2-2-4 Implementation Plan

2-2-4-1 Implementation Policy

The construction under the Project will be construction of "RCC inverse T-type retaining walls" and equipment and materials necessary for the construction works will be procured in the model sites in 4 districts situated in Haor area where even roads are submerged leaving only mounds during 6 to 7 months a year. LGED is the implementing agency of the Project, and each of the LGED district offices in 4 districts situated in Haor area and each of Upazila offices located in each of the model site under the jurisdiction of each district office are in charge of the Project implementation. This project falls in the category of a facility construction covered under Japan's Grant Aid Scheme where a lump-sum contract is to be applied. In this regard, no engineer of specific disciplinary field is required since concrete work consists major part of the construction works.

2-2-4-2 Implementation Conditions

(1) Construction period

Though there are some differences in the inundated period in Haor area depending on the ground elevation, water levels in the rivers in general begin to rise from around April and spread water makes Haor area widely inundated in May to June. The workable period for construction works at each model site is listed in the following Table 2-28 in this Project;

Table 2-28 Workable period

Village	Workable period for construction works		Remarks
Sazan	December 15th - May 15th	5.0 months	Land transport is available for 1 month before and after the specified workable period
Gurai	December 15th- May 15th	5.0 months	ditto
Lipsha	December 1st - April 30th	5.0 months	ditto
Nazarpur	January 1st - March 31st	3.0 months	ditto

(2) Establishment of Construction management office and staffing of residential supervisor

Traffic conditions among each site are too poor to manage and control works in all the sites by stationing in a site. To cope with such situation, a base management office shall be established at Sazan village in Habiganj District and also site management offices are placed at each of the rest sites. At the same time, from the aspect of schedule and quality control for the works simultaneously implemented at 4 model sites during dry season, 4 Japanese engineering supervisors and 1 clerk supervisor shall be staffed under Japanese chief supervisor (in total 6 members).

(3) Cost to be regarded including social insurance fee etc.

The premium rate of social insurance in Bangladesh is 5% of the basic payment. Also, for supervising staff and skilled laborers, it is a requirement to pay such allowances as commutation and remote working in addition to basic wage.

(4) Cabinet approval for selecting consultants

In Bangladesh, any contracts other than contracted by tenders are subject to the cabinet approval prior to the signing, and it takes about 2 to 4 weeks for this approval. Therefore, project construction schedule shall be planned taking this into account.

(5) Utilization of well water

Potable water in 4 model sites relies on groundwater. Groundwater irrigation is popularly carried out during dry season. When groundwater is used for construction works, attention shall be paid to possible draw-down of groundwater level and deterioration of water quality so as not to negatively affect livelihood of the inhabitants.

(6) Land acquisition and lease

Stockyards for concrete aggregates will be provided by LGED on the basis of free of charge. In this connection, the following areas are required for temporary yard in each site;

(a) Construction roads : a yard as large as" the width of road 4m×length of construction road" is necessary at each village along the routes of retaining walls,

(b) Stockyards :
1) Primary stockyard: a stockyard is necessary around the ghat to temporarily stock the materials unloaded from cargo ferries,
2) Secondary stockyard: stockyards are necessary at every 100m along the planned retaining wall to mix concrete and to stock concrete materials (aggregates, cement and reinforcing rods required for constructing 100m of retaining wall).

(c) Office and warehouse : Space for yards is needed to establish construction management office and warehouse at each model site.

(d) Cement hut and working hut (manufacturing forms and processing reinforcing rods):
: a yard is necessary at each site to install cement hut and a working hut to manufacture forms and to process reinforcing rods.

(e) Pile manufacturing yard : A yard is necessary at Lipsha to manufacture RC piles at the site.

Table 2-29 Summary for yards

Model site	Sazan	Gurai	Lipsha	Nazarpur
(a) Construction roads	9,220m^2	6,100m^2	2,900m^2	2,640m^2
(b) Stockyards				
1) Primary stockyard	1,000m^2×1site	1,000m^2×1site	1,000m^2×1 site	1,000m^2×site
2) Secondary stockyard	450m^2×23 sites	450m^2×15 sites	450m^2×7 sites	450m^2×6 sites
(c) Office and warehouse	550m^2×1 site	300m^2×1 site	300m^2×1 site	300m^2×1 site
(5) Cement hut + working hut	670 m^2×2 sites	670 m^2×2 sites	670 m^2×1 site	670 m^2×1 site
(6) Pile manufacturing yard	—	—	1,600m^2×1site	—
Total	12,460m^2	8,520m^2	6,920m^2	4,060m^2

2-2-4-3 Scope of Works

(1) Scope of construction work

Scope of works in implementing the Project under Japan's Grant Aid Scheme as divided into the works borne by Japanese side and those borne by Bangladesh side is listed in Table 2-30.

Table 2-30 Scope of works

Items	Works borne by Japanese side	Works borne by Bangladesh side
1) Preparatory work	Order / application of construction materials / equipment, domestic transportation of construction machines, procurement of engineers and skilled / unskilled laborers	—
2) Temporary work	Construction / withdrawal of stock-yards, cement huts, site management offices, restriction fencing, stock-yards and temporary roads	Land acquisition of required land space (private land and state-owned land)(inclusive of land compensation)
3) Material transport	Transportation of aggregates, stone material, cement, reinforcing rods, brick etc. from producing sites to the construction sites	—
4) Earth work	Excavation of foundation for retaining walls, sand replacement of foundation, disposal of spoil, back-filling of retaining walls, excavation of earth for filling	Procurement of all the land space related to the Project (including compensation for land acquisition)
5) Retaining wall construction	Retaining wall construction, manufacture of foundation piles	Procurement of all the land space related to the Project (including compensation for land acquisition), concrete test
6) Appurtenant work	Foot protection works, terrace step work and installation of staff gauges	Procurement of all the land space related to the Project (including compensation for land acquisition)
7) Water supply	Construction / withdrawal of temporary water supply facility for construction works (using either river water or groundwater)	—
8) Electric supply	Construction / withdrawal of electric generation facility for construction works	—
9) Communication facility	Construction / withdrawal of temporary communication facility for construction works	Communication facility inside management facility office and connection with outer network
10) Banking Arrangement (B/A) and Authorization to Pay (A/P) commission	—	Payment of B/A, A/P commission
11) Custom duties and domestic taxes imposed to products and services	—	Exemption or bearing of payment for taxes imposed to Japanese staff
12) Adequate use of facilities and O/M	Assistance of manual provision on implementation supervision and O/M	Adequate use of facilities constructed by this Grant Aid Scheme and provision of manual on implementation supervision and O/M

(2) Procurement plan of equipment and materials

Scope of procurement of equipment and materials is shown in Table 2-31.

Table 2-31 Scope of procurement of equipment and materials

Items	Scope of procurement			Reason of allocation	Remarks
	Bangla	Japan	3rd country		
1.Construction materials and equipment					
1) Sand	○			Cost / quality	
2) Fine/ coarse aggregates	○			Cost / quality	
3) Cement	○			Cost / quality	
4) Reinforcing rods	○			Cost / quality	
5) Bricks	○			Cost / quality	
6) Mixing agent	○			Cost / quality	
7) Stone materials	○			Cost / quality	
8) Wood	○			Cost / quality	
9) Plywood / veneer	○			Small quantity	
10) Steel scaffold pipe/board	○	○		Small quantity	Some parts procured in Japan
11) Form materials of parts	○	○		Cost / quality	Some parts procured in Japan
12) Water stop	○			Cost / quality	
13) Joint filling material	○			Small quantity	
14) Slip bars	○			Cost / quality	
15) Petrol, kerosene, oil	○			Available in local	
2.Construction machines					v. = volume
1) Backhoe loader	○			Cost / quality	Rental in local 0.6m^3
2) Tractor	○			Cost / quality	Ditto, 2t (for agriculture)
3) Crane truck	○			Cost / quality	Ditto, 2.9t hanging
4) Vibrating roller	○			Cost / quality	Ditto, 1ton scale
5) Rammer	○			Cost / quality	Ditto
6) Reinforcing rod cutter	○			Cost / quality	Ditto, 15m^3/h
7) Reinforcing rod processor	○			Cost / quality	Ditto
8) Welder	○			Cost / quality	Ditto, engine type
9) Concrete vibrator	○			Cost / quality	Ditto
10) Concrete mixer	○			Cost / quality	Ditto, drum v. 0.3m^3
11) Concrete pump	○			Cost / quality	Ditto
12) Concrete breaker	○			Cost / quality	Ditto
13) Air compressor	○			Cost / quality	Ditto, 5m^3/min.
14) Submersible pump	○			Cost / quality	Ditto, diameter 2'
15) Electric generator	○			Cost / quality	Ditto, 50kVA
16) Passenger car	○			Cost / quality	Pick-up
17) Speed boat	○			Cost / quality	

2-2-4-4 Consultant Supervision

(1) Content of services and staffing plan of the consultant in D/D

Since the Project is to be implemented as an A-type national bond project, implementation design includes detailed design and provision of tender documents, covering the following services. Also, as staffing, six(6) Japanese consultant engineers shall be placed, namely 1)chief engineer who is in charge of superintending overall control of the entire services, 2)an engineer in charge of construction design, 3)an engineer in charge of cost estimation, 4)an engineer in charge of tender documents 5)a cartographer and 6)technical staff.

