Nara. West	6.1	0.0	17.4	0.0	2.4	25.9	229.4	71.4	55.3	3.6	36.0	395.7	5,678.1	155.1	422.8	25.3	628.1	6,909.4
Total	170.8	0.0	157.7	1.5	33.1	363.1	3,632.8	430.1	283.0	23.9	437.1	4,806.9	27,204.6	926.7	2,003.7	164.4	3,030.0	33,329.4

Source : JICA

Table B.31 Summary of Flood Damages by Internal Floods

Prop. = Property damages, Tra. = Traffic damages, Inf. = Infrastructure damages, Prof. = Profit loss for public enterprises, Oth. = Other damages

(Unit : Tk. Million)

Area	Annual Flood						Worst Flood					
	Prop.	Tra.	Inf.	Prof.	Oth.	Total	Prop.	Tra.	Inf.	Prof.	Oth.	Total
1. 1990												
DC - 1	0.2	0.0	1.4	0.0	0.2	1.8	0.4	2.2	3.5	0.0	0.6	6.7
DC - 2	0.0	0.0	0.6	0.0	0.1	0.7	0.0	0.9	1.6	0.0	0.3	2.8
DC - 3	49.9	0.0	10.4	0.2	6.1	66.6	106.2	18.6	26.7	0.3	15.2	167.0
DC - 4	70.9	0.0	10.2	0.1	8.1	89.3	150.7	17.8	26.3	0.3	19.5	214.6
												0.0
Dhaka East	121.0	0.0	22.6	0.3	14.5	158.4	257.3	39.5	58.1	0.6	35.6	391.1
Nara. DND	27.3	0.0	7.8	0.0	3.5	38.6	43.4	10.1	10.3	0.0	6.4	70.2
Nara. West	0.8	0.0	19.1	0.0	2.0	21.9	9.9	10.3	31.9	0.0	5.2	57.3
Total	149.1	0.0	49.5	0.3	20.0	218.9	310.6	59.9	100.3	0.6	47.2	518.6
1. 2010												
DC - 1	0.0	0.0	9.1	0.0	0.9	10.0	0.1	12.3	22.6	0.0	3.5	38.5
DC - 2	0.0	0.0	4.6	0.0	0.5	5.1	0.0	6.9	12.2	0.0	1.9	21.0
DC - 3	85.0	0.0	31.6	0.6	11.7	128.9	178.2	54.0	80.9	1.0	31.4	345.5
DC - 4	100.9	0.0	27.6	0.4	12.9	141.8	211.6	46.6	71.2	0.8	33.0	363.2
Dhaka East	185.9	0.0	72.9	1.0	26.0	285.8	389.9	119.8	186.9	1.8	69.8	768.2
Nara. DND	109.1	0.0	36.9	0.0	14.6	160.6	171.0	47.0	48.8	0.0	26.7	293.5
Nara. West	2.0	0.0	60.3	0.0	6.2	68.5	24.4	32.0	100.7	0.0	15.7	172.8
Total	297.0	0.0	170.1	1.0	46.8	514.9	585.3	198.8	336.4	1.8	112.2	1,234.5

Source : JICA

Table B.32 Average Annual Flood Damages by Area by Year

(Unit : Tk. Million)

Area	Average Annual Flood Damages		
	External Flood	Internal Flood	Total
1. 1990			
Dhaka East - 1	40.7	2.5	43.2
Dhaka East - 2	25.4	1.0	26.4
Dhaka East - 3	121.0	74.1	195.1
Dhaka East - 4	195.5	97.5	293.0
Dhaka East (Sub-Total)	382.6	175.1	557.7
Narayanganj DND	116.0	37.4	153.4
Narayanganj West	88.5	24.9	113.4
Total	587.1	237.4	824.5
2. 2010			
Dhaka East - 1	634.5	13.9	648.4
Dhaka East - 2	169.3	7.4	176.7
Dhaka East - 3	480.4	148.1	628.5
Dhaka East - 4	631.9	159.4	791.3
Dhaka East (Sub-Total)	1,916.1	328.8	2,244.9
Narayanganj DND	483.8	156.1	639.9
Narayanganj West	318.8	76.5	395.3
Total	2,718.7	561.4	3,280.1

