CHAPTER 2 CURRENT SITUATION AND MEASURES AGAINST FLOODS WITHIN THE STUDY AREA

2.1 General

The physical jurisdiction of the Study comprises of Jamuna charlands under 4 districts (Gaibandha, Jamalpur, Kurigram and Sirajganj), and Haor areas under 4 districts (Habiganj, Kishoreganj, Netrokuna and Sunamganj). As known from the population census of 1991, projected to 2001, about 1.4 million people live in the charlands and 3.40 million in the Haors of the Study area. Due to hydrological situation, both of these areas have significantly greater flood risk than the adjacent mainland or the non-haor areas. **Fig.2.1** shows location of the Study area.

2.1.1 Situation of the Study area in the Hydrological Regions

Complying with the National Water Policy, WARPO has defined eight hydrological regions of the country based on the natural appropriate features for planning developments in water resources sector. The regions are South West (SW), South Central (SC), North West (NW), North Central (NC), North East (NE), South East (SE), Eastern Hills (EH), and Rivers and Estuaries (RE). The RE region is the water and charland area of the Ganges, Brahmaputra and Meghna rivers although rivers and estuaries appear in other regions as well. For analyses of the socio-economic data, the NWMP has used the extended hydrological regions (EHR) based on UZ boundaries which closely approximate to the hydrological regions extended to absorb the RE region.

Following the delineation of WARPO's hydrological regions, it is seen that the haor areas covered by the present Study mostly fall within the North East (NE) region with some parts of Kishoreganj and Habiganj districts under the North Central (NC) region. The char areas under the Study are within the extended hydrological regions (EHR) of North Central (NC) and North West (NW) regions.

2.2 Classification of char

The charlands under the Study are situated within the active river floodplain and are of the following categories:

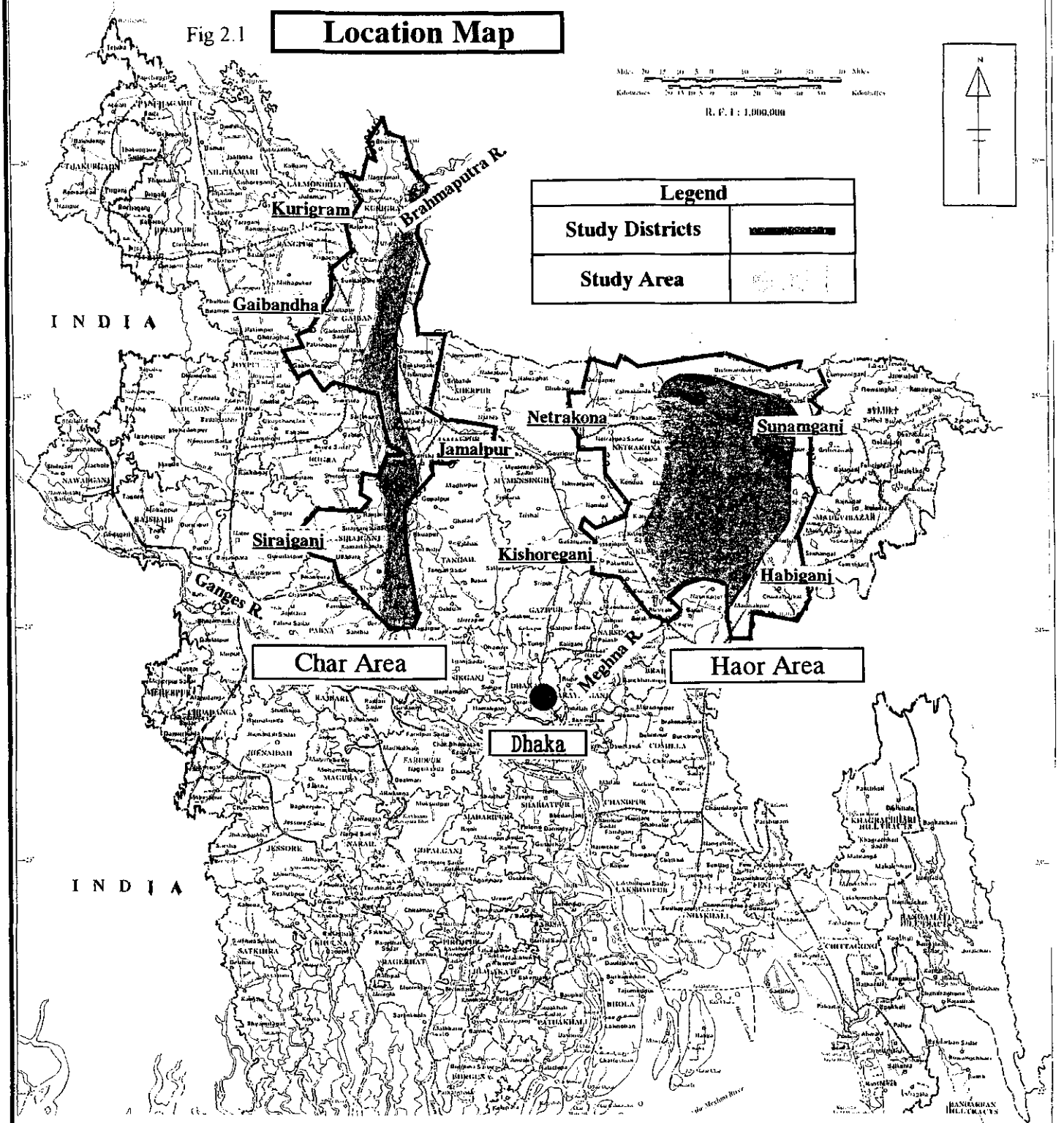
- Island Chars
- Attached Chars
- Setback Land of the existing FC embankments, and
- Unprotected Mainland up to the extent of features such as roads, settlements that restrict flooding.

The Island Char has been defined as the char which is not accessible from mainland without crossing a channel in the main river even in dry season. The Attached Char is accessible from the mainland without crossing a channel in the dry season, but is surrounded by water during the peak

of a flood in normal year. The Setback Land is mainland that lies on the riverside of an existing FC embankment and is distinguished from the other unprotected mainland in that the embankment may act as refuge site during floods and also may be instrumental in raising the flood level in the area. The Unprotected Mainland has no FC embankment and is inundated during 'higher than normal' floods. Different type of char is presented in **Fig.2.2**.