1) Geological survey, soil mechanics tests and detailed design,
2) Re-examination of the estimation conducted at the B/D study,
3) Provision of detailed drawings and tender documents etc.

In this regard, Swedish sounding survey is applied as the geological survey, the planned content and quantity of which is indicated in Table 2-32.

Table 2-32 Outline of sounding survey

Model site	Length of retaining wall	Studied depth	Number of sites
1. Sazan	2,305 m	5m	24 sites
2. Gurai	1,525 m		16 sites
3. Lipsha	725 m		8 sites
4. Nazarpur	660 m		7 sites
Total	5,215 m	−	55 sites

(2) Implementation supervision System by the consultant

Five(5) Japanese consultant staff will be planned for the members of supervising works including 1)chief supervisor, 2)construction design engineer, 3)supervision engineer, 4)resident supervisor and 5)construction engineer (spot). In addition, three(3) local engineers will be employed. The contents of supervision are as follows;

1) Delegated tender services, tendering evaluation and witness of contracting negotiations, consultation with LGED,
2) The overall supervision on construction works, inspection of finished work quality, advice on adjustment, work schedule, quality, measures of safety control,
3) Approval of construction drawings and design change, and
4) Completion inspection, etc.

2-2-4-5 Quality Control Plan

Taking account of outer organizations that can undertake the entrusted tests related to quality control are only located in each district town in Haor area, also that almost day-to-day test for concrete compression strength is necessary, the said test will be tested in a test room established in the site. The contents of quality control is indicated in Table 2-33.

Table 2-33 Contents of quality control

Work	Control Item	Method	Frequency
Cut-off	soil condition width, height	visual observation measuring size & height	for each of major parts for each of major parts
Pile foundation	bearing capacity	dynamic impact load test	every 30m
Concrete	aggregates cement fresh concrete concrete strength	grain size analysis physico-chemical tests slump test compression strength test	twice; 1st year and 2nd year twice; 1st year and 2nd year once a day, by production group once a day, by production group
Reinforcing rod	strength bar arrangement	stress strength bar arrangement inspection	twice; 1st year and 2nd year by cast part
Finished work quality of structure	size of finished work quality	measurement of size	by major material

2-2-4-6 Procurement Plan

(1) Materials

Common construction materials including cement, sand, stone materials, reinforcing rod, wood etc. can be purchased in Bangladesh. The places of procuring major materials use for concrete works are shown in Table 2-34. Procurement thereof in the third country or Japan is not planned except a part of materials such as separator which is used in form work.

Table 2-34 Procuring places of construction materials

Materials	Production area	Candidate place to procure materials
Sand	Sylhet district, Sunamganj district and in the vicinity of Indian border	Jamiganj,Jagannatpur and other area
Crushed stone		Jagannatpur and other area
Cement	Dacca, Sylhet, Chittagong and other places	Bhairab and Sylhet
Reinforcing rod	Dacca, Chittagong	Bhairab
Brick	Dacca, Chittagong, and Gajipur	Bhairab

(2) Construction machines

Since construction machineries are difficult to procure in and around each construction site, these will be procured in Dhaka and carry them to Bhairab by land transportation, then distributed to each construction site by cargo ferries. In this regard, the machineries will be rented only during workable period for construction works because the works are carried out for two consecutive dry season separated by a submerged period during a rainy season. It follows that the rent construction machines will once be returned soon after the completion of construction works during the dry season in the 1st year, and these will again be rented in the following dry season in the 2nd year.

2-2-4-7 Implementation Schedule

As the target villages of the Project are located in Haor area where land is inundated for about 6 months in a year, it has been judged that the construction work should be implemented in two dry seasons. Accordingly, the Project shall be implemented as an A-type national bond project that separates D/D from the main works. In this connection, assuming that cabinet decision for D/D is made in November (Exchange of Note :E/N in January) and that for the main works in next April (E/N in May), the work schedule shall be planned as shown in Fig. 2-18. In this schedule, the work period of main works will be scheduled for 20.5 months (including interrupted period by inundation).

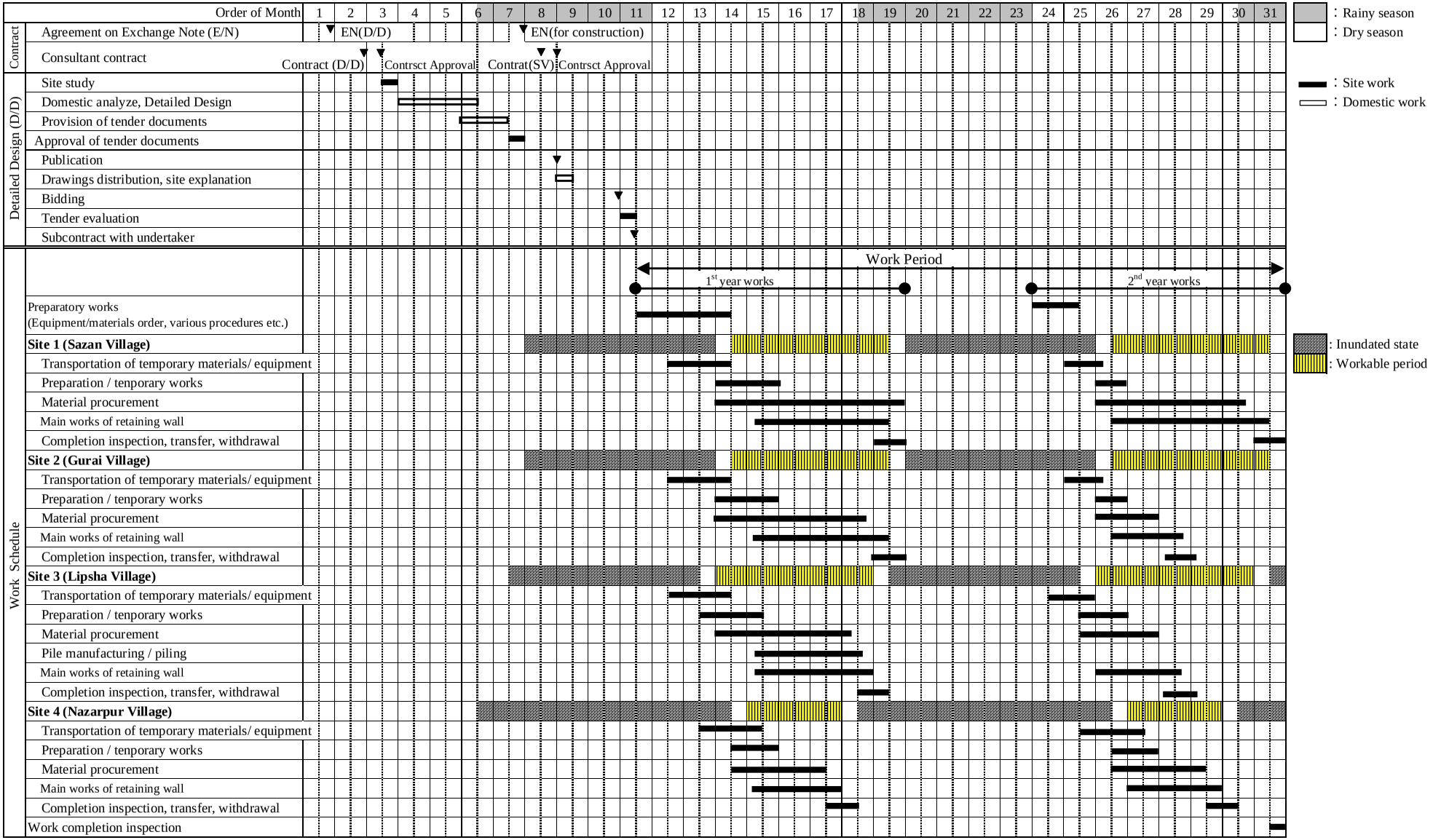


Fig. 2-18 Work Schedule of the Project

2-3 Obligations of the Government of Bangladesh

In the case that this Project is implemented as a Japan's Grant Aid Scheme, the outline of the works borne by the side of Bangladesh is listed as follows;

(1) Items to be borne before, under and post construction stage by the side of Bangladesh

1) Payment of the cost for environmental examination,
2) Provision of data and information required for D/D study conducted by Japanese consultant,
3) Payment of the commission necessary for the procedure of issuing Banking Arrangement (B/A) and document of Authorization to Pay (A/P),
4) Acquisition and provision of land for stockyards, cement huts, site management offices and temporary works including temporary access roads etc. (also inclusive of cost for land compensation),
5) Acquisition and provision of land for constructing retaining walls including their foundation works, and for filling at the backside of the walls (also inclusive of cost for land compensation),
6) Acquisition and provision of land for such appurtenant woks as constructing for foot protection work, stair works, installation of staff gauges (also inclusive of cost for land compensation),
7) Extension of communication line to the site management offices used for construction purpose,
8) Tax exemption or substitute payment in the case of imposition of custom / excised duties and domestic taxes in Bangladesh on the services by Japanese engineers participated in the Project,
9) Provision of supervision and O/M manuals for the facilities constructed by the Grant Aid, and
10) Adequate utilization and O/M of the facilities constructed by the Grant Aid.

