Traffic Volume Survey

Direction wise and Hourly Summary of Trafic Volume

(Dry Season)

Date : From 16/01/2011 to 18/01/2011
District : Moulvibazar
Road Type: Upazila road, union road, village roa

Station No **3** Station Name: **Office Bazar Intersection** Direction: **Way to D (Vairab Bazar to Mokam Bazar)**

Observation Time	Motorised										Non-motorised			Total	
	Truck			Bus			Utility / Jeep	Car / Taxi	Auto Rickshaw	Motor Cycle	Bi-Cycle	Rickshaw / Van	Cart	MT	NMT
	Heavy	Medium	Small	Large	Medium	Micro									
7:00 am to 8:00 am									1		1			1	1
8:00 am to 9:00 am									3			1		3	1
9:00 am to 10:00 am									2		1			2	1
10:00 am to 11:00 am						1			3	1	1			5	1
11:00 am to 12:00 pm									4	1				5	0
Subtotal:						1			13	2	3	1	4	16	4
12:00 pm to 1:00 pm		1							2	2	1	1		5	2
1:00 pm to 2:00 pm		2				1			2	1		1		6	1
2:00 pm to 3:00 pm						1			3		1	1		4	2
3:00 pm to 4:00 pm		1							4					5	0
4:00 pm to 5:00 pm						1			3		2			4	2
5:00 pm to 6:00 pm									4		2	1		4	3
6:00 pm to 7:00 pm									5	1	1	2		6	3
Subtotal:		4				3			23	4	7	6	13	34	13
Total:		4				4			36	6	10	7		50	17

Traffic Volume Survey

Direction wise and Hourly Summary of Trafic Volume

(Dry Season)

Date : From 16/01/2011 to 18/01/2011
District : Moulvibazar
Road Type: Upazila road, union road, village roa

Station No **3** Station Name: **Office Bazar Intersection** Direction: **Way to E (MokamBazar to Kamlakalash)**

Observation Time	Motorised										Non-motorised			Total	
	Truck			Bus			Utility / Jeep	Car / Taxi	Auto Rickshaw	Motor Cycle	Bi-Cycle	Rickshaw / Van	Cart	MT	NMT
	Heavy	Medium	Small	Large	Medium	Micro									
7:00 am to 8:00 am														0	0
8:00 am to 9:00 am												1		0	1
9:00 am to 10:00 am												1		0	1
10:00 am to 11:00 am											1			0	1
11:00 am to 12:00 pm		1							1	1	2			3	2
Subtotal:		1							1	1	3	2	5	3	5
12:00 pm to 1:00 pm		2							2		3			4	3
1:00 pm to 2:00 pm											1	1		0	2
2:00 pm to 3:00 pm						1					1	2		1	3
3:00 pm to 4:00 pm									1		2	1		1	3
4:00 pm to 5:00 pm		1				1			1	2				5	0
5:00 pm to 6:00 pm										1	3	1		1	4
6:00 pm to 7:00 pm									1	1		1		2	1
Subtotal:		3				2			5	4	10	6	16	14	16
Total:		4				2			6	5	13	8		17	21

Traffic Volume Survey

Direction wise and Hourly Summary of Trafic Volume

(Dry Season)

Date : From 16/01/2011 to 18/01/2011
District : Moulvibazar
Road Type: Upazila road, union road, village roa

Station No **3** Station Name: **Office Bazar Intersection** Direction: **Way to F (MokamBazar to Vairab Bazar)**

Observation Time	Motorised										Non-motorised			Total	
	Truck			Bus			Utility / Jeep	Car / Taxi	Auto Rickshaw	Motor Cycle	Bi-Cycle	Rickshaw / Van	Cart	MT	NMT
	Heavy	Medium	Small	Large	Medium	Micro									
7:00 am to 8:00 am		1							1					2	0
8:00 am to 9:00 am									2		1	1		2	2
9:00 am to 10:00 am									3	1	2			4	2
10:00 am to 11:00 am						1			3	1	1			5	1
11:00 am to 12:00 pm						1			3	2		2		6	2
Subtotal:		1				2			12	4	4	3	7	19	7
12:00 pm to 1:00 pm		1							6	2	1		1	9	2
1:00 pm to 2:00 pm									3	1	1	1		4	2
2:00 pm to 3:00 pm									3			1		3	1
3:00 pm to 4:00 pm						1			6					7	0
4:00 pm to 5:00 pm									5		1	1		5	2
5:00 pm to 6:00 pm		1				1			5		2	1		7	3
6:00 pm to 7:00 pm									6	2	1	1		8	2
Subtotal:		2				2			34	5	6	5	12	43	12
Total:		3				4			46	9	10	8	1	62	19

Traffic Volume Survey

Direction wise and Hourly Summary of Trafic Volume

(Dry Season)

Date : From 16/01/2011 to 18/01/2011
District : Moulvibazar
Road Type: Upazila road, union road, village roa

Station No **4** Station Name: **Kamlakalash Intersection** Direction: **Way to A (Office Bazar to Moulvi Bazar)**

Observation Time	Motorised										Non-motorised			Total	
	Truck			Bus			Utility / Jeep	Car / Taxi	Auto Rickshaw	Motor Cycle	Bi-Cycle	Rickshaw / Van	Cart	MT	NMT
	Heavy	Medium	Small	Large	Medium	Micro									
7:00 am to 8:00 am														0	0
8:00 am to 9:00 am								1	3	1				5	0
9:00 am to 10:00 am									2					2	0
10:00 am to 11:00 am									6	1	3			7	3
11:00 am to 12:00 pm								1	3	2	3	1		6	4
Subtotal:								2	14	4	6	1	7	20	7
12:00 pm to 1:00 pm						16		1	3		2	1		20	3
1:00 pm to 2:00 pm						2			3	1	1	1		6	2
2:00 pm to 3:00 pm			1			1			1		2	3	1	3	6
3:00 pm to 4:00 pm						6			1		2			7	2
4:00 pm to 5:00 pm						2			8	1	3	1		11	4
5:00 pm to 6:00 pm						3			1		1	1		4	2
6:00 pm to 7:00 pm						1			5					6	0
Subtotal:			1			31		1	22	2	11	7	19	57	19
Total:			1			31		3	36	6	17	8	1	77	26

Traffic Volume Survey

Direction wise and Hourly Summary of Trafic Volume

(Dry Season)

Date : From 16/01/2011 to 18/01/2011
District : Moulvibazar
Road Type: Upazila road, union road, village roa

Station No **4** Station Name: **Kamlakalash Intersection** Direction: **Way to B (Office Bazar to Gobindapur Bazar)**

Observation Time	Motorised										Non-motorised			Total	
	Truck			Bus			Utility / Jeep	Car / Taxi	Auto Rickshaw	Motor Cycle	Bi-Cycle	Rickshaw / Van	Cart	MT	NMT
	Heavy	Medium	Small	Large	Medium	Micro									
7:00 am to 8:00 am														0	0
8:00 am to 9:00 am										1	2			1	2
9:00 am to 10:00 am									1		1			1	1
10:00 am to 11:00 am										1	1	1		1	2
11:00 am to 12:00 pm									2		2			2	2
Subtotal:									3	2	6	1	7	5	7
12:00 pm to 1:00 pm				1					1	1	1			3	1
1:00 pm to 2:00 pm										1	2			1	2
2:00 pm to 3:00 pm									1	1	3			2	3
3:00 pm to 4:00 pm									1		1			1	1
4:00 pm to 5:00 pm						2			2					4	0
5:00 pm to 6:00 pm									1		1			1	1
6:00 pm to 7:00 pm									1		2			1	2
Subtotal:				1		2			7	3	10		10	13	10
Total:				1		2			10	5	16	1		18	17

Traffic Volume Survey

Direction wise and Hourly Summary of Trafic Volume

(Dry Season)

Date : From 16/01/2011 to 18/01/2011
District : Moulvibazar
Road Type: Upazila road, union road, village roa

Station No 4 Station Name: **Kamlakalash Intersection** Direction: **Way to C (Moulvi Bazar to office Bazar)**

Observation Time	Motorised										Non-motorised			Total	
	Truck			Bus			Utility / Jeep	Car / Taxi	Auto Rickshaw	Motor Cycle	Bi-Cycle	Rickshaw / Van	Cart	MT	NMT
	Heavy	Medium	Small	Large	Medium	Micro									
7:00 am to 8:00 am														0	0
8:00 am to 9:00 am														0	0
9:00 am to 10:00 am									1			1		1	1
10:00 am to 11:00 am						2			5	3				10	0
11:00 am to 12:00 pm						11			4	2	2			17	2
Subtotal:						13			10	5	2	1	3	28	3
12:00 pm to 1:00 pm						2			3		1	2		5	3
1:00 pm to 2:00 pm									2					2	0
2:00 pm to 3:00 pm			1			2			2	1	1			6	1
3:00 pm to 4:00 pm						6			4	3				13	0
4:00 pm to 5:00 pm						1			6		1			7	1
5:00 pm to 6:00 pm						2			3		1	1		5	2
6:00 pm to 7:00 pm						1			3		3			4	3
Subtotal:			1			14			23	4	7	3	10	42	10
Total:			1			27			33	9	9	4		70	13

Traffic Volume Survey

Direction wise and Hourly Summary of Trafic Volume

(Dry Season)

Date : From 16/01/2011 to 18/01/2011
District : Moulvibazar
Road Type: Upazila road, union road, village roa

Station No **4** Station Name: **Kamlakalash Intersection** Direction: **Way to D (MoulviBazar to Gobindapur Bazar)**

Observation Time	Motorised										Non-motorised			Total	
	Truck			Bus			Utility / Jeep	Car / Taxi	Auto Rickshaw	Motor Cycle	Bi-Cycle	Rickshaw / Van	Cart	MT	NMT
	Heavy	Medium	Small	Large	Medium	Micro									
7:00 am to 8:00 am									3		1			3	1
8:00 am to 9:00 am									2					2	0
9:00 am to 10:00 am			1						12	1	1			14	1
10:00 am to 11:00 am									19	1				20	0
11:00 am to 12:00 pm						1		1	19	1	1			22	1
Subtotal:			1			1		1	55	3	3		3	61	3
12:00 pm to 1:00 pm						2		1	20	3		3		26	3
1:00 pm to 2:00 pm		1				1			16		1			18	1
2:00 pm to 3:00 pm									21		3	1		21	4
3:00 pm to 4:00 pm									27	1				28	0
4:00 pm to 5:00 pm									17		1	2		17	3
5:00 pm to 6:00 pm									24	2		1		26	1
6:00 pm to 7:00 pm									27	2	2			29	2
Subtotal:		1				3		1	152	8	7	7	14	165	14
Total:		1	1			4		2	207	11	10	7		226	17

Traffic Volume Survey

Direction wise and Hourly Summary of Trafic Volume

(Dry Season)

Date : From 16/01/2011 to 18/01/2011
District : Moulvibazar
Road Type: Upazila road, union road, village roa

Station No **4** Station Name: **Kamlakalash Intersection** Direction: **Way to E (Gobindrapur Bazar to Office Bazar)**

Observation Time	Motorised										Non-motorised			Total	
	Truck			Bus			Utility / Jeep	Car / Taxi	Auto Rickshaw	Motor Cycle	Bi-Cycle	Rickshaw / Van	Cart	MT	NMT
	Heavy	Medium	Small	Large	Medium	Micro									
7:00 am to 8:00 am														0	0
8:00 am to 9:00 am										1	1			1	1
9:00 am to 10:00 am														0	0
10:00 am to 11:00 am			1						1		2			2	2
11:00 am to 12:00 pm						2			2		2			4	2
Subtotal:			1			2			3	1	5		5	7	5
12:00 pm to 1:00 pm				1					1		1			2	1
1:00 pm to 2:00 pm										1	2			1	2
2:00 pm to 3:00 pm										1	3			1	3
3:00 pm to 4:00 pm									3	1				4	0
4:00 pm to 5:00 pm									1		2			1	2
5:00 pm to 6:00 pm									1	1				2	0
6:00 pm to 7:00 pm									1	1				2	0
Subtotal:				1					7	5	8		8	13	8
Total:			1	1		2			10	6	13			20	13

Traffic Volume Survey

Direction wise and Hourly Summary of Trafic Volume

(Dry Season)

Date : From 16/01/2011 to 18/01/2011
District : Moulvibazar
Road Type: Upazila road, union road, village roa

Station No **4** Station Name: **Kamlakalash Intersection** Direction: **Way to F (Gobindapur Bazar to Moulvi Bazar)**

Observation Time	Motorised										Non-motorised			Total	
	Truck			Bus			Utility / Jeep	Car / Taxi	Auto Rickshaw	Motor Cycle	Bi-Cycle	Rickshaw / Van	Cart	MT	NMT
	Heavy	Medium	Small	Large	Medium	Micro									
7:00 am to 8:00 am									3					3	0
8:00 am to 9:00 am									5		1			5	1
9:00 am to 10:00 am									12	1	1			13	1
10:00 am to 11:00 am									23		2	1		23	3
11:00 am to 12:00 pm			1				1	1	28	4	5	1		35	6
Subtotal:			1				1	1	71	5	9	2	11	79	11
12:00 pm to 1:00 pm									29	3	3			32	3
1:00 pm to 2:00 pm									20	1	3	2		21	5
2:00 pm to 3:00 pm						2			26		5	2		28	7
3:00 pm to 4:00 pm									21	2	3			23	3
4:00 pm to 5:00 pm									27		1	2		27	3
5:00 pm to 6:00 pm									19	1		1		20	1
6:00 pm to 7:00 pm									19	1	1	2		20	3
Subtotal:						2			161	8	16	9	25	171	25
Total:			1			2	1	1	232	13	25	11		250	36

Traffic Volume Survey

Direction wise and Hourly Summary of Trafic Volume

(Dry Season)

Date : From 16/01/2011 to 18/01/2011
District : Moulvibazar
Road Type: Upazila road, union road, village roa

Station No **5** Station Name: **Gobindapur Bazar Intersection** Direction: **Way to A (Nazirabad to Dughar)**

Observation Time	Motorised										Non-motorised			Total	
	Truck			Bus			Utility / Jeep	Car / Taxi	Auto Rickshaw	Motor Cycle	Bi-Cycle	Rickshaw / Van	Cart	MT	NMT
	Heavy	Medium	Small	Large	Medium	Micro									
7:00 am to 8:00 am									3		1			3	1
8:00 am to 9:00 am									8	5	6			13	6
9:00 am to 10:00 am			1		2				5	1	9			9	9
10:00 am to 11:00 am					4				9	5	3	2		18	5
11:00 am to 12:00 pm			2		3				2	8	9	1		15	10
Subtotal:			3		9				27	19	28	3	31	58	31
12:00 pm to 1:00 pm			2		2	1	2		5	2	7	3		14	10
1:00 pm to 2:00 pm			3		2	6	2	1	3	4	5			21	5
2:00 pm to 3:00 pm			1		2	4	1		7	7	6	3		22	9
3:00 pm to 4:00 pm			2		3		4		5	3	2	1		17	3
4:00 pm to 5:00 pm			2		2	2	3		4	7	6	2		20	8
5:00 pm to 6:00 pm			1		1	2	1		1	6	7	1		12	8
6:00 pm to 7:00 pm			3			2		1	4	8	7	3		18	10
Subtotal:			14		12	17	13	2	29	37	40	13	53	124	53
Total:			17		21	17	13	2	56	56	68	16		182	84

Traffic Volume Survey

Direction wise and Hourly Summary of Trafic Volume

(Dry Season)

Date : From 16/01/2011 to 18/01/2011
District : Moulvibazar
Road Type: Upazila road, union road, village roa

Station No **5** Station Name: **Gobindapur Bazar Intersection** Direction: **Way to B (Nazirabad to Kamlakalash)**

Observation Time	Motorised										Non-motorised			Total	
	Truck			Bus			Utility / Jeep	Car / Taxi	Auto Rickshaw	Motor Cycle	Bi-Cycle	Rickshaw / Van	Cart	MT	NMT
	Heavy	Medium	Small	Large	Medium	Micro									
7:00 am to 8:00 am									1					1	0
8:00 am to 9:00 am									4		1			4	1
9:00 am to 10:00 am									11	1				12	0
10:00 am to 11:00 am									10	2	1	1		12	2
11:00 am to 12:00 pm									14	3	1			17	1
Subtotal:									40	6	3	1	4	46	4
12:00 pm to 1:00 pm									15	4	2			19	2
1:00 pm to 2:00 pm									21	5	6	1	1	26	8
2:00 pm to 3:00 pm									21	5	5			26	5
3:00 pm to 4:00 pm			1						18	3	6			22	6
4:00 pm to 5:00 pm							1		22	2	7	2		25	9
5:00 pm to 6:00 pm									17		6			17	6
6:00 pm to 7:00 pm									14	1	3			15	3
Subtotal:			1				1		128	20	35	3	39	150	39
Total:			1				1		168	26	38	4	1	196	43

Traffic Volume Survey

Direction wise and Hourly Summary of Trafic Volume

(Dry Season)

Date : From 16/01/2011 to 18/01/2011
District : Moulvibazar
Road Type: Upazila road, union road, village roa

Station No **5** Station Name: **Gobindapur Bazar Intersection** Direction: **Way to C (Dughar to Nazirabad)**

Observation Time	Motorised										Non-motorised			Total	
	Truck			Bus			Utility / Jeep	Car / Taxi	Auto Rickshaw	Motor Cycle	Bi-Cycle	Rickshaw / Van	Cart	MT	NMT
	Heavy	Medium	Small	Large	Medium	Micro									
7:00 am to 8:00 am														0	0
8:00 am to 9:00 am			1						2	3	1			6	1
9:00 am to 10:00 am									5	2	2		1	7	3
10:00 am to 11:00 am			1		2		1		4	2	1	2		10	3
11:00 am to 12:00 pm					3	5	1		5	2	7	1		16	8
Subtotal:			2		5	5	2		16	9	11	3	15	39	15
12:00 pm to 1:00 pm			3		1	2	2		6	4	5	4		18	9
1:00 pm to 2:00 pm			4		1				10	1	7			16	7
2:00 pm to 3:00 pm					2		1		7	1	3	1		11	4
3:00 pm to 4:00 pm					1		1		12	4	4	1		18	5
4:00 pm to 5:00 pm			1		1				9	4	5	2		15	7
5:00 pm to 6:00 pm					1	6		1	7	4	7			19	7
6:00 pm to 7:00 pm					1	1	2		9	2	3	1		15	4
Subtotal:			8		8	9	6	1	60	20	34	9	43	112	43
Total:			10		13	14	8	1	76	29	45	12	1	151	58

Traffic Volume Survey

Direction wise and Hourly Summary of Trafic Volume

(Dry Season)

Date : From 16/01/2011 to 18/01/2011
District : Moulvibazar
Road Type: Upazila road, union road, village roa

Station No **5** Station Name: **Gobindapur Bazar Intersection** Direction: **Way to D (Dughar to Kamlakalash)**

Observation Time	Motorised										Non-motorised			Total	
	Truck			Bus			Utility / Jeep	Car / Taxi	Auto Rickshaw	Motor Cycle	Bi-Cycle	Rickshaw / Van	Cart	MT	NMT
	Heavy	Medium	Small	Large	Medium	Micro									
7:00 am to 8:00 am							1		3	1				5	0
8:00 am to 9:00 am									13	6	2	3		19	5
9:00 am to 10:00 am									10	1	2			11	2
10:00 am to 11:00 am							1		10	1	1	1		12	2
11:00 am to 12:00 pm			1		1		2		12	3	3	2	1	19	6
Subtotal:			1		1		4		48	12	8	6	15	66	15
12:00 pm to 1:00 pm									12	3	1	2		15	3
1:00 pm to 2:00 pm									15	5	3	1		20	4
2:00 pm to 3:00 pm									13	7	4	7		20	11
3:00 pm to 4:00 pm									16	5	4	3	2	21	9
4:00 pm to 5:00 pm									13	6	3	8		19	11
5:00 pm to 6:00 pm									15	7	3	8		22	11
6:00 pm to 7:00 pm									11	4	4	7		15	11
Subtotal:									95	37	22	36	60	132	60
Total:			1		1		4		143	49	30	42	3	198	75

Traffic Volume Survey

Direction wise and Hourly Summary of Trafic Volume

(Dry Season)

Date : From 16/01/2011 to 18/01/2011
District : Moulvibazar
Road Type: Upazila road, union road, village roa

Station No **5** Station Name: **Gobindapur Bazar Intersection** Direction: **Way to E (Kamlakalash to Nazirabad)**

Observation Time	Motorised										Non-motorised			Total	
	Truck			Bus			Utility / Jeep	Car / Taxi	Auto Rickshaw	Motor Cycle	Bi-Cycle	Rickshaw / Van	Cart	MT	NMT
	Heavy	Medium	Small	Large	Medium	Micro									
7:00 am to 8:00 am		1												1	0
8:00 am to 9:00 am									4	1				5	0
9:00 am to 10:00 am			1						8	1	1			10	1
10:00 am to 11:00 am									11		1		1	11	2
11:00 am to 12:00 pm									18	3	4		2	21	6
Subtotal:		1	1						41	5	6		9	48	9
12:00 pm to 1:00 pm						1		3	18	3	1			25	1
1:00 pm to 2:00 pm						1	1		14	6			1	22	1
2:00 pm to 3:00 pm									18	3	3			21	3
3:00 pm to 4:00 pm									15	4	3			19	3
4:00 pm to 5:00 pm									17	3	4	1		20	5
5:00 pm to 6:00 pm									18	3	5			21	5
6:00 pm to 7:00 pm									12	3	1			15	1
Subtotal:						2	1	3	112	25	17	1	19	143	19
Total:		1	1			2	1	3	153	30	23	1	4	191	28

Traffic Volume Survey

Direction wise and Hourly Summary of Trafic Volume

(Dry Season)

Date : From 16/01/2011 to 18/01/2011
District : Moulvibazar
Road Type: Upazila road, union road, village roa

Station No **5** Station Name: **Gobindapur Bazar Intersection** Direction: **Way to F (Kamlakalash to Dughar)**