Fig 2.1

Location Map



General Features of the Study Area

Zila Head Quarter	Upazila Head Quarter	Study Area (km2)
Char Area		
1 Gaibandha	Fulchhari, Gaibandha Sadar, Saghatta, Sundarganj	2,665
2 Jamalpur	Dewanganj, Islampur, Madarganj, Sarishabari	
3 Kurigram	Char Rajibpur, Chilmari, Kurigram Sadar, Nageshwari, Raumari, Ulipur	
4 Sirajganj	Belkuchi, Chauhali, Kazipur, Shahjadpur, Sirajganj Sadar	
Haor Area		
5 Habiganj	Ajmiriganj, Bahubal, Baniachang, Habiganj Sadar, Lakhai, Madhabpur, Nabiganj	6,502
6 Kishoreganj	Austagram, Bajitpur, Itna, Karimganj, Kishoreganj Sadar, Mithamain, Nikli, Tarail	
7 Netrokona	Khaliajuri, Kalmakanda, Madan, Mohanganj	
8 Sunamganj	Bishwambarpur, Chhatak, Derai, Dharampasha, Dowarabazar, Jagannathpur, Jamalganj, Sulla, Sunamganj Sadar, Tahirpur	

2.2.1 UZs having Char areas under the Study

The char area under the Study involves the following 19 Upazilas:

UZs under Gaibandha District

1. Fulchari
2. Gaibandha Sadar
3. Shaghata
4. Sundarganj

UZs under Jamalpur District

5. Dewanganj
6. Islampur
7. Madarganj
8. Sarishabari

UZs under Kurigram District

9. Char Rajibpur
10. Chilmari
11. Kurigram Sadar
12. Nageshwary
13. Raumari
14. Ulipur

UZs under Sirajganj District

15. Belkuchi
16. Chauhali
17. Kazipur
18. Sahjadpur
19. Sirajganj Sadar

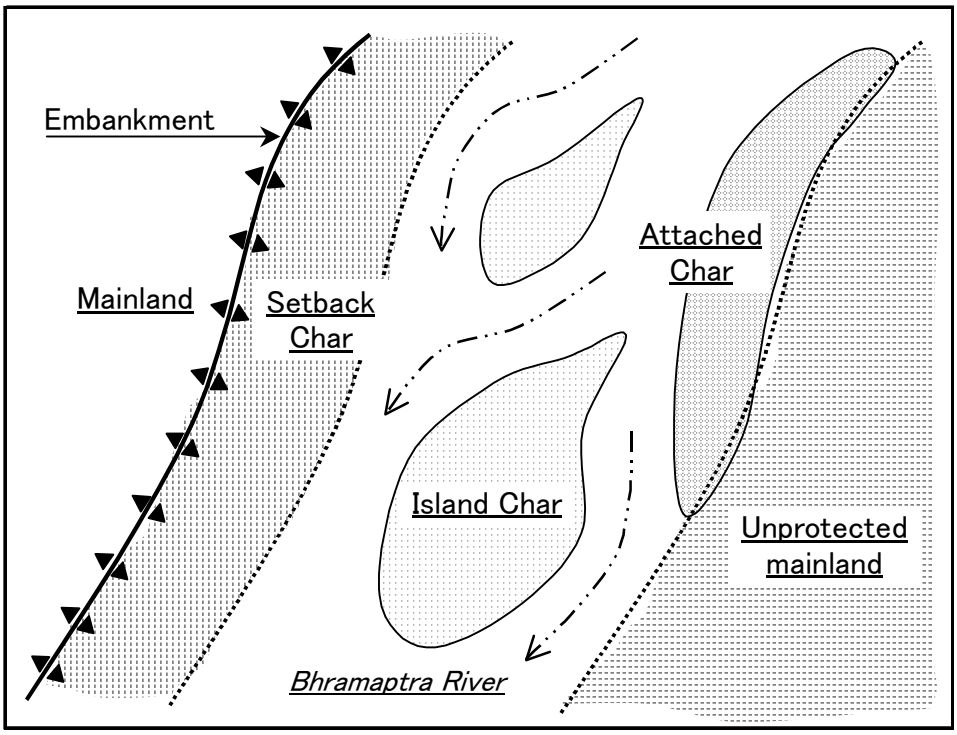


Fig 2.2 Land Classification of Char Area

2.3 Classification of haor area

The other part of the Study is the haor area. For the purpose the Study, the haor area has been broadly classified under two categories, namely:

- Deep haor, and
- Shallow haor

The agricultural land classification (F_0, F_1, F_2, F_3 and F_4) has been used to distinguish the deep haor from the shallow haor. The F_4 type of land where the depth of floodwater goes more than 3m has been categorized as the deep haor area, while F_1, F_2 and F_3 lands (flood depths up to 0.90m, 1.80m and 3.00m respectively) have been termed as shallow haor. Fig.2.3 presents deep and shallow haor locations in the Study area.

2.3.1 UZs in the Haor area under the Study

The haors in the Study area are spread over 29 UZs of 4 districts, as listed below:

UZs Habiganj District
1. Ajmiriganj
2. Bahubal
3. Baniachang
4. Habiganj Sadar
5. Lakhai
6. Madhabpur
7. Nabiganj

UZs Kishoreganj District
8. Astagram
9. Bajitpur
10. Itna
11. Karimganj
12. Kishoreganj Sadar
13. Mithamain
14. Nikli
15. Tarail

UZs Netrokuna District
16. Khaliajuri
17. Kalmakanda
18. Madan
19. Mohanganj

UZs Sunamganj District

20. Bishwambarpuri
21. Chhatak
22. Derai
23. Dharmapasha
24. Dowarabazar
25. Jagannathpur
26. Jamalganj
27. Sulla
28. Sunamganj Sadar
29. Tahirpur

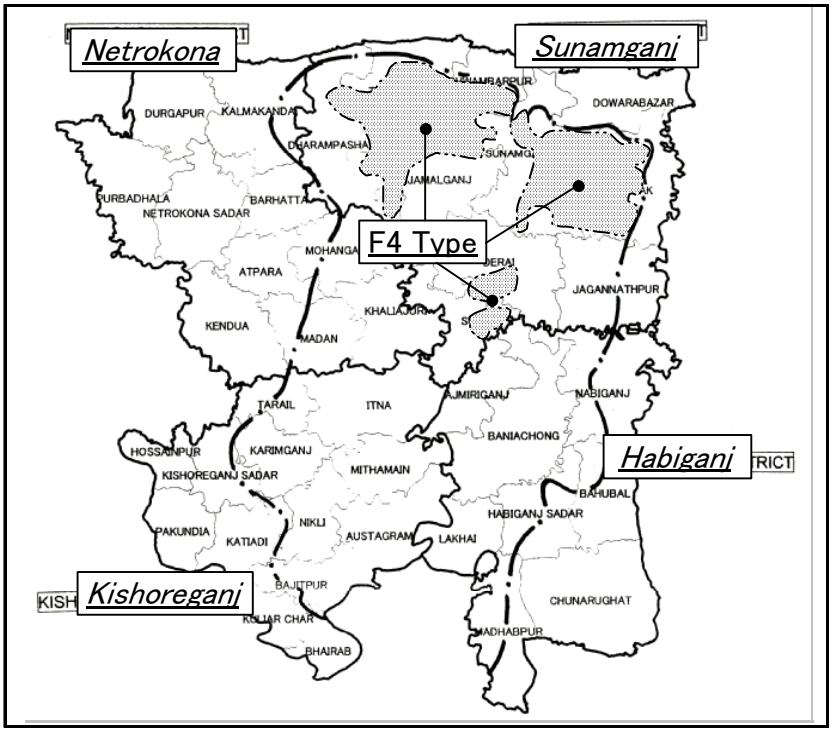


Fig 2.3 Land Classification of Haor Area

2.4 River systems in the Study area

2.4.1 River system in Char area

The chars under the Study area is situated in the active river floodplain of the Brahmaputra-Jamuna river., The lifestyle of the char dwellers is directly related with the hydrology and morphology of the river. The river carries the floodwater caused by the snowmelt in the Himalayas and also that of the monsoon rainfall occurring over its vast catchment area – both inside and outside of Bangladesh.