(2) Non-structural measures

Wave erosion in the mounds will be controlled through the construction of protection walls at 4 model sites in each district in Haor area owing to this Grant Aid Scheme, thus mitigating threatening of wave damages to the villagers. However, the implementation of the Project will not directly bring about the benefit of income generation in spite of such benefits of the Project in the form of consolidated infrastructure allowing alleviation of the expenses on measures against wave erosion borne by them, prevention of flood engulf of house buildings and livestock and increase of opportunities for seasonal migration works, just because they don't have efficient means of livelihood improvement. Hence, the application of non-structure measures directly bringing livelihood betterment will become indispensable to maximize the benefit of the Project. Considering these measures essential to enhance the fruit of this Project, accordingly, LGED will carry out "non-structural measures" making an efficient use of the counterpart fund and tuning up with this Grant Aid Scheme, as shown in Table 2-35.

Table 2-35 Contents of non-structural measures

Non-structural measures	Contents
1. Skill training for livelihood improvement	Most of the villagers in Haor area are peasants with 0.2ha or smaller land. In the rainy season, many of them become jobless situation without cropping due to inundation. In order to support livelihood activities during the rainy season, skill techniques will be instructed for the villagers on farming techniques, sale of farm products, sewing, bamboo handicraft, fishing gear manufacturing, poultry, dairy farming and home gardening.
2. Training on literacy and hygiene education	Literacy rate in Haor area remains low as compared to the national average, placing obstacles on skill training and extension of livelihood improvement. Literacy education is provided to remove obstacles. In addition, education on hygiene related to potable water / sewage and also on family planning.
3. Input of micro-credit	Micro-credit is granted to the volunteers out of people who completed skill training to support their livelihood improvement activities. Upazila staff provides technical support for livelihood improvement activities and collection of interest of the credits.
4. Assistance for medical services	Since number of medical facilities in Haor area is limited, medical centers are established at each Union to launch medical support by mobilizing NGOs and to offer free medicament towards the poor.

2-4 Project Operation Plan

2-4-1 Operation and Maintenance System and Staffing

As indicated in Policy-3 (page 2-8) and Policy-17 (page 2-15), existing staff of LGED district offices and existing equipment shall effectively be mobilized for the management and O/M of the Project. Upazila offices under the umbrella of the LGED district offices will directly manage and maintain "RCC inverse-T type retaining wall" to be constructed at each model site based on the O/M manual provided by this Grant Aid Project. Likewise, Each of LGED district offices will extend the construction of "retaining wall" to Haor area by making use of supervision manual provided thereby.

In this regard, project management office (PMO) established in Habiganj District will not only play a role of coordinating office among 4 LGED district offices and Japanese consultant / constructor, but also will serve as a base of "non-structural measures", the project borne by the side of Bangladesh during the Grant Aid Scheme.

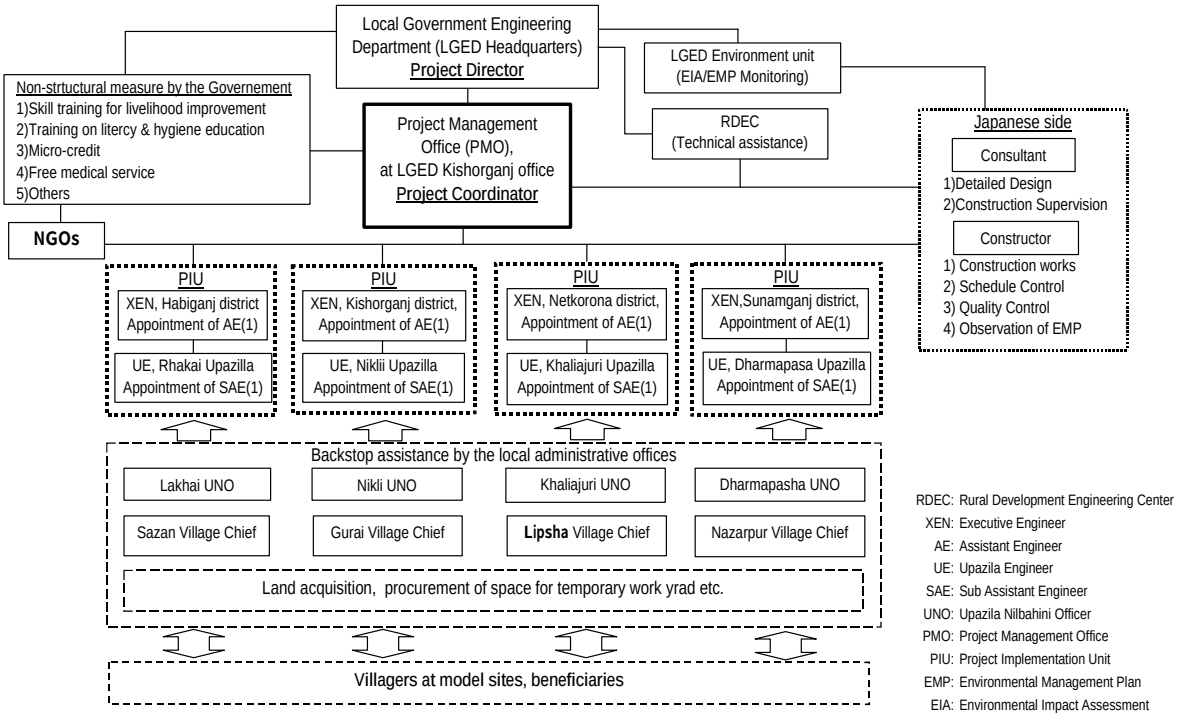


Fig. 2-19 Management and O/M system of the Project

2-4-2 Contents of Operation and Maintenance Works

Since the main work of the Project is concrete casting, almost no O/M is necessary. However, foot protection work is applied with brick pavement and mortar jointing to the 3 model sites except for Gurai Village (Kishoreganji District) in order to protect from scouring by surf during rainy season. Installation of foot protection leads to a requirement of regular O/M and partial repair works. Besides, considering further extension into Haor area, the expected contents of O/M are summarized in Table 2-36.

Table 2-36 Contents of O/M

Item	Village	Length	Contents of O/M
1. Foot protection work	1) Sazan	1,235 m	Every year after recessing submerged water, LGED Upazila office confirms broken parts of the foot protected in each model site, to do maintenance according to need
	2) Gurai	0 m	
	3) Lipsha	170 m	
	4) Nazarpur	150 m	
2. Staff-gauge records management	Each 1 site in 4 model sites		Monitoring of staff gauges and recording of water level data are sustained on daily basis by hiring villagers at each model site
3. Filling of front / rear side of retaining walls	The entire model sites		If front side or back side filling of the retaining wall is eroded by yearly wave, refilling is made (mobilizing villagers) to secure footing depth of the retaining wall

2-5 Project Cost Estimation

2-5-1 Initial Cost Estimation

The estimated approximate Project Cost of the Grant Aid Project is given below;

(1) Overall Project cost : around 1,163 million yen

(2) Project cost to be undertaken by Japan : around 1,060 million yen

Table 2-37 Cost borne by Japan's Grant Aid Scheme (million yen)

Item				Estimated project cost
Facility construction works	Wave Protection Appurtenant works	Sazan Village	L=2,305m	973
		Gurai Village	L=1,525m	
		Lipsha Village	L=725m	
		Nazarpur Village	L=660m	
Detail Design and Supervision				87

(3) Project cost to be undertaken by the Bangladesh side: around 102.8 million yen

Table 2-38 Cost borne by the Bangladesh side

Item	Local currency (million Tk.)	Japanese yen (million Yen)	Remarks
1) Land procurement for temporary works	0.0	0.0	These land are donated by villagers
2) Land procurement for main works	0.0	0.0	
3) Banking agreement, Authorization to Pay	17.9	31.8	3% of the Project cost
4) Tax	29.5	52.5	10% of design cost and 4.5% of the Project cost
5) Cost of environmental examination	0.4	0.7	4 model sites
6) Cost of non-structural measures	10.0	17.8	50 million Tk / 5 years
Total	57.8	102.8	

(4) Conditions of Estimation

1) Time of estimation : November 2006
2) Currency exchange rate : 1 US$ = 117.93 Japanese Yen
   1 Tk. = 1.78 Yen, (Tk. is local currency unit in Bangladesh)
3) Implementation period : Project period is given in the work schedule (20.5 months)
4) Others : This cost estimate is provisional and would be further examinated by the Government of Japan for the approval of the Grant.

