

### 5.5 Multi-purpose Flood Shelters with platform

The community flood shelters are not adequately developed yet. It should be planned for varying sizes and densities depending upon local needs. While planning the size and density of the shelters, the timing to evacuation, the distance to be covered to reach a shelter and the facility of transportation are to be considered. Thus, for the shelters to be fully effective and beneficial, it will be preferable to have more small shelters than fewer large ones, so that distance to the shelters from the evacuees' homes should be optimal as far as possible. With this in view, the Master Plan envisages a multi-purpose shelter with refuge platform for about every 2000 population and their cattleheads. The platform should accommodate the shelter building, the open-air evacuees, livestock, water supply and latrines, storehouse for seed grains, health and community centre. However, some Flood Shelters are planned for only Haor areas, which would be built on raised column and floor.

While considering the community based flood shelters, provision for boats and community afforestation program should also be planned.

The number, location and size should be decided on the basis of specific needs. Three alternative types are mentioned below:

Type 1: A platform measuring 50m x 80m with two raised hand tubewells and two latrines and a twin community buildings, a health centre and store room.

Type II: A platform measuring 60m x 30m with 2 hand tubewells and 2 latrines and a twin community building, a health centre and store room. Additionally livestock refuge area on a linear embankment 5m wide and 500m long with adequate cross drainage facility where needed.

During the normal floods, when the homesteads will not be inundated, these refuge platforms could be used for purposes like crop drying in haor and char areas. The community based flood refuge platform with shelter will address the infrastructure needs of the community.

One flood shelter building of size  $2 \times 36\text{m} \times 7.3\text{ m} = 525\text{ m}^2$  (considering only 20% of 2000 population will sleep in the building) may be constructed in the char and haor areas. There will be 4 hand tubewells and 2 latrines in the Shelter compound.

Under extreme situation, another 50% will stay with their livestock under the open for a survival while estimated 30% of the population will remain in their houses and will sleep on raised platforms. It is estimated that the 2000 population will be composed of 250-300 families and will have about 250 livestock shifted to the refuge platform/linear embankment.

Type III RCC Flood Shelter on columns on elevated level, having the floor area  $2 \times 36\text{m} \times 7.3\text{m}$  with 2 tubewells and 2 latrines.

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### 5.5.1 Implementation of Flood Shelters

The building materials will be such that in case of erosion of the char they can be salvaged, while for the haor areas it may be RCC/pucca building. The char for construction of the shelter with refuse platforms should be comparatively stable without having a threat of erosion in the vicinity and must have been in existence for the last 7 years or more. In the haor area, protection against wave erosion will be needed for the shelter while in the char area the shelter will have vegetative cover.

Necessity of flood shelters in chars and haor areas are furnished in **Table 5.6** and **Table 5.7**

**Table 5.6: Necessity of multi-purpose flood shelter in Char area**

Char District	UZ	Population of char	Total Flood refuge, shelters required (no.)	Flood Shelters already existing (no.)	More shelters needed (No.)
Gaibandha	Fulchari	91,547	46	0	46
	Gaibandha Sadar	24,029	12	1	11
	Shaghata	61,133	31	1	30
	Sundarganj	24,321	12	2	10
Jamalpur	Dewanganj	148,392	74	2	72
	Islampur	66,132	33	10	23
	Madarganj	74,161	37	6	31
	Sharishabari	88,442	44	3	41
Kurigram	Charrajibpur	47,550	24	0	24
	Chilmari	51,029	26	0	26
	Kurigram Sadar	20,806	10	1	9
	Nageshwari	109,223	55	4	51
	Raumari	45,109	23	3	20
	Ulipur	61,573	31	0	31
Sirajganj	Belkuchi	96,576	48	5	43
	Chauhali	116,642	58	4	54
	Kazipur	129,180	65	9	56
	Shahjadpur	63,750	32	7	25
	Siragnj Sadar	79,561	40	5	35
		Total:	<b>700</b>	<b>63</b>	<b>637</b>