The chars are highly dynamic due to erosion and deposition of sediments. Many of the Brahmaputra-Jamuna chars experience yearly submergence of different magnitudes during the wet season. The chars are almost completely inundated by the floods that have been estimated to have a return period of 25 years at Chilmari and 12 years at Sirajganj. These flood-and-erosion prone chars are the homes of substantial number of people who fall victims to these natural happenings.

2.4.2 River system in Haor area

The Haor area under the Study receives abundant river flood from catchments on the slope of Shillong Plateau in the north and Tripura Hills in the southeast. Runoffs from these basins cause 'early floods' from April-May which accumulate in floodplain depression areas. These floods are termed as Flash Floods in the border belts (piedmont plains) because of quick rise and fall in the water levels – e.g. 3-6 m rise in 24 hours and its recession in the next 24-48 hours. Almost all the flash flood basin outfalls are near the Indo-Bangladesh border. From the outfall, the water travels usually a short distance of 10-20 km through a single channel known as 'nodal reach' along which it causes heavy damages to village, embankments, structures etc. Downstream of the 'nodal reach', in the haor area, the channel networks are 'deltaic'. As a result, velocity and depth of flash flood waters in the haor area is lower than that passing through the 'nodal reach'. So, when the flash flood reaches the haor area it looses its characteristic fury and becomes normal river flood. In April-May when the flash-flood waters reach the haor area, it is known as 'early flood', which usually causes damages to standing Boro crop by submergence, if not protected by (submersible) embankments.

In June-September, local rainwater and the river flow from Borak system joined with occasional flash flood water raises water levels of the deltaic rivers in the haor area increasingly. The accumulated waters in the large central basin keep most of the area flooded for more than six months in a year.

The NE regional major rivers are shown with their important tributaries in Fig.2.4. Salient features of these river systems are as follows:

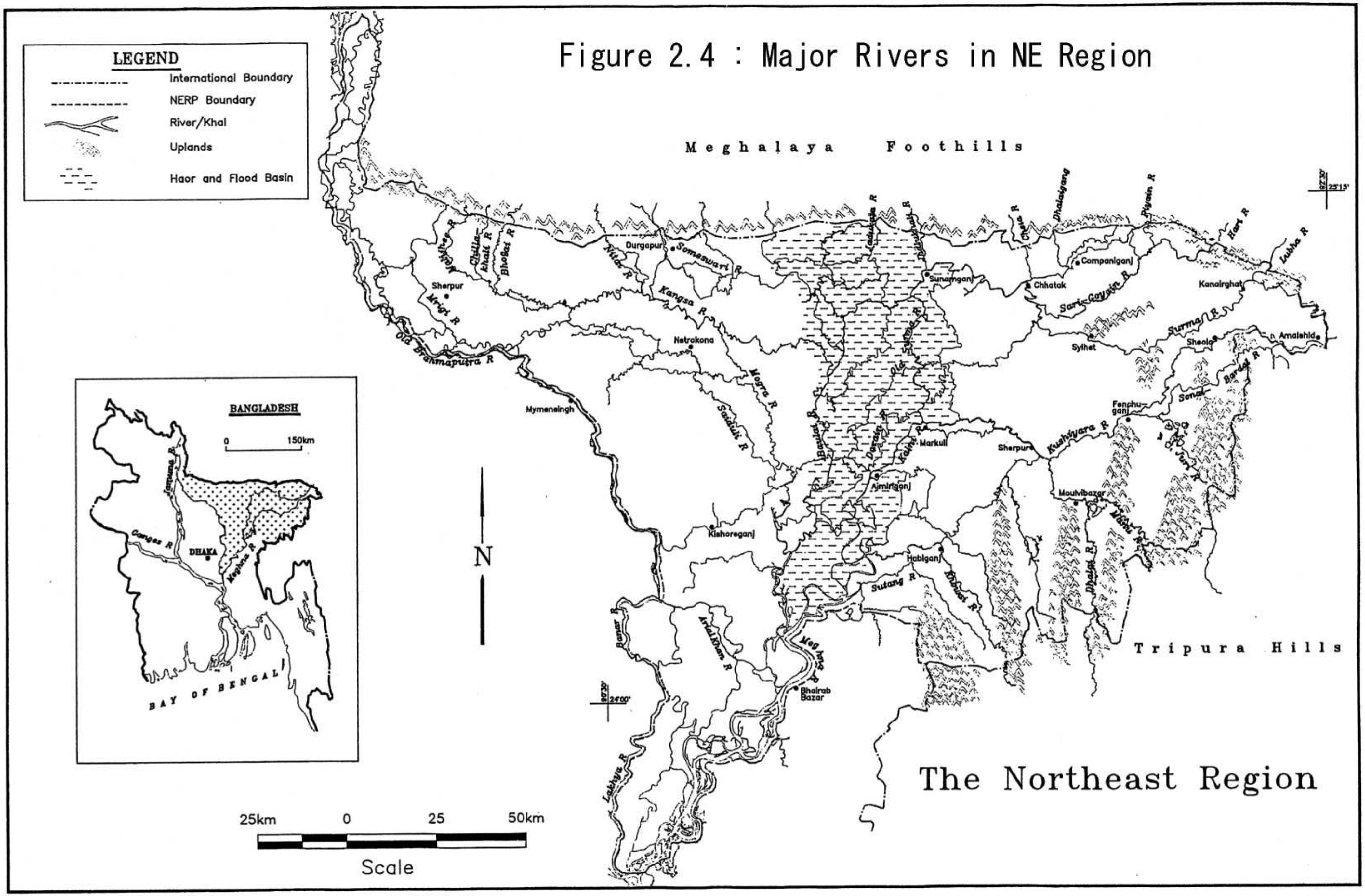


Figure 2.4 : Major Rivers in NE Region

Barak System:

It is the principal tributary to the Meghna system. From the Indian state of Assam, it enters Bangladesh in the northeastern corner at Amalshid where it is bifurcated into Surma and Kushiyara From Amalshid about 2/3rd of the flow goes to the Kushiyara and the 1/3rd to the Surma.