2-5-2 Operation and Maintenance Cost

Operation and Maintenance (O/M) cost of retaining wall constructed by the Project is given in Table 2-39.

Table 2-39 O/M costs

Model site	a) Foot protection work (thousand Tk.)	b) Data management of water-level gauges (thousand Tk.)	Filling at the front/rear side of protection walls
1. Sazan	1,080	20	No cost evolves from the work because the villagers undertake it
2. Gurai	—	20	
3. Lipsha	150	20	
4. Nazarpur	130	20	
Sub-total	1,360	80	—
Total a)+b)		1,440 thousand Tk.	About 2.6 million yen

O/M budgets by fiscal year for the maintenance of infrastructure including local roads, culvert, irrigation facilities etc. managed by each LGED district and Upazila offices are given in Table 2-40. The total budget of O/M in 4 districts in Haor area was 115.9 million Tk. (approx. 197 million Yen) in fiscal year 2004/05. This budget shows as high escalation rate as that of the budgets of development projects and O/M cost of this Project will be allocated from this budget. The estimated O/M cost, 1,440 thousand Tk. (approx. 2.6 million J.Yen) accounts for only 1.3% of the total budget amount for O/M in 4 districts in fiscal 2004/05, implying within the affordable amount.

Table 2-40 Budget for O/M of 4 LGED district offices and each target Upazila office

(Unit: Million Tk.)

Fiscal year	2000/01	2001/02	2002/03	2003/04	2004/05	2005/06
1. Habiganj District	15.50	17.50	19.00	25.00	27.00	n.a.
2. Kishoreganj District	16.10	17.50	25.00	25.23	31.50	35.00
3. Netkorona District	n.a.	14.80	13.10	21.00	32.60	31.50
4. Sunamganj District	n.a.	20.00	17.50	23.00	24.80	32.00
Total	**-**	**69.80**	**74.60**	**94.23**	**115.90**	**-**
					J.Y 197million	
Comparison with 2001/02	-	100%	107%	135%	166%	-
Annual growth rate	-	-	7%	26%	23%	-

2-6 Other Relevant Issues

(1) Environmental Clearance Certificate

In Bangladesh, Environmental Clearance Certificate (ECC) is required for project implementation. Although this Project is placed in Category B according to LGED, it can be also placed in the Red Category in reference to the Environment Guidelines published by the Department of Environment (DOE, Bangladesh). LGED is requested to immediately clarify this matter, for if it is placed in the Red Category, not only Initial Environmental Evaluation (IEE) but also Environmental Impact Assessment (EIA) must be conducted to gain approval for ECC from the DOE. Immediate acquirement of ECC is a prerequisite to implementation of this Project.

(2) Land acquisition

For construction of RCC inverse T-type retaining wall, a certain width of land has to be procured. LGED postures that since the inhabitants are expressing significant expectation to this Project and they are the direct beneficiaries, it is necessary to procure land through a council system among them and there will be no monetary land acquisition. However, if no agreements were reached with landowners and leaseholders, any workshop for inhabitants' council upon determination of design of retaining wall routes must be held because it takes four months at a maximum for acquisition procedures.

(3) Budgetary Steps for the Works undertaken by Bangladesh

For implementation of the Project, LGED needs to bear the commission necessary for the procedure of issuing banking arrangement, tax for project implementation, and cost for non-structural measures, etc. Total costs borne by LGED will be 57.8 million Tk. (approx. 103 million yen). Although this is only 0.2% of their annual budget for development works at the local development sector (25,806 million Tk., fiscal year 2004/2005), they are required to certainly contribute funding to the Project.

Chapter 3 Project Evaluation and Recommendations

Chapter 3 Project Evaluation and Recommendations

3-1 Project Effect

3-1-1 Direct Effect

(1) Direct effect of the Project

Direct effects of the Project are “wave erosions in mounds at the model sites are prevented (Direct effect-1)” and “LGED acquires techniques to construct effective wave protection wall (Direct effect-2) shown in the Table 3-1.

Table 3-1 Direct effects of the Project

Expected outputs	Current status and problems	Activities under the Project	Objectively verifiable indicators
Wave erosions in mounds at the model sites are prevented (Direct effect-1)	Inhabitants prevent wave erosion by using bamboo or stone materials during the rainy season, annually spending 1,500 Tk./household. However, the edge of their mound is receding by 40cm/year and not only their living environment is deteriorated but also houses washed out and livestock is damaged.	To construct wave protection wall for preventing wave erosion (Total length: 5,215 m).	1) Erosion of the edge of the mounds (40cm/year) will stop. 2) Expenses for wave protection measures (1,500Tk. /household) will be reduced. 3) Damages (houses, livestock) by wave action will be reduced.
LGED acquires techniques to construct effective wave protection wall (Direct effect-2)	LGED has enhanced their technical capabilities, accumulation of know-how, and organizational structure through infrastructure improvement projects and has also constructed “wave protection wall” for preventing wave erosion” in Haor area. However, LGED has limited experience in designing and constructing “RCC inverse-T type retaining wall” on soft ground.	LGED has an experience of constructing “RCC inverse-T type retaining wall” on soft ground through the Project.	Design and O/M manuals for construction of “RCC inverse-T type retaining wall” will be formulated in order to extend to Haor areas other than the model sites.

(2) Evaluation of Outputs

(a) Eroded area in mounds

Cross sectional surveys have been carried out along the proposed route of wave protection wall at the interval of 50 m during B/D field survey. Comparing the cross sections before and after construction of retaining wall, increasing or decreasing of eroded area in mounds can be identified.

(b) Cost for erosion control measures and damages on houses, livestock, etc. by wave action

Table 3-2 shows data of cost for erosion control measures from interview of inhabitants and damages by wave action in 2004 from LGED Upazila Offices are obtained by baseline survey. By conducting the survey again after implementing the Project, reduction of cost for erosion control measure and flood damage can be confirmed.

Table 3-2 Results of the baseline survey on the indicators of outputs

Model Site	Cost for erosion control (Tk./year)	Flood damage in 2004		
		House (number)	Livestock including cattle, goat, sheep (number)	Poultry including chicken, duck (number)
1. Sazan	1,240	150	20	50
2. Gurai	1,330	5	9	50
3. Lipsha	2,870	10	0	20
4. Nazarpur	610	6	55	120
Average (Total)	1,500	(171)	84	240

3-1-2 Indirect Effect

"Base for inhabitants is prepared to improve their living standard at the model sites" is expected as an indirect effect.

(1) Extended area of mounds

Living environment will be better by that population density is reduced through increasing area of mounds by earth filling along the backside of the wave protection wall (land space between the wall and mounds) by the inhabitants after the construction of wave protection wall.

(2) Rate of seasonally migrating workers and the period of seasonal migration

The villagers in the four(4) model sites are either engaged in fishing around their villages or migrant workers during rainy season because they cannot continue farming after the submersion of their farmland. However, 41% of non-migrant workers and 84% of migrants believe "pressure of wave erosion measure is disincentive of engaging migrant workers" with shortening the period of leaving their villages and worrying remained their family members and houses, etc. attacked by wave action. It is expected that a number and duration of migrant workers in Lipsha and Nazarpur villages being reduced by constructing of wave protection wall under the Project, of which indicators are shown in Table 3-3. In other hand, Sazan and Gurai villages are located at accessible local roads to communicate urban area where can be able to have high demand of employing opportunities, therefore, this effect is not expected in the Sazan and Gurai villages.

Table 3-3 Indicators for indirect effect of the Project

Indicator for outcomes	Current value: Rate of migrant workers (2006)	Planned value (2009)
Rate of seasonally migrating workers increases in Lipsha and Nazarpur*	1) Lipsha : 67% 2) Nazarpur: 53%	Being increased

*) Rate of migrant workers for a long term will not increase in Sazan and Gurai villages because they have employment opportunity in neighboring.