Table 5.7: Necessity of Multi-purpose Shelter in HAOR area

Haor District	UZ	Population	Flood refuge/ shelters total reqd (no.)	Already existing (no.)	More needed (No.)
Habiganj	Ajmiriganj	101,744	50	9	41
	Bahubal	4,621	2	2	0
	Baniachang	194,732	97	4	93
	Habiganj Sadar	90,750	45	6	39
	Lakhai	134,742	67	4	63
	Madhabpur	101,234	50	3	47
	Nabiganj	90,259	45	9	36
Kishoreganj	Ashtogram	167,704	84	5	79
	Bajitpur	153,786	77	3	74
	Itna	154,901	77	4	73
	Karimganj	281,529	140	4	136
	Kishoreganj Sadar	142,554	71	0	71
	Mithamain	141,788	71	19	52
	Nikli	124,100	62	3	59
	Tarail	88,585	44	2	42
Netrokuna	Khaliajuri	83,649	42	2	40
	Kalmakanda	63,992	32	3	29
	Madan	61,208	31	5	26
	Mohanganj	62,714	31	4	27
Sunamganj	Bishwambarpur	56,936	28	3	25
	Derai	207,114	103	8	95
	Dharmapasha	158,774	79	6	73
	Jagannathpur	76,507	38	9	29
	Jamalganj	123,115	62	6	56
	Sulla	113,680	57	4	53
	Sunamganj Sadar	193,646	87	9	78
	Tahirpur	96,548	47	6	41
	Chatak	128,939	64	9	55
	Dowarabazar	28,568	14	6	8
			<b>1697</b>	<b>157</b>	<b>1540</b>

### 5.6 Development of Flood Forecasting and Warning Dissemination

BWDB's Flood Forecasting and Warning Centre has, as mentioned in Chapter 2, has a program to cover the whole flood prone areas of the country and to disseminate information and warnings to the people of the probable inundation areas in a more straightforward and meaningful way through its on-going DANIDA-aided project. However, the Centre does not have any tools to forecast flash floods which require a direct access to the real-time rainfall data in Indian territory. The flash floods occur due to the rainfall in Indian territory across the border.

The objective of the present Danida aided project is;

1. To forecast for 50 stations in place of present 25 stations.
2. To forecast for the area inundation in lieu of the present point level prediction
3. To improve flood warning dissemination. Three NGOs in three Pilot UZs have been working

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to make the flood warning system people oriented at the field level.

### **5.6.1 Recommendation for improvement of Flood Forecasting and Warning system**

Flood preparedness is a part of the flood proofing. For efficient flood preparedness, the present flood forecasting and warning system is inadequate. The forecasting is now announced for a point level prediction about which the vulnerable people in the flood prone areas remain confused. The FFWC should materialize the 'area inundation' warning system and its program for efficient dissemination through NGOs, which is being practiced in the 3 Pilot UZs at present, as elaborated under Chapter 2 Section 2.10, should be continued and extended to other flood prone UZs. This will benefit people of the flood prone areas under the present Study and help them in taking timely decision about flood preparedness.

The whole country should be brought under the flood forecasting and warning system as envisaged by the FFWC.

Cross-country information of rainfall, water level and discharge must be ensured for the efficient forecasting of flood with sufficient lead-time. The present status of availability of upper riparian data is often delayed and scanty. Arrangement through the Joint Rivers Commission (Bangladesh) may be initiated for quick availability of required data of all the upper riparian locations..

## 5.7 Operations and Maintenance

An essential component of all development works is an effective operation and maintenance of the facilities constructed. Operation and maintenance procedures include developing effective institutional arrangements, allocating the funds necessary to ensure the integrity of facilities, and continuous assessment of the performance of facilities during their lifetime. Taking average area of a homestead as 0.01 hectare, considering raising of the homestead 0.4 m every three years, the total volume for O&M of the homesteads every three years are 9,540,000 m<sup>3</sup> for char area and 26,112,000 m<sup>3</sup> for the haor area as shown in Tables 5.8 and 5.9. Taking average household area as 0.01 ha, volume of earth work for O&M every three years is calculated in 1,000m<sup>3</sup>.

The following three-yearly O&M are suggested for the entire plan period. However, the maintenance should start after two years of the completion of construction.