Kushiyara System:

At present, the Kushiyara is the principal connection between the Barak and the Meghna. In addition to receiving the 2/3rd flow of the Barak, it also collects the outflows from a 6845 km2 area in the Tripura Hills and in the small parts of Mizoram and Assam in addition to that of its own floodplain. The lower part of the Kushiyara river between Markuli and Madna is known as the Kalni and between Madna and Dilalpur is known as the Dhaleshwari. Water balance studies indicate that the Kushiyara's contribution to the Upper Meghna amounts to 48.5 km^3/year (1537 m^3/s).

The river has eight significant tributaries, all originating in Tripura and Assam. These tributaries do not all enter the Kushiyara directly. The Sonai-Bardal is tributary to the Juri, the Dhalai is tributary of the Manu and the Karangi is a tributary to the Lungla. The Lungla, Karangi and Sutan rise in the Sylhet Hills and have little or no catchment area in Tripura. The water balance studies indicate that the inflows total 10.2 km^3/year or 5.9% of the total water supply to the Meghna sub-region, equivalent to mean annual flow of 324 m^3/s.

Surma System:

The Surma is the second major link between the Barak and the Meghna via the Boulai which it joins with near Jamalganj in the district of Sunamganj. In addition to carrying the 1/3rd flow of the Barak, the river carries outflows from the eastern 7540 km^3 or 56% of the tributary area in Meghalaya. This area occupies most of the southern slopes of the Shillong Plateau which rises to maximum elevation of 2575 m and records world's greatest annual rainfall. The Surma has seven significan tributaries originating in Meghalaya and entering from the north.

The Surma delivers significant flows into the Surma-Kushiyara floodplain. Water balance studies indicate that Surma's contribution to Boulai amounts to 2214 m^3/s or 69.7 km^3/year. It also shows that inflows from the Meghalayan tributaries total 35.2 km^3/year or 20.3% of the total water supply to the Meghna sub-region. This is equivalent to a mean annual flow of 1116 m^3/s.

Discharges of the Surma have been measured by BWDB at Kanaighat, Sylhet and Sunamganj. The 'Old Surma channel' takes off from the Surma river south of Sunamganj and connects to Kushiyara river at Markuli. At present the channel is closed by embankments at both ends.

Kangsha-Mogra-Boulai System:

The Kangsha collects substantial outflows from the western Meghalayan Range and delivers them

into the Boulai which is an extension of the Surma. The Boulai also collects the flow of the Mogra. There are many old and new channel connections between the Kangsha and its tributaries as well as between the Kangsha and the Mogra. Hence the Kangsha-Mogra and Boulai is considered as one system. The Boulai delivers more water into the Meghna than the Kushiyara.

The Kangsha has five significant tributaries all originating in Meghalaya and joining it from the north and it seems to receive some spills from the Old Brahmaputra also.

The Boulai river has three principal tributaries.

The Surma enters Boulai from the east and the Kangsha enters Boulai from the west together collecting all the inflow from Meghalaya, in addition to the 1/3rd inflow of the Barak carried by the Surma.

Mogra rises near Phulpur on the plains of Mymensingh from where it flows a southeasterly course to its confluence with Boulai about 25 km from Dilapur. Its upper reaches carry little water and the lower reaches are flooded in the wet season. It is estimated that Mogra's contribution to the Boulai amounts to 13.7 km^2/year (434 m^3/s). This includes the 244 m^3/s or 7.7 km^2/year of spill from Kangsha via the Thakurakuna-Atpara channel (Dhanai khal). The reach of Mogra downstream of Atpara is called Dhanu. Water level have been observed by BWDB at Netrokuna and Atpara.

Boulai originates from the bifurcation of the Jadukata near Tahirpur from where it follows a westerly course of about 12 km and then turning south follows a 100 km course to Dilalpur on the Upper Meghna receiving major inflows from the Someswari, Surma, Kangsha and Mogra. The flow of the Boulai has never been measured. Water balance studies indicate its total contribution to the Upper Meghna amounts to 102 km^3/year (3247 m^3/s).

Meghna System:

The outflows of the Kushiyara and the Kansha -Boulai-Mogra system converge at Dilalpur from where the Meghna system starts. Downstream of Dilalpur, some congestion to drainage appears and in the monsoon season a large lake is formed in the upstream areas. The hydraulic gradient increases in the Meghna downstream of Bhairab Bazar.

Old Brahmaputra-Lakhya System:

Most of the flow in the Old Brahmaputra originates as spill from the Brahmaputra just upstream of Bahadurabad. The Old Brahmaputra bifurcates at Toke where most of the flow passes to Lakhya and thence via the Dhaleshwari to the Lower Meghna near Satnol.

The principal rivers of these areas include the Surma and the Kushiyara which drain the eastern side of the Northeast Region, the Kangsha drains the western side and Kalni and Boulai drain the central basin. All these rivers discharge into the Upper Meghna a short distance upstream of Bhairab Bazar. Below the Lakhya offtake, the downstream portion of the Old Brahmaputra carries

flow only during the flood season.

During monsoon, high waves are generated in the vast stretch of water bodies in the Haor areas when the villages look like dotted islands.

2.5 Normal sequence of annual floods

The normal sequence of annual floods starts in pre-monsoon during April-May with flash floods in the NE, SE and EH regions. The river floods start at the advent of monsoon and continue from June to September. The Meghna and the Jamuna normally reach their peaks during July and August, and the Ganges during August and September. The peaks generally coincide, on average, every six years and produce higher than normal flood levels. When the peaks coincide along with other factors such as excessive rainfall over the entire catchment areas during a spring tide in the Bay of Bengal, they may bring catastrophic floods like that of 1988. Two severe floods in succession, as happened in 1987 and 1988, may occur every decade or so. For an event of given magnitude, the damages caused to properties increases each time as new housing, commercial activities or industries are established on the floodplains.

2.6 Flood damages in the Study area

Large areas of Bangladesh are flooded every year. The severe floods like the one occurred in 1998 inflict tremendous damages to crops and properties. Detailed lists of damages due to the floods of 1988 and 1998 in the Study area as adopted from the NWMP Draft Development Strategy 2000, are furnished in Table 2.1.