3-1-3 Other Anticipated Effect

In the four(4) model sites, the number of villagers who left their villages due to erosion of mound, is expected to return, when the area of mounds is extended and the living environment is improved through earth filling along the backside of the wave protection wall by inhabitants.

3-2 Recommendations

3-2-1 Recommendations for the Bangladesh side

LGED is the most reliable organization in government agencies in Bangladesh in partnership with international organizations and donors in the aspects of engineering, staff and budget allocation, project implementation and O/M, etc. And also, LGED steadily executes allocation of the budget for the purposes such as staffing, equipment, O/M and so on to the 64 district offices and the Upazila offices located all over the Country. Therefore, it is assured that O/M will be properly done to the "wave protection wall" in the model sites to be constructed under the Project.

While, the Project is actually a model project and "To develop wave protection effectively for preventing wave erosion in Haor area (other than the model sites)" is expected as the Project's overall goal. Through local infrastructure improvement, LGED has experiences in "RCC inverse-T type retaining wall" in Haor area suggested in this B/D. However, it has limited performances in designing and constructing on soft ground considering subsidence, bearing capacity, wave force and buoyant force etc. Therefore, LGED is required to employ necessary engineers from its Headquarter and District Offices at the stage of project design and implementation so that LGED actively involves in this Project and also required to formulate design policies and O/M manuals for construction of "RCC inverse T-type retaining wall".

3-2-2 Collaboration with Technical Cooperation and other Donors

With financing from JBIC, the building of Rural Development Engineering Center (RDEC) was constructed in LGED and equipment/materials for soil mechanics tests and concrete tests were procured. Subsequently, Japanese technical cooperation has enhanced its functions. It is expected that collaborating with RDEC will enable the technical transfer of "RCC inverse T-type retaining wall" to LGED engineers and enable them to accumulate technical information or knowledge in LGED during the detail design stage and implementing stage of the Project. It will also stimulate the sustainability of LGED, contributing to the further development of Haor area in the future.

3-3 Relevance of the Project

The Government of Bangladesh has employed PRSP based on MDGs as a national development plan and reduction of poverty is actually their top priority. Although the country has in recent years maintained an annual growth rate of 4 to 5%, its GNI per capita, $445 is still low (fiscal year 2004/05). As 36% of the population lives on less than one dollar a day, the Country has the largest population of poor in all the least developed countries (LDC). PRSP recognizes that the economic growth is indispensable to overcome the poverty and its special

target is the poor in rural areas, wherein 70% of the overall population is concentrated. The target area of the Project is in Haor Area wherein larger number of the poor live, and about 35,000 people living in harsh natural environment is direct beneficiary of the Project. For this reason, this Project is expected to greatly contributive from the viewpoint of ensuring human security.

Since retaining wall will be constructed by reinforced concrete, O/M after construction will not be necessary. However, regular O/M and repair will be needed for foot protection from corrosion by waves during the rainy season. LGED has District Offices in each of the 64 Districts throughout the Country and take budgetary steps for maintenance works under the responsibility of each District Officer, there will be no particular difficulty in O/M of "RCC retaining wall" after implementing the Project.

Thus, implementation of the Project under Japan's Grant Aid Scheme is deemed highly necessary and relevancy. Also, there will be no negative effect on the environment generated by the Project implementation.

3-4 Conclusion

(1) Possibility of implementing the Project

As mentioned above, the Project is expected to produce considerable effects on the basis of high necessity and relevancy, since the aim of the Project is to protect basic infrastructure, building and people's wealth from wave erosion, highly considerations on safety on soft ground, stability and durability against wave force. In this regard, at the stage of designing this wave protection wall, the height of wall was decided according to Bangladesh regulation, however, to calculate stability of the wall, especially wave force and buoyant force under inundated condition, "Technical standard for stream sediment control" in Japan was adopted because that of Bangladesh regulation does not consider those forces. In case this Project will be implemented under Japan's Grant Aid Scheme, it is impossible to exclude the calculation of wave force and buoyant force to secure durability of the wall. However, as a result, concrete volume of the wall increased, which caused the increase in construction cost, it indicates that unit construction cost would be 2.5 times higher than that of "RCC inverse T-type retaining wall" constructed under assistance from CARE or ADB. Present design policy of the Project is quite appropriate, so it is impossible to modify the design just for the cost reduction. Furthermore, the wall will be only constructed at the model sites under this Project. However, it would be difficult for the Bangladesh side in the future to expand with constructing similar wave protection wall in other Haor areas due to its severe financial circumstance. Also, the effectiveness of Japan's Grant Aid Scheme would be extremely limited because overall goal of the Project, that is; "To develop wave protection effectively for preventing wave erosion in Haor area (other than the model sites)", would not be achieved. Furthermore, the high unit cost of construction does not enable to gain understanding of other donors or international organizations in Bangladesh. Thus, Project implementation based on the method proposed in this Basic Design Study should be carefully revisited.

On the other hand, LGED needs to continue constructing "wave protection for preventing wave erosion" to improve the living environment in Haor area, even if the Japan's Grant Aid Scheme will not be implemented. For enhancing technology related to rural infrastructure and accumulating related technological information, Rural Development Engineering Center (RDEC) was established by LGED. Through strengthening capacity of RDEC,

it is expected to further carry out the construction of wave protection through their self-reliant efforts. Since there are urgent needs to construct the wave protection, this Report would propose several types of wall under the condition that LGED would construct by themselves, utilizing data and experience collected thorough this Basic Design Study. Considering, current financial circumstance of the Government of Bangladesh and the current LGED design policies or manuals related to "wave protection for preventing wave erosion", the following types are suggested to design wave protection by LGED.

(a) RCC inverse T-type retaining wall (spread foundation)
(b) RCC L-type retaining wall (spread foundation)
(c) RCC leaning retaining wall (spread foundation)
(d) Bricklaying gravity type retaining wall (spread foundation)
(e) CC block slope protection

(2) Vision and points in designing a wave protection wall by LGED's self-reliant efforts

Design of above five types considering 1) residents' demand, 2) environment, and 3) bearing capacity of foundation, are summarized in the flowchart in Fig.4-1, and detail information on those types are follows;

(a) RCC inverse T-type retaining wall (spread foundation)

In the CARE design manual which LGED uses for designing wave protection wall at present, there is no criterion on the stability analysis for "RCC inverse T-type retaining wall". Thus it is assumed that the constructed wall was designed based on standard condition according to Bangladesh Road Design Standard. This indicates that wave and buoyant forces under inundation condition in Haor area were not considered in the design. Though Haor area becomes inundated for 6 to 7 months in a year, the maximum water level is observed only for three months from July to September out of six months. Furthermore, within those three(3) months, the time when high waves are generated by monsoon is very short. Thus, the present wall would rarely overturn or slide at inundated time, even wave and buoyant forces are not considered in the design.

This wall type excludes wave and buoyant forces, thus, LGED needs to recognize that the minimum safety factors are considered. It also needs to confirm that the foundation has enough bearing resistance not to overturn even in the case of subsidence. Because the ground condition around the model site of this Project is very soft, therefore, it is essential to design and implement the construction after boring and geotechnical tests for sufficient examination of the soil condition.

(b) RCC L-type retaining wall (spread foundation)

This wall type is designed to hold its stability with wide bottom slab. Considering that the wall resist the soil pressure from the backfill with its own weight, the wall has to be placed on the current ground level to minimize its height in order to reduce concrete volume. Under the inundated condition, therefore, the buoyant force makes retaining wall unstable because the bottom of the wall exposed at the surface, not under the ground. Moreover, generally, the concrete volume of this wall type is larger than that of "RCC inverse T-type retaining wall(a)" so that its unit construction cost becomes larger.

