CHAPTER 5 DEVELOPMENT MASTERPLAN

5.1 Introductions

The word "Master Plan" indicates a plan that identifies the guidelines and policies for future development focusing on the main issues to be dealt within 15-25 years ahead.

5.2 Project and Programs (including Flood Forecasting and Warning dissemination)

5.2.1 Master Plan key issues for the flood proofing

Master Planning of the "Rural Development Focusing on Flood Proofing" concerns, among other things, the preparation of guidelines and policies for development and maintenance of flood proofing facilities for the upcoming 25 years. It may also be called a strategic planning, focusing on flood proofing issues, which provides for the frame work of executive planning (5-Year Plan, Annual Development Plan etc) that concerns the implementation of specific investment projects, their maintenance programs and operating principles.

In course of the Study it became clear that the present Master Plan for the flood proofing, as part of the Rural Development, needs to address, inter alia, following major issues through minor structural (or non-structural) measures.

1. Earthfilling to restore the area of village mounds with protection against erosion due to waves.
2. Raising of homesteads to make them flood free.
3. Propagation of awareness for flood preparedness.
4. Provision of multi-purpose Flood Shelters with latrines, hand tubewells etc for people and domestic animals.
5. Establishing effective system of flood forecasting and dissemination of warning by use of telephone/radio communication.
6. Clustering houses on high platforms.

5.3 Protection of village mounds in the Haor areas against wave erosion

One or more of the following actions may be required for the protection of village mounds:

5.3.1 Action I: 'Earth-only' protection with 'Chailla' grass

Every year during monsoon, the windward side slopes of the village mound in the haor area loose earth due to wave action. This happens at least on two sides of the mound from which direction the wind blows. During the next dry season, the lost earth should be replenished. The main problem about the 'earthwork only' type of protection is that it is not durable against wave action because soil is mostly non-clayey. The durability may improve with a coating on the side slopes with carried **cohesive soil,** duly compacted and turfed. A layer of earthfilled synthetic bags on top of filling may also improve durability in a small scale. However, these need further testing for confirmation. Side slope shallower than 1:1.5 may also increase durability by reducing erosion. Indigenous protection by 'Chailla' (*Hematheria Protensa)* may be added before the monsoon.

5.3.2 Action II: Establishing a vegetative protection by 'Hijal' and 'Koroch'

This can help make the whole process of the village mound protection sustainable in the long run, which should be the main tool for an enduring wave protection of the village mounds. However, this may require 10-15 years to become fully effective. A layout of typical vegetative protection is shown in **Figure 5.1.**. The immediate action that should be started now is the afforestation program of Hijal and Koroch. Once the plantation is established, it will go on reproducing naturally, provided the villagers are motivated and trained to preserve the same. Normally, there is chance of pilferage of grown/semi-grown tree for using as fuel.

5.3.3 Action III: Revetments by brick/concrete block on slope of village mound

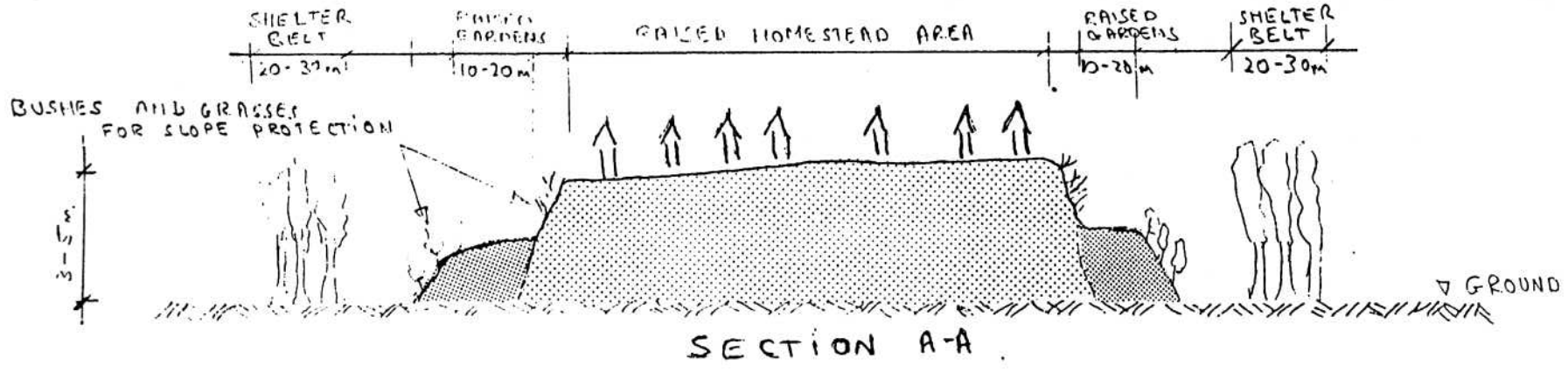
The brick/concrete block revetment works will give dependable protection for 25-30 years provided they are well designed, properly constructed and well maintained. This may be considered for both shallow haor and deep haor areas.