Observation Time	Motorised										Non-motorised			Total	
	Truck			Bus			Utility / Jeep	Car / Taxi	Auto Rickshaw	Motor Cycle	Bi-Cycle	Rickshaw / Van	Cart	MT	NMT
	Heavy	Medium	Small	Large	Medium	Micro									
7:00 am to 8:00 am									4	1				5	0
8:00 am to 9:00 am							1		10	3	6	1	2	14	9
9:00 am to 10:00 am									11	3	1			14	1
10:00 am to 11:00 am									10	2	1	2		12	3
11:00 am to 12:00 pm							1		8	1	1		5	10	6
Subtotal:							2		43	10	9	3	19	55	19
12:00 pm to 1:00 pm									11	7	1	4	1	18	6
1:00 pm to 2:00 pm						1			15	5	3	4	6	21	13
2:00 pm to 3:00 pm									13	4	4	5	3	17	12
3:00 pm to 4:00 pm									13	7	3	8		20	11
4:00 pm to 5:00 pm									12	4	6	9		16	15
5:00 pm to 6:00 pm									11	2	5	7	1	13	13
6:00 pm to 7:00 pm									10	5	1	9		15	10
Subtotal:						1			85	34	23	46	80	120	80
Total:						1	2		128	44	32	49	18	175	99

Traffic Volume Survey

Direction wise and Hourly Summary of Trafic Volume

(Dry Season)

Date : From 16/01/2011 to 18/01/2011
District : Moulvibazar
Road Type: Upazila road, union road, village roa

Station No **6** Station Name: **Atghar Intersection** Direction: **Way to A (Jotorpur Bazar to Gobindapur Bazar)**

Observation Time	Motorised										Non-motorised			Total	
	Truck			Bus			Utility / Jeep	Car / Taxi	Auto Rickshaw	Motor Cycle	Bi-Cycle	Rickshaw / Van	Cart	MT	NMT
	Heavy	Medium	Small	Large	Medium	Micro									
7:00 am to 8:00 am						1		1	1		1		1	3	2
8:00 am to 9:00 am					1				3		4			4	4
9:00 am to 10:00 am			1						16	1	2	1	1	18	4
10:00 am to 11:00 am		1			1				12	1	3			15	3
11:00 am to 12:00 pm					2		1		14	1	3			18	3
Subtotal:		1	1		4	1	1	1	46	3	13	1	16	58	16
12:00 pm to 1:00 pm					1				17	1	6		1	19	7
1:00 pm to 2:00 pm					1				20	5	7		1	26	8
2:00 pm to 3:00 pm					1				21	8	13			30	13
3:00 pm to 4:00 pm					2				15	4	5			21	5
4:00 pm to 5:00 pm					1				18	3	7			22	7
5:00 pm to 6:00 pm					1				15	4	7			20	7
6:00 pm to 7:00 pm					1				14	6	8			21	8
Subtotal:					8				120	31	53		55	159	55
Total:		1	1		12	1	1	1	166	34	66	1	4	217	71

Traffic Volume Survey

Direction wise and Hourly Summary of Trafic Volume

(Dry Season)

Date : From 16/01/2011 to 18/01/2011
District : Moulvibazar
Road Type: Upazila road, union road, village roa

Station No **6** Station Name: **Atghar Intersection** Direction: **Way to B (Jotorpur to Dyke)**

Observation Time	Motorised										Non-motorised			Total	
	Truck			Bus			Utility / Jeep	Car / Taxi	Auto Rickshaw	Motor Cycle	Bi-Cycle	Rickshaw / Van	Cart	MT	NMT
	Heavy	Medium	Small	Large	Medium	Micro									
7:00 am to 8:00 am											1	2		0	3
8:00 am to 9:00 am									5	1	2	1	1	6	4
9:00 am to 10:00 am									5	2	4			7	4
10:00 am to 11:00 am									4		7	1	1	4	9
11:00 am to 12:00 pm									5	1	8	2		6	10
Subtotal:									19	4	22	6	30	23	30
12:00 pm to 1:00 pm									5	4	5	2		9	7
1:00 pm to 2:00 pm									3	1	5	3		4	8
2:00 pm to 3:00 pm									5	1	5	4		6	9
3:00 pm to 4:00 pm									7	1	4	3	3	8	10
4:00 pm to 5:00 pm									5	2	6	3		7	9
5:00 pm to 6:00 pm									4	2	5	2	1	6	8
6:00 pm to 7:00 pm									7	2	5	2	1	9	8
Subtotal:									36	13	35	19	59	49	59
Total:									55	17	57	25	7	72	89

Traffic Volume Survey

Direction wise and Hourly Summary of Trafic Volume

(Dry Season)

Date : From 16/01/2011 to 18/01/2011
District : Moulvibazar
Road Type: Upazila road, union road, village roa

Station No **6** Station Name: **Atghar Intersection** Direction: **Way to C (Gobindapur to Jotorpur)**

Observation Time	Motorised										Non-motorised			Total	
	Truck			Bus			Utility / Jeep	Car / Taxi	Auto Rickshaw	Motor Cycle	Bi-Cycle	Rickshaw / Van	Cart	MT	NMT
	Heavy	Medium	Small	Large	Medium	Micro									
7:00 am to 8:00 am						1			4		1			5	1
8:00 am to 9:00 am			1						2		1	1		3	2
9:00 am to 10:00 am									11	2	6	1		13	7
10:00 am to 11:00 am					2	1			11	2	3			16	3
11:00 am to 12:00 pm						5	1		10	1	2			17	2
Subtotal:			1		2	7	1		38	5	13	2	15	54	15
12:00 pm to 1:00 pm			2		1	1			12	1	3	1		17	4
1:00 pm to 2:00 pm					1	1			8	1	1		1	11	2
2:00 pm to 3:00 pm			1						11	2	2	1		14	3
3:00 pm to 4:00 pm		1			1	1			14	2	2	1	1	19	4
4:00 pm to 5:00 pm			2		1				12	1	2	1	1	16	4
5:00 pm to 6:00 pm			1						10	2	2	1	1	13	4
6:00 pm to 7:00 pm			1		1				9	1	1		1	12	2
Subtotal:		1	7		5	3			76	10	13	5	23	102	23
Total:		1	8		7	10	1		114	15	26	7	5	156	38

Traffic Volume Survey

Direction wise and Hourly Summary of Trafic Volume

(Dry Season)

Date : From 16/01/2011 to 18/01/2011
District : Moulvibazar
Road Type: Upazila road, union road, village roa

Station No **6** Station Name: **Atghar Intersection** Direction: **Way to D (Gobindapur Bazar to Dyke)**

Observation Time	Motorised										Non-motorised			Total	
	Truck			Bus			Utility / Jeep	Car / Taxi	Auto Rickshaw	Motor Cycle	Bi-Cycle	Rickshaw / Van	Cart	MT	NMT
	Heavy	Medium	Small	Large	Medium	Micro									
7:00 am to 8:00 am											1		1	0	2
8:00 am to 9:00 am									2		1		2	2	3
9:00 am to 10:00 am								2	2		5		2	4	7
10:00 am to 11:00 am									2	3	6		5	5	11
11:00 am to 12:00 pm									2	2	7	1	4	4	12
Subtotal:								2	8	5	20	1	35	15	35
12:00 pm to 1:00 pm									4	2	6	3	2	6	11
1:00 pm to 2:00 pm									4	1	7	3	1	5	11
2:00 pm to 3:00 pm									2	1	7		4	3	11
3:00 pm to 4:00 pm			1						2	1	6	1	3	4	10
4:00 pm to 5:00 pm									1	3	7	1	2	4	10
5:00 pm to 6:00 pm									2	1	9	2	3	3	14
6:00 pm to 7:00 pm									1	1	6	2	4	2	12
Subtotal:			1						16	10	48	12	79	27	79
Total:			1					2	24	15	68	13	33	42	114

Traffic Volume Survey

Direction wise and Hourly Summary of Trafic Volume

(Dry Season)

Date : From 16/01/2011 to 18/01/2011
District : Moulvibazar
Road Type: Upazila road, union road, village roa

Station No **6** Station Name: **Atghar Intersection** Direction: **Way to E (Dyke to Jotorpur Bazar)**

Observation Time	Motorised										Non-motorised			Total	
	Truck			Bus			Utility / Jeep	Car / Taxi	Auto Rickshaw	Motor Cycle	Bi-Cycle	Rickshaw / Van	Cart	MT	NMT
	Heavy	Medium	Small	Large	Medium	Micro									
7:00 am to 8:00 am											1			0	1
8:00 am to 9:00 am									6		4	2	2	6	8
9:00 am to 10:00 am									4	1	2			5	2
10:00 am to 11:00 am									3	1	7	1	1	4	9
11:00 am to 12:00 pm									5	1	2	1		6	3
Subtotal:									18	3	16	4	23	21	23
12:00 pm to 1:00 pm									4	3	6	4		7	10
1:00 pm to 2:00 pm									2	1	6	4	1	3	11
2:00 pm to 3:00 pm									4	1	5	4	1	5	10
3:00 pm to 4:00 pm									3	2	3	5		5	8
4:00 pm to 5:00 pm									2	2	7	3	2	4	12
5:00 pm to 6:00 pm									5	2	5	1	1	7	7
6:00 pm to 7:00 pm									4	1	4	3		5	7
Subtotal:									24	12	36	24	65	36	65
Total:									42	15	52	28	8	57	88

Traffic Volume Survey

Direction wise and Hourly Summary of Trafic Volume

(Dry Season)

Date : From 16/01/2011 to 18/01/2011
District : Moulvibazar
Road Type: Upazila road, union road, village roa

Station No **6** Station Name: **Atghar Intersection** Direction: **Way to F (Dyke to Gobindapur Bazar)**

Observation Time	Motorised										Non-motorised			Total	
	Truck			Bus			Utility / Jeep	Car / Taxi	Auto Rickshaw	Motor Cycle	Bi-Cycle	Rickshaw / Van	Cart	MT	NMT
	Heavy	Medium	Small	Large	Medium	Micro									
7:00 am to 8:00 am									1		2		2	1	4
8:00 am to 9:00 am									2		4		2	2	6
9:00 am to 10:00 am								1	4		6		4	5	10
10:00 am to 11:00 am									1	2	8		4	3	12
11:00 am to 12:00 pm									2	2	2	3	3	4	8
Subtotal:								1	10	4	22	3	40	15	40
12:00 pm to 1:00 pm									3	1	6	2	2	4	10
1:00 pm to 2:00 pm									2	1	7	2	3	3	12
2:00 pm to 3:00 pm									1	1	2	1	3	2	6
3:00 pm to 4:00 pm									3	2	4	1	2	5	7
4:00 pm to 5:00 pm									4	3	9	2	3	7	14
5:00 pm to 6:00 pm									2	1	6	4	1	3	11
6:00 pm to 7:00 pm									2	2	5	4	2	4	11
Subtotal:									17	11	39	16	71	28	71
Total:								1	27	15	61	19	31	43	111

Traffic Volume Survey

Direction wise and Hourly Summary of Trafic Volume

(Dry Season)

Date : From 16/01/2011 to 18/01/2011
District : Moulvibazar
Road Type: Upazila road, union road, village roa

Station No **7** Station Name: **Atghar Bazar to Dyke - 20 m from dyke** Direction: **Way to A (Atghar to Kadamtoli)**

Observation Time	Motorised										Non-motorised			Total	
	Truck			Bus			Utility / Jeep	Car / Taxi	Auto Rickshaw	Motor Cycle	Bi-Cycle	Rickshaw / Van	Cart	MT	NMT
	Heavy	Medium	Small	Large	Medium	Micro									
7:00 am to 8:00 am									1	1				2	0
8:00 am to 9:00 am									2	1	1		1	3	2
9:00 am to 10:00 am								1			4	2	2	1	8
10:00 am to 11:00 am									4	1	9	4	1	5	14
11:00 am to 12:00 pm									2	1	5	2	2	3	9
Subtotal:								1	9	4	19	8	33	14	33
12:00 pm to 1:00 pm									2	1	8	2	1	3	11
1:00 pm to 2:00 pm									3	1	4	2	3	4	9
2:00 pm to 3:00 pm											1	1		0	2
3:00 pm to 4:00 pm			1						3	2	1	3	1	6	5
4:00 pm to 5:00 pm									4	2	7	1	1	6	9
5:00 pm to 6:00 pm									3	2	8	1		5	9
6:00 pm to 7:00 pm									3	2	9			5	9
Subtotal:			1						18	10	38	10	54	29	54
Total:			1					1	27	14	57	18	12	43	87

Traffic Volume Survey

Direction wise and Hourly Summary of Trafic Volume

(Dry Season)

Date : From 16/01/2011 to 18/01/2011
District : Moulvibazar
Road Type: Upazila road, union road, village roa

Station No **7** Station Name: **Atghar Bazar to Dyke - 20 m from dyke** Direction: **Way to B (Kadamtali to Atghar)**

Observation Time	Motorised										Non-motorised			Total	
	Truck			Bus			Utility / Jeep	Car / Taxi	Auto Rickshaw	Motor Cycle	Bi-Cycle	Rickshaw / Van	Cart	MT	NMT
	Heavy	Medium	Small	Large	Medium	Micro									
7:00 am to 8:00 am														0	0
8:00 am to 9:00 am									3		1			3	1
9:00 am to 10:00 am								1	3	1	6		2	5	8
10:00 am to 11:00 am									3	1	7	2	1	4	10
11:00 am to 12:00 pm									2	1	2	1	2	3	5
Subtotal:								1	11	3	16	3	24	15	24
12:00 pm to 1:00 pm									1	1	3	1	2	2	6
1:00 pm to 2:00 pm									2	1	3	1	1	3	5
2:00 pm to 3:00 pm									1	1	2	1		2	3
3:00 pm to 4:00 pm									1	2	4		2	3	6
4:00 pm to 5:00 pm									1	2	3		2	3	5
5:00 pm to 6:00 pm									2	1	2		1	3	3
6:00 pm to 7:00 pm									2	1	3			3	3
Subtotal:									10	9	20	3	31	19	31
Total:								1	21	12	36	6	13	34	55

Traffic Volume Survey

Direction wise and Hourly Summary of Trafic Volume

(Dry Season)

Date : From 16/01/2011 to 18/01/2011
District : Moulvibazar
Road Type: Upazila road, union road, village roa

Station No **8** Station Name: **Atghar Bazar to Pachuan Kheyaghat (Over Culvert)** Direction: **Way to A (Pachuan Kheyaghat to Atghar)**

Observation Time	Motorised										Non-motorised			Total	
	Truck			Bus			Utility / Jeep	Car / Taxi	Auto Rickshaw	Motor Cycle	Bi-Cycle	Rickshaw / Van	Cart	MT	NMT
	Heavy	Medium	Small	Large	Medium	Micro									
7:00 am to 8:00 am											1			0	1
8:00 am to 9:00 am									1		1			1	1
9:00 am to 10:00 am											1		1	0	2
10:00 am to 11:00 am									1				1	1	1
11:00 am to 12:00 pm									2					2	0
Subtotal:									4		3		5	4	5
12:00 pm to 1:00 pm									2		1			2	1
1:00 pm to 2:00 pm									1				1	1	1
2:00 pm to 3:00 pm									2		1			2	1
3:00 pm to 4:00 pm							1			1	2		1	2	3
4:00 pm to 5:00 pm							1				2			1	2
5:00 pm to 6:00 pm										1	2			1	2
6:00 pm to 7:00 pm							1		1		1			2	1
Subtotal:							3		6	2	9		11	11	11
Total:							3		10	2	12		4	15	16

Traffic Volume Survey

Direction wise and Hourly Summary of Trafic Volume

(Dry Season)

Date : From 16/01/2011 to 18/01/2011
District : Moulvibazar
Road Type: Upazila road, union road, village roa

Station No 8 Station Name: **Atghar Bazar to Pachuan Kheyaghat (Over Culvert)** Direction: **Way to B (Atghar to Pachuan Kheyaghat)**

Observation Time	Motorised										Non-motorised			Total	
	Truck			Bus			Utility / Jeep	Car / Taxi	Auto Rickshaw	Motor Cycle	Bi-Cycle	Rickshaw / Van	Cart	MT	NMT
	Heavy	Medium	Small	Large	Medium	Micro									
7:00 am to 8:00 am											1	1		0	2
8:00 am to 9:00 am											1	1		0	2
9:00 am to 10:00 am									1		1		1	1	2
10:00 am to 11:00 am		1							1					2	0
11:00 am to 12:00 pm									1		1		1	1	2
Subtotal:		1							3		4	2	8	4	8
12:00 pm to 1:00 pm							1		3		1			4	1
1:00 pm to 2:00 pm							1		1		2		1	2	3
2:00 pm to 3:00 pm									1			1		1	1
3:00 pm to 4:00 pm							1		1	1	2		1	3	3
4:00 pm to 5:00 pm		1							2	2				5	0
5:00 pm to 6:00 pm									1	1	2		1	2	3
6:00 pm to 7:00 pm							1				1			1	1
Subtotal:		1					4		9	4	8	1	12	18	12
Total:		2					4		12	4	12	3	5	22	20

Traffic Volume Survey

Direction wise and Hourly Summary of Trafic Volume

(Dry Season)

Date : From 16/01/2011 to 18/01/2011
District : Moulvibazar
Road Type: Upazila road, union road, village roa

Station No **9** Station Name: **Kalapur Bazar to Hail Haor** Direction: **Way to A (Monghalpur to Kalapur)**

Observation Time	Motorised										Non-motorised			Total	
	Truck			Bus			Utility / Jeep	Car / Taxi	Auto Rickshaw	Motor Cycle	Bi-Cycle	Rickshaw / Van	Cart	MT	NMT
	Heavy	Medium	Small	Large	Medium	Micro									
7:00 am to 8:00 am									1	1	15			2	15
8:00 am to 9:00 am									6	1	6	4	1	7	11
9:00 am to 10:00 am						1	1		4	5	12	2		11	14
10:00 am to 11:00 am									4	4	10	5		8	15
11:00 am to 12:00 pm						2			2	5	9	10	3	9	22
Subtotal:						3	1		17	16	52	21	77	37	77
12:00 pm to 1:00 pm								1	3	2	6	2	1	6	9
1:00 pm to 2:00 pm									1	3	9	13		4	22
2:00 pm to 3:00 pm									3	3	4	5	1	6	10
3:00 pm to 4:00 pm							1	2	1	7	8	2	2	11	12
4:00 pm to 5:00 pm						1			6	9	23	17	1	16	41
5:00 pm to 6:00 pm										3	14	9		3	23
6:00 pm to 7:00 pm									2	2	6	3		4	9
Subtotal:						1	1	3	16	29	70	51	126	50	126
Total:						4	2	3	33	45	122	72	9	87	203

Traffic Volume Survey

Direction wise and Hourly Summary of Trafic Volume

(Dry Season)

Date : From 16/01/2011 to 18/01/2011
District : Moulvibazar
Road Type: Upazila road, union road, village roa

Station No **9** Station Name: **Kalapur Bazar to Hail Haor** Direction: **Way to B (Kalapur to Monghalpur)**

Observation Time	Motorised										Non-motorised			Total	
	Truck			Bus			Utility / Jeep	Car / Taxi	Auto Rickshaw	Motor Cycle	Bi-Cycle	Rickshaw / Van	Cart	MT	NMT
	Heavy	Medium	Small	Large	Medium	Micro									
7:00 am to 8:00 am											5			0	5
8:00 am to 9:00 am									3	1	4	2		4	6
9:00 am to 10:00 am						1	1		2	1	2	3		5	5
10:00 am to 11:00 am									5	3	7	6	2	8	15
11:00 am to 12:00 pm						1			4	5	8	7	1	10	16
Subtotal:						2	1		14	10	26	18	47	27	47
12:00 pm to 1:00 pm								1	5	3	6	5	1	9	12
1:00 pm to 2:00 pm									3	3	6	8	1	6	15
2:00 pm to 2:00 pm									2	3	6	6	2	5	14
3:00 pm to 4:00 pm							1	2	3	4	6	5		10	11
4:00 pm to 5:00 pm						2			4	6	17	15	2	12	34
5:00 pm to 6:00 pm									2	3	23	7	1	5	31
6:00 pm to 7:00 pm									2	5	8	2		7	10
Subtotal:						2	1	3	21	27	72	48	127	54	127
Total:						4	2	3	35	37	98	66	10	81	174

Traffic Volume Survey

Direction wise and Hourly Summary of Trafic Volume

(Dry Season)

Date : From 16/01/2011 to 18/01/2011
District : Moulvibazar
Road Type: Upazila road, union road, village roa

Station No **10** Station Name: **Bhunabir 20m from national highway** Direction: **Way to A (Bhunabir to Shamsherganj)**

Observation Time	Motorised										Non-motorised			Total	
	Truck			Bus			Utility / Jeep	Car / Taxi	Auto Rickshaw	Motor Cycle	Bi-Cycle	Rickshaw / Van	Cart	MT	NMT
	Heavy	Medium	Small	Large	Medium	Micro									
7:00 am to 8:00 am		1				1	3		4		4	4		9	8
8:00 am to 9:00 am						3			5		3	4		8	7
9:00 am to 10:00 am						5	3		9	1		5		18	5
10:00 am to 11:00 am		2				2	5	1	18	4	5	8		32	13
11:00 am to 12:00 pm		1	3				4		20	3	5	8		31	13
Subtotal:		4	3			11	15	1	56	8	17	29	46	98	46
12:00 pm to 1:00 pm			1			3		1	14	1	3	5		20	8
1:00 pm to 2:00 pm			1			2	2		17	2	5	3		24	8
2:00 pm to 3:00 pm			5				3		21	4	12	5		33	17
3:00 pm to 4:00 pm			1			3	3		32	1	4	6		40	10
4:00 pm to 5:00 pm									29	5	9	10		34	19
5:00 pm to 6:00 pm						1			20	2	7	7		23	14
6:00 pm to 7:00 pm								1	15		3	3		16	6
Subtotal:			8			9	8	2	148	15	43	39	82	190	82
Total:		4	11			20	23	3	204	23	60	68		288	128

Traffic Volume Survey

Direction wise and Hourly Summary of Trafic Volume

(Dry Season)