Table 2.1: Flood damages in the 4 haor districts and 4 char districts in 1988 and 1998

District	Year	Affected area (sq km)	Affected population	Affected crop area total (ha)	Affected crop area partial (ha)	No. of affected houses total	No. of affected houses partial	No. of dead people	Affected road total	Affected road partial	Live-stock dead
Gaibandha	1988	1,670	866,150	44,581	0	11,717	26,175	56	1,242	0	450
	1998	n.a.	538,487	22,523	26,599	n.a.	41,598	14	694	0	0
Jamal-pur	1988	1,598	1,187,425	75,236	38,540	25,282	60,531	22	311	1,310	315
	1998	n.a.	1,132,820	15,123	22,548	n.a.	44,426	18	325	1,764	150
Kurigram	1988	1,337	644,953	47,894	28,760	11,273	12,085	11	0	816	2,354
	1998	n.a.	359,784	7,209	33,999	n.a.	58,387	9	0	567	360
Sirajganj	1988	2,526	1,865,908	104,100	0	91,480	275,175	126	1,934	0	2,910
	1998	n.a.	2,000,869	64,375	55,379	n.a.	284,645	35	584	1,690	507
Char Total:	**1988**	**7,131**	**4,564,436**	**271,811**	**67,300**	**139,752**	**373,966**	**215**	**3,487**	**2,126**	**6,029**
	1998	**n.a.**	**4,031,960**	**109,230**	**138,525**	**n.a.**	**429,056**	**76**	**1,603**	**4,021**	**1,017**
Habiganj	1988	1,750	893,350	14,105	0	8,851	14,409	8	0	0	8
	1998	n.a.	797,110	140,313	0	n.a.	25,136	12	297	1,664	1,934
Kishoreganj	1988	2,247	1,234,321	47,307	0	20,262	45,520	309	1,603	0	450
	1998	n.a.	721,167	24,232	17,717	n.a.	79,381	33	428	1,094	513

Netrokuna	1988	1,998	587,678	30,429	15,786	16,400	21,015	175	1,245	0	175
	1998	n.a.	254,060	19,201	54,179	n.a.	11,663	9	0	94	154
Sunamganj	1988	2,705	1,090,000	2,600	2,456	8,350	9,100	25	0	187	25
	1998	n.a.	279,678	24,257	0	n.a.	7,320	5	0	268	0
Haor Total:	**1988**	**8,700**	**3,805,349**	**94,441**	**18,242**	**53,863**	**90,044**	**517**	**2,848**	**187**	**658**
	1998	**n.a.**	**2,052,015**	**208,003**	**71,896**	**n.a.**	**123,500**	**59**	**725**	**3,120**	**2,601**
Source: NWMP Draft Development Strategy 2000											

Riverine char dwellers are generally the easiest victims of flood and erosion. In many cases, families in the flood prone areas have to shift their houses by dismantling and carrying to a higher ground, for instance roads or embankments.

It is estimated that the monsoon flood in 1998 affected about 30 million people, which was longer in duration and in some locations higher in depth than the disastrous ones that occurred in 1987 and 1988, albeit the death toll was fewer in 1998.

Damages occur in a lesser magnitude in normal years of flooding. Inundation of homesteads coupled with the river erosion in the Jamuna keep the Char dwellers in extreme disadvantageous situation. They get stranded inside their flooded rooms on a raised makeshift platform. The valuables of the char dwellers, like livestock and foods are often lost every year. The meager protection of homestead by the home garden vegetation is undoubtedly ineffective. In the haor area, on the other hand, erosion due to wave action during 6-7 months in a year keeps the villager busy in protecting the mounds from wave action by indigenous vegetative grass known as Chailla. This measure is also not effective fully. There is chance of flood of a greater magnitude every 5-6 years, when the situation becomes worse than in normal years.

Flood Damage in the Study area during 1998, 1999 and 2000

The consultants carried out Flood Related Surveys in the Sample Mouzas of the Study areas and collected information concerning, among other things, the damages due to the floods of 1998, 1999, and 2000. In all, 256 mouzas in 40 UZs of the 8 districts (4 for Haor and 4 for Char) were selected for the Sample Survey.. The results are summarized in the following **Table 2.2** and **Table 2.3**. The results indicate less damages in normal flood years of 1999 and 2000 in contrast with those of 1998 which is 5-year frequency flood for the haor area; and 25 to 12 year frequency flood for different places from Chilmari to Sirajganj along Jamuna river. The average areas of inundation and the consequent damages are higher in 1998 than in the subsequent 2 years.

Table 2.2: Inundation in the Sample Survey area in 1998, 1999 and 2000

District	Total area (ha)	Sample survey area gross (ha)	Inundation 98			Inundation 99			Inundation 00		
			Area (ha)	% inundated	Av. Duration Weeks	Area (ha)	% inundated	Av. Duration Weeks	Area (ha)	% inundated	Av. Duration Weeks
CHAR AREA											
Gaibandha	53,078	9,310	7,014	75%	9	4,600	49%	4	3,868	42%	3
Jamalpur	52,760	14,251	12,018	84%	7	10,526	74%	6	10,725	75%	5
Kurigram	85,482	16,566	13,665	82%	8	10,339	62%	5	11,150	67%	5
Sirajganj	78,002	7,793	2,912	37%	12	2,003	26%	4	2,286	30%	3
Total Char	**269,322**	**47,920**	**35,609**	**Av 74 %**		**27,468**	**Av 57%**		**28,029**	**Av 58%**	
HAOR AREA											
Habiganj	131,951	9,469	4,563	48%	21	2,671	28%	18	3,098	33%	19
Kishoreganj	169,376	54,575	47,298	87%	21	33,300	61%	18	39,547	72%	19
Netrokuna	70,122	11,833	10,895	92%	23	9,525	80%	19	10,804	91%	21
Sunamganj	268,147	22,690	16,043	71%	18	11,594	51%	15	8,185	36%	14
Total Haor	**639,596**	**98,567**	**78,799**	**Av 80%**		**57,090**	**Av 58%**		**61,634**	**Av 63%**	
Source: Sample survey 2001											

Table 2.3 :Damages in the Sample Survey area in 1998, 1999, 2000

Char/Haor of District	Total area of Char /Haor (ha)	Sample survey area gross (ha)	Damaged Crop						Damaged Cattle			Damaged House			Human life lost		
			1998		1999		2000		1998	1999	2000	1998	1999	2000	1998	1999	2000
			area (ha)	% area dama-ged	area (ha)	% area dama-ged	area (ha)	% area dama-ged	No.	No.	No.	No.	No.	No.	No.	No.	No.
CHAR AREA																	
Gaibandha	53,078	9,310	4,313	46%	3,687	40%	3,287	35%	506	0	0	1,028	19	14	0	0	0
Jamalpur	52,760	14,251	8,354	59%	6,619	46%	6,008	42%	1,310	20	0	1,855	90	25	4	0	0
Kurigram	85,482	16,566	7,478	45%	5,002	30%	4,809	29%	2,903	1,359	1,310	3,435	1,743	1,494	12	0	1
Sirajganj	78,002	7,793	993	13%	671	9%	647	8%	539	290	208	629	396	330	16	1	1
Total Char	**269,322**	**47,920**	**21,138**	Av 44%	**15,979**	Av 33%	**11,751**	Av 31%	**5,258**	**1,669**	**1,518**	**6,947**	**2,248**	**1,863**	**32**	**1**	**2**
HAOR AREA																	
Habiganj	131,951	9,469	2,325	25%	1,426	15%	1,519	16%	3,140	1,680	1,425	677	371	455	16	3	7
Kishoreganj	169,376	54,575	20,431	37%	4,946	9%	4,756	9%	3,962	316	679	11,332	1,401	2,569	35	0	0
Netrokuna	70,122	11,833	3,155	27%	2,383	20%	7,295	62%	1,816	1,216	2,613	1,347	598	1,173	7	0	0
Sunamganj	268,147	22,690	1,423	6%	1,028	5%	1,419	6%	1,644	161	289	3,100	475	385	0	0	0
Total Haor	**639,596**	**98,567**	**27,334**	Av 28%	**9,783**	Av10 %	**14,989**	Av 15%	**10,562**	**3,373**	**5,006**	**16,456**	**2,845**	**4,582**	**58**	**3**	7