List of UZs in the Study area having deep and/or shallow haor is furnished in the following Table 5.1.

Table 5.1: Deep and shallow haor location

District	UZ	Total UZ area (ha)	Haor area		Deep or Shallow haor
			(ha)	% of UZ	
Habiganj	Aimiriganj	22,399	22,399	100%	Shallow
	Bahubal	25,066	5,915	24%	Shallow
	Baniachang	48,228	39,866	89%	Shallow
	Habiganj Sadar	25,378	13,586	54%	Shallow
	Lakhai	19,655	19,655	100%	Shallow
	Madhabpur	29,427	10,861	37%	Shallow
	Nabiganj	43,963	19,669	55%	Shallow
Kishoreganj	Ashtogram	35,555	35,555	100%	Shallow
	Bajitpur	19,377	14,463	75%	Shallow
	Itna	40,195	40,195	100%	Shallow
	Karimganj	20,051	20,051	100%	Shallow
	Kishoreganj Sadar	19,373	7,361	38%	Shallow
	Mithamain	22,292	22,292	100%	Deep
	Nikli	21,440	21,168	99%	Shallow
	Tarail	14,147	8,291	59%	Shallow
Netrokuna	Khaliajuri	29,764	29,764	100%	Shallow
	Kalmakanda	37,742	12,870	34%	Shallow
	Madan	22,586	13,131	58%	Shallow
	Mohanganj	24,319	14,357	59%	Shallow
Sunamganj	Bishwambarpur	19,426	11,057	57%	Shallow & Deep
	Chatak	43,478	22,663	52%	Shallow & Deep
	Derai	42,094	42,094	100%	Shallow & Deep
	Dharmapasha	49,606	47,342	95%	Shallow & Deep
	Dowarabazar	28,142	5,076	18%	Shallow
	Jagannathpur	36,827	18,992	52%	Shallow
	Jamalganj	33,876	33,876	100%	Shallow & Deep
	Sulla	26,073	26,073	100%	Shallow & Deep
	Sunamganj Sadar	56,077	36,992	72%	Shallow & Deep
	Tahirpur	31,370	23,982	76%	Shallow & Deep