Date : From 16/01/2011 to 18/01/2011
District : Moulvibazar
Road Type: Upazila road, union road, village roa

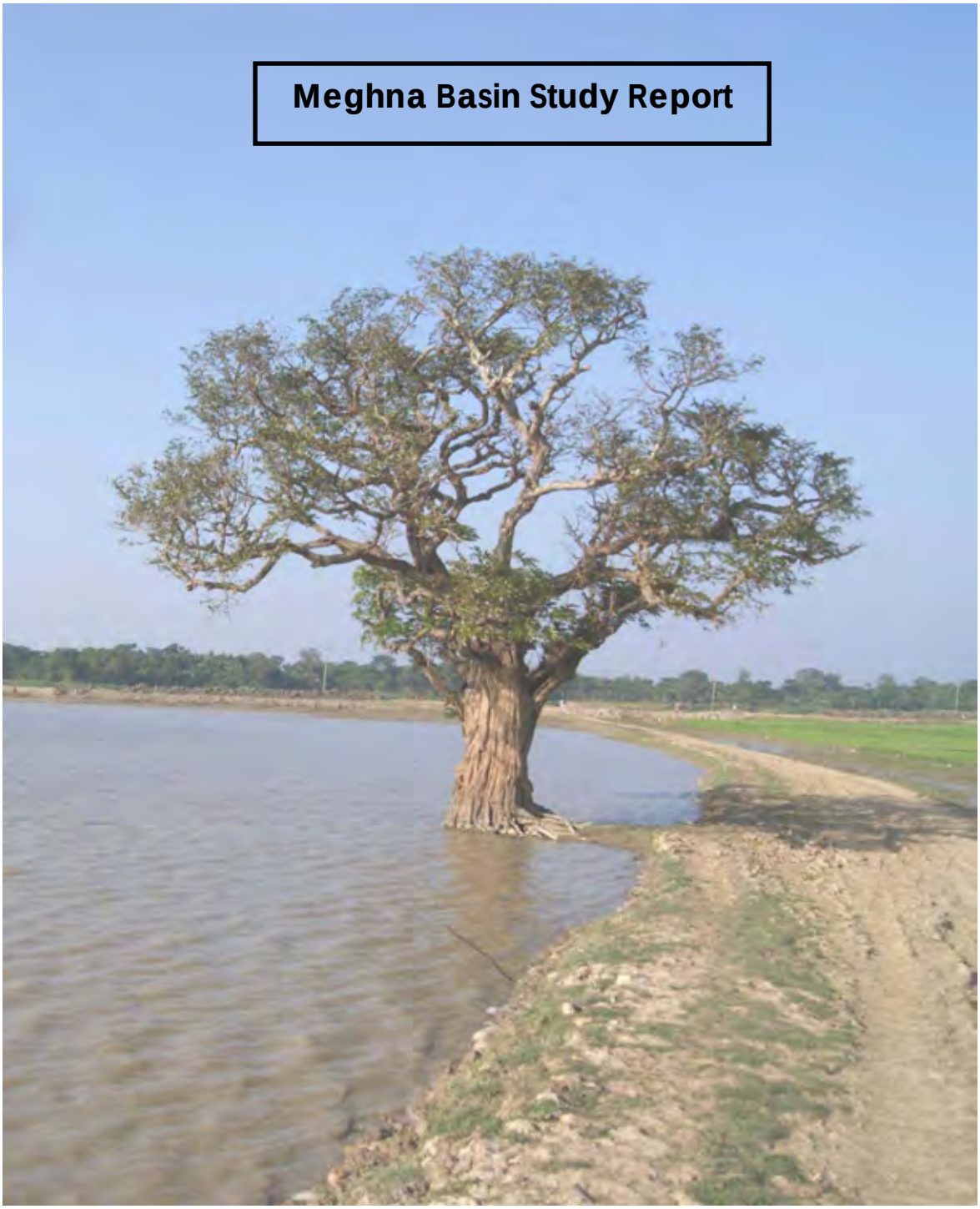
Station No **10** Station Name: **Bhunabir 20m from national highway** Direction: **Way to B (Shamsherganj to Bhunabir)**

Observation Time	Motorised										Non-motorised			Total	
	Truck			Bus			Utility / Jeep	Car / Taxi	Auto Rickshaw	Motor Cycle	Bi-Cycle	Rickshaw / Van	Cart	MT	NMT
	Heavy	Medium	Small	Large	Medium	Micro									
7:00 am to 8:00 am								1	4	1	9	2		6	11
8:00 am to 9:00 am			3			2	1		16	2	6	10		24	16
9:00 am to 10:00 am			3			1		1	22	3	20	8		30	28
10:00 am to 11:00 am			2			1	3		27	4	9	11	1	37	21
11:00 am to 12:00 pm			3					2	32	6	10	11		43	21
Subtotal:			11			4	4	4	101	16	54	42	97	140	97
12:00 pm to 1:00 pm			2				4	1	28	6	9	14		41	23
1:00 pm to 2:00 pm			2				2		27	3	16	16		34	32
2:00 pm to 3:00 pm			3			3	1		31	6	14	11		44	25
3:00 pm to 4:00 pm			4				1	1	40	4	11	9		50	20
4:00 pm to 5:00 pm			4				4		37	13	20	21		58	41
5:00 pm to 6:00 pm			2						50	14	28	19		66	47
6:00 pm to 7:00 pm			2			1	3		36	8	14	9		50	23
Subtotal:			19			4	15	2	249	54	112	99	211	343	211
Total:			30			8	19	6	350	70	166	141	1	483	308
Grand Total:		22	106	3	54	192	92	53	3,213	856	1,643	766	224	4,591	2,633

6. 土工等材料調査

Japan International Cooperation Agency

Meghna Basin Study Report



January, 2011
Dhaka

পানি ও বন্যা ব্যবস্থাপনা ইনস্টিটিউট
Institute of Water and Flood Management

Table of Contents

Chapter One

The Meghna Basin

1.1 Introducing Meghna Basin

The Maghna basin is a part of the composite Ganges-Brahmaputra-Meghna basin draining 172,13000 square kilometers in China, Nepal, India and Bangladesh. The total area of the Meghna basin in 82,000 sq Kilometer, among which India poses 47000 sq km and rest of the 35000 sq km, is in Bangladesh. So this basin is also a shared basin between Bangladesh and India. This is the smallest basin among the Ganges-Brahmaputra-Meghna basin. In Bangladesh the basin is situated at the North –Eastern part of the country, which is hilly and contains a numbers of geologically depressed areas called Haor region. Table 1.1 stated the catchment area and Figure 1.1 shows the location of the Meghna basin.

Table 1.1: Area of the catchment area Ganges-Brahmaputra-Meghna basin

Catchment Areas of Major Rivers						
Rivers	Total Catchment Area (Sq.Km.)	Catchment Area (Sq. Km.)				
		India	Nepal	Bhutan	China	Bangladesh
Brahmaputra	552000	195000	-	47000	270900	39100
Ganges	1087300	860000	147480	-	33520	46300
Meghna	**82000**	**47000**	-	-	-	**35000**
	1721300 (100%)	1102000 (64.02%)	147480 (8.57%)	47000 (2.73%)	304420 (17.69%)	120400 (7%)

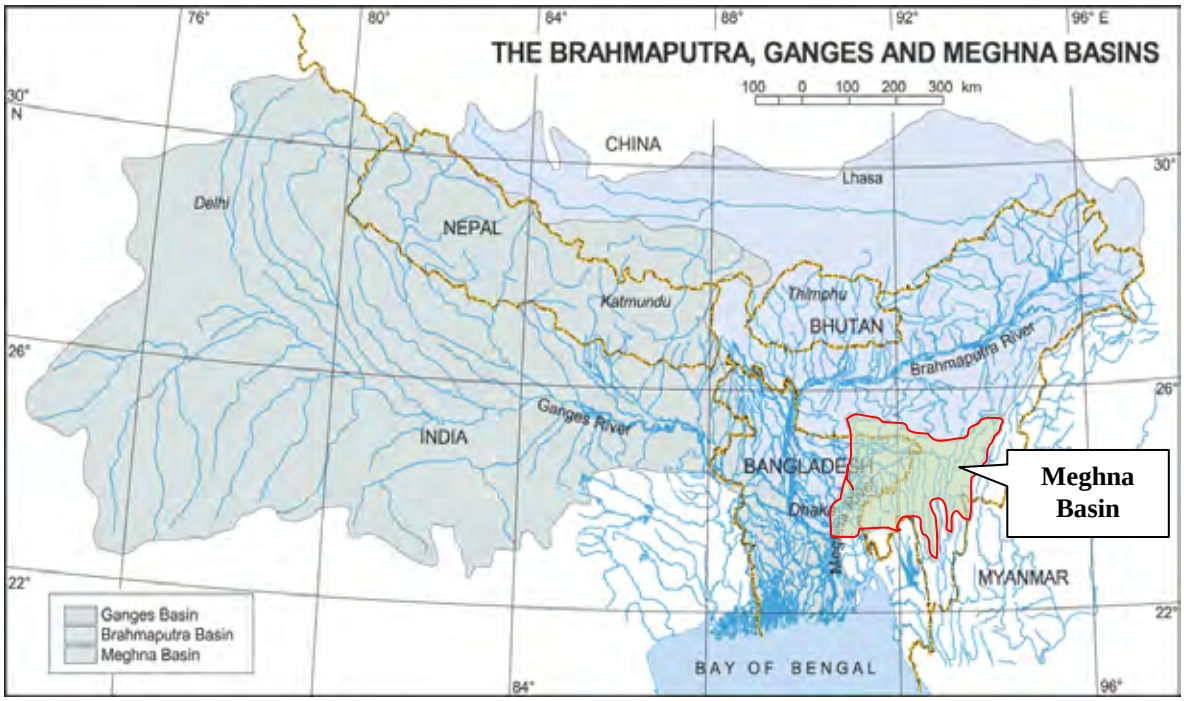


Figure 1.1: The Brahmaputra, Ganges and Meghna Basin

The main rivers of this basin (Figure 1.2) are the Barak, the Surma, the Kushiyara and the Meghna. After entering in Bangladesh the Barak River is bifurcated into two rivers named the Surma and the Kushiyara. Both river is flowing in the North-Easter region of the Bangladesh and support one of the important wet land of the country the Haor area. The boundary of the north east region is the Old Brahmapurta River in west and Shillong Plateau on the north, and by the Tripura Hills on the south east. The region is a triangular shaped wedge roughly 250 km east to west and 120 km north-south. The North east region encompasses 24,000km^2.

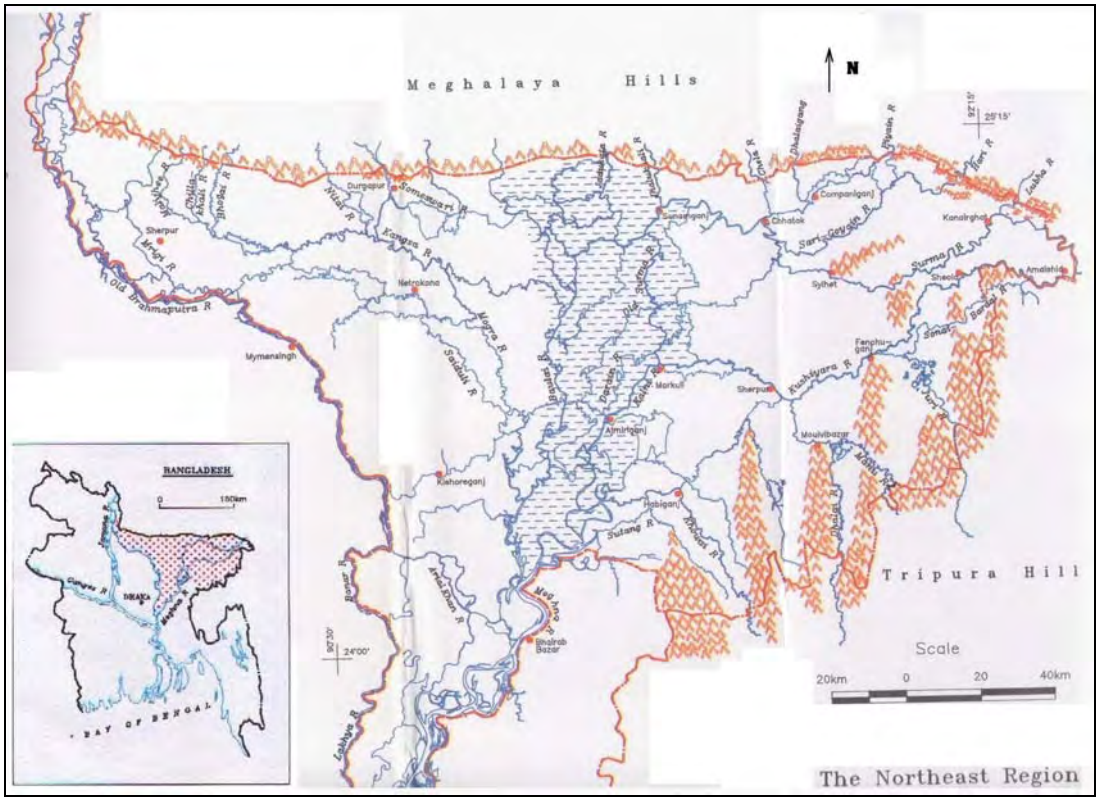


Figure 1.2: North-East Region of Bangladesh (Source: FAP 6)

In Bangladesh Haors are found mainly in greater Sylhet and greater Mymensingh regions. During monsoon a Haor is a vast stretch of turbulent water. Mainly the Haors are of tectonic origin and possibly connected with the rise of Madhupur tract. Beels does not subside but Haor basins do. In its original form, the Haor basin comprising the floodplains of the Meghna tributaries would have consisted of a rich mosaic of permanent and seasonal lakes and ponds with abundant aquatic vegetation. But through gradual sedimentation, the basin becomes shallower leading to the formation of reeds and sedges. This resulted in providing enough food and shelter for fish and other aquatic, fauna and attracted the migratory birds.

Chapter Two
Study Area and Methodology

2.1 Study Area

The Meghna basin of North East Bangladesh is the study area. The area is full of many natural water bodies called Haor. During field visit, several Haors were observed. Among them Damriar Haor in Fenchuganj, Pagner Haor in Jamalganj, Tangir (Tangua) Haor in Derai and Dekhar Haor in Sumanganj are important. These Haors were under different flood control and drainage project. The Figures 2.1 and 2.2 show the location of visited hoars. Mainly the Haors are covered two districts of North-eastern region, Sylhet and Sunamganj. In Figure 2.1, the dark colors represented water body, especially, Haors.

Figure 2.1: Location of the visited haors of Meghna Basin (Source: Google earth, 2010)

2.2 Methodology of the study

For the study, both primary and secondary data and information was collected. For the collection of the primary data, expert observation and rapid rural appraisal (RRA) method was adopt. In RRA, interview with key respondents (KII), discussion with local people,

focus group discussion (FGD) was followed. These RRA process enable the researchers to understand the current scenario, problem and possible solution for the haor area.

For the secondary data collection detail literature review was carried out. Different published document from different government and non government organization were reviewed. These literatures are available in IWFM library. Especially the collection of FAP 6 reports were reviewed for the study.

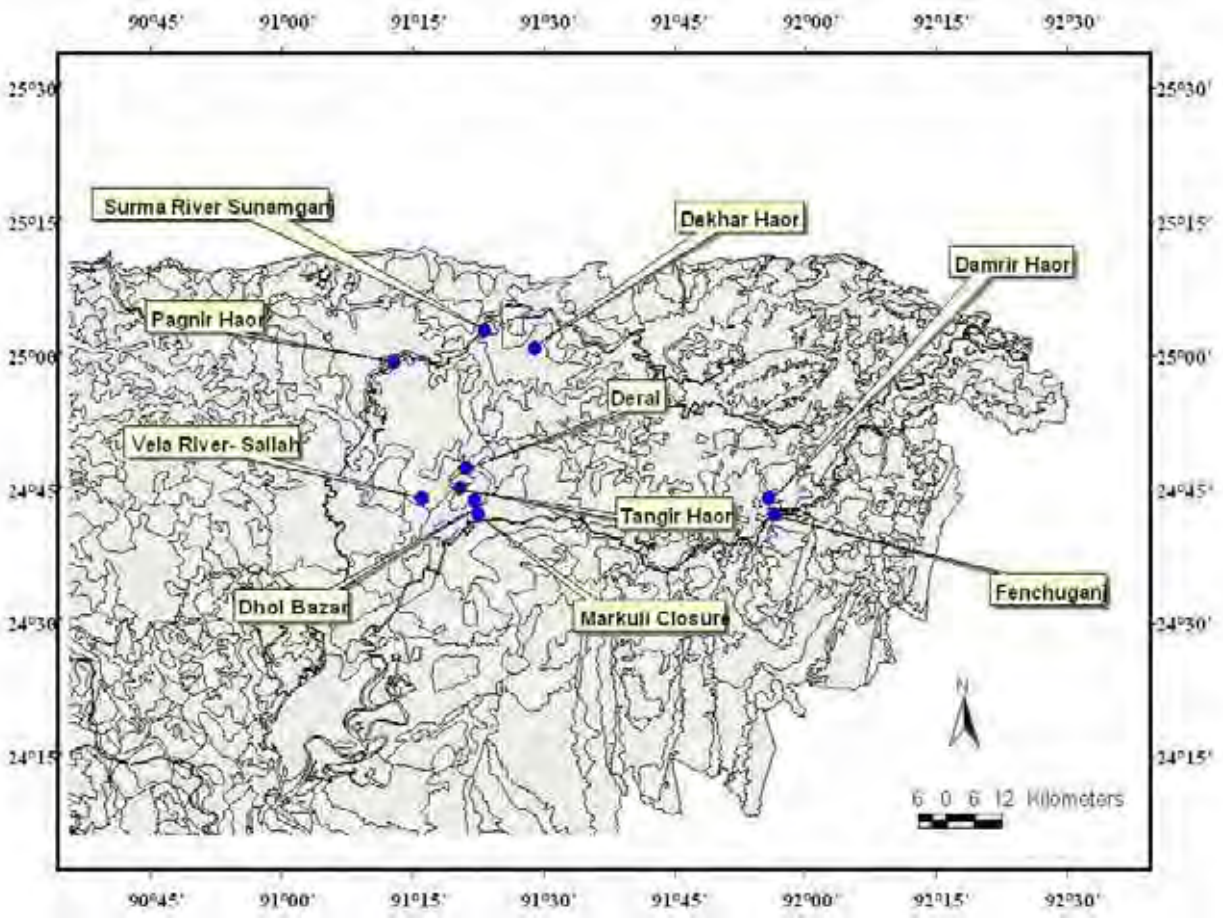


Figure 2.2: Location of the visited sites and photo shooting

Chapter Three

Sediment Problem in the Meghna Basin

(To summarize sediment transportation in Meghna river basin and identify problems in the river management)

3.1 Overview

River sedimentation and erosion are two of the main physical processes that modify the landscape in the North east haor region. There are several reasons why it is important to consider sedimentation and morphologic change when planning future water resource developments. First, the river channel's in the region make up a very dynamic network that is changing and evolving in response to events that may have been initiated years or decades in the past. Furthermore, periodic human interference has led to major perturbations of the entire system from time to time.

3.2 Methodology

Extent of sedimentation is a main problem of the haor area, as well as high precipitation also. For identifying the survey items, secondary literatures were reviewed. The secondary literatures were collected mainly from the IWFM library, internet and from different publish and unpublished documents. Historical data were collected from the FAP 6 reports. For investigating the sedimentation problem, two field visits were done during wet and dry season, 2010. During field investigation, expert observation, focus group discussion with local people, personal interview with aged local people were conducted.

3.3 Sedimentation

Increased rainfall in the haor area suggests the pattern of runoff and rate of sediment production may also have changed over the last century. It is expected that this change would have led to accelerated sediment production from the watersheds. Sufficient information of sedimentation is not available. No sediment data are available from the Indian portion of catchments. Estimates of sediment inflows were made using miscellaneous suspended sediment samples that have been collected by BWDB from rivers near the border.

One feature of the BWDB sediment is that a field separation procedure is used to split the finer sized sediments from the suspended sand load. The concentration values

reported by BWDB are supposed to represent only the fraction coarser than 0.06 mm (the suspended sand load). This procedure was adopted with the assumption that the sand load corresponds to the suspended “bed material load", while the finer separated fraction corresponds to the "wash load". In many investigations the "wash load" and "bed material load" must be distinguished, since the "bed material load" is the component that is eroded and deposited from the river bed, while the "wash load" is simply flushed through the rivers.

3.4 Sedimentation problem in Haor management

Among the visited haors, one haor was found with sedimentation problem. The name of the haor is Damrir Haor. Damrir Haor is situated in Fenchuganj Upazila of Sylhet District. Actually the Haor covered a large area of four adjacent upazilas. This Haor is a combination of 23 large beels and many small channels and rivers. The Haor is situated on the east side of the Sylhet-Fenchuganj High way. On the west side, another Haor named, Dupriar Haor is also situated. The Haor has problem of siltation and erosion in channels. During field visit, it was found that vast area under water and middle portion of the Haor found uplifted. The following figure (Figure 3.1) shows some over view of that Damrir haor. It is found that vast area under water and the central portion of the area is uplifted for the sedimentation and there agricultural activities is going on. Discussion with local people and local leaders explain the past and present scenario of the haor. According to local people, sedimentation in low land and erosion in channels are problem for the haor. They said erosion damage their agricultural land. On the other hand sedimentation also a problem. But this is an opportunity also for the local people. They got new land for the rice cultivation. And such things also observed during the visit. A vast uplifted area was covered by the paddy field and some barren land was also observed. It was found that in that Haor, mainly clay and silty clay was deposited. Some channels were found already dead and some have been filled by sedimentation. On the other hand some channels were also found having a severe problem of bank erosion. According to the local people, siltation is a major problem for that Haor rather than the erosion.