**Table 5.8: O&M of earthwork in raised homesteads in Char area**

District	UZ	Area of char (ha)	Area (%) of total UZ	Population	No. of household	volume (1,000m <sup>3</sup> )
Gaibandha	Fulchari	26,631	87%	91,547	15,128	605
	Gaibandha Sadar	6,657	21%	24,029	4,412	176
	Shaghata	8,557	38%	61,133	12,324	493
	Sundarganj	8,533	20%	24,321	1,821	73
Jamalpur	Dewanganj	20,888	78%	148,392	28,998	1,160
	Islampur	11,611	34%	66,132	12,924	517
	Madarganj	10,097	45%	74,161	15,053	602
	Sharishabari	10,164	39%	88,442	10,682	427
Kurigram	Char Rajibpur	9,694	87%	47,550	9,110	364
	Chilmari	18,607	83%	51,029	10,275	411
	Kurigram Sadar	7,650	28%	20,806	3,663	147
	Nageshwari	21,060	51%	109,223	19,745	790
	Raumari	7,702	39%	45,109	4,974	199
Sirajganj	Ulipur	20,769	41%	61,573	5,685	227
	Belkuchi	8,315	51%	96,576	17,275	691
	Chauhali	24,367	100%	116,642	21,400	856
	Kazipur	25,836	70%	129,180	24,723	989
Siragnj Sadar	Shahjadpur	6,942	21%	63,750	7,573	303
	Siragnj Sadar	12,542	38%	79,561	12,735	509
	Total:					9,540

**Table 5.9: O&M Earthwork for homestead raising in Haor area required every three years**

District	UZ	Area of Haor (ha)	Haor area (%) of total UZ	Population of Haor area	No. of village mounds	Total area of mounds (ha)	Av. area of a mound (ha)	Volume (1,000m <sup>3</sup> )
Habiganj	Ajmiriganj	22,399	100%	101,744	410	397	0.97	1,588
	Bahubal	5,915	24%	4,621	120	120	1.00	480
	Baniachang	39,866	83%	194,732	1150	1243	1.08	4,972
	Habiganj Sadar	13,586	54%	90,750	120	120	1.00	480
	Lakhai	19,655	100%	134,742	245	246	1.00	984
	Madhabpur	10,861	37%	101,234	120	120	1.00	480
Kishoreganj	Nabiganj	19,669	45%	90,259	352	316	0.90	1,264
	Ashtogram	35,555	100%	167,704	90	753	8.37	3,012
	Bajitpur	14,463	75%	153,786	2	2	1.00	8
	Itna	40,195	100%	154,901	270	324	1.20	1,296
	Karimganj	20,051	100%	281,529	50	94	1.88	376
	Kishoreganj Sadar	7,361	38%	142,554	120	120	1.00	480

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	Mithamain	22,292	100%	141,788	80	142	1.78	568
	Nikli	21,168	99%	124,100	128	202	1.58	808
	Tarail	8,291	59%	88,585	120	120	1.00	480
Netrokuna	Khaliajuri	29,764	100%	83,649	181	405	2.24	1,620
	Kalmakanda	12,870	34%	63,992	164	265	1.62	1,060
	Madan	13,131	58%	61,208	53	86	1.62	344
	Mohanganj	14,357	59%	62,714	125	126	1.01	504
Sunamganj	Bishwambarpur	11,057	57%	56,936	120	120	1.00	480
	Derai	42,094	100%	207,114	76	81	1.07	324
	Dharmapasha	47,342	95%	158,774	115	135	1.17	540
	Jagannathpur	18,992	52%	76,507	120	120	1.00	480
	Jamalganj	33,876	100%	123,115	158	274	1.73	1,096
	Sulla	26,073	100%	113,680	187	201	1.07	804
	Sunamganj Sadar	36,992	66%	193,646	88	102	1.16	408
	Tahirpur	23,982	76%	96,548	58	54	0.93	216
	Chatak	22,663	52%	128,939	120	120	1.00	480
	Dowarabazar	5,076	18%	28,568	120	120	1.00	480
<b>Total:</b>								26,112

### 5.7.1 O&M for the protective works against wave erosion

#### 5.7.1.1 O&M of the 'earth-only' protection of the village mounds in Haor area

The 'earth-only' type of protection will practically need replenishment of lost earth due to wave erosion every year until the vegetation of Hijal and Koroch grow fully in 10-15 years. On observation of the situation of the village mound after each flood, measures should be taken to replenish the lost earth in the next dry season. Village mounds should use the indigenous mode of protection by Chailla during the 10-15 years, until the protective vegetation grows. The provision of the O&M has been kept in the construction planning itself.