Source: Map of Agricultural classification of land



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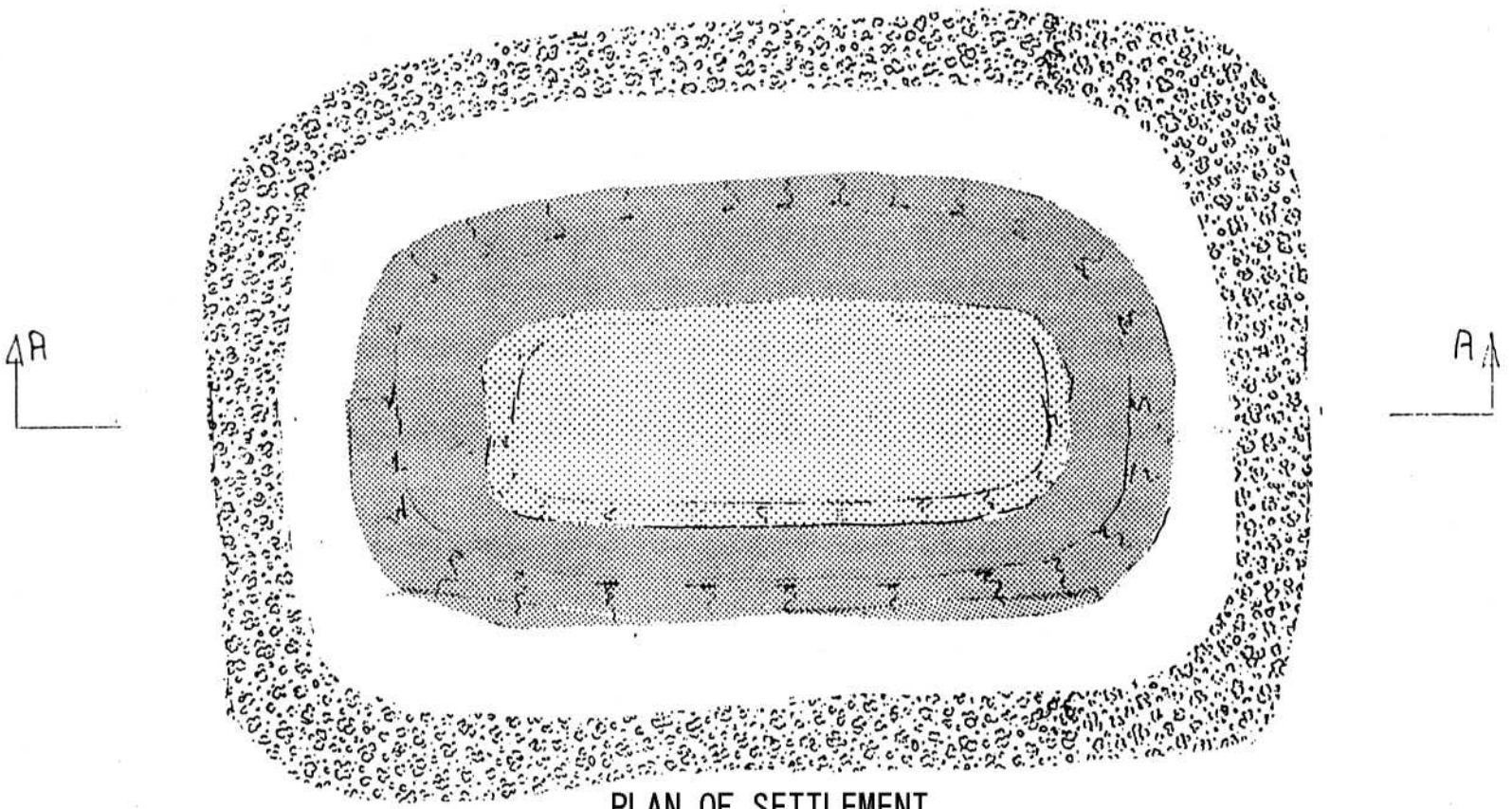

PLAN OF SETTLEMENT

NOT TO SCALE

FIGURE 5.1 : SKETCH OF VEGETATIVE PROTECTION

5.3.4 Action IV: Provision of masonry/RCC walls in lieu of brick/concrete block revetment

This action will be the most costly, although very much liked by the villagers due to its easy construction procedure and durability. They villagers have seen the different kinds of protection works against wave erosion done by LGED-CARE, NGOs and draw their conclusion in favor of masonry wall structure because of its effectiveness, ease in construction and durability. From the engineering point of view also, this is the most dependable but costlier item. Generally, this calls for minimal maintenance. This may be considered for deep Haor area generally.

5.3.5 Program for the village mound protection

Usually width of a village mound varies from 30 to 70 m and the length varies from 100 to 400 m. The oblong shape of most of the mounds is not optimal for minimizing the length of wall/revetment and hence the cost per unit area of protection. However, this situation may be improved, where possible, by constructing the longer side wall/revetment further away from the existing slope of the mound and filling inside by earth, thus producing more area of the raised mound to accommodate the already homeless/landless families in the areas. This extended area of the raised and protected land may also be used for the Multipurpose Flood Shelters. Average total length of protection of two sides of a mound may be taken 250 m and average height of the revetment above ground level 3.5m including Free Board.