Figure 3.1: Overview of the Damrir haor, land under water, uplifted barren land and agricultural activities (Source: Field Visit)

3.5 Main inflow of sediment

A tentative annual budget for the suspended sand loads entering the North East (NE) region is stated here. Loads on ungauged catchments were estimated by pro-rating the measured annual load from each sub-region on a drainage area basis. The analysis shows that the Meghalaya Foothills/ Shillong Plateau supply in the order of 14.5 million tones/year of sand in suspension to the North East region, mostly from Jadukata River, Jhalukhaii River and Someswari River. These values are lower bound estimates since additional sediment will he transported as bed load. By comparison the total annual runoff generated from these catchments is 62.9 km^3/year of water. The Barak rivers was estimated to provide 11 million tones/year of sand and 31.8 km^3/year of water. The Tripura Hills were estimated to produce around 5 million tones/year of sand and 10.2 km3/year of water. These values illustrate the critical importance of the Meghalaya Foothills in supplying sediment and water to the NE region, also shown is the estimated total sediment load on the Meghna River at the downstream end of the region. The estimated sediment load of 18 million tones/year. Figure 3.2 shows the sediment budget of the North east region. The computed net sedimentation rate for the region amounts to 12.5 million. If the quantity were spread over the entire study region, the net aggradations would average about 0.5 mm/year. The sediment budget analysis represents a first attempt to quantify the amount of sand size sediment that is being supplied to the region. Given the nature of the available data, the results must be considered as preliminary. Its main use is to focus attention towards the key areas that are important sediment sources to the region - namely the Meghalaya Foothill/ Shillong platue area.

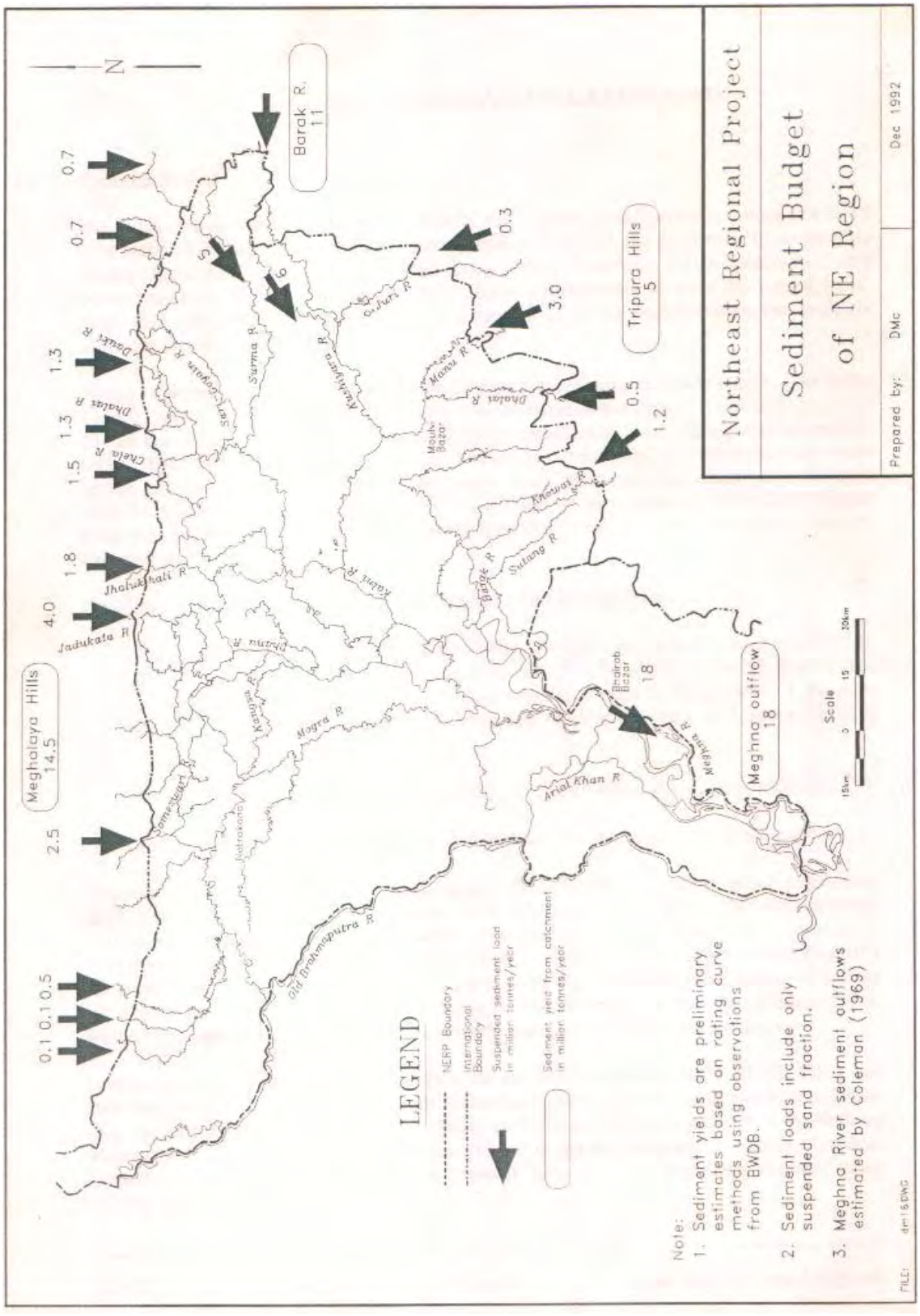


Figure 3.2: Sediment budget of the North East region

The available sediment data are inadequate to document changes in sediment supply from key catchments in the Meghalaya since there are insufficient observations to compare year to year variations in sediment transport rating curves. Therefore, in this study, evidence for changes in sediment supply has been largely based on interpretation of historic morphological changes and very rough in nature. Detailed of the monitoring of sediment load is important for the sustainable sediment management in the region.

3.6 River-bed evolution

For river bed evolution, historical cross section data from different reports and BWDB data were used. By analyzing those data the following cross sections were prepared and the historical cross sections were scanned from the FAP 6 report.

3.6.1 Cross section of Kushiyara River at Fenchugang

The variation cross sections of Kushiyara River near Fenchuganj station are shown (1969 to 1993) in Figure 3.2. The depth was maximum near the left bank and its RL value was around -5 m (PWD). The width and depth of each of the sections subjected to change over the period of time.

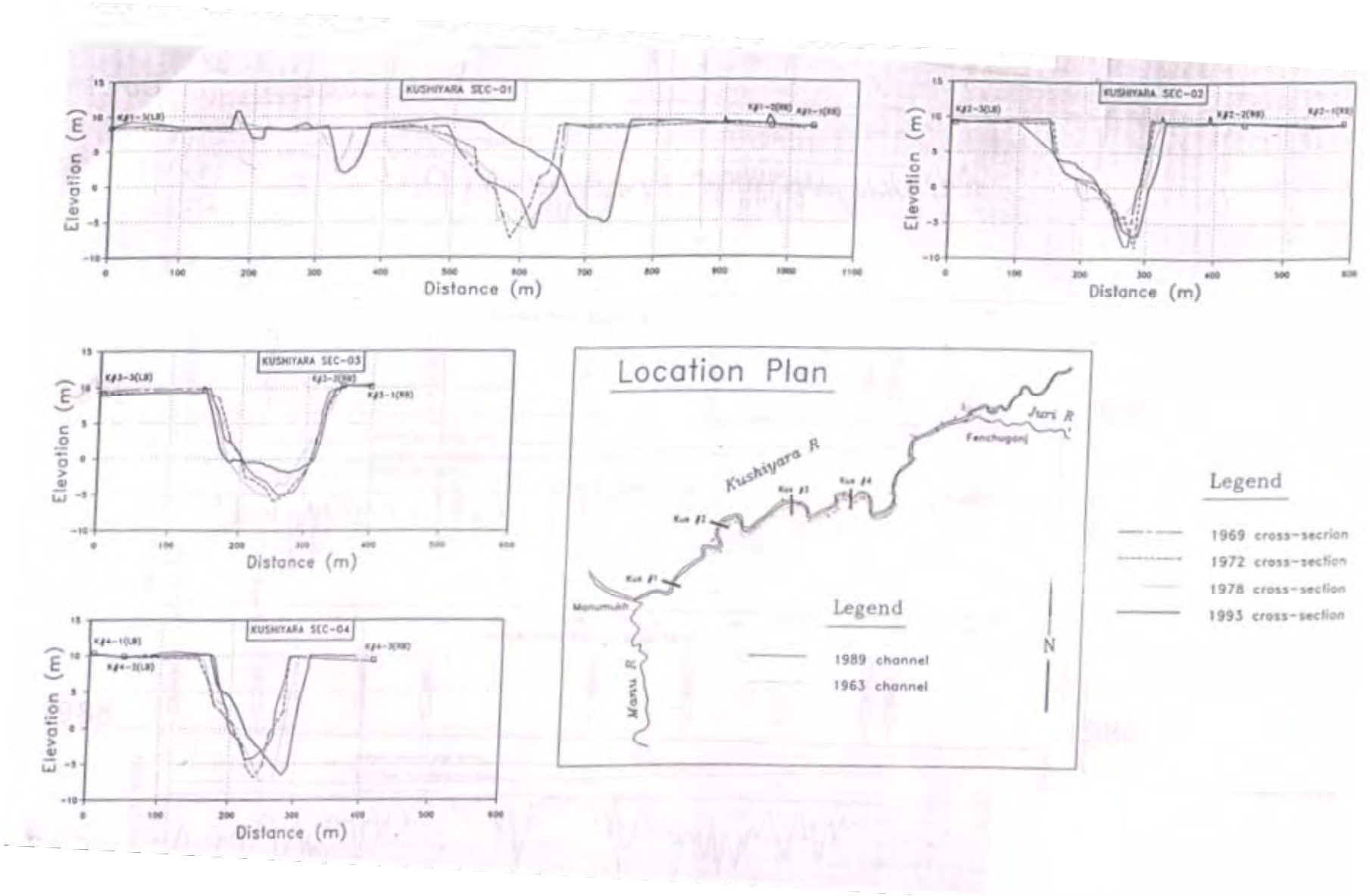


Figure 3.3: Cross-Section of Kushiyara in 1969, 1972, 1978 and 1993 period

3.6.2 Cross section of Kushiyara river in different river station (2004 to 2008)

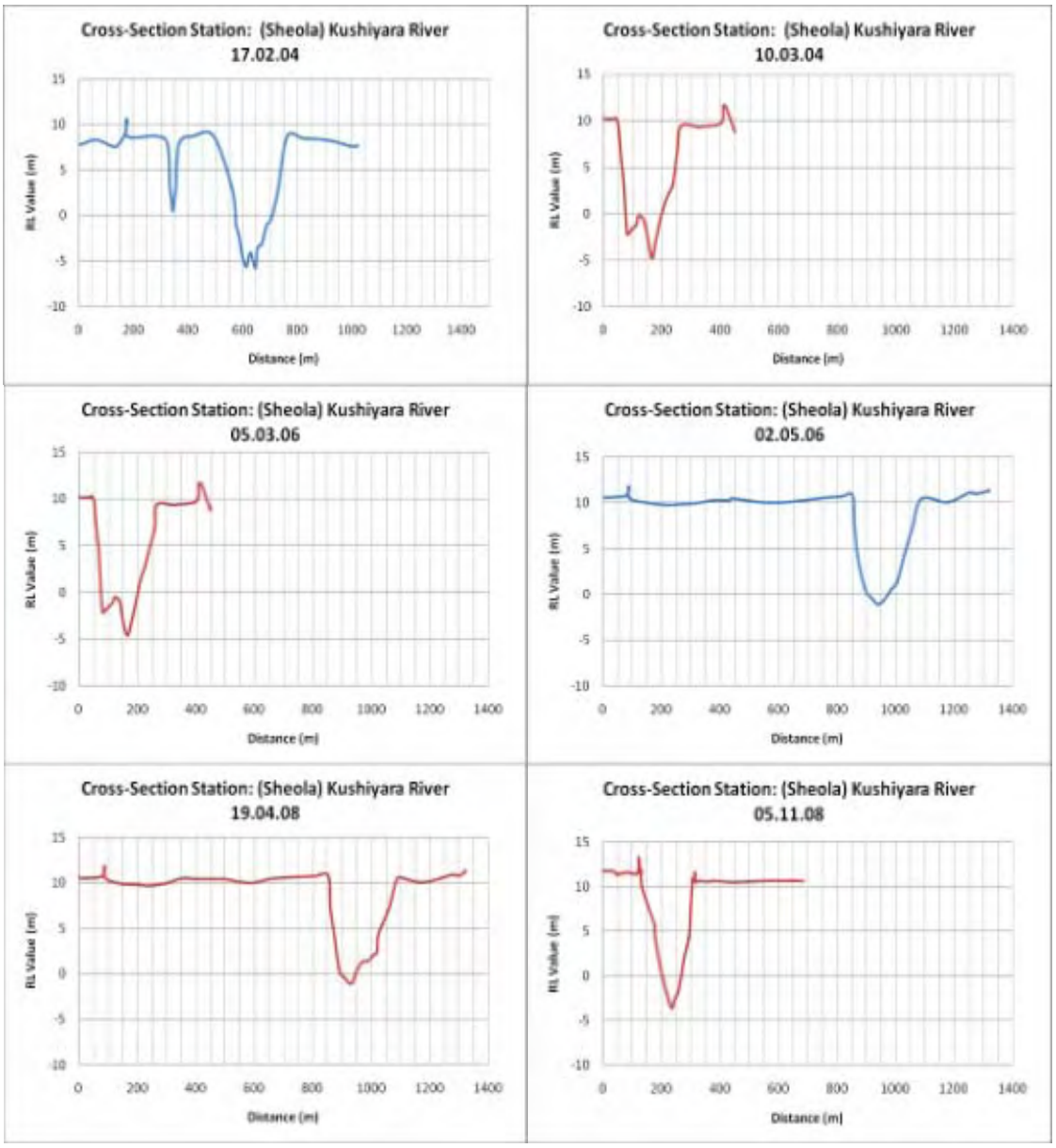


Figure 3.3: Cross-Section of Kushiyara river at different time period

According to the graph of Kushiyara river at sheola station (Figure 3.3), the cross section was changes from the year 2004 to 2008 at different distance near the left bank of the river. In 2004, the depth was maximum near the left bank and its RL value was deeper than -5 m (PWD). In 2006, the RL value is below 5 mPWD and in 2008 RL value was decreasing with a variation from 1-3 m (PWD).

3.6.3 Cross section of Surma River at Amalshid station in 1992

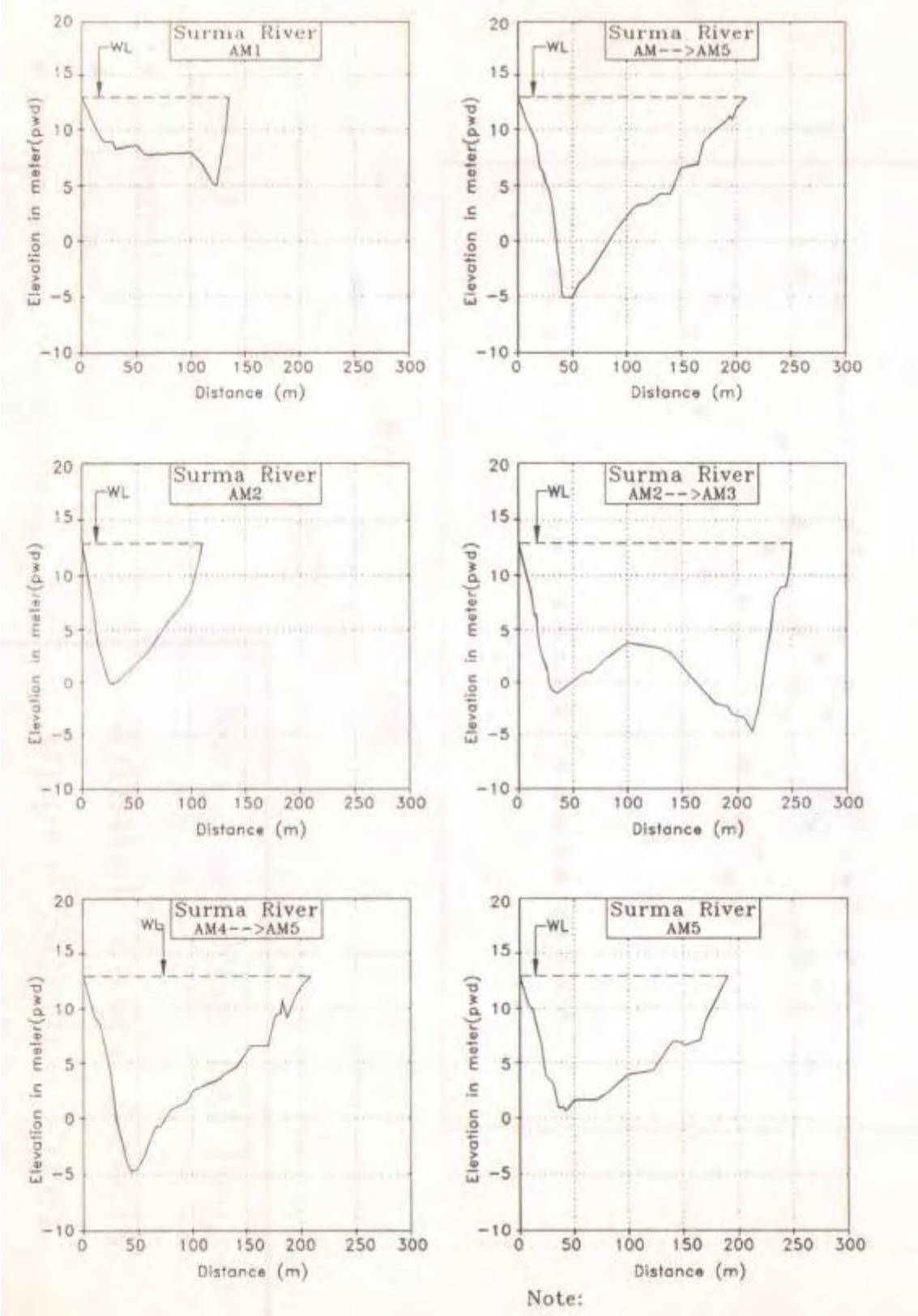


Figure 3.4: Cross section of Surma River at Amalshid station during 1992 period

At different location the depth was different at different distance near the left bank of the river. The maximum depth was near the left bank and its RL value was -5 mPWD.

3.7 Rise and decline Trend

By observing the time series cross section of different river, it was found that the river bed is changing yearly. Difference in dry and wet season was also observed. The change in depth indicates that sedimentation processes in those rivers are significant. The rise and decline of the river bed is very significant in all three rives. But the trend of sedimentation is not consistent. In some location the trend is upward in some location it is downward. Along the Kushiyara river, bed level variation (Figure 3.8) significant (aggradation or degradation).

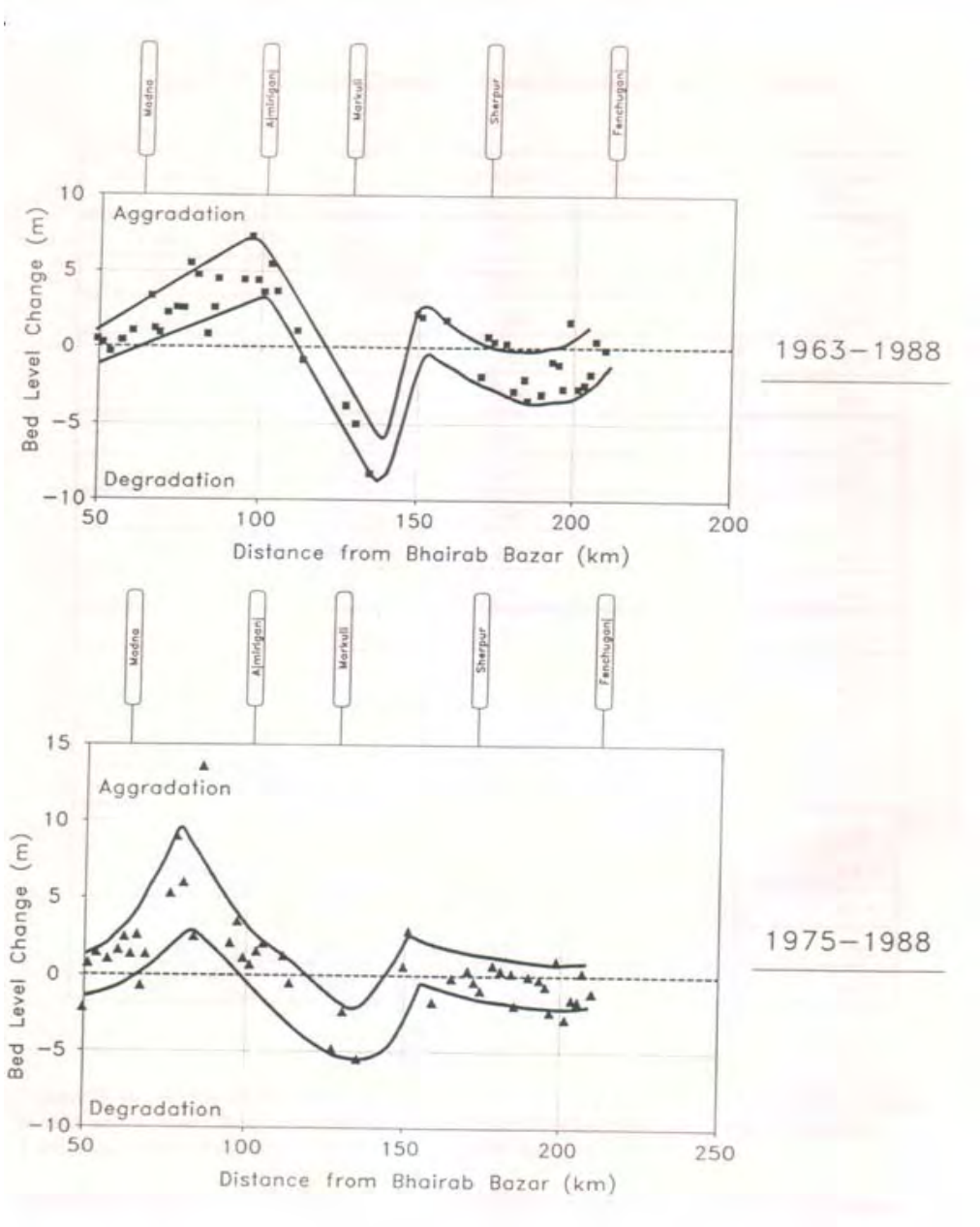


Figure 3.8: Bed level change of Kushiyara river during 1975 to 1988 period

3.8 Transportation and Navigation

The Inland Water Transport Authority (IWTA) administers navigation and water transport. There are 1400 km of classified navigation routes in the region. These routes are used by larger commercial boats carrying passengers or freight. The basis of the route classification is the "Least Available Draft" or LAD:

- Class 1 routes have an LAD of 3.60 m - 3.90 m all year round;
- Class 2 routes have an LAD of 2.10 m - 2.40 m ail year round and are intended to link important ports such as Bhairab Bazar with the main Class I routes;

- Class 3 routes have an LAD of 1.50 m - 1.80 m during the dry season:
- Class 4 routes are basically seasonal routes where it is not possible to maintain an LAD of 1.5 m in the dry season.