Source : JICA

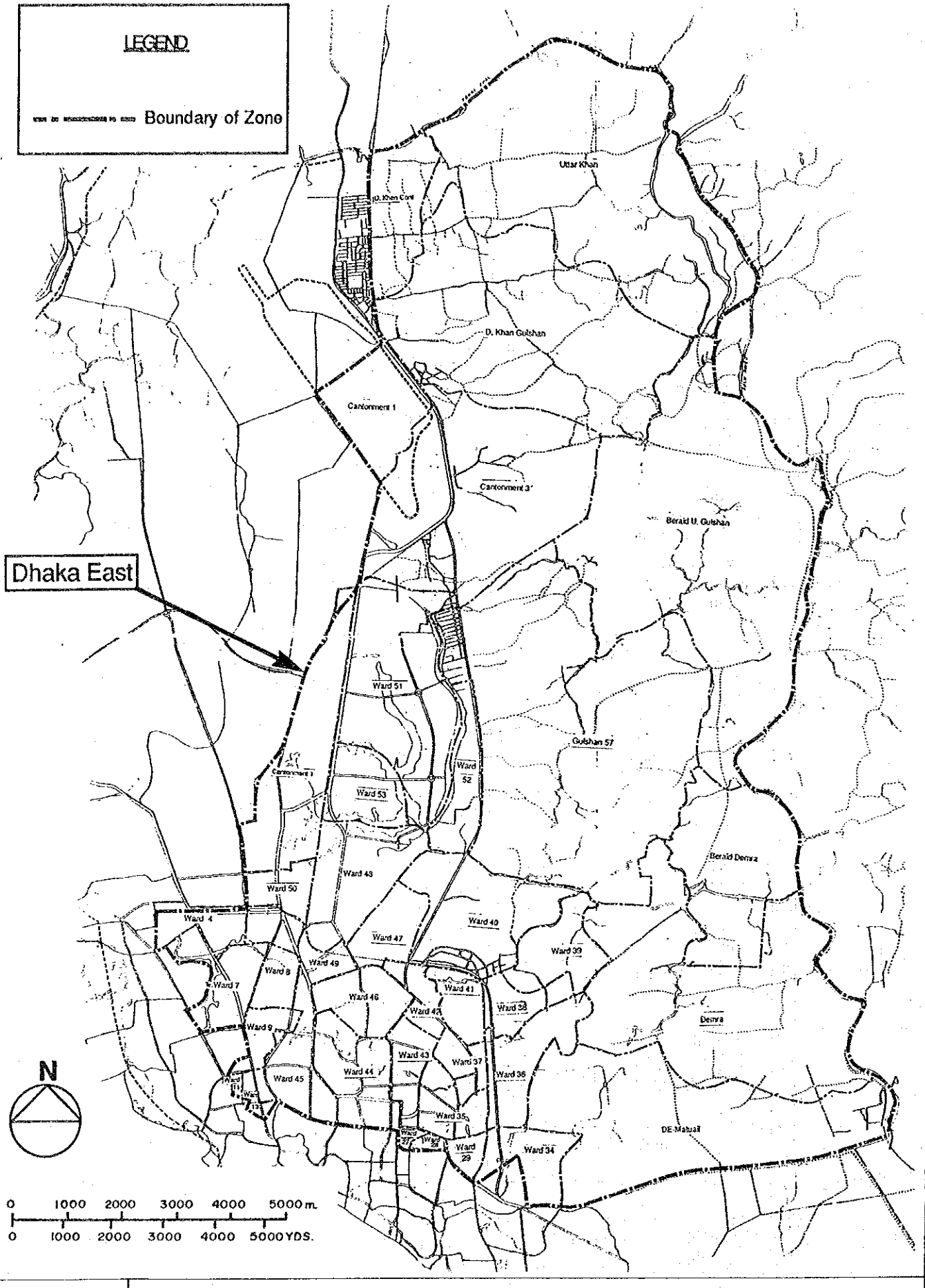

FIG. B.1 DIVISION OF STUDY AREA BY ZONE : DHAKA EAST

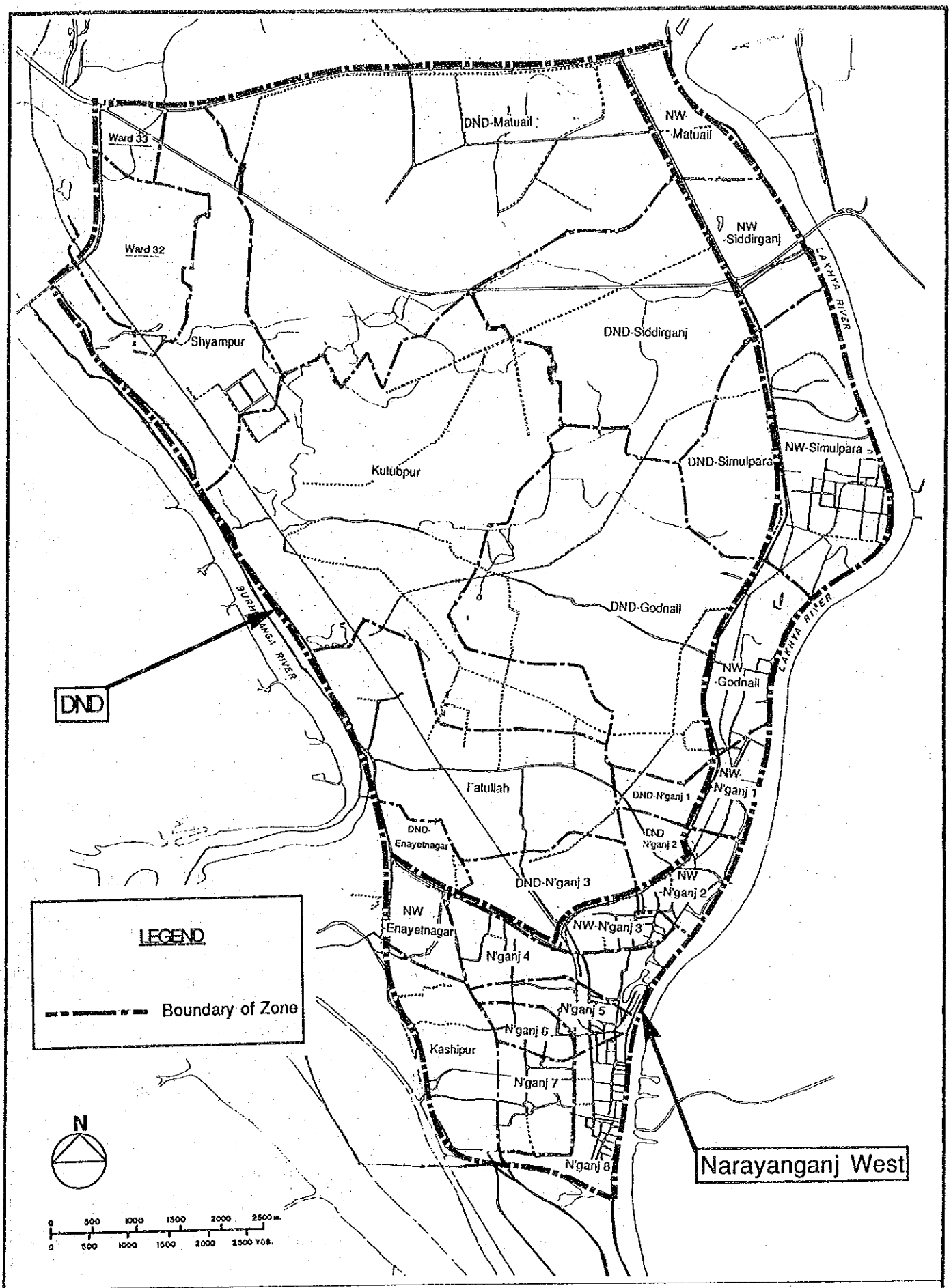

FIG. B.2 DIVISION OF STUDY AREA BY ZONE : DND, NARAYANGANJ WEST

GREATER DHAKA PROTECTION PROJECT (STUDY IN DHAKA METROPOLITAN AREA) OF BANGLADESH FLOOD ACTION PLAN NO.8A IN THE PEOPLE'S REPUBLIC OF BANGLADESH