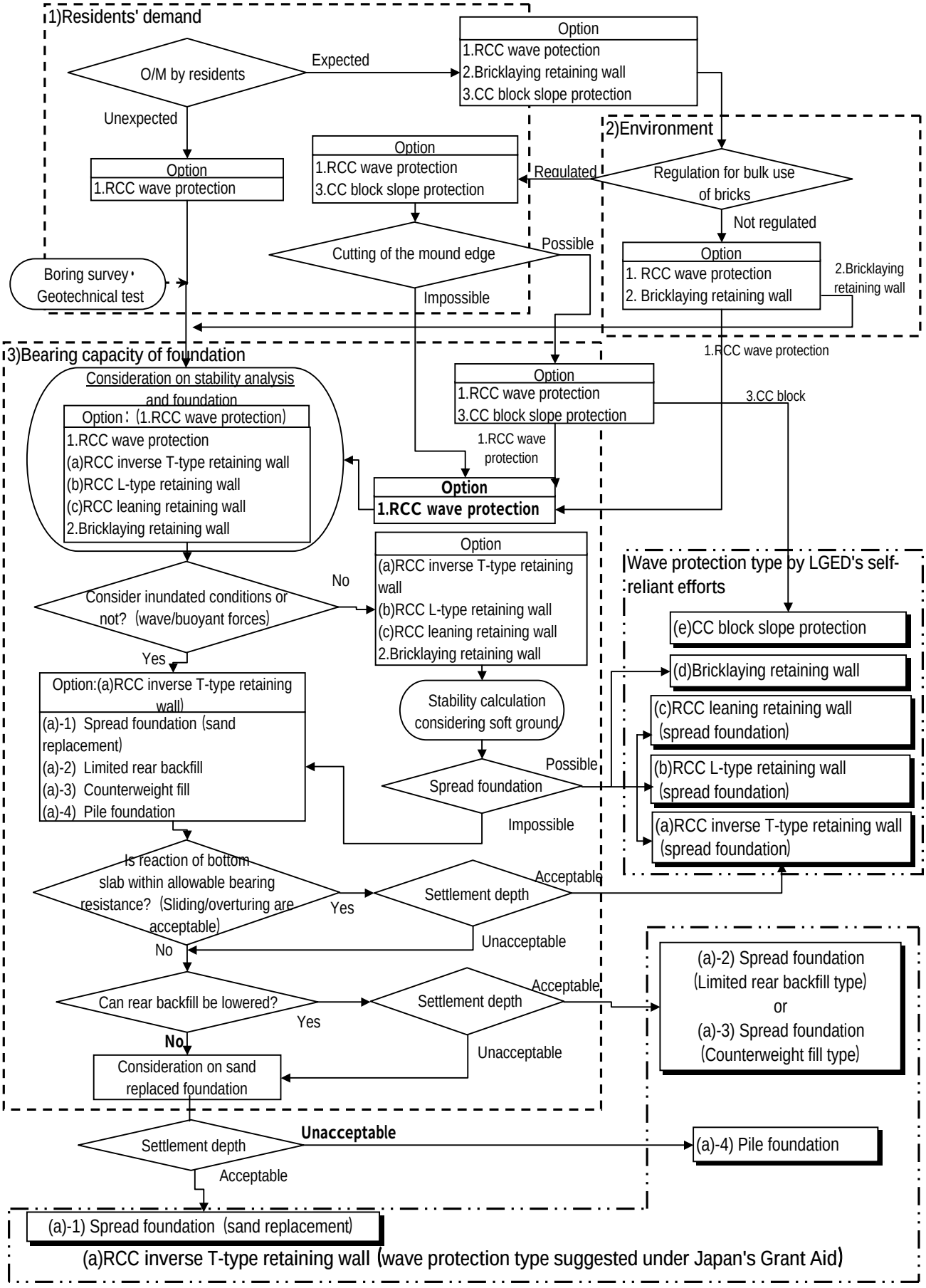


Fig. 3-1 Design flowchart of wave protection types improved by LGED's self-reliant efforts

Accordingly, this type of wave protection is applied under limited conditions such as the case when a wall is used also as a submersible road. It is also necessary to have embedment about 1 m underneath at the front side of footing for protecting from wave erosion (please refer to the table 3-4).

(c) RCC leaning retaining wall (spread foundation)

This wall type is designed for leaning on slope at the mound edge and suppressing earth filling at the backside with its own weight. Under the inundated condition, therefore, the wall will be unstable by buoyant force. In general, concrete volume of this wall type is larger than that of "RCC inverse T-type retaining wall(a)" but unit construction cost is lower in case a wall height is low because a few reinforcing rods are used only for preventing cracks. Easiness of its construction is another advantage. Nevertheless, the wall needs to have minimum bearing capacity, because reaction of bottom slab becomes greater due to its narrow width. Same as the case of "CC block sloping wave protection(e)" after-mentioned, there is a possibility that rear backfill materials would draw out, and in such situation the wall itself could overturn on the mound side. These factors assure that implementation on cutting slope will be more desirable, and at the same time consideration of foundation would be crucial, which implementation of boring surveys and geomechanical tests would be indispensable.

(d) Bricklaying gravity type retaining wall (spread foundation)

As Ministry of Environment of Bangladesh has set regulations for construction and operation of brick manufactures based on concerns over environmental issues such as exhaustion of wood resources and atmospheric pollution. In the near future, certain regulations will be probably established against extensive use of brick materials for construction. Under Japan's Grant Aid Scheme, crashed stone is planned to be used for aggregate, and brick materials will be only used for consolidation foundation and foot protection.

On the other hand, LGED first adopted "RCC inverse T-type retaining wall(a)" in 1997 for the CARE project. Before that, "Bricklaying gravity type retaining wall" or "CC block slope protection" were major cases. The main body of "Bricklaying gravity type retaining wall" is made of laid bricks using cement mortar. For this reason, if residents or the union (village) government can maintain properly, this wall type will be effective. Although a large number of "Bricklaying gravity type retaining wall" are constructed in Haor area, most of them have collapsed within 10 years after construction. In this regard, this wall could be applied to the area where wave height is low, and where the height of the wall could be kept low.

Quality of mortar joints greatly affects the durability of a wall, requiring ample supervision of the construction. Considering that the wall structure is designed to suppress earth filling at the backside with its own weight, the soil pressure may cause overturn of the deteriorated wall due to joint degradation or crack caused by differential settlement. This makes it essential, as the case of "RCC wave protection", to make a stability calculation based on ground conditions of each area by conducting boring surveys and geotechnical tests.

(e) CC block slope protection

"CC block slope protection" is another construction method suggested by CARE project. Since this is a method of placing blocks along the mound slope, CC block has a high adoptability to soft ground compared to

“RCC inverse T-type retaining wall(a)”, “Bricklaying gravity type retaining wall(d)”, and “RCC leaning retaining wall(c)”, all of which belong to the gravity wall type. However, in places where big waves come or a water level significantly fluctuates, backfilling of “CC block sloping protection(e)” can be easily drawn out, so several parts of the existing CC block are collapsed. Once collapsed, it will be difficult for residents themselves to repair the wall because CC blocks are too heavy to carry. And if the CC block remains un-repaired, the collapse expand rapidly. Taking into account its high operation and maintenance cost, LGED intends to avoid adoption of “CC block slope protection” in the mounds except for public facilities such as local roads.

On the other hand, application of this type is effective in the following cases;

1) It is possible to cut the edge of a mound according to the resident’s agreement for reduction of mound,
2) It is possible to install parapet at the top of the wall preventing wave erosion of mound, and
3) The height of the wave is low.

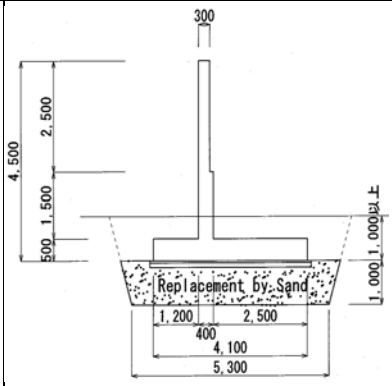
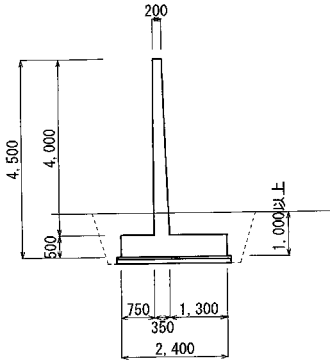
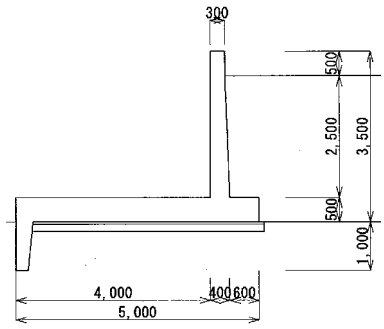
However, there are actually quite few villages that can accept cutting of the mound edge, and in many cases CC blocks are placed on embankment, causing a high possibility of collapse. As a result there will not be many suitable sites.