#### 5.7.1.2 O&M of protective works by hard materials

The most important part of the O&M will lie in the maintenance of the brick block revetment and the masonry wall. The revetment work will need more careful maintenance and should be treated specially by the persons/organizations responsible.

##### (1) Maintenance of the brick block revetment:

The weight of the blocks in revetment is designed on the basis of criteria such as wind speed, fetch length, depth of water, calculated wave height on empirical formulas etc. Damage may occur during the operation period for which yearly maintenance will be an important requirement.

Maintenance of the revetment works shall include replenishment of the lost/damaged blocks, placement of the displaced blocks, working up the settled earthwork and replacing the lost/damaged filter/geo-textile. Protection of pilferage of the blocks should get careful attention. A 5% of the construction cost should be kept for the yearly O&M. The O&M work will to be implemented during the next dry season and will involve mainly in replenishment of the lost filter/geo-textile, bringing the displaced brick blocks back to place. Removal of earth from the vicinity of the wall should not be allowed. Any excavation of earth should be at least 10m away

from the protective works.

**(2) Maintenance of the protective RCC/Masonry wall:**

This type of the protective work needs lesser degree of maintenance. Any tilting, if observed, should be promptly reported to the authority, who will investigate the cause and take remedial action, consulting a qualified engineer. It should be ensured that removal of earth from the vicinity of the wall is not allowed. Any excavation of earth should be at least 10m away from the protective works. The weep-holes of the wall should be regularly checked and maintained with the filters behind. A nominal budgetary provision, may be about 1% of the cost of construction, may be kept in the ADP.

**5.7.2 O&M for the flood free homesteads**

The homestead surface is subjected to erosion by loss of earth due to rainfall and inundation by 15-20 cm per year. Replenishing the lost grounds by earthwork of average 30 to 40 cm every three years will compensate for this.

The estimate of O&M works for maintaining the flood free households are calculated in **Tables 5.8 and 5.9** Haor areas respectively. The O&M estimates of earthworks are for every three years. The average yearly O&M earthwork volume will therefore be one-third of the presented values.

Three-yearly maintenance should be more effective in that it will reduce inconveniences to the inmates due to the earth filling every year and secondly it will be beneficial for natural compaction of the filled earth due to time factor. The O&M of earthfilling should therefore be done after three year of initial raising of the homesteads.

**5.7.3 O&M for Multipurpose Flood Shelter**

The ones having the multipurpose utility, such as school cum flood shelters, receive some O&M budgetary allocation but others normally do not. Most of the existing old shelters are ill maintained. The maintenance works of the multipurpose flood shelters should be planned for.

The earthen platform of the Shelter should be maintained with replenishing the yearly-lost earth due to rain (150mm). The 3-yearly earthwork will involve  $3 \times 0.15 \times 50 \times 80 = 1,800 \text{ m}^3$  /shelter. For the vegetation and shelter house maintenance at the post flood stage should be undertaken.

**Table 5.10** and **Table 5.11** shows O&M work estimate of the multi-purpose flood shelter per year during the plan period for Char and Haor areas respectively.