Table 3.1 lists the main rivers and their designated classification according to BIWTMAS (1988).

Table 3.1: Navigation Route Classes

River	Route Class
Meghna	2
Surma	2
Kushiyara	2
Dhaleswari	3 -4
Kangsha	3-4
Lakhya	3 -4

The Meghna/Kushiyara River system is an international transit route that is used to connect Calcutta with Assam via Zakiganj, with annual traffic volumes of 18000 ton/year (BIWTMAS, 1988). There were 15 million m^3 of shoals that restricted drafts to less than 3.6 m on the lower Kushiyara/Kalni River system in 1988. Most of these shoals were restricted to a 50 km reach between Madna and Markuli There was another 4 million m^3 of shoals on the Baulai River system, mostly in the reach between Kaliajuri and Itna.

The total production from the IWTA (Inland Water Transport Authority) dredge fleet in the entire country averaged about 2.5 million cubic meter/year over the period 1978-1987, Most of this maintenance dredging was carried out outside of the NE region. Development dredging projects has been recommended on Kangsha River (about 1 million m^3) and on Kushiyara River (0.5 million m^3). These projects, if implemented, would be conducted over a three or four year period. These volumes illustrate that so far, dredging efforts have been relatively small in the region. However pre-feasibility studies reported in BIWTMAS (1988) indicated that improving navigation on the Kushiyara River by means of a 2 million m^3 development dredging project would be economically feasible. During the field visit, it was observed that both Surma and Kushiyara Rivers are

most important for the inland water transport of goods and people. The water route is mainly used for transporting the construction material imported from India (Figure 3.9). Sand business beside the Surma river in Jamalganj is one of the example. For the Kushiyara river sand business was not observed, but stone and cement transportation was significantly observed. In Markuli launch terminal (Figure 3.10), it was found that motor boats were waiting for departure for different near and far location to carry people, goods and also many other things. But the recent sedimentation problem in Kushiyara river all types of water transportation become difficult day by day. But on the other hand No such problem was observed for the Surma river.

Figure 3.9: A cargo vessel in Surma river Carrying construction materials

Figure 3.10: Markuli Launch terminal in Kushiyara river

3.9 Problem in river Management

- Erosion
- Sedimentation
- Navigation problem
- Water withdrawal for different purposes

Those are some burning issues for the North East river management.

Check box

Components	Addressed	Unaddressed	Source	Remarks
overview	X		Literature	
sedimentation, siltation	X		Literature and field observation	Need more research
river-bed evolution	X		Historical and recent cross section data	
Rise and decline, trend	X		Historical and recent cross section data	
impact on the flows and navigation	X		Literature and field observation	Need more research

Chapter Four

Flow and Sedimentation

(To identify features and problems in Meghna river basin management, especially the river evolution in the history and river management efforts in the past)

4.1 The Meghna Basin Overview

The rivers in this basin are flashy in nature. The river Surma, Kushiyara, Khowai, crossed their respective danger levels at different points mostly in the month of July and August. As a result, flash floods of moderate magnitude were experienced in the districts of Sylhet, Sunamganj and Habiganj during the monsoon 2009. A comparative statement of water level for current year 2009 and historical events of 1998 and 1988 for this basin is Shown in Table 4.1.

4.1.1 The Surma at Kanaighat

As a flashy river, the Surma at Kanaighat showed several peaks during this monsoon. It crossed the danger level on 2nd July fro 3 days and 17th August for 10 days. It attained its highest yearly peak 14.21 m on 21st August, which was 81 cm above its danger level (13.20m).

4.1.2 The Surma at Sylhet

Like Kanaighat, the river at this point registered several peaks during the monsoon 2009 but it didn’t cross its danger level at this point. It attained its highest yearly peak 11.23 m (PWD) on 23rd of August, which was just 2 cm below its danger level (11.25m).

4.1.3 The Surma at Sunamganj

The river at this point also followed the same pattern as in Sylhet. The Surma at Sunamganj crossed the danger level on 2nd of July for 6 days and 15th August for 12 days. It attained its highest peak 8.86 m on 22nd July, which was 51 cm above its danger level (8.25m).

4.1.4 The Kushiyara at Amalshid

The river at this point observed several medium & high peaks during the monsoon 2009. It crossed danger level on 7th August for 1 day and 17th August for 10 days. It attained its yearly highest peak 16.64 m on 22nd August, which was 79 cm above the danger level (15.85m).

4.1.5 The Kushiyara at Sheola

The Kushiyara at Sheola observed similar rise and fall as of that Amalshid. It crossed its danger level on 17th of August and remained above its danger kevel up to 26th of August. It attained its yearly highest peak 14.03 m on 22nd of August, which was 53 cm above its danger level (13.50 m).

4.1.6 The Manu at Manu Rail Bridge

As a flashy river, the river at this point observed several peaks during this monsoon but it did not cross the danger level. It attained its highest peak of the year 17.8 m on 1st July, which was 20 cm below the danger level (18.00 m).

4.1.7 The Khowai at Habiganj

As the flashiest river in Bangladesh, the Khowai at Habiganj showed several peaks during the monsoon 2009. It crossed its danger level on 1st of July, 8th of August, 22nd of August and 10th September each for 1days. It attained its yearly highest peak 10.31 m on 22nd of August, which was 81 cm above its danger level (9.50m). Comparative hydrographs for the year of 2009, 2004, 2000 & 1998 of Surma at Sylhet, Khowai at Habiganj and Meghna at Bhairab Bazar are shown in Figures 4.1, 4.2 and 4.3.

4.2 Flow of Meghna River basin

The Surma-Meghna river system flows on the east of the Brahmaputra river through Bangladesh. Out of the two main branches, the Surma River rises as the Barak, on the Southern slopes of the Nagaland-Manipur watershed in India. The Barak divides into two branches within the Cachar district of Assam in India. The Nortnern branch is called Surma, which flows through eastern side of Bangladesh by the side of Sylhet town and flows southwards. The southern branch of the Barak is called the Kushiyara, which flows through India and then enters Bangladesh. At first the northern branch joins the Meghna near Kuliarchar and then the southern branch also joins the Meghna river near Ajmiriganj.

The lower Meghna is one of the largest rivers in the world, as it is the mouth of the three great rivers- the Ganga-padma, the Brahmaputra and the Meghna.

Table 4.1: Comparison of Water Level of the Year 2009 and Historical Events of 1988 & 1998 of Some Important Stations in Meghna Basin.

Sl. No	River	Station	Recorded Maximum (m)	Danger Level (m)	Peak of the year (m)			Days above Danger level m)		
					09	98	88	09	98	88
1	Surma	Kanaighat	15.26	13.20	14.21	15.00	15.10	13	73	75
2	Surma	Sylhet	11.95	11.25	11.23	11.72	11.95	-	14	21
3	Surma	Sunamganj	9.46	8.25	8.8	8.90	9.03	18	56	62
4	Kushiyara	Amalshid	18.28	15.85	16.64	17.60	17.50	11	54	65
5	Kushiyara	Sheola	14.60	13.50	14.03	14.14	14.09	10	37	80
6	Manu	Manu Rly Br	20.42	17.07	17.8	18.63	18.95	-	6	66
7	Manu	Moulvi Bazar	15.50	11.75	11.03	11.68	13.01	-	-	25
8	Khowai	Habiganj	12.00	9.50	10.31	11.44	11.00	4	8	14
10	Upper Meghna	Bhairab Bazar	7.66	6.25	6.02	7.33	7.66	-	68	68
11	Gumti	Comilla	13.56	10.38	11.33	12.79	11.80	-	17	17

Table 4.1, shows the comparison of Water Level of the Year 2009 and Historical Events of 1988 and 1998 of Some Important Stations in Meghna Basin The total length of the river may be about 930 Km (580 miles). The river is predominantly a meandering channel, but in several reaches, especially where small tributaries contribute sediment, braiding is evident with sand islands bifurcating the river into two or more channels. The average annual discharge is of the order of 3,510 cumecs (124,000 cusecs), about one-third that of the Ganges.

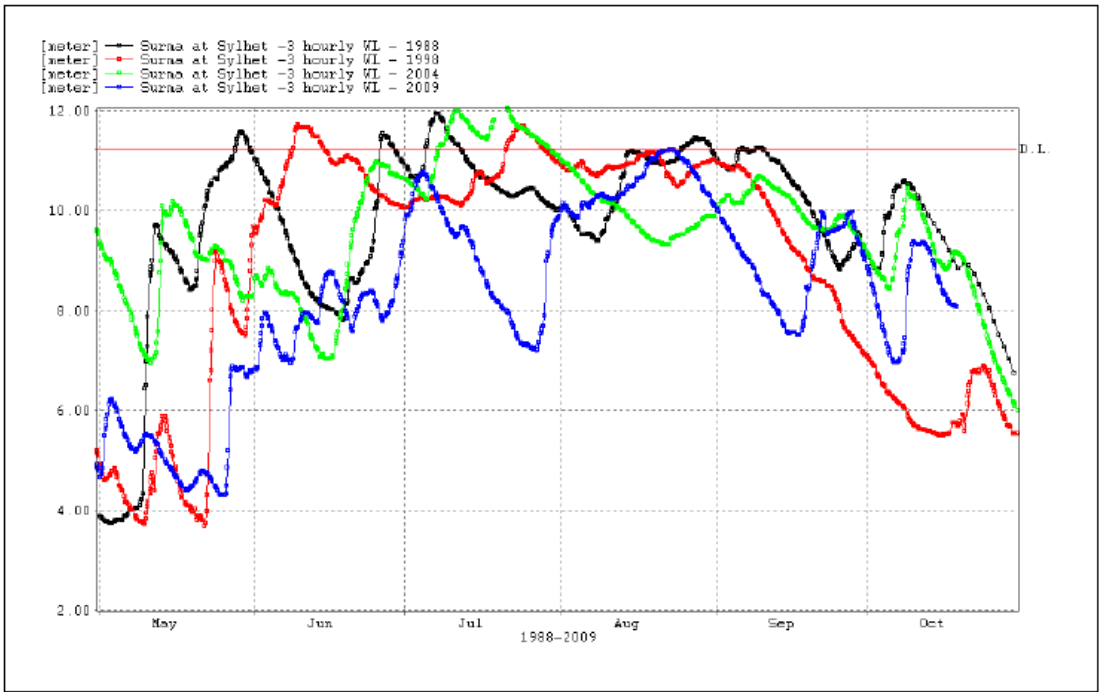


Figure 4.1: Comparison of Hydrographs (Surma at Sylhet)

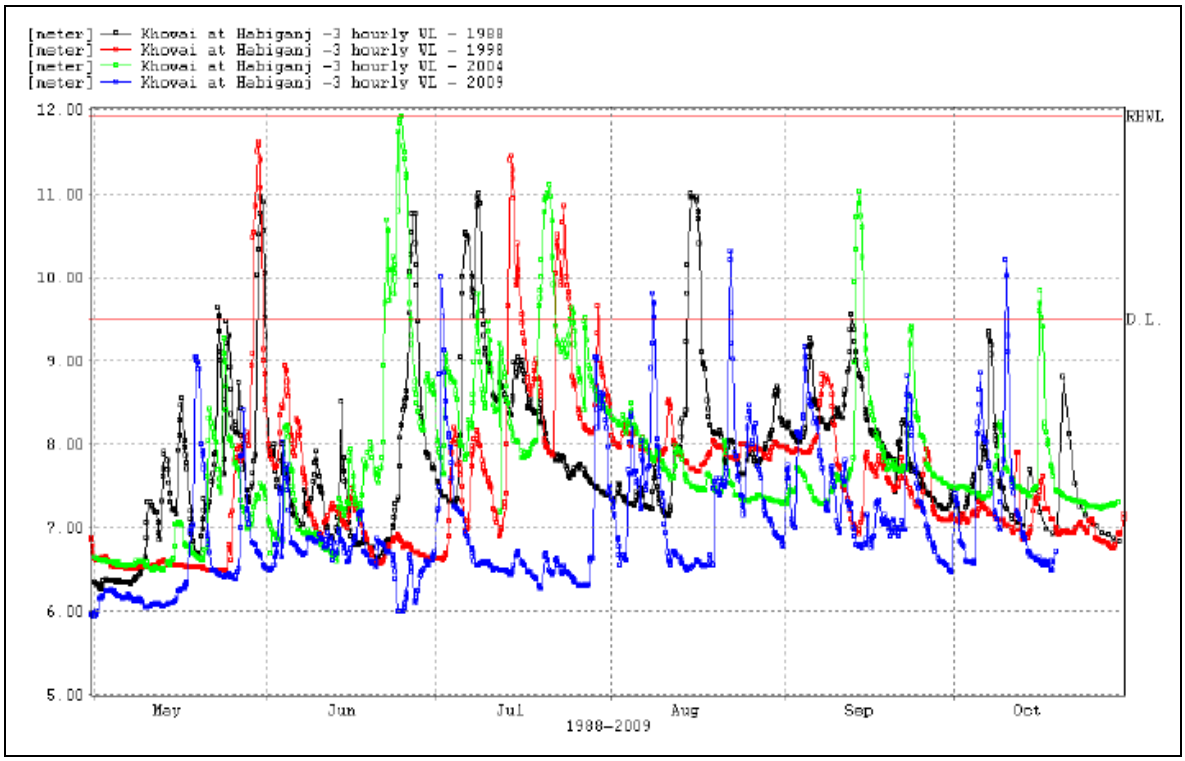


Figure 4.2: Comparison of Hydrographs (Khowai at Habiganj)

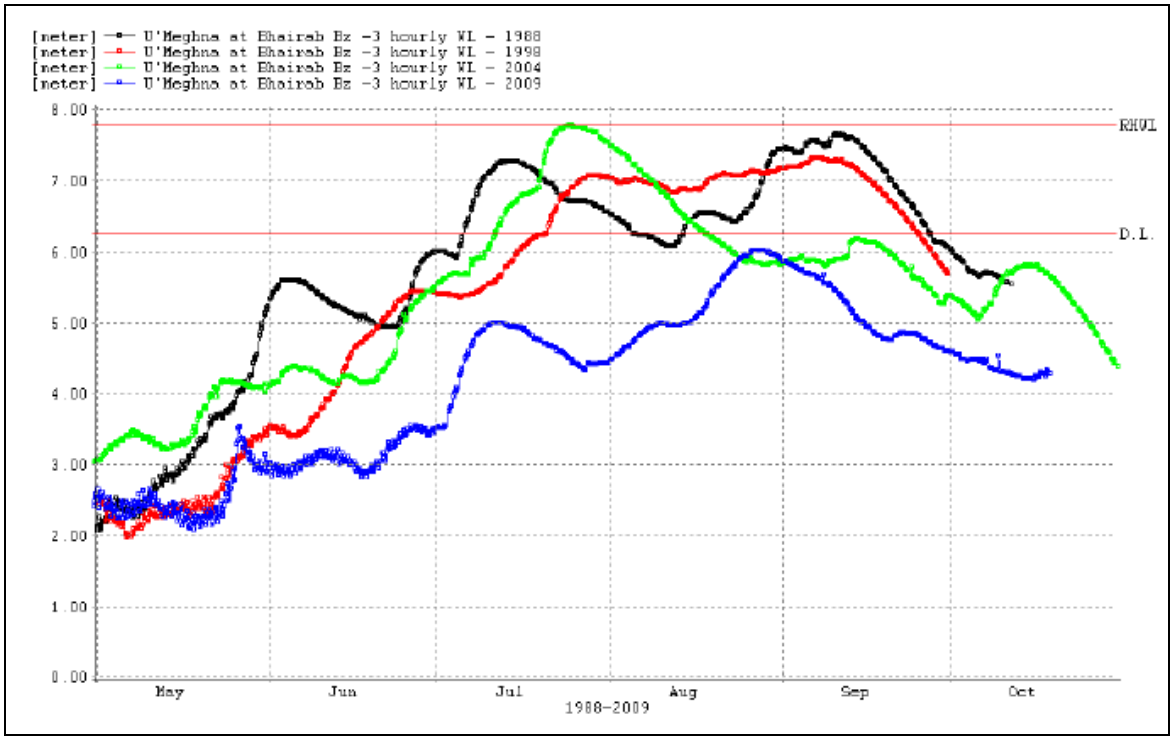


Figure 4.3: Comparison of Hydrographs (Meghna at Bhairab Bazar

4.3 Slope

Slope of Kushiyara and Surma River in different extent of reach is given in the following table 4.2 and 4.3.

Table 4.2: Slope of Kushiyara river

Kushiyara river		
Extent of Reach	**Slope (m/km)**	
Amalshid- Fenchugang	Average	0.040
	Pre monsoon	0.070
	Monsoon	0.060
Fenchugang – Manumukh	Average	0.030
	Pre monsoon	0.040
	Monsoon	0.040
Manumukh - Suriya river	Average	0.020
	Pre monsoon	0.040
	Monsoon	0.040
Suriya river - Markuli	Average	0.010
	Pre monsoon	0.030
	Monsoon	0.030
Markuli – Dhaleswari River	Average	0.022
	Pre monsoon	0.080
	Monsoon	0.008
Dhaleswari River	Average	0.015
	Pre monsoon	0.060
	Monsoon	0.006

Table 4.3: Slope of Surma river

Surma river		
Extent of Reach	**Slope (m/km)**	
Amalshid- Chhatak	Average	0.040
	Pre monsoon	0.040
	Monsoon	0.050
Chhatak – old surma river	Average	0.005
	Pre monsoon	0.005
	Monsoon	0.026
old surma river – Baulia river	Average	0.008
	Pre monsoon	0.030
	Monsoon	0.014
Baulia river – Kaliajuri river	Average	0.008
	Pre monsoon	0.028
	Monsoon	0.014
Kaliajuri river – Ghorautra	Average	0.008
	Pre monsoon	0.010
	Monsoon	0.006
Ghorautra - Meghna River	Average	0.008
	Pre monsoon	0.010
	Monsoon	0.006

4.4 Navigation

It is estimated that the north-eastern region has about 1800 km of river routes that can be used by steamers and large country boats. The inland water transport departments of both the state and central governments have been trying to improve the water transport system in the region. The River Barak also has small ports at Karimganj, Badarpur and Silchar and ferry services at several places across it. Meghna- Barak waterway systems are the shortest as compared to rail and road networks. During flood season, when other modes of transport are not in operation, only inland water transport mode is the linking route for the NE region to the rest of the country. Food grains and other basic commodities are being taken to the NE region only through inland water transport mode during flood season.

4.5 Flood pattern (normal flood, flash flood)

Deep flooding together with early flood and flash floods observed in the Meghna basin of Bangladesh. Floods represent abnormal flooding, when floodwater rises earlier, higher, more quickly or laterthan farmers expect when they decide which crops to grow on their different kinds of land. Consequently, floods may damage or destroy established crops, or they may prevent farmers from planting their usual seasonal crops on time or at all. Flash floods result from very heavy rainfall occurring over neighboring hill or terrace areas.

Water-levels in rivers and on the land rise rapidly, flow rapidly and usually recede rapidly, within a few hours or days. Such floods particularly affect piedmont plains in Norht East region. Figure 4.4 shows the flood prone map of Bangladesh.