5.3.5.1 Implementation of 'earth-only' approach of village mound protection

On average the wave action can cause erosion of 1-2 meters per year on the windward faces of mounds that use only the indigenous protection by 'Bamboo-Chailla' combination.. Without the Bamboo-Chailla treatment, the erosion could be more. With average size of 200m x 50m of the mounds, the length of the sides facing wave action may be 250m. Normally the height of the mounds are 3-4m from the average ground level.. Taking an average of 3.5m height, thickness of 1.5m and length 250m, the average volume of earth work comes to 1.5 x 3.5 x 250 = 1,312m^3 to be replenished every year per mound. There are in total 5062 no. of mounds in the 4 haor districts under the Study. Nearly 85% of the mounds may have to be replenished with earth to recoup the eroded volume due to wave erosion every year for the first 10 years of the planning period. Hijal/Koroch tree will grow during this period, so thereafter only 10% of the mounds may require such treatment every year for another 5 years. Volume has been calculated as = No. of mounds x (0.85x10 + 0.10 x 5) x 1312 m^3.

Table 5.2 shows the total volume of earthwork required in 15 years UZ wise.

Table 5.2: 'Earth-only' protection of the village mounds

District	UZ	No. of village mounds	Total Vol of earth required for 15 years (m3)
Habiganj	Ajmiriganj	410	**4,841,280**
	Bahubal	120	**1,416,960**

	Baniachang	1150	**13,579,200**
	Habiganj Sadar	120	**1,416,960**
	Lakhai	245	**2,892,960**
	Madhabpur	120	**1,416,960**
	Nabiganj	352	**4,156,416**
Kishoreganj	Ashtogram	90	**1,062,720**
	Bajitpur	2	**23,616**
	Itna	270	**3,188,160**
	Karimganj	50	**590,400**
	Kishoreganj Sadar	120	**1,416,960**
	Mithamain	80	**944,640**
	Nikli	128	**1,511,424**
	Tarail	120	**1,416,960**
Netrokuna	Khaliajuri	181	**2,137,248**
	Kalmakanda	164	**1,936,512**
	Madan	53	**625,824**
	Mohanganj	125	**1,476,000**
Sunamganj	Bishwambarpur	120	**1,416,960**
	Derai	76	**897,408**
	Dharmapashaaa	115	**1,357,920**
	Jagannathpur	120	**1,416,960**
	Jamalganj	158	**1,865,664**
	Sulla	187	**2,208,096**
	Sunamganj Sadar	88	**1,039,104**
	Tahirpur	58	**684,864**
	Chatak	120	**1,416,960**
	Dowarabazar	120	**1,416,960**
	TOTAL:	**5062**	**59,772,096**

5.3.5.2 Protection of village mound by vegetative cover (Hijal/Koroch)

In all the village mounds as listed in **Table 5.2**, afforestation of Hijal/Koroch during the plan period may be carried out by implementing on 90% of the number of mounds in first 5 years of the plan period and 10% in another 2 years. Koroch may be preferred to Hijal as it grows faster than Hijal. Afforestation program should be started immediately.

5.3.5.3 Protection of village mounds by hard material

There are many vulnerable village mounds that call for immediate attention to save them from complete disappearance. They are to be protected by hard material. From the Field Survey, it is seen that about 7% of the mounds require urgent treatment by hard materials, failing which they may be wiped out. After considering different alternatives of the kind of hard materials, it has been found that brick block revetment and masonry wall protection are the most acceptable engineering solution for the respective locations. Out of the approximately 7% of total number of mounds that need hard material protection, 4% could be executed by brick/concrete block revetment on slope in both shallow and deep haor areas and 3% by brick masonry wall where found necessary preferably in deep haor areas.