Source: Sample survey 2001

2.7 Flood response to inundation of homestead

The present response to inundation of homesteads are manifested mainly by (a) raising sleeping place during flood by constructing 'macha' - raised platform mostly by bamboo, sometime wood, (b) pre-flood (or post-flood) raising of the homesteads (or room) by earthworks, (c) flood time evacuation to a raised ground, road, embankment, flood shelter, or relatives' houses in flood free areas.

2.7.1 UZ wise depth of inundation of the households / village mounds

From the questionnaire sample surveys conducted under the Study, the depths of inundation of the households above the court yards/village mounds for the Sample Survey UZs have been calculated for the haor/char areas of the UZs on percent of the no. of homesteads basis. The room floor level is generally 30 to 40 cm above the court yard level. The **Table 2.4 and Table 2.5** have been prepared on the basis of the Sample Surveys (Sociology Sec.11.2, consolidated in **Table 5.5 and Table 5.6**). The UZs with * mark in the Tables were beyond the Sample Survey, the figures shown against them are the average of the other UZs which were surveyed under the districts.

It may be observed from the Tables of inundation of Chars and Haors that percent of inundated homesteads in the char areas is more than that in the Haor areas. The village mounds in the Haors were overtopped by flood waters in 1998 but in a lesser depth and fewer times than that happened in the char homesteads during the same monsoon.

Table 2.4: Depth of homestead inundation in CHAR AREA, UZ wise in 1998

District / Char Area	UZ	% of house-hold court yard experienced depth of inundation				Av. period of inundation (month)
		Not inundated	**< 30 cm**	**30-100 cm (av.65 cm)**	**100- 150 cm (av.125 cm)**	
Gaibandha	**Fulchari**	**1**	**3**	**87**	**9**	**1.40**
	Gaibandha Sadar	**0**	**0**	**91**	**9**	**1.87**
	Shaghata	**0**	**19**	**74**	**7**	**2.11**
	Sundarganj	**0**	**0**	**90**	**10**	**1.06**
Jamalpur	**Dewanganj**	**1**	**11**	**80**	**8**	**2.21**
	Islampur	**1**	**22**	**70**	**7**	**2.31**
	Madarganj	**1**	**3**	**88**	**8**	**1.53**
	Sharishabari	**2**	**4**	**86**	**8**	**1.02**
Kurigram	**Charrajibpur**	**7**	**11**	**75**	**8**	**1.98**
	Chilmari	**5**	**2**	**85**	**8**	**1.81**
	Kurigram Sadar	**0**	**5**	**86**	**9**	**1.89**
	Nageshwari	**3**	**5**	**84**	**8**	*
	Raumari	**3**	**5**	**84**	**8**	*
	Ulipur	**0**	**0**	**90**	**10**	**1.91**
Sirajganj	**Belkuchi**	**0**	**0**	**90**	**10**	**2.45**
	Chauhali	**2**	**2**	**87**	**9**	**1.88**
	Kazipur	**0**	**14**	**78**	**8**	**1.46**
	Shahjadpur	**1**	**4**	**89**	**6**	*
	Siragnj Sadar	**0**	**1**	**90**	**9**	**1.86**

Source: Field Survey 2001

Table 2.5 : Depth of inundation in the household in HAOR AREA, UZ wise in 1998

District	UZ	In 1998, % of house-holds experienced max depth of inundation				Av. period of inundation (month)
		Not inundated	**< 30 cm**	**31-60 cm (av.45 cm)**	**61- 90 cm (av.75 cm)**	
Haor Area						
Habiganj	**Ajmiriganj**	**18**	23	58	1	**2.86**
	Bahubal	**32**	26	42	1	*
	Baniachang	**24**	21	54	1	**1.39**
	Habiganj Sadar	**32**	26	42	1	*
	Lakhai	**48**	30	21	1	**0.93**
	Madhabpur	**32**	26	42	1	*
	Nabiganj	**37**	31	32	1	**2.10**
Kishoreganj	**Ashtogram**	**6**	26	66	2	**4.27**
	Bajitpur	**5**	35	60	1	**0.86**
	Itna	**52**	35	12	1	**0.97**
	Karimganj	**32**	26	41	1	*
	Kishoreganj Sadar	**32**	26	41	1	*
	Mithamain	**59**	21	19	1	**0.88**
	Nikli	**22**	4	72	2	**5.00**
	Tarail	**49**	34	15	1	**1.33**
Netrokuna	**Khaliajuri**	**0**	0	96	4	**2.26**
	Kalmakanda	**21**	24	56	2	*
	Madan	**40**	37	23	1	**3.54**
	Mohanganj	**23**	36	40	1	**1.57**
Sunamganj	**Bishwambarpur**	**25**	29	43	1	*
	Derai	**18**	28	53	1	**3.94**
	Dharmapasha	**26**	27	46	1	**3.48**
	Jagannathpur	**25**	29	43	1	*
	Jamalganj	**24**	32	43	1	**2.34**
	Sulla	**33**	33	32	1	**3.35**
	Sunamganj Sadar	**25**	29	43	1	*
	Tahirpur	**24**	26	47	1	**1.13**
	Chatak	**25**	29	43	1	*
	Dowarabazar	**25**	29	43	1	*

Source: JICA Study Team Flood related facilities Sample Survey 2001

2.8 Present Flood Proofing activities

The present flood proofing in the Study area mainly comprises of raising of homesteads and infrastructure, such as roads, flood shelters, shared areas, water supply and sanitation facilities above normal flood level. At present, the following are the common items of flood proofing in the char and haor areas.

2.8.1 Structural Flood Proofing

(1) Raising homesteads

The main item of Flood Proofing in char and haor areas is raising of homestead by earthwork by the people themselves. Also elevating the community places, social institutions, small scale village roads, tube wells, dug wells, latrines etc are in practice. Nowadays some NGOs are assisting the poor in raising their homesteads, although in a very limited scale. While planning to raise homesteads, stability of the char in the face of erosion is a prime factor to consider. When erosion devours or about to devour the cahe dwellings, people shift the housing structure to another char or in the same char in a safer locality. In the haor area, waves erode side(s) of village mounds every monsoon and the people restore the lost earth in the next dry season.