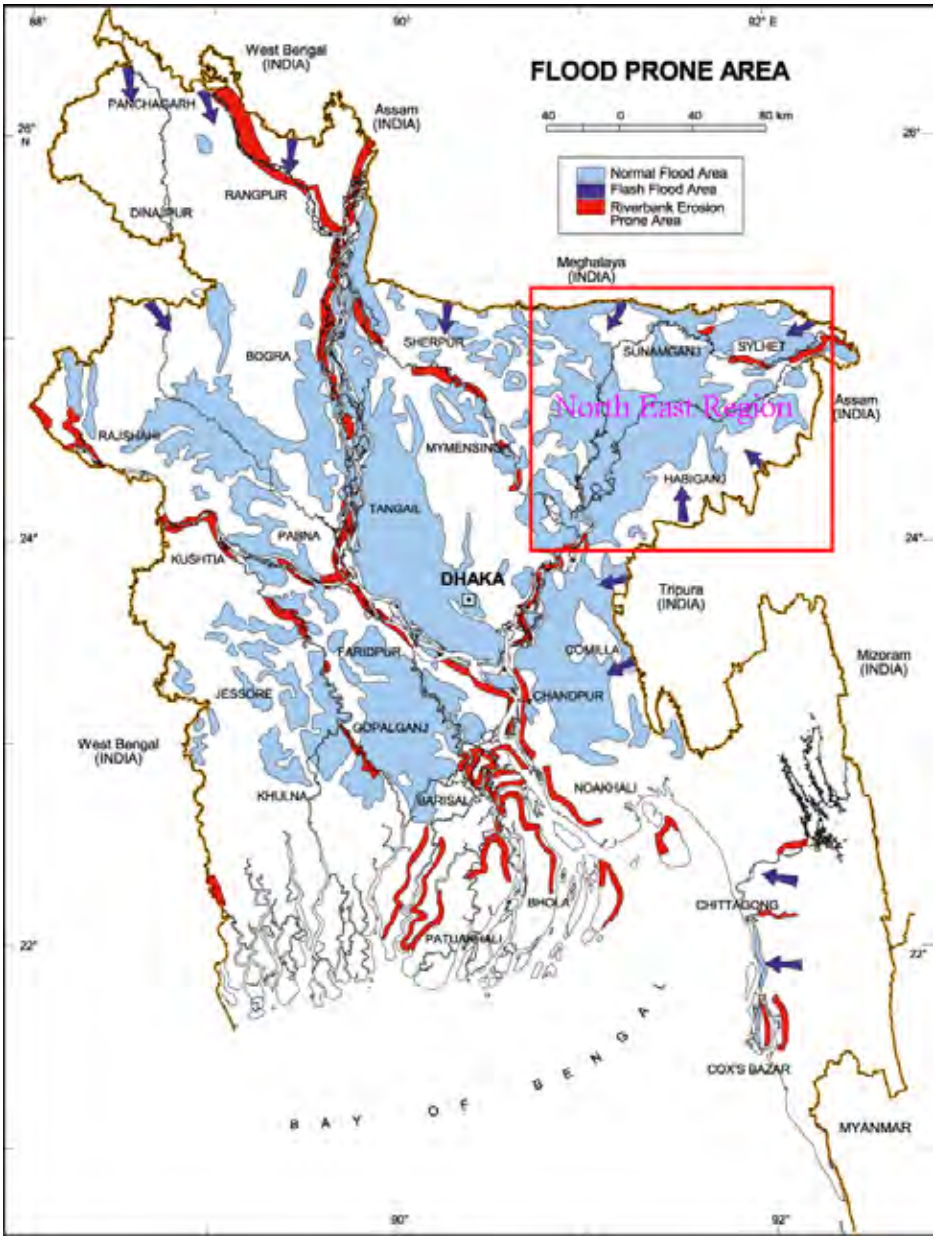


Figure 4.4: Flood prone area map of Bangladesh　　(Source: Banglapedia)

In north-eastern region, flash floods often bring in large amounts of sediments which are spread irregularly over the land and within river channels, raising river-beds. Such sediments generally are sandy near to hills and within river channels, and more silty elsewhere. Floods occurring in April-May can destroy boro paddy crops in depression sites if the floodwater remains for more than a few days. Later floods mainly damage aus

and transplanted aman paddy crops, if at all, by rapidly-flowing water or burial by sediments; usually, however, water-levels fall again before such crops are drowned. Normal flood of River floods result mainly from heavy rainfall and snow-melt in the upper catchment areas of the Ganges, Tista, Brahmaputra and eastern rivers lying outside Bangladesh. More than 90 percent of the flow in Bangladesh's main rivers originates outside the country. However, heavy rainfall occurring within Bangladesh at the same time can aggravate such floods. River floods are liable to occur mainly between June and September; eastern rivers can also experience floods (usually flash floods) in April-May and October-November. The following figure shows the types of flood affected the north east region.

4.6 Drainage and Velocity

The Surma-Meghna system the Meghna is the longest (669 km) river in Bangladesh. It drains one of the heaviest rainfall areas (eg, about 1,000 cm at Cherapunji in Meghalaya) of the world. The river originates in the hills of Shillong and Meghalaya of India. The main source is the Barak river, which has a considerable catchment area in the ridge and valley terrain of the Naga-Manipur hills bordering Myanmar. The Barak-Meghna has a length of 950 km of which 340 km lie within Bangladesh. On reaching the border with Bangladesh at Amalshid in Sylhet district, the Barak bifurcates to form the steep and highly flashy rivers surma and kushiyara. The Surma, flowing on the north of the Sylhet basin, receives tributaries from the Khasia and Jaintia hills of Shillong. Some of the important tributaries of these two rivers are Luba, Kulia, shari-goyain, Chalti-nadi, Chengar-khal, piyain, Bogapani, Jadhukata, Someshwari and kangsa. The Surma meets the Meghna at Kuliarchar upazila of Kishoreganj district. The Kushiyara receives left bank tributaries from the tripura hills, the principal one being the manu. Unlike the Surma, the tributaries of the Kushiyara are less violent, although prone to producing flash floods, due in part to the lesser elevations and rainfall of Tripura hills. Figure 4.5 shows the drainage map of the North- East region.

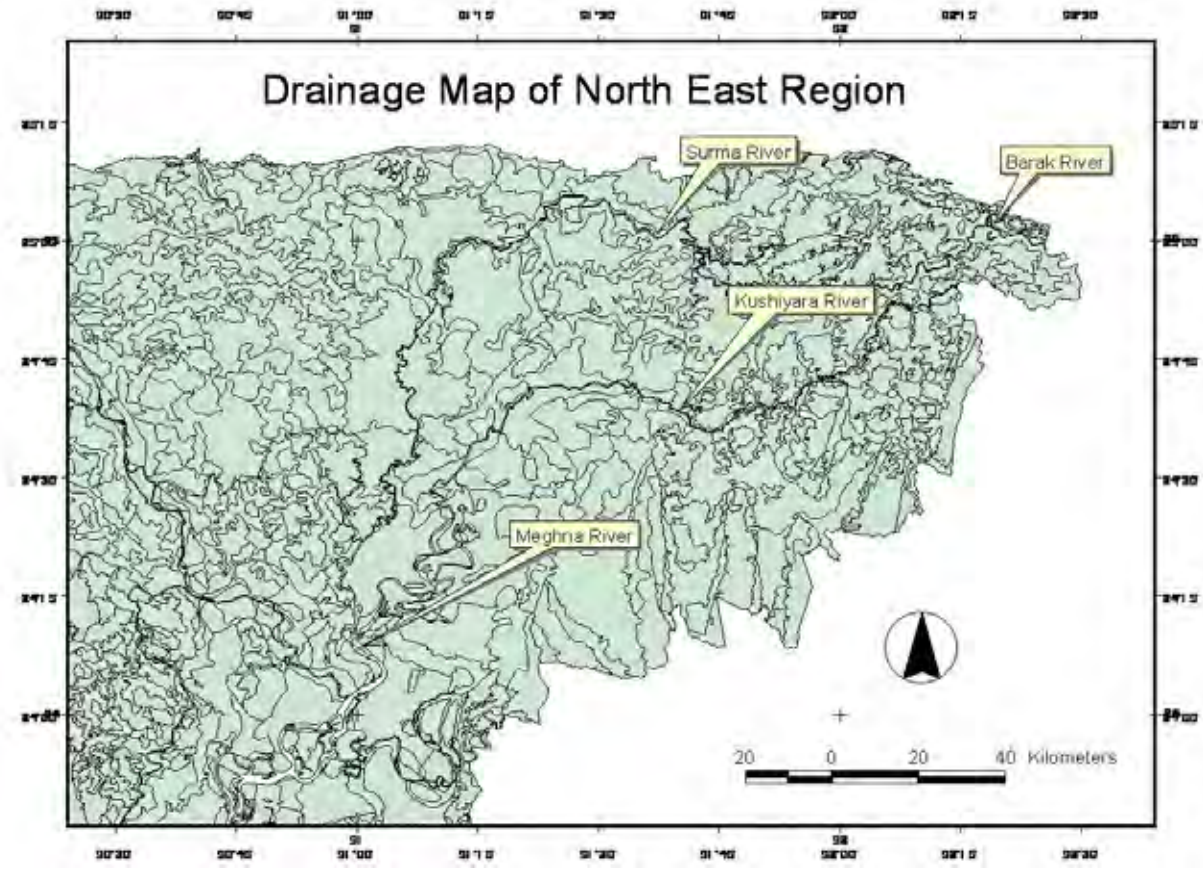


Figure 4.5: Drainage map of North east region marking with the main rivers
(Source: Produce from shp file)

Between the Surma and Kushiyara, there lies a complex basin area comprised of depressions or haors, meandering flood channels, and abandoned river courses. This area remains deeply flooded in the wet season. The two rivers rejoin at Markuli and flow via Bhairab as the Meghna to join Padma at Chandpur. The major tributaries of any size outside the Sylhet basin are the Gumti and khowai rivers, which rise in Tripura. Other hilly streams from Meghalaya and Assam join the Meghna. The total drainage area of the Meghna up to Bhairab Bazar is about 802,000 sq km, of which 36,200 sq km lie in Bangladesh. The peak flow of the Meghna is 19,800 cu m/sec, and the maximum velocity range from 1-2 m/sec with depth varying from 33m to 44m. The average discharge of the river is about 6,500 cu m/sec. It has a steep slope while flowing in the Indian hilly part. At flood stages, the slope of the Meghna downstream at Bhairab Bazar is only 1:88,000. In terms of drainage pattern, the Meghna exhibits a meandering channel, and at some places it reflects an anastomosing pattern.

4.7 Land use

The total area of the Northeast Region is 2.4 million ha. The net cultivated area, which is comprised of the net cropped area and current fallow land, covers about two-thirds of the total area. Waste land, which is cultivable, but remains un-cropped for more than one year one constitutes about five percent of the area. Land, which is not available for cultivation such as homesteads, roads, market places, rivers, canals, and so on, accounts for 26%. The forested area occupies 4% of the Region. The hilly areas, which cover 7% of the Region, occur in the eastern and northern part. The hills are mainly forested, but rice and tea are grown in the valleys and on the hill slope respectively.

4.8 Rainfall

Rainfall The single most dominant element of the climate of Bangladesh is the rainfall. Because of the country's location in the tropical monsoon region, the amount of rainfall is very high. However, there is a distinct seasonal pattern in the annual cycle of rainfall, which is much more pronounced than the annual cycle of temperature. The winter season is very dry, and accounts for only 2%-4% of the total annual rainfall. Rainfall during this season varies from less than 2 cm in the west and south to slightly over 4 cm in the northeast. The additional uplifting (by the Meghalaya Plateau) of the moist air causes higher amount of rainfall in the northeast. Rainfall during the rainy season is caused by the tropical depressions that enter the country from the Bay of Bengal. These account for around 85% in the northwestern part of Bangladesh. Geographic distribution of annual rainfall shows a variation from 150 cm in the west-central part of the country to more than 400 cm in the northeastern and southeastern parts. The maximum amount of rainfall has been recorded in the northern part of Sylhet district. The following tables (Table 4.4 & 4.5) and figures (Figure 4.6) shows the North Eastern Meghna basin rainfall.

Table 4.4: Rainfall in Meghna Basin during the month of August 2009 (mm)

Station	Max.	Nor	Act	Dev	1dymax	10dmax	Remarks
Kanaighat	1232	800	654	-146	92	307	
Sylhet	1139	606	726	120	89	359	
Sunamganj	2515	1159	1363	204	240	811	There is no significant change of actual monthly volume with respect to normal
Sheola	1070	603	642	39	85	410	
Moulvi Baza	667	377	348	-29	58	169	
Manu Rly Br	521	377	391	14	60	232	
Habiganj	956	389	353	-36	71	160	
Durgapur	1094	607	584	-23	92	362	
Bhairab Bz	916	315	242	-73	50	133	
Comilla	661	347	354	7	58	173	
Chandpur	589	336	256	-81	41	166	
Average		**538**	**538**				

Table 4.5: Rainfall in Meghna Basin during the month of September 2009 (mm)

Station	Max.	Nor	Act	Dev	1dymax	10dmax	Remarks
Kanaighat	1032	638	349	-289	53	216	
Sylhet	1220	575	385	-190	88	188	
Sunamganj	1130	845	511	-334	70	312	Actual monthly volume of rainfall is 38% less than normal rainfall
Sheola	1232	551	315	-236	75	197	
Moulvi Baza	487	281	214	-67	90	120	
Manu Rly Br	640	353	183	-170	75	118	
Habiganj	498	301	265	-36	62	184	
Durgapur	1525	595	373	-222	162	253	
Bhairab Bz	635	294	230	-64	69	131	
Comilla	483	267	126	-142	42	84	
Chandpur	602	241	124	-117	23	72	
Average		449	279				

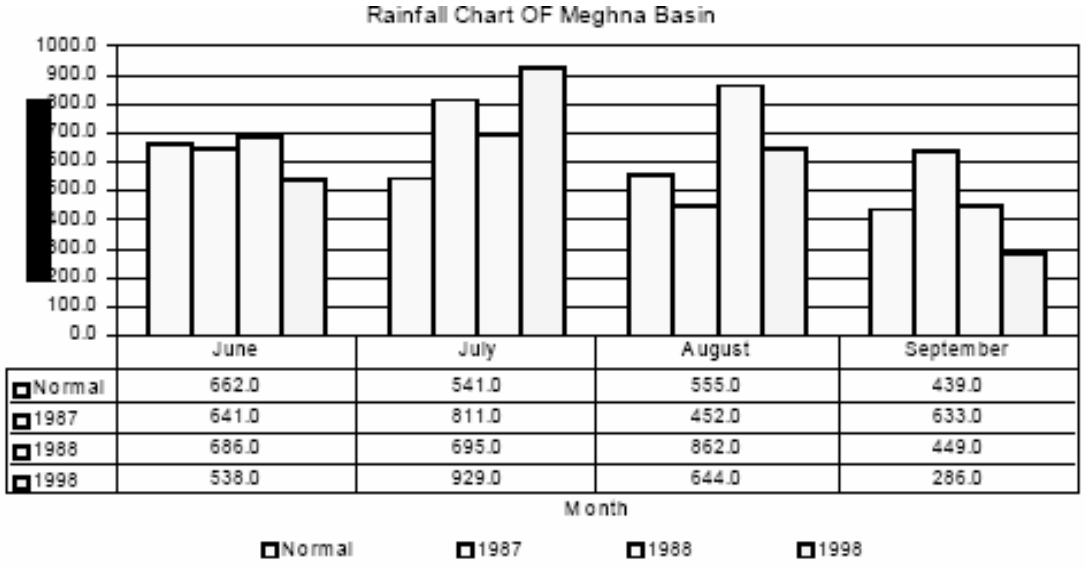


Figure 4.6: Rainfall chart of Meghna Basin in mm

4.9 The issues of the Meghna river basin (overview, sedimentation, navigation, facilities, management, capacity, maintenance, budget, IWRM, and so forth)

For a large river basin, large number of multi-sectoral issues must be present. The major portion of the Meghna basin is out side of the Bangladesh. In such situation regional co operation in basin management is essential among the basin shared country. But unfortunately such types of practice are not observed. If such thing is present, the co ordinations among the partners are not so strong. Again huge population pressure also increase the demand of water in different sector. Constructions of dam, barrage and other structure by upstream country have great impact on downstream country. Failure of riverine structure may cause flash flood and destroy life and livelihood of the downstream countries. Resolving conflicts over water management issues for international rivers present challenges for the nations of the world. However since

changing national boundaries is not an option, we have to develop understanding and mutual respect in order to resolve water resources management issues for the benefit of all co-riparian countries.

Water resources management in North East faces immense challenges of resolving diverse problems and issues. The most critical of these are floods in the wet season and the scarcity of water in the dry season, ever expanding water needs of a growing economy and population, supply of safe drinking water and sanitation, arsenic problem, water pollution, massive river sedimentation and river bank erosion. There is a growing need for maintaining the ecosystems particularly in the fish resources and wetlands. The water management is increasingly facing challenges of exogenous developments of a global nature, such as climate change and sea level rise, as well as of upstream river basin development beyond the border of the country. Also there is the issue of competitive demand of various water uses.

4.9.1 Sedimentation

Hugh amount of water and sediment enter through the river system of Meghna Basin. The Geologically depressed areas named haor of that area are flooded with the river water. And when the water become retained, the carried sediment become deposited in the haor areas. Sedimentation changes the land pattern from low land to high land. For that reason the total land use pattern also changed in the haor area. One of the examples of sedimentation is given here.

Damrir Haor is situated in Fenchuganj Upazila of Sylhet District. Actually the Haor covered a large area of four adjacent upazila. This Haor is a combination of 23 large beels and many small channels and rivers. The Haor is situated on the east side of the Sylhet-Fenchuganj High way. On the west side another Haor named, Dupriar Haor is also situated. The Haor have problem of siltation and erosion in channels. During visit, it was found that vast area under water and middle portion of the Haor found uplifted. The following figure (Figure 4.7) shows some over view of that Damrir haor. In that figure it is found that vast area under water and the central portion of the area is uplifted for the sedimentation and there agricultural activities is going on. Discussion with local people and local leaders explain the past and present scenario of the haor. According to local people sedimentation in low land and erosion in channels are problem for the haor. They said erosion damage their agricultural land. On the other hand sedimentation also a problem. But this is an opportunity also for the local people. They got new land for the

rice cultivation. And such things also observed during the visit. A vast uplifted area was covered by the paddy field and some barren land was also observed. It was found that in that Haor, mainly clay and silty clay was deposited. Some channels were found already dead and some have been filled by sedimentation. On the other hand some channels were also found having a severe problem of bank erosion. According to the local people siltation is a major problem for that Haor rather than the erosion.

Figure 4.7: Sedimentation problem in the channels and middle portion of the haor

4.9.2 Navigation

Meghna River has the following problem for the navigation

River Siltation: Progressive siltation of river channels, including the offtakes of distributaries in particular, makes them shallower and unfit for navigation. It is estimated that the rivers of Bangladesh carry an amount of over two billion tons of sediment every year.

Reduction in Trans boundary Flow: Navigability of the rivers in the North East has been adversely affected in the past two decades owing to reduction of trans boundary flow in the dry season.

Abstraction of Surface and Ground-water: Progressively increasing abstraction of both surface and ground waters in the dry season for irrigation purposes has resulted in reduced stream flow, especially in many tributary rivers of the country.

4.9.3 Facilities

Different facilities and services produced from the North east region has decline for the improper management of the rivers of the basin. Sedimentation problem interrupt the navigation. Sedimentation in haor area reduces the fisheries cultivation and wet land resources and services and forces the wetland facilities group to change their occupation.

4.9.4 Management

Management of a shared riparian basin is complicated. When the large portion of the basin is out of the international boundary, the management becomes more complex. Water sharing is one of the main points of mismanagement.

4.9.5 Capacity

The carrying capacity of the Meghna basins is declining day by day. Hugh amount of population, increase of water demand in different sector reducing the capacity of the Meghna basin. Again construction of dam by the upper riparian country reducing the capacity of the large basin of Meghna river.

Check box

Components	Addressed	Unaddressed	Source	Remarks
The characteristics of the Meghna river basin	X		Literature	Further study needed
The issues of the Meghna river basin	X		Literature and field observation	Further detail study needed

Chapter Five

Embankment Protection

(To survey soil material for earthworks and suitable plants for embankment protection in Bangladesh, especially focusing in volume and cost of the soil/plant material)

5.1 Over view

The haor area is rich of sediment carrying by the river water during the flood. These sediment deposited in the low land of the haor area and some time deposited in the small channel which constrict the channel. On the other hand erosion for the wave action in the haor area is high. The people in haor areas live in isolated settlements that are located on earthen mounds or on raised platforms. Boats are the only means of transportation during the flood season. Residents use bullock carts for transportation during the dry season. Extensive de-plantation has been occurred to reclaim the agricultural land. The cropping pattern has also significantly changed over last three decades. These alterations have increased wave attacks in the haor areas. A decade ago, wave attacks were not a serious threat to the existence of settlements. In the past, the farmers cultivated long stem paddy during monsoon that could absorb wave impacts. Presently, the land is vacant during the monsoon season and the wave height has thus increased two fold from 0.6 meter to 1.5 meter, threatening the settlement. The traditional methods are no longer adequate against wave attacks. Many villages have been washed away and the existing ones are in threat.

Now for the protection of the home stead and agricultural land from flash flood and wave action, submersible embankment and high embankment is need to be constructed in the haor area. But the huge amount of soil is needed for the construction of the earthen embankments. The possible source of the earthen materials for construction of the embankment might be the deposited sediment carrying by the flood water. The following figures show the grain size of the sampled sediment.

5.2 Methodology

For this section of the study, literature review, field observation and laboratory analysis was done. Four soil samples were collected and analyzes in IWFM soil analysis laboratory by sieve and hygrometric analysis. For identifying the survey items, secondary literature was reviewed. The secondary literatures were collected mainly from the IWFM

library, internet and from different publish and unpublished documents. Historical data were collected from the FAP6 reports. In field expert observation, focus group discussion with local people, personal interview with aged local people was done.

5.3 Soil properties

Non-calcareous alluvium and Acid Basin Clay Soil is found in the Meghna Basin .but in the haor region acid Basin Clay grey to dark grey heavy clays, which are strongly to extremely acid is found. The topsoil is grey to dark grey, often stained deep red or brown along root channels and cracks. It becomes hard and cracked when dry. There are peaty layers and silty substrata in some places. The topsoil becomes nearly neutral after submergence of about two weeks, but is extremely acid on drying out. The subsoil is strongly to extremely acid. They have a strong prismatic and blocky structure in soils, which dry out seasonally. There are about 348,994 ha of Acid Basin Clays found in Bangladesh. These soils occur mainly in the haor basin and more clearly in the Eastern Surma-Kusiyara floodplain area.

5.3.1 Particle size

The soil composition of agricultural land is mainly silt and silty clay and deposited soil in the channel is sandy. The sieve analysis result for the four sample was indicate that. The results are given below in figure 5.1 to 5.5.