Table 5.3: Planning of protection work by hard materials in Haor area

District	UZ	No. of village mounds	Most vulnerable no. of village mounds as obtained from field surveys 2001	Total length of protection (m)	Remark
Habiganj	Ajmiriganj	410	12	3,000	Shallow haor
	Bahubal	120	6	1,500	Shallow haor
	Baniachang	1150	30	7,500	Shallow haor
	Habiganj Sadar	120	4	1,000	Shallow haor
	Lakhai	245	20	5,000	Shallow haor
	Madhabpur	120	0	0	Shallow haor
	Nabiganj	352	26	6,500	Shallow haor
Kishoreganj	Ashtogram	90	12	3,000	Shallow haor
	Bajitpur	2	0	0	Shallow haor
	Itna	270	24	6,000	Shallow haor
	Karimganj	50	2	500	Shallow haor
	Kishoreganj Sadar	120	14	3,500	Shallow haor
	Mithamain	80	15	3,750	Deep & Shallow
	Nikli	128	6	1,500	Shallow haor
	Tarail	120	6	1,500	Shallow haor
Netrokuna	Khaliajuri	181	18	4,500	Shallow haor
	Kalmakanda	164	26	6,500	Shallow haor
	Madan	53	6	1,500	Shallow haor
	Mohanganj	125	14	3,500	Shallow haor
Sunamganj	Bishwambarpur	120	10	2,500	Deep & Shallow
	Derai	76	12	3,000	Deep & Shallow
	Dharmapashaaa	115	14	3,500	Deep & Shallow
	Jagannathpur	120	12	3,000	Shallow haor
	Jamalganj	158	16	4,000	Deep & Shallow
	Sulla	187	18	4,500	Deep & Shallow
	Sunamganj Sadar	88	6	1,500	Deep & Shallow
	Tahirpur	58	8	2,000	Deep & Shallow
	Chatak	120	6	1,500	Deep & Shallow
	Dowarabazar	120	6	1,500	Shallow haor
	TOTAL:	**5,062**	**349**	**87,250**	

The UZ-wise required lengths of protection by hard materials are presented in table 5.3. The lengths are found by multiplying the number of vulnerable mounds by 250, which is considered the average length protection per mound.

Most of the protection works of village mounds by hard materials may be done in the first ten years.. It is expected that from the middle part of the plan period, from around year 2012 for example, protective works by hard materials will not be needed to a large extent, as by that time the vegetative protection by Hijal and Koroch will grow up. However, a nominal provision of protection by hard materials may be kept for the period beyond 2012 to meet exigencies if any.

5.3.5.3.1 Protection by brick/CC block revetment

As indicated in **Table 5.3**, total number of vulnerable village mound that require hard material

protection is 349. Nearly 200 of them may be protected by brick CC block revetment laid on slope. The tentative size of the brick block for revetment may be 45cm x 45cm x 22.5cm, laid on filter/geo-textile on a slope of 1:2. As stated earlier, this is not very popular amongst the villagers. In the past, revetment works were done in some places, which did not prove very stable in position. The most important part of this kind of works is its requirement of periodic O&M, which is generally lacking particularly in rural areas. Therefore, adequate O&M through institutional arrangement has to be secured. It is considered that this kind of protection will be provided for the 4% of total number of village mounds during the entire period of the master plan. The general problems with the stability of the brick blocks experienced earlier were probably due to their smaller size (hence weight) than that required by a proper design as also the lack of compaction, filter/geo-textile and adequate flat slope.

5.3.5.3.2 Protection of village mounds by RCC/Masonry wall

The most vulnerable mounds in the deep haor areas, as also in some shallow haor areas, should get this kind of protection, where other modes, e.g. slope revetment, is not effective due to more severe hydro-meteorological condition.

The cost of the masonry wall will be higher than that of the CC or brick block revetment. By the same consideration as in the revetment, it is considered that the total length of the masonry wall in an average village mound will be 250 meters. It is considered that this kind of costly but definite protection will be provided for the 3% of the total village mounds during the entire period of the master plan. The indicative height of the RCC/masonry wall be 3-4 m.

Out of total 349 village mounds that need hard materials protection as shown in Table 5.3, 149 mounds may be provided with masonry/RCC walls. Villagers prefer masonry wall to any other kind of protective measures.

5.4 Raising of households/Village Mounds by earthworks

Homesteads lose earth from the top surface and the side slopes due to rainfall and by the occasional inundation. Also the earth mounds settle over time. Generally the mounds loose 150 mm/year due to rainfall and when overtopped by floodwaters, it looses a further 50 mm yearly (Source FAP 6 report). When inundated, the house plinth and the related structure start to disintegrate. Houses start to sink into the platform, walls fall apart and the walling materials and bamboo supports start to rot. Therefore, it is necessary to recoup the lost earth due to rainfall and normal flooding every year for a flood free housing. Instead of raising the room(s) only, the present Study favors raising the homestead with courtyard so that flood stricken people can at least do some household works without getting confined in rooms for months together during flood. The indicative calculations of earthwork volumes required for initial raising the homesteads above the design flood level are shown in the following **Table 5.4** and **Table 5.5**. The indicative calculations are based on the average homestead with courtyard of the char areas as 0.01 hectare ($100m^2$) and the average village mounds in the haor areas have 1 to 2 ha. In the calculation of the earthwork, however, the actual areas of the village mounds, as collected during the survey have been used.