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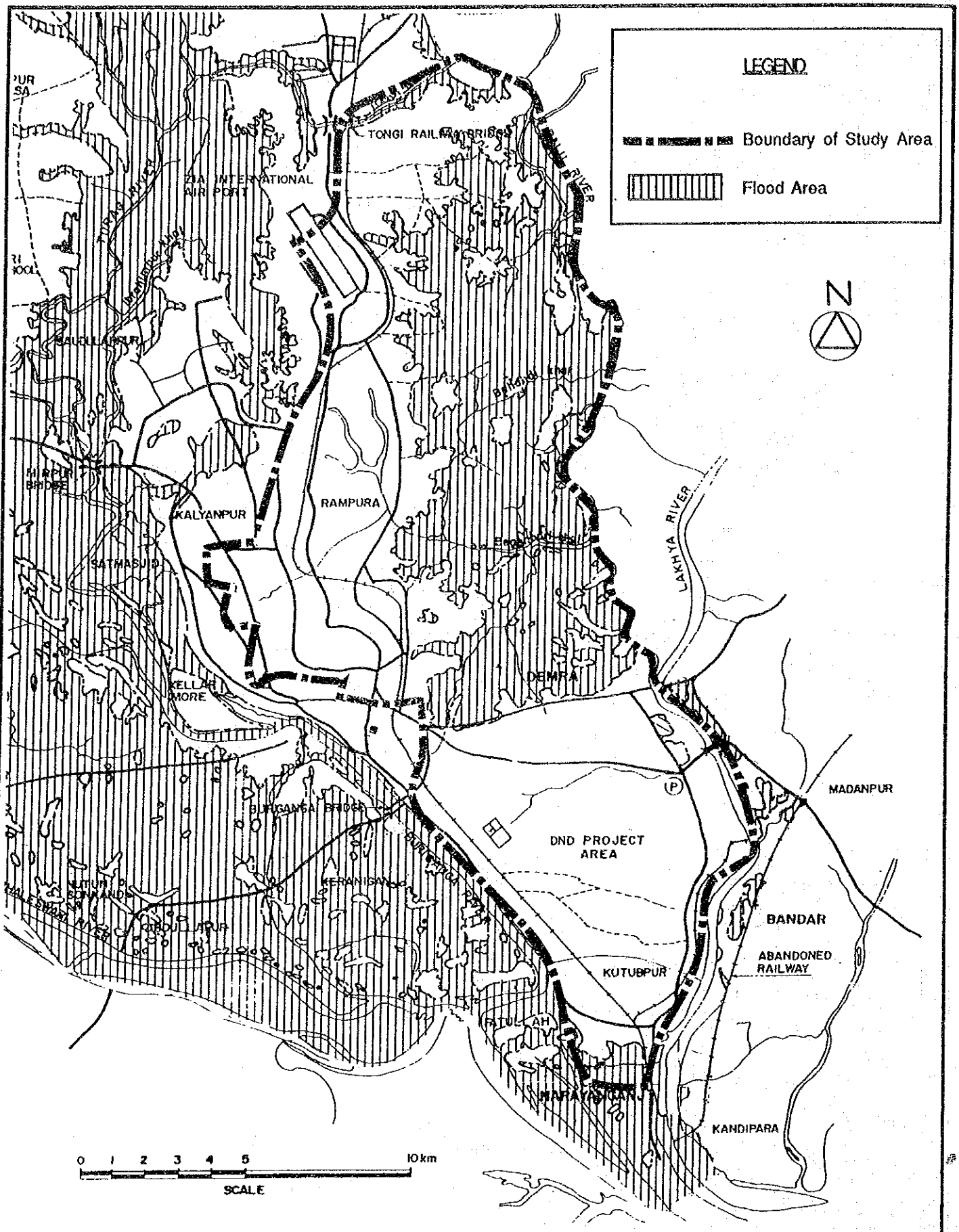

FIG. B.3 EXTERNAL FLOOD MAP : ANNUAL FLOOD

GREATER DHAKA PROTECTION PROJECT (STUDY IN DHAKA METROPOLITAN AREA) OF BANGLADESH FLOOD ACTION PLAN NO.8A IN THE PEOPLE'S REPUBLIC OF BANGLADESH

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