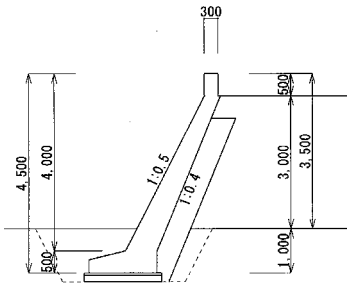
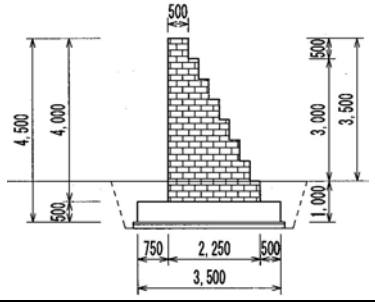
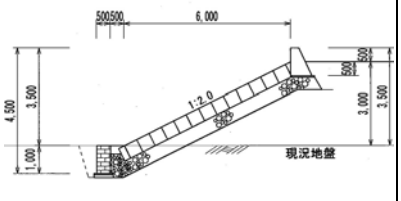
(3) Comparison of wave suggested protection walls

Table 3-4 shows comparison of the design cross-section, volume of concrete and the unit construction cost of “wave protection for preventing wave erosion (RCC inverse T-type retaining wall)” which is adopted by this BD Study.

It should be reiterated that those suggestions are based on moderate security conditions taking into account the sustainability of Bangladesh side. So, it is advisable for LGED to take further considerations of preconditions of each type. Furthermore, LGED is also requested to take responsibility of warranty.

Table 3-4 Comparison of suggested wave protection walls

	Proposed Japan's Grant Aid Scheme (cross section planned in this B/D Study)	Suggested designing and implementation by the Bangladesh Government	
		(a)RCC inverse T-type retaining wall (spread foundation)	(b)RCC L-type retaining wall (spread foundation)
Design Condition	-Safe for highest wave at five-year probable water level -Sand replacement, widening footing, or lowering rear backfill are needed, according to bearing capacity or settlement depth	-Relax the design conditions securing minimum safety factors to avoid overturn - Sufficient bearing capacity for preventing overturn by settlement	<Applicable site> -Sites with low wave heights - Wall height should be low, - also utilized as a submergible road
Standard cross section			
Concrete volume / m	3.4 m^3/m	2.3 m^3/m	3.8 m^3/m
Direct construction cost base			
1) per m^3	34.0 thousand yen/m^3 (1.00)	13.4 thousand yen/m^3 (0.39)	13.0 thousand yen/m^3 (0.38)
2) per m	115.6 thousand yen/m (1.00)	30.8 thousand yen/m (0.27)	49.3 thousand yen/m (0.43)
3) per 5 km	578 million yen (1.00)	154 million yen (0.27)	247 million yen (0.43)

	Suggested designing and implementation by the Bangladesh Government		
	(c)RCC leaning retaining wall (spread foundation)	(d)Bricklaying gravity type retaining wall	(e)CC block slope protection
Design Condition	<Applicable site> -Slope cutting -Sites with low wave heights -Wall height should be low -Sufficient bearing capacity	<Applicable site> -Lowered backside earth fill -Sites with low wave heights -Wall height should be low -Sufficient bearing capacity	<Applicable site> -Slope cutting -Sites with small waves -Small fluctuation of a water level
Standard cross section			
Concrete volume / m	2.6 m^3/m	Bricklaying：5.5 m^3/m	CC block 6.9 m^2/m
Direct construction cost base			
1) per m^3	11.3 thousand yen/m^3 (0.33)	4.4 thousand yen /m^3 (0.13)	3.9 thousand yen /m^2
2) per m	29.5 thousand yen /m (0.26)	24.3 thousand yen /m (0.21)	27.2 thousand yen /m (0.24)
3) per 5 km	148 billion yen (0.26)	122 billion yen (0.21)	136 billion yen (0.24)

Remark: Construction costs are calculated on the basis of 4.5m wall height and Suggestion(a)-(e) are estimated by LGED cost in 2004.

[Appendices]

Appendix-1　Member List of the Study Team

1-1.　Basic Design Study

	Responsibility	Name	Position
1.	Team Leader	Mr. Noriaki NAGATOMO	Japan International Cooperation Agency Additional Resident Representative Bangladesh Office
2.	Project Coordinator	Mr. Yoshimasa SAKAMOTO	Japan International Cooperation Agency Grant Aid Management Department Project Management Group III Rural Development Team
3.	Chief Consultant/ Facility Planning	Mr. Kazumitsu TSUMURA	Sanyu Consultants Inc.
4.	Facility Design	Mr. Seiichi YAMAKAWA	Sanyu Consultants Inc.
5.	Construction Planning /Cost Estimation	Mr. Kosuke HIROTA	Sanyu Consultants Inc.
6.	Foundation Survey /Team Coordinator	Mr. Yasushi FUKUDA	Sanyu Consultants Inc.

Appendix-2 Survey Schedule

2-1 Basic Design Study

date	day	No.	Official Menbers	Consultant members				
				No.	A) Chief Consultant /Facility Planning TSUMURA Kazumitsu	B) Facility Design YAMAKAWA Seiichi	C) Construction Planning /Cost Estimation HIROTA Kousuke	D) Foundation Survey /Team Coordinator FUKUDA Yasushi
Feb. 19	Sun			1	Move (Narita→Bangkok)		Move (Narita→Bangkok)	
Feb. 20	Mon			2	Move (Bangkok→Dhaka) Meeting with JICA officials		Move (Bangkok→Dhaka), Meeting with JICA officials	
Feb. 21	Tue			3	Briefing of Ic/R to LGED Move (Dhaka→Netrokona)		Briefing of Ic/R to LGED Move (Dhaka→Netrokona)	Preparing entrust survey Move (Dhaka→Netrokona)
Feb. 22	Wed			4	Field Survey (Lipsha)		Field Survey (Lipsha)	
Feb. 23	Thu			5	Field Survey (Nazarpur) Move (Nazarpur→Dhaka)		Field Survey (Nazarpur), Move (Nazarpur→Dhaka)	
Feb. 24	Fri	1	Move (Narita→Bangkok)	6	Preparing entrust survey	Move (Narita→Bangkok)	Preparing entrust survey	
Feb. 25	Sat	2	Move (Bangkok→Dhaka) Internal meeting	7	Preparing entrust survey, Internal meeting	Move (Bangkok→Dhaka) Internal meeting	Preparing entrust survey, Internal meeting	
Feb. 26	Sun	3	Courtesy call on Embassy of Japan, JICA, Explanation of Ic/R to LGED	8	Courtesy call on Embassy of Japan, JICA, Explanation of Inception report (Ic/R) to LGED			
Feb. 27	Mon	4	Move (Dhaka→Gurai) Field survey (Gurai) Move(Gurai→Hobigonj)	9	Move (Dhaka→Gurai) Field survey (Gurai) , Move(Gurai→Hobigonj)		Move (Dhaka→Gurai) Field survey (Gurai) , Move(Gurai→Hobigonj)	
Feb. 28	Tue	5	Field surevey (Lakhai) Move (Lakhai→Dhaka)	10	Field surevey (Lakhai) Move (Lakhai→Dhaka)		Field surevey (Lakhai)	
Mar. 1	Wed	6	Provision of Minitues of Discussion (M/D)	11	Provision of Minitues of Discussion (M/D)		Field surevey (Lakhai)	Field surevey (Nazarpur)
Mar. 2	Thu	7	Signing of M/D Report to JICA and EOJ	12	Signing of M/D, Report to JICA and EOJ		Field surevey (Lakhai)	〃
Mar. 3	Fri	8	Move (Dhaka→Bangkok→)	13	Field surevey (Lakhai)		Field surevey (Sylhet)	〃
Mar. 4	Sat	9	Arrive at Narita	14	〃		Move (Sylhet→Sunamganj) Interview from LGED office	〃
Mar. 5	Sun			15	〃		Field surevey (Sunamganj→ Nazrpur/Lipsha)	〃
Mar. 6	Mon			16	〃		Field surevey (Nazarpur)	〃
Mar. 7	Tue			17	〃		Field surevey (Lipsha)	〃
Mar. 8	Wed			18	Field surevey (Nazarpur)		〃	〃
Mar. 9	Thu			19	Field surevey (Lipsha)		Field surevey (Gurai)	Field surevey (Lipsha)
Mar. 10	Fri			20	Field surevey (Gurai)		〃	〃
Mar. 11	Sat			21	Field surevey (Gurai) Move (Gurai→Dhaka)		〃	〃
Mar. 12	Sun			22	Data analysis	Data analysis	〃	〃
Mar. 13	Mon			23	〃	〃	〃	〃
Mar. 14	Tue			24	〃	〃	〃	〃
Mar. 15	Wed			25	〃	〃	〃	〃
Mar. 16	Thu			26	〃	〃	Move (Gurai→Dhaka)	Move (Lipsha→Dhaka)
Mar. 17	Fri			27	〃	〃	Data analysis	Data analysis
Mar. 18	Sat			28	Internal Meeting	Internal Meeting	Internal Meeting	Internal Meeting
Mar. 19	Sun			29	Data analysis	Data analysis	Data analysis	Inspection of Baseline survey
Mar. 20	Mon			30	〃	〃	〃	〃
Mar. 21	Tue			31	〃	〃	〃	Inspection of entrust survey
Mar. 22	Wed			32	〃	〃	〃	〃
Mar. 23	Thu			33	Inspection of entrust survey, Report to JICA, EOJ, LGED			
Mar. 24	Fri			34	Move (Dkaha→Bangkok→)			
Mar. 25	Sat			35	Arrive at Narita			