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**Table 5.10 O&M of the Multipurpose shelter in CHAR and HAOR areas during entire plan period**

District	UZ	Population of char	Flood refuge, shelters (no.)	O&M cost per year	Remarks
<b>Char area</b>					
Gaibandha	Fulchari	91,547	46	O&M cost may be taken as % of the construction cost annually	O&M will start after one year of construction
	Gaibandha Sadar	24,029	11		
	Shaghata	61,133	30		
	Sundarganj	24,321	10		
Jamalpur	Dewanganj	148,392	72		
	Islampur	66,132	23		
	Madarganj	74,161	31		
	Sharishabari	88,442	41		
Kurigram	Charrajibpur	47,550	24		
	Chilmari	51,029	26		
	Kurigram Sadar	20,806	9		
	Nageshwari	109,223	51		
	Raumari	45,109	20		
	Ulipur	61,573	31		
Sirajganj	Belkuchi	96,576	43		
	Chauhali	116,642	54		
	Kazipur	129,180	56		
	Shahjadpur	63,750	25		
	Siragnj Sadar	79,561	35		
	Sub-Total for CHAR:		<b>637</b>		



Table 5.11 O&amp;M of the Multipurpose shelter in HAOR areas during entire plan period

District	UZ	Population of Haor	Flood refuge, shelters (no.)	O&M cost per year	Remarks
Haor area					
Habiganj	Ajmiriganj	101,744	41	O&M cost may be taken as % of the construction cost annually	O&M will start after one year of construction
	Bahubal	4,621	0		
	Baniachang	194,732	93		
	Habiganj Sadar	90,750	39		
	Lakhai	134,742	63		
	Madhabpur	101,234	47		
	Nabiganj	90,259	36		
Kishoreganj	Ashtogram	167,704	79		
	Bajitpur	153,786	74		
	Itna	154,901	73		
	Karimganj	281,529	136		
	Kishoreganj Sadar	142,554	71		
	Mithamain	141,788	52		
	Nikli	124,100	59		
	Tarail	88,585	42		
Netrokuna	Khaliajuri	83,649	40		
	Kalmakanda	63,992	29		
	Madan	61,208	26		
	Mohanganj	62,714	27		
Sunamganj	Bishwambarpur	56,936	25		
	Derai	207,114	95		
	Dharmapasha	158,774	73		
	Jagannathpur	76,507	29		
	Jamalganj	123,115	56		
	Sulla	113,680	53		
	Sunamganj Sadar	193,646	78		
	Tahirpur	96,548	41		
	Chatak	128,939	55		
Dowarabazar	28,568	8			
	Sub-Total for CHAR:		1540		
	Grand total:		2,177		

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### **5.8 Propagation of awareness for Flood preparedness**

Flood preparedness is also a part of flood proofing. Hence in order to make the flood proofing more effective it is essential that people and officials be aware of the ensuing floods well in advance on the basis of an improved flood forecasting.

After a warning is disseminated, people of the flood prone areas would get prepared for a possible flood with their possible responses to the ensuing event. Flood preparedness includes establishment of a flood forecasting system and dissemination of warning including the potential breaches in the flood embankments. It also includes operational capability on the part of the responsible GoB agencies, NGOs and others for the planning and effecting a timely evacuation, sheltering of the affected people when a warning is issued for such action.

It is also imperative that flood awareness be aroused in people by imparting training through NGOs. BWDB has already engaged 3 NGOs in three pilot UZs for the purpose of dissemination and training of the people. Extension of the program to other flood prone UZs may be carried out in future.

### **5.9 ‘Zoning’**

The landuse planning or ‘zoning’ seeks to ensure that people and their economic assets are not located in hazardous areas and that new developments do not create new risks. This concept is sometimes known as ‘hazard avoidance’ and can be attempted through regulations and incentives.

### **5.10 Village platform with the spoil relocation of river dredging under FAP 6**

The platform development as tested by FAP 6 during the Kalni-Kushiyara pilot dredging at two locations within the present Study area in the mid-90s should further be sought after. The project planning of such dredging and the resulting platform development for habitation and vegetation purposes during the 5-year of implementation period of the Kalni-Kushiyara River Management Project will create 44 platforms. Thirty-one platforms will be built on dedicated privately owned land as extension to existing village platforms. Thirteen platforms will be newly constructed on government ‘khas’ land for the settlement of destitute and landless families. The 44 platforms will provide 247 ha new land for about 6250 families. After the successful test implementation of Gazaria and Kalailseo platforms, villagers are now keen to get such platforms on their lands. The present Rural Development Study area will be benefited if the planned dredging under FAP 6 project is implemented.