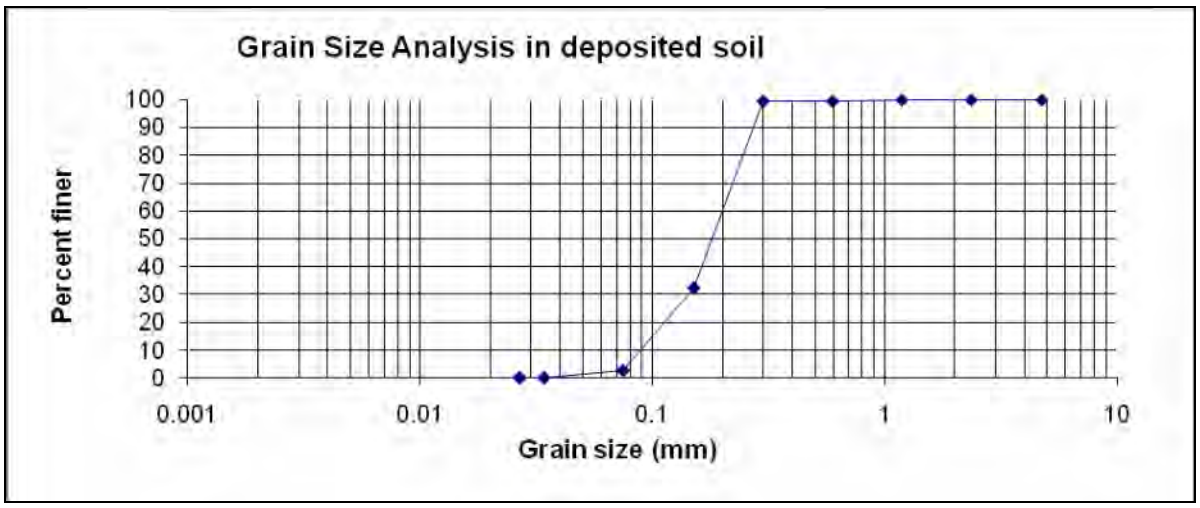


Figure 5.1: Shows the Soil Characteristics of deposited soil on the bed

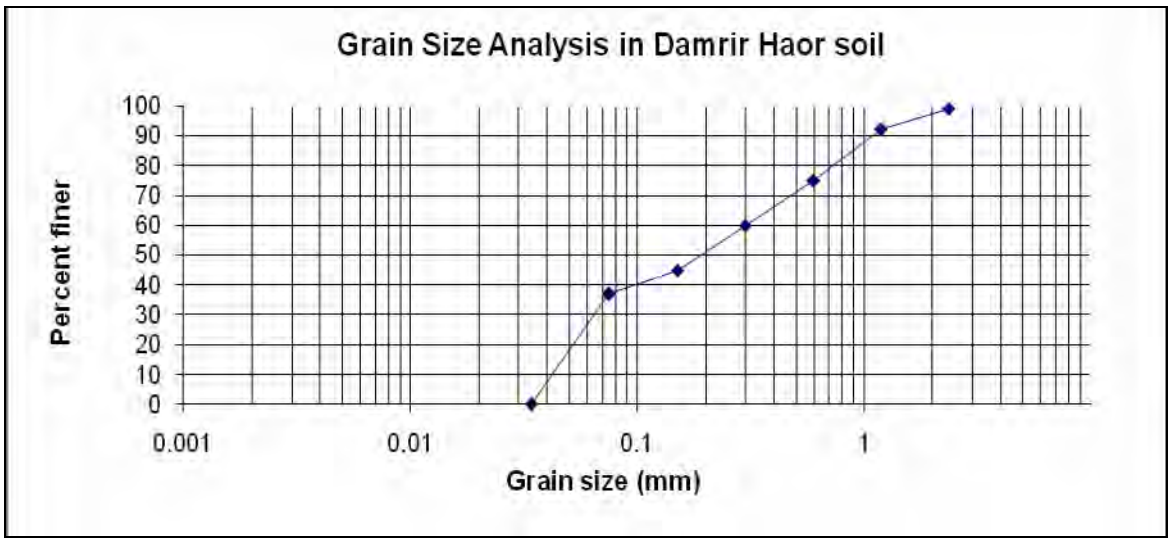


Figure 5.2: The Soil Characteristics of Damrir Haor soil

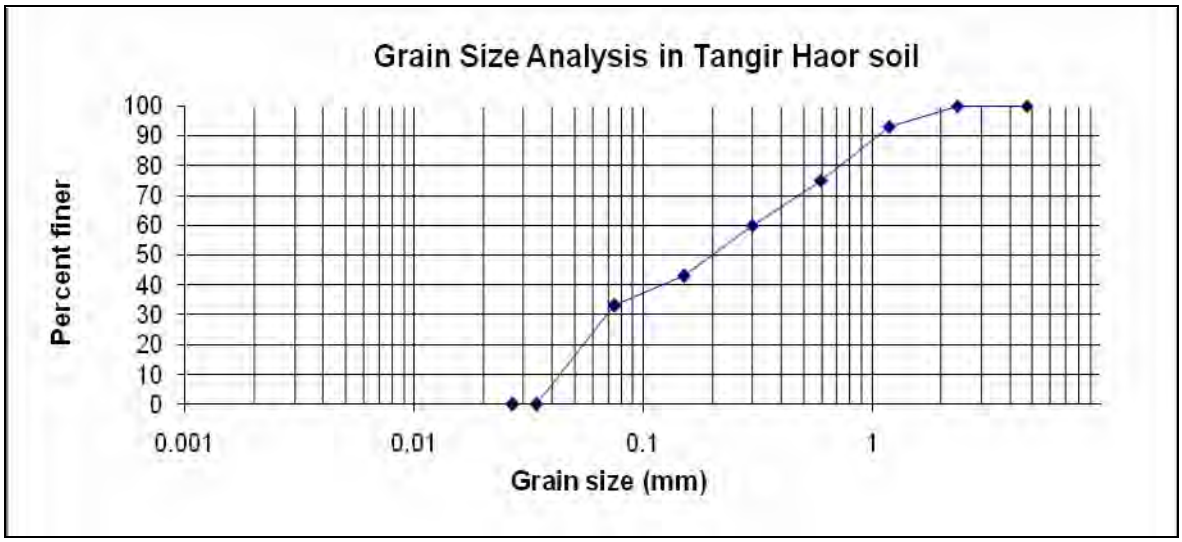


Figure 5.3: The Soil Characteristics of Tangir Haor soil

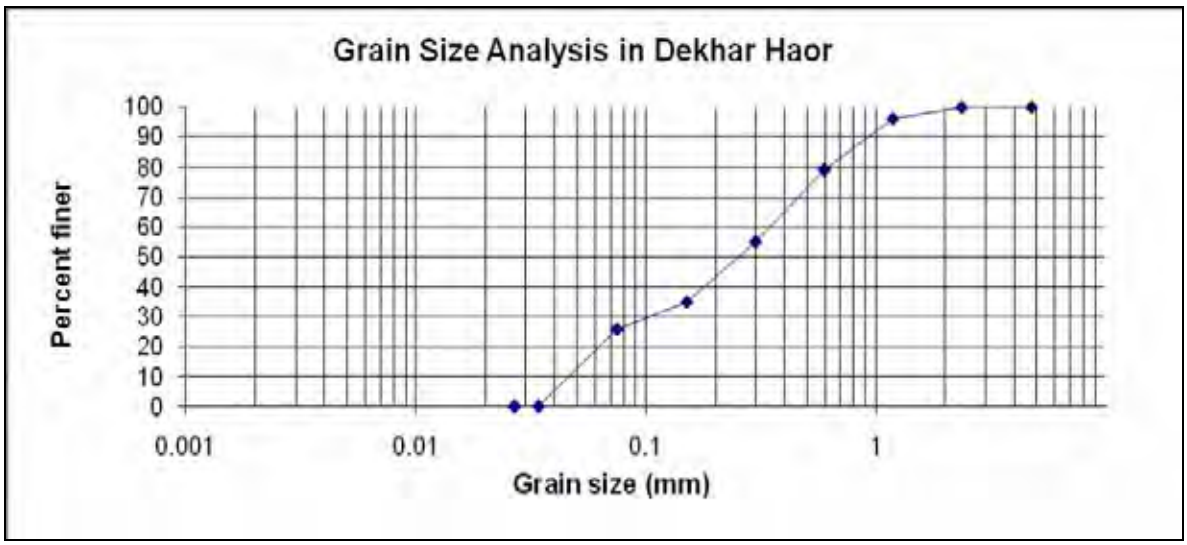


Figure 5.4: The Soil Characteristics of Dekhar Haor soil

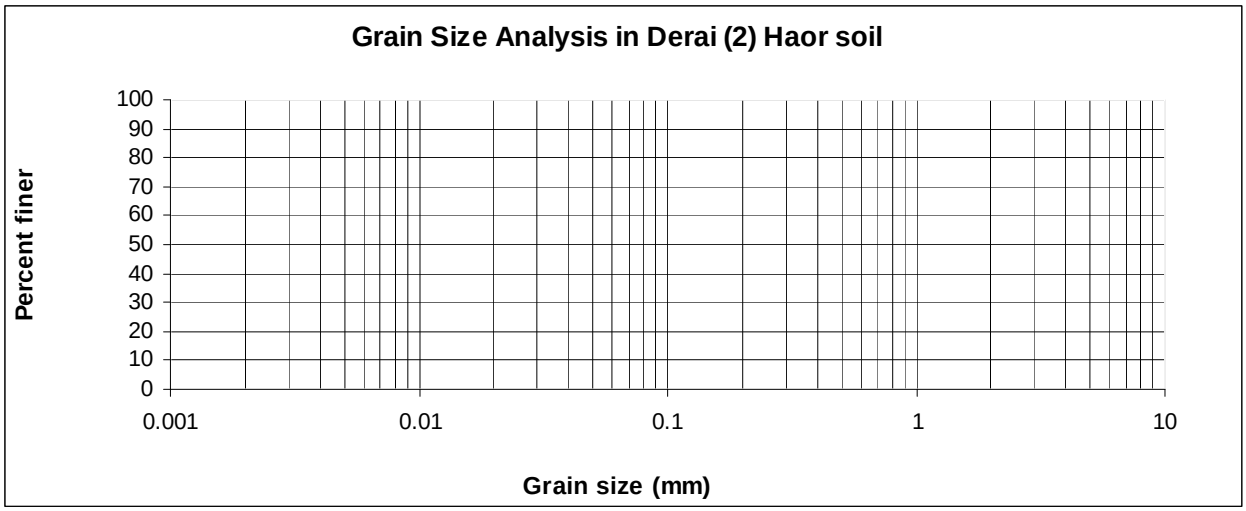


Figure 5.5: The Soil Characteristics of Derai 2 soil sample

When the mud become dried up, it is harder like brick (Figure 7.7). The deposited soil will be used for making embankment and auricular land soil will cover the embankment. This activity will ensure the depth of the channels and make communication of the people of the area by road. The soil sample was collected from the Low land and from the dried river bed, where sedimentation was observer. Figure 7.6 show the sampling location of soil.

5.3.2 Morphological characteristics of the Surma - Kushiyara River

For the comparison of the grain size deposited in different haors and river bed was compared with the sediment of surma and Kushiyara river bed materials. After sieve analysis of the sample, it was found that the grain size is almost similar. Which indicate that the sediment deposited in different haor ans small river bed is carried by the Surma or Khshiyara River. The bed material in the Kushiyara and Kalni reaches is typically fine to medium sand (median size between 0.30 and 0.16 mm). Banks are typically stiff clay or silty clay. The bed material in the Surma/Baulai River consists of fine to medium sand, with median sizes ranging from 0.25 mm to 0.085 mm. There is a noticeable decline in the grain size along the river, with the sediments in the Baulai River having a median size of only about 0.1 mm. There are virtually no sediments finer than 0.063 mm in the channel bed, which indicates that finer silt sizes are transported through the channel as "wash load".

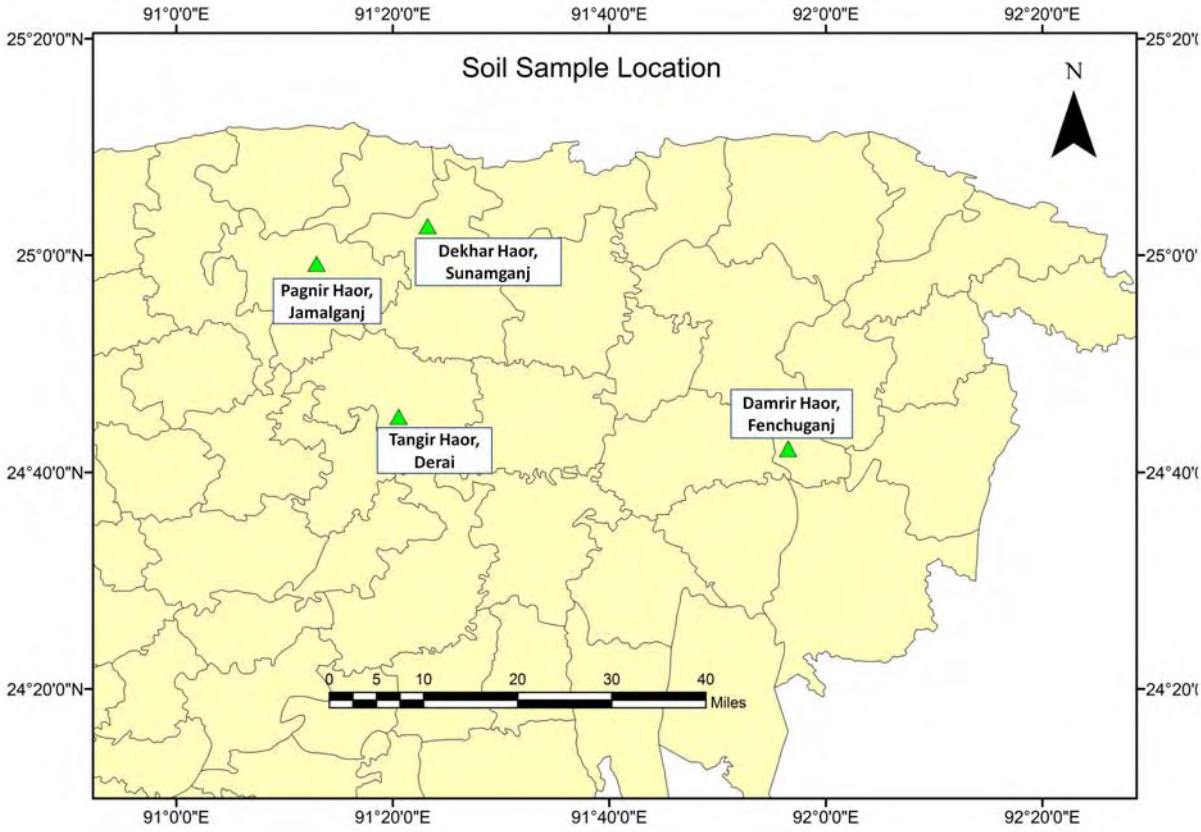


Figure 5.6: Location of soil Sample collection

Figure 5.7: Dried very hard clay soil of the haor area

The laboratory analyses of the soil sample also indicate that the sample ranges from the clay to silty clay and ranges up to medium sand. So there is a similarity was found. From the soil sample analysis and the secondary sources it was found that the similarities between the two result for the four location of soil sampling.

5.4 Name and species of the plants standing on the riverfront

The Haors are considered the most productive wetland resources of Bangladesh. The basin supports a large variety of wetland bio-diversity and works as natural reservoir as it plays a key role in basin water resources by regulating water flows of the Meghna river system. The swamp forests, which were once dominant with the flood tolerant tree species like Hijal *(Barringtonia acutangula)* and Koroch *(Pongamia pinnata).* The ollowing table (Table 7.3) states the local name and scientific name of the plant species found in the river front). These “Hijal’ and “Karas” trees are most common in different places in Haor area and found all over in the edge of the high and low land, rivr bank, small channel bank. Except these plants, a type of grass named “Kasiban” (Figure is growing in that area usually is an ideal fodder. Reed plant like “Nol”, “Bet”, “Dhol Kalmi” were also common. Good number of different fishing birds and flock of migratory birds also observed in that Haor. These birds play a vital role for the maintenance of the ecosystem of the Haor. Figure 5.8 and 5.9 shows some of the available tree example of the Haor area.

Table 5.3: Name and species of the plants standing on the riverfront

Local Name	**Scientific name**
Hijal	*Barringtonia acutangula*
Koroch	*Ponogamia pinnata*
Bhui Dumur	*Ficus heterophyllus*
Nol	*Arundo donax*
Khagra	*Pharagmites karka*
Barun	*Crataeva nurvala*
Dhol Kalmi	*Ipomoea carnea*

Other common plants of the haor area are given in the following table (Table 7.4). Mainly Eight plant communities have identified in the haor area (number of species in parentheses):

submerged plants, free floating plants, rooted floating plants, sedges and meadows, floodplain grassland, reed swamp, fresh water swamp forest, crop field vegetation, and homestead vegetation.

Figure 5.8: Karas, Hijol, Bet and Dhol Kamli plant in front of the river

Figure 5.9: Nol and Karoch plant is standing in haor water

Table 5.4: Name and other species available in the haor area

Local Name	Scientific name
Madar	*Erythrina variegata*
Gab	*Diospyros peregrina*
Makna	*Euryale ferox*
Singara	*Trapa bispinosa*
Jaldumur	
Chitki	*Phyllanthus reticulatus*
Thankuni	*Centella asiatica*
Kalmi	*Lpomoea aquatica*
Helencha	*Enhydra flactuans*
Hogla	*Typha elephantina*
Duckweed,	
Water hyacinth	
Lotus	
Water lily	

5.5 Quarrying and conveyance cost

In field it was observed that, human labors were digging the soil. No mechanical excavation was found. And it is not suitable for the poor communication system in the haro area. A labor can excavate approximately 7.5m^3 soil material in a day and can carry 1.5 tons (15 kg weight X 100times) of earthen material by using the bamboo basket. But it varies person to person. The average labor cost is around 150 to 200 Bangladesh Taka (2.2 to 2.8 US $). But the mechanical quarrying and conveyance is suitable in those locations where the communication system is good and excavator and bulldogger can easily enter in those areas. By using mechanical instruments the amount of quarrying will increase in less amount of cost.

5.6 Means of conveyance

Human labor was available for the conveyance of the earthen materials. They use bamboo basket and handcart for the carrying of the earthen materials. This is only possible when the amount of materials is fewer amounts. But in the case of huge materials, mechanical instruments will be

needed like truck, tractor trolley, engine boat etc. The following figure (Figure 7.10) is showing some means of conveyance in haor area.

Figure 5.10: Different means of conveyance in haor area

5.7 Conveyance route of sand materials

Sand material business is an important business in the Meghna Basin. The sand is mainly used for the construction work. This coarse sand is excellent for the heavy construction and for that the demand of this sand is also very high in all over the country. This sand is imported from the India. On the bank of Surma River it is common feature. The business men rent a piece a land beside the river for a particular time (Figure 7.11) and store their sand which is imported from the India. Later they sold this sand to the other construction farms. During the field visit, in Jamalganj of Sunamganj district it is found every where of the both bank of the river Surma. In Kushiyara River near Markuli same scenario was observed. The following figures (Figure 7.11) showing some of the sand business scenario.

Figure 5.11: large stockpile of sand along the both bank of Surma River near Jamalganj

Figure 5.12: Large cargo vassels and engine motor boat were used for the convenience of the sand

The sand is transported from that area to the other part of the country either in water way or by road. But water way is preferable for the low cost large volume of material transportation. The route is followed as Fenchuganj-Ajmirigonj, Sunamganj – Ajmirigonj by using large cargo vassel and motor boat (Figure 5.12).

5.8 Trimming cost, conveyance method and cost of the plants

Locally available plant such as Hijal and Karoch are very common in the North East haro region. Figure 7.13 shows the trimming plantation of Karas plant beside a submersible embankment. The plants are easily planted and can tolerate in flood water for a long time. Human labors can plant these trees easily. Only low cost labor is needed for the decorated plantation of these threes. Again these plants can re produce by its seed and also from the branch. So the reproduction rate is also good for those plants. By using very minimum effort they can easily transferred form one place to another. By road of the water way they can be transported one place to another. For the availability the price of those trees is also less. For that reason nursery business of these plants is suitable and possible for the North east haor area.