(2) Protection and extension of village mounds

Protection of village mounds from wave action (erosion) in the Haor areas is carried out by one of the following:

(a) Bamboo and ‘chailla’ grass and vegetative barrier on the windward direction

(b) Brick or concrete blocks on earth slopes generally financed by NGOs

(c) Masonry or concrete wall by a very limited rich section of people and by NGOs,

(3) Flood Sheltering

The existing flood shelters under the Relief and Rehabilitation Departments are being supplemented by a number of LGED Flood Shelter cum Schools. In comparison to the actual needs, their number is however extremely meager.

2.8.2 Non-structural Flood Proofing

Protection of char village from the river erosion being unfeasible, the char dwellers respond by migration to another place in a nearby locality or in an adjacent char. They vegetate around the homesteads to protect them from the action of flow but with limited success. Other non-structural modes are community education, awareness, training etc.

2.8.3 Earlier Flood Proofing Projects / Studies

2.8.3.1 CARE Bangladesh's Flood Proofing Project

Under the Integrated Flood Securing Programme (IFSP) of USAID, the CARE Bangladesh is currently implementing a 5-year Flood Proofing Project. The goal of IFSP is to promote and protect Food and Livelihood Security of vulnerable groups in underdeveloped highrisk rural and urban areas of Bangladesh. Under the project, CARE Bangladesh has an agenda to flood-proof the vulnerable communities in the flood prone haor and char areas. The pilot project has been completed at a total cost of US$1.61m during the fiscal years 1996-1999 covering 115 villages, 79 in char areas of Kurigram district and 36 in haor area of Madan UZ in Netrokuna district; and now it has a five-year (2000-2004) Flood Proofing Project under implementation. Over the five year period the project intends to reach the Direct Project Participants in 1025 villages of 20 Upazilas of different flood-prone environments.

The CARE Bangladesh's Flood Proofing Project is designed to implement in three flood environments such as (a) active floodplain in the main rivers (riverine char), (b) deeply flooded tectonic depression areas (haor), (c) Sea surge area in the southern part of Bangladesh. The area of CARE flood proofing activities are furnished in the following Table-2.6.

Table:2.6: CARE Bangladesh activities of Flood Proofing Project

District	Upazilas		
	Completed	**On-going**	**Will be taken up next year for implementation**
Kurigram	Ulipur	Kurigram Sadar Nageshwary Rowmari	Char Rajibpur
Gaibandha	Sundarganj	Shaghata Fulchari	
Netrokuna	Madan	Mohanganj	
Sirajganj			Chouhali Kazipur Sirajganj Sadar
Kishoreganj	Nikli Karimganj	Bajitpur	
Sunamganj			Derai Jagannatpur Jamalganj
Bogra, Shariatpur, Barguna, Bhola			Projects will be taken up next year

2.8.3.2 FAP 3.1 Flood Proofing component

The other Flood Proofing Pilot Project was under the FAP 3.1 Jamalpur Project Refinement Study in 1995-96.In the Flood Proofing, 900 households at 3 sites – 2 in Brahmaputra charlands and 1 in

Old Brahmaputra floodplain were involved. People preferred raising plinth of homestead as the best form of flood proofing, with flood shelters. Beneficiaries were required to provide the land free for the communal facilities like flood shelters.

The Pilot Project was successful in that it was completed in one year, but the remaining planned works could not be implemented due to lack of funding. A longer project monitoring would be required to assess the real success.

2.8.3.3 FAP 6 Study Relating Flood Proofing

The Flood Action Plan has a study report on the North East Regional Water Management Plan, which aims at improving the flood situation and life of the people in the area. The Study has its boundary squarely covering the entire 4 haor-districts under the present Study of Rural Development focusing on flood proofing.

Under the proposed 'Flood and Erosion Affected Villages Development Project' of FAP, the following flood proofing structural measures have been planned:

- Earthwork to enlarge previously wave eroded homesteads above the danger of flooding,
- Establish strategic stand on swamp forest, reed swamp and grassland habitats to protect villages from wave erosion and produce sustainable harvest of bio-mass products, and
- Settlement of new villages created from the spoil of the FCDI (dredging/channel re-excavation) projects put forward by NERP.

2.9 Flood Sheltering

Community flood proofing activities are yet to develop adequately in country. Flood shelters have not been a traditional flood proofing as yet. There has not been enough of flood shelters built to accommodate the flood affected mass, not to speak of their livestock, valuables etc. On average, the people of the flood prone areas have to look for a refuge place once in a five year period. Flood shelters have been introduced by the government and non-government agencies during the past forty years. Initial shelters were mainly earthen platforms (called killas in coastal areas). At present, the flood shelters are situated in the places as stated in the following list:

The present no. of shelters situated in char and haor areas are furnished in **Table 2.7.**

Table 2.7: Number of existing flood shelters and their capacities (Char and Haor areas)

District (Char)	Pop.	No.of Flood shelters	Shelter capacity (persons)	Cove-rage (%)	District (Haor)	Pop.	No.of Flood shelters	Shelter capacity (persons)	Cove-rage (%)
Gaibandha	201,051	4	700	0.3%	Habiganj	718,090	40	10,200	1.4%
Jamalpur	377,128	36	8,350	2.2%	Kishoreganj	1,254,947	41	11,500	0.9%
Kurigram	335,291	8	825	0.2%	Netrokuna	271,563	21	10,640	3.9%
Sirajganj	485,710	184	49,290	10.1 %	Sunamganj	1,183,826	66	11,906	1.0%
TOTAL	**1,399,180**	**232**	**59,165**	**4.2%**	**Total:**	**3,428,426**	**168**	**44,246**	**1.3%**

Source: JICA Study Team Flood related facilities Sample Survey 2001

Important aspect of the flood sheltering is that people require not only shelter for themselves but they need some raised and flood free ground also for their livestock. They also need drying yard for the crops to dry in monsoon, this facility is not available in most places.

2.10 Flood Forecasting and Warning system now in practice

2.10.1 Role of Flood Forecasting and Warning Centre (FFWC) of BWDB

The FFWC was established in 1972 under Bangladesh Water Development Board (BWDB). The UNDP supported the centre through different projects from the inception till 1992. The centre received assistance for its improvement and expansion from DANIDA during 1991-1995 though a component of the FAP. Currently the DANIDA-assisted project "Consolidation and Strengthening of Flood Forecasting and Warning Services" is under implementation for the period January 2000 through December 2004.

The FFWC collect and process the hydro-meteorological data, carry out model operation, generate flood maps, prepare and disseminate flood bulletins and warnings. The Centre collects information and data through various rainfall and water level gauge stations, radar stations, satellite imageries of Bangladesh Meteorological Department (BMD), Space Research and Remote Sensing Organization (SPARSO), websites etc.

Major deficiency of FFWC is the lack of availability of hydro-meteorological real-time data for the rivers of Bangladesh the catchment of which lie outside the country's territory.