Table 5.4: Calculation of earthwork for raising homestead in Char area

District	CHAR AREA UZ	Char area (%) of total UZ	Area of char (ha)	Population of char area 2001	No. of house-hold in char area 2001	% of homesteads where court yards were inundated in 1998 by			No.of Homestead to be raised by this height including 30 cm Free Board			Taking average household area as 0.01 ha, volume of earth work for the three category of filling, (1000 x m^3)			Total earth work for raising homestead (1000x m^3)
						30 cm	30-100 cm. Av 65 cm	100-150 cm. Av 125 cm.	Av. 60 cm	Av. 95 cm	Av. 155 cm	Av. 60 cm	Av. 95 cm	Av. 155 cm	
Gaibandha	Fulchari	87%	26,631	91,547	15,128	3	87	9	454	13,161	1,362	27	1,250	211	1,489
	Gaibandha Sadar	21%	6,657	24,029	4,412	0	91	9	0	4,015	397	0	381	62	443
	Shaghata	38%	8,557	61,133	12,324	19	74	7	2,342	9,120	863	140	866	134	1,141
	Sundarganj	20%	8,533	24,321	1,821	0	90	10	0	1,639	182	0	156	28	184
Jamalpur	Dewanganj	78%	20,888	148,392	28,998	11	80	8	3,190	23,198	2,320	191	2,204	360	2,755
	Islampur	34%	11,611	66,132	12,924	22	70	7	2,843	9,047	905	171	859	140	1,170
	Madarganj	45%	10,097	74,161	15,053	3	88	8	452	13,247	1,204	27	1,258	187	1,472
	Sharishabari	39%	10,164	88,442	10,682	4	86	8	427	9,187	855	26	873	132	1,031
Kurigram	Char Rajibpur	87%	9,694	47,550	9,110	11	75	8	1,002	6,833	729	60	649	113	822
	Chilmari	83%	18,607	51,029	10,275	2	85	8	206	8,734	822	12	830	127	969
	Kurigram Sadar	28%	7,650	20,806	3,663	5	86	9	183	3,150	330	11	299	51	361
	Nageshwari	51%	21,060	109,223	19,745	5	84	8	987	16,586	1,580	59	1,576	245	1,880
	Raumari	39%	7,702	45,109	4,974	5	84	8	249	4,178	398	15	397	62	474
	Ulipur	41%	20,769	61,573	5,685	0	90	10	0	5,117	569	0	486	88	574
Sirajganj	Belkuchi	51%	8,315	96,576	17,275	0	90	10	0	15,548	1,728	0	1,477	268	1,745
	Chauhali	100%	24,367	116,642	21,400	2	87	9	428	18,618	1,926	26	1,769	299	2,093
	Kazipur	70%	25,836	129,180	24,723	14	78	8	3,461	19,284	1,978	208	1,832	307	2,346
	Shahjadpur	21%	6,942	63,750	7,573	4	89	6	303	6,740	454	18	640	70	729
	Siragnj Sadar	38%	12,542	79,561	12,735	1	90	9	127	11,462	1,146	8	1,089	178	1,274
								Total:	16654	198861	19745			**Total:**	**22,952**