Figure 5.13: Trimming plantation of Karas plant beside a submersible embankment

Check box

Components	Addressed	Unaddressed	Source	Remarks
Conditions Properties of materials	X		Literature	Partially addressed
Name and species of the plants	X		Literature and field observation	
Distribution, range, dimension, volume of materials and plants		X		Need Further Research
Quarrying cost, conveyance cost, means of conveyance, conveyance route of sand materials	X		Literature and field observation	Partially addressed
Trimming cost, conveyance method and cost of the plants	X		Literature and field observation	Partially addressed

7.洪水被害データ

【2004 年洪水被害額の推定】

ア．全国セクター別被害額の整理

Options Flood Risk and Damage Reduction in Bangladesh において、セクター別の洪水被害数量と推定被害額が整理されており、主要なセクターについて以下に整理した。

付表-1 農業被害額(2004 年洪水)

Flood affected area(m.ha)(a)	Percentage of total area (%)	Human deaths	Crop area damaged (m.ha)(b)	Damage in million Taka	Agricultural rehabilitaiton (Millin Taka)
5.56	23.43	747	0.85	**31,839**	**1580.1**

Econimic Review & DAE reports

付表-2 BWDB の施設被害

No.	Items	Unit	Damage Quantity	Cost (M.Taka)
1	Embankment (fully,F)	km	298	
	Embankment (partially,P)	km	2666	
			2964	2,397
2	Irrigation/drainage/canals (F)	km	7	
	Irrigation/drainage/canals (P)	km	745	
			752	247.6
3	Water Cotrol Facilities (F)	nos	77	
	Water Cotrol Facilities (P)	nos	964	
			1041	615
4	Protective Works	km	71	4415.6
	Protective Works (P)	km		no data
5	Spur/Groin	nos	3	
	Spur/Groin(P)	nos	17	
8	Others			127.9
	Total			7,803.5

出典) Options Flood Risk and Damage Reduction in Bangladesh (2006)

付表-3 鉄道被害

Length of tracks damaged(km)	Number of Bridges and Culverts Dameged	Other Damages	Cost of rehabilitaion (M.Taka)
415	128	-	1270.00

出典) Options Flood Risk and Damage Reduction in Bangladesh (2006)

Meghna 川関連被害区間は、以下のとおりである。(2004 Flood)

付表-4 鉄道被害（調査区域管内）

Bairab Bazar- Akhaura	30 km
Bairab Bazar- Gouripur- Mymer	97 km
Bairab Bazar-Tongi	64km
Sylhet- Chatak	43 km
Shyamganj-Jariajhanjjail	21 km

付表-1.4 道路被害(主要道)

Type of Road	Lengh Damaged (km)	Number of Bridges	Num. of Culverts	Num.of Ferry Ghat	Immidiate Requiremant (M.Taka)	Rehabilitation Cost (M.Taka)	Total Cost (M.Taka)
National	230.79	10	3	9	115	426	**541**
Regional	447.5	26	33	6	192	1,298	**1,490**
District	2102.21	105	88	5	824	6,613	**7,437**
Total	2780.5	141	124	20	1,131	8,337	**9,468**

出典) Options Flood Risk and Damage Reduction in Bangladesh (2006)

付表-5 地方道被害

Component	Total	Damaged	Rehabilitation Cost (M.taka)
Rural Road	219,760	19,882	5,580
Bridges/Culv	763,180	26,205	3,430
GC/market	17,106	231	286
Ghat/jetty	204	-	
Total	-	-	9,286

出典) Options Flood Risk and Damage Reduction in Bangladesh (2006)

付表-6 漁業養殖被害

year	Num. of Fingerlings (Million)	Price (M.Taka)	Fish (M.T)	Price (M.Taka)	Infrastructure Damage (M.Taka)	Total Price (M.Taka)
Culture fisheries	10.24	2.05	63,649	27.46	4.96	34.47
Government Fish Farm	0.8	0.57	20	2	5.46	8.03
Total						42.50

出典) Options Flood Risk and Damage Reduction in Bangladesh (2006)

付表-7 家畜被害

Direct Loss	Due to Adverse Situation	Loss of Housing	Production Loss	Private commercial farms	Government Establishment	Total Loss (M. Taka)
1,384.90	16,828.21	914.35	1,049.57	222.42	12.18	20,411.63

Note) The loss was estimated on the basis of informtion received on 02-08-2004

付表-8 住宅被害(PWD 管轄分)

Items	Unit	Damage Quantity	Cost (M.Taka)
Various type of strucure			118

出典) Options Flood Risk and Damage Reduction in Bangladesh(2006)

付表-9 収入、資産の被害

Item	1988	1998	**2004**
Inundated area（%）	61	68	**38**
Duration of Flood	23	72	**21**
Persons Affected (Million)	45	31	**30**
total Death	2335	918	**329**
Loss of Income.Assets (US$)	330 Million	2 billion	**7 Billion**

(490,000 M Tk)

出典) Options Flood Risk and Damage Reduction in Bangladesh(2006)

付表-10 通信関連被害

Items	Unit	Cost (M.Taka)
Dhaka Telecom Region (S)	million	135.4
Dhaka Telecom Region (N)	million	10.1
Dhaka Telecom Region (E)	million	30.0
Shlhet Telecom	million	7.7
Rangpur Telecom	million	3.1
Total		186.2

出典) Options Flood Risk and Damage Reduction in Bangladesh(2006)

イ. 工業被害

Options Flood Risk and Damage Reduction in Bangladesh(2006)によると、工業被害については以下のような推定被害を算出している。

・製造業：515,010 Million taka

・建設業：260,630 Million taka

2004 年の被害は製造業の 20%、建設業の 5%が被害を受けたとして、116,030 Million taka を計上する。

ウ. 被害として計上してない項目

水供給、下水道、森林被害、電力、一般資産等については、計上していない。

エ. 上記の被害額の合計値

上述した被害額の総計を整理すると、以下のとおりとなる。

付表- 11 2004 年洪水による合計被害額推定

項　目	直接被害額	その他(復旧費等)	合計(M.Taka)
1. 農　業	31,839	1,580	33,419
2. BWDB の施設被害	7,804		7,804
3. 鉄道被害	1,270		1,270
4. 道路被害(主要道)	9,468		9,468
5. 地方道被害	9,286		9,286
6. 漁業養殖被害	43		43
7. 家畜被害	20,411		20,411
8. 住宅被害(公共事業省管轄分)	118		43
9. 収入、資産被害	490,000		490,000
10.通信関連被害	186		186
11. 工業被害			116,030
合　計			687,960
9 上記から収入、資産被害を除外	490,000		197,960

出典) Options Flood Risk and Damage Reduction in Bangladesh(2006)

なお、2004 年洪水の洪水被害額は、CRED データベースによれば、2,200 億 USD(1,600 億 BDT*)とされているが、詳細な内訳までは不明である。(1USD=70.10BDT(2011.2)として換算した場合)

付表- 12　2004 年洪水被害額（ＣＲＥＤデータベース）

Disaster	Date	Damage (000 US$)
Flood	5/07/1998	4,300,000
Storm	15/11/2007	2,300,000
Flood	20/06/2004	2,200,000
Flood	06/1988	2,137,000
Storm	29/04/1991	1,780,000
Storm	15/05/1995	800,000
Flood	08/1987	727,500
Flood	07/1974	579,200
Flood	09/2000	500,000
Earthquake (seismic activity)	26/12/2004	500,000

Created on: Feb-15-2011. - Data version: v12.07
Source: "EM-DAT: The OFDA/CRED International Disaster Database
www.em-dat.net - Université Catholique de Louvain - Brussels - Belgium"

8.ニーズ確認ワークショップ結果

JICA Preparatory Planning Study for
Meghna River Basin Management

Workshop
on
Needs and Problem Analysis for
Upper Meghna River Basin Management
27th October, 2011

Organized by:
Bangladesh Water Development Board (BWDB)
and
JICA Study Team on Preparatory Planning Study for Meghna River Basin Management

Photographs








Table of Contents

1. Introduction

Bangladesh has been suffering form repeating water-related disasters. Meghna river, which runs through Haor, is difficult to manage against flood/drought. JICA decided to dispatch a study team to propose a series of effective projects for Meghna river basin management.

The objective of this Workshop is to gather information on needs of the concerned stakeholders and problems they are facing, in order to identify the areas and targets with regard to upper Meghna river basin management. This workshop comprises two sessions: 1) the first session is the “stakeholder analysis”, and 2) the “problem analysis”. The stakeholder analysis is intended to understand how the stakeholders are involved in and their role in upper Meghna river basin management (including Haor areas) and to analyze the issues they are facing. The problem analysis is intended to identify and analyze problems of upper Meghna river basin management to establish a comprehensive “problem-tree” regarding upper Meghna river basin management.

2. Program Outline and Participants

Program Outline

Item	Description		
Objective	To conduct Needs and Problem Analysis for Upper Meghna River Basin Management among relevant government agencies		
Date and Time	27th October, 2011 12:30 - 16:30		
Place	BWDB Director General Conference Room		
Contents	Opening	12:30 – 12:40	Chaired by Mr. .A. Kashem, Chief Engineer (Design), BWDB
	Introduction to the Workshop	12:40 – 13:00	Facilitated by JICA Study Team member
	Lunch	13:00 – 14:00	
	Stakeholder Analysis	14:00 – 15:30	Chaired by Engr. Md. A. Wadud Bhuiyan, Chief Planning, BWDB To identify problems and needs of relevant stakeholders
	Problem Analysis	15:30 – 16:30	Chaired by Engr. Md. A. Wadud Bhuiyan, Chief Planning, BWDB To organized problems and their causes related to upper Meghna river basin management
	Closing	16:30 – 16:40	Closed by Dr. Nilufa Islam, Director, WARPO

Program Participants

Participants	• WARPO (Director General, Director) • BWDB (Chief Staff Officer, Chief Planning, Director (Planning-I), Chief Engineer (Design), Chief Engineer (O&M), Sub Divisional Engineer (Chief Planning), Superintending Engineer (Chief Planning), Executive Engineer (Design), Executive Engineer (Sylhet), Executive Engineer (Netrokona), Executive Engineer (Chief Planning), Executive Engineer (Sunamganj O&M Division)) • BHWDB (Director General, Director) • LGED (Superintending Engineer (IWRM), Executive Engineer (SSWRDP), Senior Assistant Engineer, Senior Assistant Engineer (SSWRDP)) • CEGIS (Executive Director, Director (Water Resources Division)) • IWM (Deputy Executive Director) • JRC (Executive Engineer) • DoF (Assistant Director) • JICA Expert as Advisor on River Management • Project Formulation Advisor on Disaster Mitigation – Climate Change • JICA Study Team member (Participatory Development/ Employment Generation) • JICA Study Team member (Environment and Social Considerations) • JICA Study Team staff • JICA Study Team staff • JICA Study Team staff

3. Presentation as Introduction to the Workshop

Workshop on Needs and Problem Analysis for Upper Meghna River Basin Management

Date and Time: 27th October, 2010, 12:30 – 16:30
Venue: Director General's Conference Room, 2nd Floor, Bangladesh Water Development Board

Organized by:
Bangladesh Water Development Board &
JICA Study Team for Preparatory Study for Planning on Meghna River Basin Management Project

1

Introduction of JICA Study Team

- JICA Preparatory Study on Meghna River Basin Management has started from September and will finish in February 2011.
- The purpose of the Study is to analyze the needs to formulate series of potential projects and programs for the betterment of Upper Meghna river basin management.

2

Objectives of the Workshop

- To gather information on needs of the concerned stakeholders and problems they are facing
- To comprehensively analyze the problems regarding upper Meghna river basin management
- Clarify the areas of needs in the area and improvements to be made in upper Meghan river basin management.

3

Program Outline

Time	Session
12:30-12:40	■ Opening
12:40-13:00	■ Introduction of Participants ■ Introduction of the Workshop by JICA Study Team
13:00-14:00	■Lunch
14:00-15:30	■ Session 1: Stakeholder Analysis
15:30-16:30	■ Session 2: Problem Analysis

4

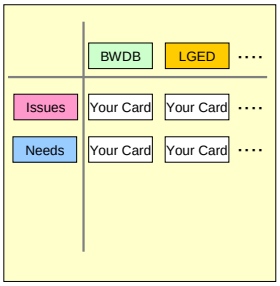
Sessions 1: Stakeholder Analysis

- To understand the problems the stakeholders are facing in upper Meghna river basin management (including Haor areas)
- To analyze the needs to solve the problems

5

Sessions 1: Stakeholder Analysis

- Participants are to write two cards:
  - Major issue they are facing in upper Meghna river basin and/ or Haor areas
  - Need of the organization to solve the issue



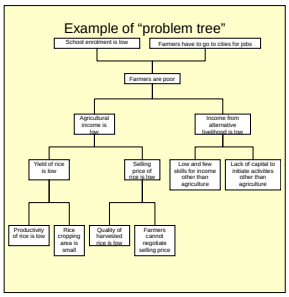
Sessions 2: Problem Analysis

- To identify and analyze problems of upper Meghna river basin management
- To establish a comprehensive "problem-tree" regarding upper Meghna river basin management

7

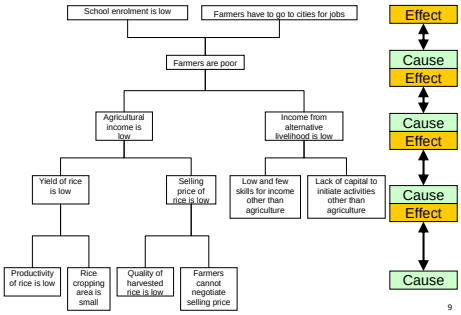
Sessions 2: Problem Analysis

- Participants are to:
  - Write one card about the most crucial issue regarding upper Meghna river basin management.
  - Discuss to analyze the cause-effect relationships between the problems to establish a "problem tree".



(continued)

Example of a “Problem Tree”



9

“Guiding Rules” for the Workshop

- Write own idea on the card
- Write one topic on each card
- Consent is to be obtained during the whole process
- Not to specify who wrote the card

10

“Guiding Rules” for Stakeholder Analysis

- Write only one “problem” or “need” on one card
- Write in a simple sentence (“There is no staff for operation and maintenance” rather than “Lack of manpower”)
- Write existing and actual facts rather than what may happen in the future
- Try to write detailed status of the problem rather than what is lacking (“No staff for operation and maintenance” rather than “lack of manpower”)

11

“Guiding Rules” for Problem Analysis

- Write only one “problem” on one card
- Write in a simple sentence (“There is no staff for operation and maintenance” rather than “Lack of manpower”)
- Write existing and actual facts rather than what may happen in the future
- Try to write status of the problem rather than what is lacking (“Residents cannot get medical treatment” rather than “There is no hospital in the area”)
- Try to write one particular problem rather than writing cause-effect on one card

Maintenance is inadequate
Skill of maintenance staff is low

rather than

Maintenance is inadequate because skill of maintenance staff is low

12

4. Result of Stakeholder Analysis

The results of Stakeholder Analysis are summarized below.

Main issues:

- Damage (to agriculture, transportation, etc.) due to flooding or flash floods
- Decrease in capacity of rivers due to sedimentation
- Lack of comprehensive data on hydrology, sedimentation, flood damage (agriculture, transportation, etc.)
- Difficulty in dealing with river basin areas which are outside of Bangladesh

Main needs:

- Dredging of rivers
- Rehabilitation and raising of submergible embankments
- Implementation of comprehensive study on Meghna river basin
- Regional cooperation with relevant agencies in upper riparian country of Meghna river

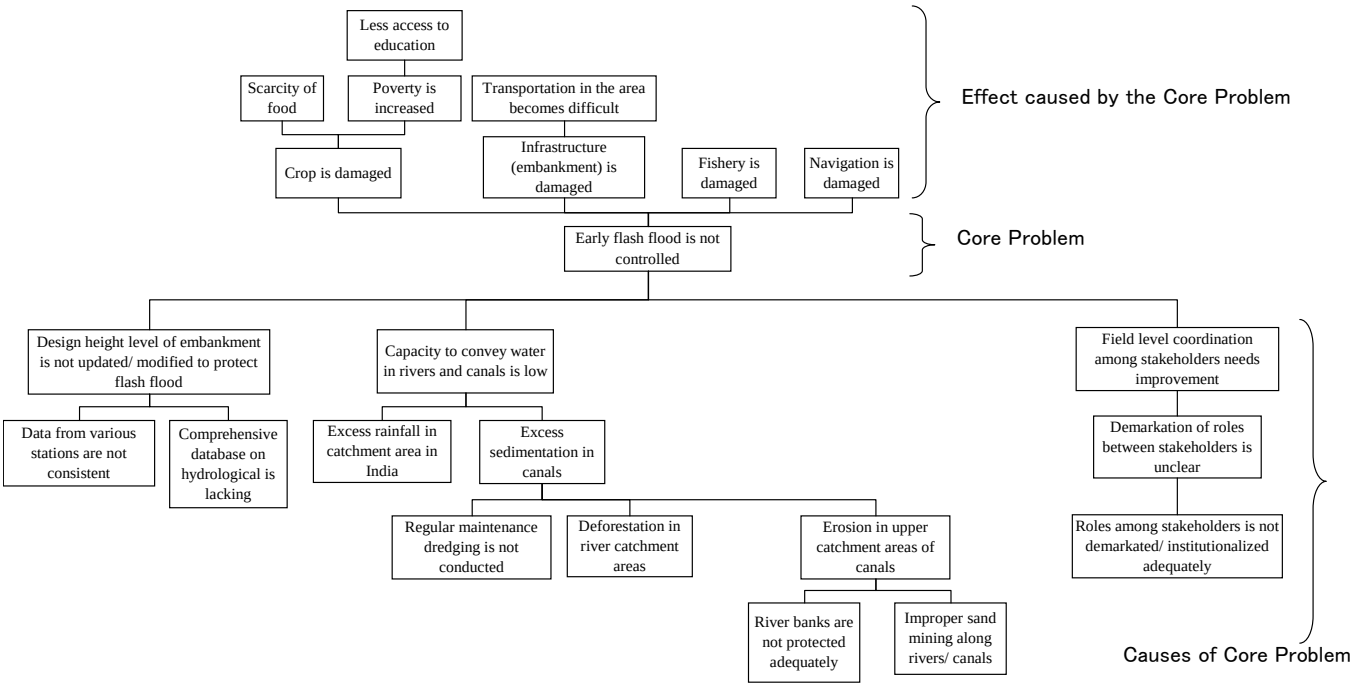
Detailed opinions of issues and needs are given below:

	BWDB	LGED	WARPO	BHWDB	IWM	CEGIS	JRC
Issues	Livelihood of the people is low	Lack of flood forecasting data	Lack of coordination among the stakeholders, as there are many stakeholders engaged in the water sector	Siltation problem	Consistent data on hydrology lacking	Agricultural production is low	Problem by upper riparian country during development works of common rivers in Meghna river
	Delay of water discharge from Haor areas	Accesibility problem during flood		Height of the submergible embankment is inadequate		People do not have enough housing area	
	Inundation of Haor area	Lack of data regarding siltation		Flash food		Degrading bioderversity	
	Narrow passage to drain water from Haor areas	Bank erosion is severe in Meghna river		Crop damage		Early flood	
	Excessive sedimentation			Lack of irrigation facility		People are poor	
	Reduction of water conveyance capacity in rivers			Environmental pollution		Bad communication	
	Crop damage			Health and education problem			
	Boro crop is damaged						
	Stakeholders participation						
Needs	Urgently rehabilitation is necessary in Netrokona	River bank protection is required	Needs to find out the mechanism of integration and monitoring system for better management	Increment of the submergible dyke is required	All stations should gather data in consistent manner	Crop diversification is needed	Regional cooperation with upper riparian country
	Food security needs to be ensured	Dredging is required		Masterplan required	Comprehensive studies needed on hydrology	Flood protection for houses	
	Dregding required			Dredging of the following rivers: Surma, Bowlie River Kalni-Kushiara River Monu River Kongsha River Sumaswari River Jadukata River Khowai River Meghna River	Bench mark fixing is required	Forest resources should be restored	

	BWDB	LGED	WARPO	BHWDB	IWM	CEGIS	JRC
	Finanacial assistance required			Design hight level of all the submersible embankment should be increased up to 8m from the sea-level		Flood protection	
	Rehabilitation of submergible dyke is required			Construction of embankment should be block pitching in river side and tree plantation in country side		Alternate livelihood needed	
	Desiltration is required			Compartmentation of Haor area by embankment as per the geographical contour		Communication facility is needed	
	Excavation is required			Boat passing and fish passing should be constructed permanent in nature			
	Proper management of the embankment is required			Food for education and sufficient education facilities, teacher housing, transporartion for students are necessary			
	Lack of O&M fund			Crops insurance policy may be established			
	Master Plan is required for Meghna river basin			Proper accommodation for doctors, maternity hospital staff, river ambulance for evacuation of patients are necessary			
	Protection is needed in terms of soft and hard measure			Eco-friendly infrastructure may be developed			
	Regional dialogue and coordination (including India) is required as the large portion of catchment area of Meghna is outside Bangladesh			Early warning system of flood forecasting should be developed			

5. Result of Problem Analysis

Problem Analysis was conducted among the participants and the “problem tree” for upper Meghna river basin management was formulated as below:



6. List of Participants

Sl. No.	Name	Designation	Organization
1	Md. Kamrul Islam	Senior Assistant Engineer (Participatory Small Scale Water Resource Sector Project)	LGED (Local Government Engineering Department) Dhaka
2	M.A. Kashem	Chief Engineer, Design	BWDB (Bangladesh Water Development Board)
3	Abu Saleh Khan	Deputy Executive Director	IWM (Institute of Water Modeling), Dhaka
4	AKM Shafiqul Haque	Executive Engineer	BWDB, Sylhet
5	Major Golam Kibria Khan Chowdhury	Director General	BHWDB (Bangladesh Haor and Wetland Development Board)
6	Eng. Md. Rowshan Ali	Director	BHWDB (Bangladesh Haor and Wetland Development Board)
7	Eng. Md. Harun-Ar-Rashid	Executive Engineer	BWDB (Bangladesh Water Development Board), Netrokona
8	Fazlur Rashid	Executive Engineer, Office of the Chief Planning	BWDB (Bangladesh Water Development Board)
9	Md. Mahmudur Rahman	Executive Engineer	JRC (Joint River Commission), Dhaka
10	Md. Azharul Islam	Director, Planning1	BWDB (Bangladesh Water Development Board)
11	Md Jahangir Kabir	Executive Engineer., Design Circle	BWDB (Bangladesh Water Development Board)
12	Robin Kumar Biswas	Sub Divisional Engineer, Office of the Chief Planning	BWDB (Bangladesh Water Development Board), Dhaka
13	Md. Sarafat Hossain Khan	Executive Engineer, Office of Chief Planning	BWDB (Bangladesh Water Development Board), Dhaka
14	Giasuddin Ahmed Chowdhury	Executive Director	CEGIS (Center for Environmental and Geographical Information Services)
15	Dhali Abdul Quium	Chief Engineer, O&M	BWDB (Bangladesh Water Development Board), Dhaka
16	Md. Sarafat Wahed	Director, Water Resources Division	CEGIS (Center for Environmental and Geographical Information Services)
17	S.M. Ataur Rahman	Executive Engineer	BWDB (Bangladesh Water Development Board), Dhaka
18		JICA Expert (Advisor on River Management)	BWDB (Bangladesh Water Development Board)
19	S.M. Shaidul Haque	Chief Staff Officer	BWDB (Bangladesh Water Development Board), Dhaka
20	Obaidur Rahman	Superintending Engineer, Office of CP	BWDB (Bangladesh Water Development Board), Dhaka
21	Md. Moshiur Rahman	Superintending Engineer	LGED (Local Government Engineering Department)

Sl. No.	Name	Designation	Organization
			Dhaka
22	Md. Abdur Rouf	Senior Assistant Engineer	LGED (Local Government Engineering Department)
23	Dr. Nilufa Islam	Director	WARPO (Water Resources Planning Organization)
24	Md. Abdus Salam Mandal	Executive Engineer, Small Scale Water Resources Development Project	LGED (Local Government Engineering Department) Dhaka
25		Project Formulation Advisor	JICA
26		Program Officer	JICA
27	Eng. Sailen Chandra Paul	Executive Engineer	BWDB (Bangladesh Water Development Board) Sunamganj O&M Division
28	Dr. Md. Sainar Alam	Assistant Director	Department of Fisheries
29	Dr. M A Taher Khandaker	Director General	WARPO (Water Resources Planning Organization)
30	Engr. Md. A. Wadud Bhuiyan	Chief Planning	BWDB (Bangladesh Water Development Board), Dhaka
31		Environmental and Social Considerations	JICA Study Team
32		Participatory Development/ Employment Generation	JICA Study Team
33		Survey Assistant	JICA Study Team
34		Survey Assistant	JICA Study Team
35		Survey Assistant	JICA Study Team