During 1975-1991, the centre used to forecast flood by co-axial correlation, gauge to gauge relation and Muskingum-Cunge Routing Model. From 1991 onward, the forecasting has been based on the flood modeling technology developed by Danish Hydraulic Institute (DHI) with the support services from the SWMC. The forecasting centre use the MIKE 11 and FLOOD WATCH modeling systems. After 1998, modern techniques of flood monitoring have been introduced with computerized programs.

FFWC provides flood bulletins and warnings to a number of policymakers, organizations, institutions, government offices, NGOs, Media (TV, Radio, News paper) etc. The bulletins relate expected rise/fall of water levels of different rivers at the location of specific BWDB gauge stations in subsequent 24 hours. The FFWC's flood warnings/bulletins do not cover the depth and extent of inundation of flood prone areas in UZs/Unions. The warnings and messages are neither area-specific nor people oriented. People living in vulnerable areas can not relate the warnings having only the rise/fall of water levels on a specific location to the context of their locality and therefore can not depend on those to take timely precautionary measures relating to a flood response.

2.10.1.1 Present telemetering system

There are 14 telemetering stations installed in 1996. Six are now operational as they are directly connected with the FFWC. But the remaining 8 are connected through T&T micro wave. Due to problem in the T&T micro wave, the 8 telemetering lines are not functioning now (February 2002).

The locations of present telemetering stations are given below:

Table 2.8: List of telemering in the FFWC of BWDB.

Sl. No.	Location	River	Remark
1	Chapai Nowabganj	Mohananda	Functioning
2	Kurigram	Dharla	**Not functioning**
3	Nayerhat	Kaligana	Functioning
4	Mirpur (Dhaka)	Turag	Functioning
5	Mill Barak (Dhaka)	Buriganga	Functioning
6	Rekabi Bazar (N.Ganj)	Lakhya	Functioning
7	Tongi (Tongi Khal)	Turag	**Not functioning**
8	Shaistaganj	Khowai	**Not functioning**
9	Narayanganj	Lakya	Functioning
10	Kamalganj	Monu	Not functioning
11	Dhalai (Moulvibazar)	Dhalai	Not functioning
12	Manu (Moulvibazar)	Manu	Not functioning
13	Zakiganj	Kushiyara	Not functioning
14	Sherpur	Sherpur	Not functioning

2.10.1.2 Data Collection by wireless

There are 80 stations from which data are collected through wireless. Beside the telemetering receiver station, the wireless data receiving station is also situated in the FFWC (BWDB HQs).

2.10.2 Consolidation and Strengthening of the Flood Forecasting and Warning Services (FAP 10)

FFWC is implementing a 5-year project - Consolidation and Strengthening of the Flood Forecasting and Warning Services (2000-2004) as a part of FAP 10 with the financial assistance if DANIDA. The project has two broad components – (a) the Flood Forecasting and (b) the Dissemination of flood warning. Flood Forecasting requires technologies and technical services. Equipment and forecasting methodologies of FFWC have undergone continuous upgrading, extension and improvement. However, the present warning dissemination system needs further improvement. At present the information passes very slowly through the various levels down to the level of people.

2.10.2.1 Pilot UZs for setting up dissemination of flood warnings

To assess the setting up of a workable flood warning dissemination system, 3 pilot UZs (Lohajang UZ in Munshiganj, Chauhali in Sirajganj and Sundarganj in Gaibandha) were established with the following procedural program.

The UZ Disaster Management Committee (UNO is the head) receives flood bulletin and warning from the FFWC in the usual rise/fall of the water level for a BWDB gauge station.. The Committee then interprets the information with context to a number of 'Flood Marker Posts' (FMP) established in different locations in flood prone villages in the UZ and sends the depth and area-specific flood warning to the related Union DMC (under Chairman UP) through messenger. The Union DMC in

its turn informs the villagers using the UP Members/ Volunteers/ Imams / Schools Teachers and others and arranges to announce in the local markets, religious congregations, schools and by speech of mouth in the locality. Through trainings conducted by the NGOs people now know what would be the depth and extent of flood when the forecasted water level touches certain marks in the FMP.

To deliver the flood warning issued by FFWC properly to villagers the following channel of dissemination has been recommended in a seminar held in January 2002 under the auspices of the FFWC (BWDB) and the DMB.

From FFWC,

- by telephone/mobile/fax/e-mail to UZDMC (UNO is the head of UZDMC)
- by messenger to Union DMC
- by volunteers to Ward Members of the Union,

through drum beating, micro-phone, announcement in Masjid, school, word of mouth to People

The seminar held in January 2002 has carried out the following:

1. Reviewed the finding of the pilot dissemination activities in 3 UZs
2. Obtained feedback from stakeholders to improve dissemination procedure
3. Shared the ideas on need of Flood Forecasting nationwide
4. Developed further joint approach in forecasting and dissemination of warnings and proposed for intensive interaction between FFWC and the Disaster Management Bureau (DMB).

During the last flood season (2001), the testing of the flood warning dissemination system could be tried only in a limited scale, because severe flood did not occur in Bangladesh in 2001. However, the NGOs and other related people could gather experience in preparing for the implementing the dissemination system.

2.11 Disaster Management Bureau (DMB) Profile

Disaster Management Bureau, which addresses flood as one of the 5 disasters was created under the Ministry of Disaster Management and Relief in 1992, with UNDP and UNICEF support. DMB has the following objectives.

1. To coordinate disaster management activities
2. To organize training and public awareness activities
3. To collect, preserve and analyze data of the disastrous events
4. To operate on emergency operation centre
5. To promote prevention, mitigation and preparedness at all levels on various disasters
6. To arrange preparation of Union, UZ and District level Disaster Management Plans including Training and Public Awareness Building plans for Short, Medium and Long term needs of the country
7. To help line Ministries, Departments and Agencies to develop Contingency Disaster management Plan and to test this plan and arrange effective dissemination of disaster warning
8. To organize logistic arrangement in connection with the Disaster Management.

2.12 FAP 6 Study for flash flood warning system in the Northeastern Region

FAP 6 conducted a Study in 1994 to provide timely and readily understood warnings to villagers in Flash Flood prone areas of Northeast Region, which cover some parts of the Haor area of the present Study. Storm over the Indian states of Meghalaya and Tripura can occur both in pre-monsoon and monsoon. The flash floods travel down the rivers for 20 to 30 km from across the border, wrecking havoc in the riverside villages before their energy is dissipated by merging with flows in the larger rivers in haor areas where they loose their fury and become normal early floods. Details of the technology required including the cost to generate these warning signals which included installation of telemetering in cross-country locations in Tripura and Meghalaya, and of the actions villagers should take in case of receiving a notice of flash flood have been worked out in the FAP 6 Report. It was recommended that a full fledged Directorate named "Flash Flood Warning Agency" be established within the BWDB to establish, operate and maintain the proposed system. The Study identified 9 major flash flood channels and their affected areas. Four numbers of such channels are the source of early floods in haor areas of the present Study.