Table 5.5: Calculation of earthwork for raising homestead in Haor area

District	Haor Area UZ	Haor area (%) of total UZ	Area of Haor (ha)	Popu-lation of Haor area 2001	No. of village mounds in Haor area 2001	Total area of village mounds (ha)	Average area of a village mound (ha)	% of homesteads where court yards were inundated in 1998 by			No. of village mounds to be raised including 50 cm Free Board			With respect to the average area of village mound, volume of earth work for the three category of filling, in thousand m^3			Total earth work (1000x m^3)
								30 cm	30 -60 cm. Av 45 cm	60 -90 cm. Av 75 cm.	Av. 80 cm	Av. 95 cm	Av. 125 cm	Av. 80 cm	Av. 95 cm	Av. 125 cm	
Habiganj	Ajmiriganj	100%	22,399	101,74	410	397	0.97	23	58	1	93	238	4	718	2,187	50	2956
	Bahubal	24%	5,915	4,621	120	120	1.00	26	42	1	31	50	1	250	479	15	743
	Baniachang	83%	39,866	194,73	1150	1243	1.08	21	54	1	240	621	12	2,078	6,377	155	8610
	Habiganj	54%	13,586	90,750	120	120	1.00	26	42	1	31	50	1	250	479	15	743
	Lakhai	100%	19,655	134,74	245	246	1.00	30	21	1	73	51	2	587	491	31	1109
	Madhabpur	37%	10,861	101,23	120	120	1.00	26	42	1	31	50	1	250	479	15	743
	Nabiganj	45%	19,669	90,259	352	316	0.90	31	32	1	108	113	4	778	961	40	1778
Kishoreganj	Ashtogram	100%	35,555	167,70	90	753	8.37	26	66	2	23	59	2	1,552	4,721	188	6462
	Bajitpur	75%	14,463	153,78	2	2	1.00	35	60	1	1	1	0	6	11	0	17
	Itna	100%	40,195	154,90	270	324	1.20	35	12	1	93	32	3	897	369	41	1307
	Karimganj	100%	20,051	281,52	50	94	1.88	26	41	1	13	21	1	196	366	12	573
	Kishoreganj	38%	7,361	142,55	120	120	1.00	26	41	1	31	49	1	250	467	15	732
	Mithamain	100%	22,292	141,78	80	142	1.78	21	19	1	17	15	1	237	256	18	511
	Nikli	99%	21,168	124,10	128	202	1.58	4	72	2	5	92	3	58	1,382	51	1490
	Tarail	59%	8,291	88,585	120	120	1.00	34	15	1	41	18	1	330	171	15	516
Netrokuna	Khaliajuri	100%	29,764	83,649	181	405	2.24	0	96	4	0	174	7	0	3,694	203	3896
	Kalmakanda	34%	12,870	63,992	164	265	1.62	24	56	2	39	92	3	509	1,410	66	1985
	Madan	58%	13,131	61,208	53	86	1.62	37	23	1	19	12	1	253	188	11	452
	Mohanganj	59%	14,357	62,714	125	126	1.01	36	40	1	45	50	1	359	479	16	854
Sunamganj	Bishwambar	57%	11,057	56,936	120	120	1.00	29	43	1	35	52	1	278	490	15	784
	Derai	100%	42,094	207,11	76	81	1.07	28	53	1	21	40	1	180	408	10	598
	Dharmapash	95%	47,342	158,77	115	135	1.17	27	46	1	31	53	1	295	590	17	902
	Jagann	52%	18,992	76,507	120	120	1.00	29	43	1	35	52	1	278	490	15	784
	Jamalganj	100%	33,876	123,11	158	274	1.73	32	43	1	50	68	2	699	1,119	34	1852
	Sulla	100%	26,073	113,68	187	201	1.07	33	32	1	62	60	2	533	611	25	1169
	Sunamganj	66%	36,992	193,64	88	102	1.16	29	43	1	26	38	1	237	417	13	666
	Tahirpur	76%	23,982	96,548	58	54	0.93	26	47	1	15	27	1	111	241	7	359
	Chatak	52%	22,663	128,93	120	120	1.00	29	43	1	35	52	1	278	490	15	784
	Dowarab	18%	5,076	28,568	120	120	1.00	29	43	1	35	52	1	278	490	15	784
										Total:	1280	2282	60	12723	30313	1120	**44157**

5.4.1 Implementation plan for raising homestead level

The homestead raising in the attached and unprotected mainland should get preferential execution during the first 5 years. The island chars may be taken up for raising the homesteads after the first 5 years. Stability of chars should be considered while taking up works of homestead raising in char areas. The chars, which are less than 7 years of age, should not be considered for homestead raising.

In the Haor area, the work may be initiated from the shallow part of the haor in order to focus on more promising implementation possibility. The haor area having agricultural land type F4

(>3.0m inundation) has been defined as 'deep haor'. And areas of the other land types, such as the F_2, F_3, have been termed as 'shallow haor'.

5.4.1.1 Borrowpit fishery and duck farming in haor area

While executing the earthwork for raising the homestead level in the haor areas manually, planning should envisage to develop the borrow pits in large tanks, say 50m by 30m in size with raised boundaries which could be used for fishery and other profitable purpose like duck farming.