Appendix-3 List of Parties Concerned in Bangladesh

1. Embassy of Japan in Bangladesh

Matsushiro Horiguchi	Ambassador

2. Japan International Cooperation Agency, Bangladesh office

Akio Arai	Resident Representative
Noriaki Nagatomo	Deputy Resident Representative/Team leader of the Basic Study
Kentaro Yokota	
Sayedul Arefin	Deputy Director

3. Economic Relations Division, Ministry of Finance

M. Emadadul Haque	Deputy Secretary

4. Local Government Engineering Department: LGED

Dahka headquarter

Md. Shahidul Hassan	Chief Engineer
Md. Wahidur Rahman	Superintending Engineer
Md. Zahangir Alam	Project Director, Construction of Cyclone Shelters
Md. Roushan kabir	Project Director, Eastern Bangladesh Rural Infrastructure Development Project (EBRIDP)
Md. Saidul Haque	Project Director, Rural Development Project-21
Md. Abdul Bashar	Executive Engineer (Quality Control), Central Quality Control Unit
Md. Atiqur Rahman	Assistant Engineer
Md. Shamaji	Assistant Engineer, Environmental Unit
Susumu Sugatani	JICA Expert

Netrokona District Office

Md. Nazrul Islam	Executive Engineer
Md. Reffat Nuet	Assistant Engineer
Md. Quamruzzaman	Assistant Engineer (Mechanical)
Md. Firoz Alam Talukdos	Upaliza Engineer, Khaliajuri

Sunamganj District Office

Golam Mostafa	Executive Engineer
Md. Fazlul Hoqur	Upaliza Engineer, Dharmapasha
Jahangir Alam	Sub-divisional Assistant Engineer, Dharmapasha
Md. Babul Aktar	Sub-divisional Assistant Engineer, Dharmapasha

Michael Roy	Management Consultant

Kishoreganj District Office

Md. Ali Siddique	Executive Engineer
Gopal Chandra Sarker	Assistant Engineer
Md. Amanullah Bahar	Upaliza Engineer, Nikli
Mono Ranjan Das	Sub-divisional Assistant Engineer, Nikli
A.K.M. Shireaful Haque	Lab Technician,

Hobiganj District Office

Monzur Qader Chowdhury	Executive Engineer
Nazrl Islam	Assistant Engineer
Md. Sullan Ahmed	Upazila Engineer, Lakhai
Kozi Sahid	Sub-divisional Assistant Engineer, Lakhai

5. Bangladesh Water Development Board

Md. Shawkat Ali	Superintending Engineer, Surface water Hydrology Circle
Mohiuddin Ahmed	System Analyst, Hydrology

6. Bangladesh Haor & Wetlands Development Board

Md. Inamul Haque	Director General

7. Department of Environment

Md. Hasan Khan	Deputy Director (Technical)

8. Department of Methodological

Ms. Jinnatun Nessa	Assistant Director

7. Local Administration Office

Chakuwa Union, Khaliajuri Upazila, Netrokona District

Alomgir Hossain Titu	Chairman, Chakwa Union, Khaliajuri Upazila, Netrokona
Amio Kanta Dhar	Master, Lipsha Government Primary School

Joysree Union, Dharmapasha Upazila, Sunamganj District

Nuruzzaman	UNO, Dharmapassa Upazila, Sunamganj

Lakhai Union, Lahkai Upazila, Hobiganj District

Soukat Akbar	UP member, Sazan Village

8. CARE Bangladesh Kishoreganj Rejional Office

S. Sekhar Bhattacharjee	Regional Program Manager, SHOUHARDO

Appendix-4 Minutes of Discussions

MINUTES OF DISCUSSIONS
ON
THE BASIC DESIGN STUDY ON THE PROJECT
FOR
IMPROVING THE LIVING STANDARD OF VULNERABLE PEOPLE
IN THE HAOR AREAS
IN THE PEOPLE'S REPUBLIC OF BANGLADESH

Based on the results of the Preliminary Study, the Government of Japan decided to conduct a Basic Design Study on the Project for Improving the Living Standard of Vulnerable People in the Haor Areas (hereinafter referred to as "the Project") and entrusted the study to the Japan International Cooperation Agency (hereinafter referred to as "JICA").

JICA sent to The People's Republic of Bangladesh (hereinafter referred to as "Bangladesh") the Basic Design Study Team (hereinafter referred to as "the Team"), which is headed by Mr. Noriaki Nagatomo, Additional Resident Representative, JICA Bangladesh Office and is scheduled to stay in the country from February 20, 2006 to March 24, 2006.

The Team held discussions with the officials concerned of the Government of Bangladesh and conducted a field survey at the study area.

In the course of discussions and field survey, both parties confirmed the main items described on the attached sheets. The Team will proceed to further works and prepare the Basic Design Study Report.

Dhaka, March 2, 2006

永友紀章

Mr. Noriaki Nagatomo
Leader
Basic Design Study Team
Japan International Cooperation Agency

Mr. M. Emdadul Haque
Deputy Secretary
Economic Relations Division
Ministry of Finance

Witness

02/03/06

Mr. Md. Zahangir Alam
Project Director
Local Government Engineering Department

ATTACHMENT

1. Objective of the Project

The objectives of the Project are:

(1) To improve the living standard of most vulnerable flood prone villages in the Haor areas,
(2) To propose a project model which will be replicated in other villages of Haor in the future with other financial resources. and
(3) To transfer technology to Bangladesh counterpart and local contractors.

2. Project site

The proposed project sites are:

(1) Gurai Village, Gurai Union in Nikli Upazila (Kishoreganj Disrtrict),
(2) Lipsha Village, Chakuwa Union in Khaliajuri Upaizla (Netrokona District),
(3) Nazarpur Village, Joysree Union in Dharmapasha Upazila (Sunamganj District) and
(4) Sazan Village, Lakhai Union in Lakhai Upazila (Habiganj District).

And the locations of above mentioned sites are shown in Annex-I.

3. Responsible and Implementing Agency

3-1. The Responsible Ministry is Local Government Division under Local Government Rural Development & Cooperatives.

3-2. The Implementing Agency is Local Government Engineering Department (LGED).

4. Items requested by the Government of Bangladesh

After discussions with the Team, the item finally requested by Bangladesh side is the construction of wave protection walls for four sites of Haor Areas in total length of 7,050m as described in Annex-II. JICA will assess the appropriateness of the request and will recommend to the Government of Japan for approval.

5. Japan's Grant Aid Scheme

Bangladesh side understands the Japan's Grant Aid Scheme and the necessary measures to be taken by the Government of Bangladesh as explained by the Team and described in Annex-3 of the Minutes of Discussions of the Preliminary Study signed by both parties on September 14, 2005.

6. Schedule of the Study

6-1. The consultants will proceed to further studies in Bangladesh until March 24, 2006.

6-2. JICA will prepare a draft report in English and dispatch a mission in order to explain its contents around June, 2006.

6-3. In case that the contents of the report are accepted in principle by the Government of

2

Bangladesh, JICA will finalize the report and send it to the Government of Bangladesh around August, 2006.

7. Other relevant issues

7-1. The model facilities of the wave protection wall which will be constructed by the Project are expected to be spread over Haor areas in the future with other financial resources. For this, both sides agreed on importance of technology transfer through the Project activities, and Bangladesh side agreed to allocate necessary number of personnel for the Project during both the design and implementing stages.

7-2. The Team explained that the basic design will be conducted taking due consideration on not only physical and social conditions but also appropriateness as model, namely, technical soundness and economic viability for local resources.

7-3. Bangladesh side and the Team confirmed that final location and length of the requested wave protection walls would be decided based on technical point of view on conditions of soil mechanics for foundation, topography and assessment of development plan of LGED.

7-4. The Team explained that Initial Environmental Examination (IEE) and necessary approval for the Project by Bangladesh side should be completed before JICA dispatches a mission to explain the draft Basic Design report. Bangladesh side explained that draft IEE would be prepared and provided to the Team before their departure on March 24, 2006. And also, Bangladesh side explained that the preparation of Environmental Management Plan (EMP) for the Project is not needed to implement the Project.

7-5. Bangladesh side will take necessary actions to secure land for construction of the wave protection walls and temporary yards for construction materials.

7-6. Once the draft Basic Design report is accepted, Bangladesh side shall proceed to Development Project Proposal (DPP) procedure.

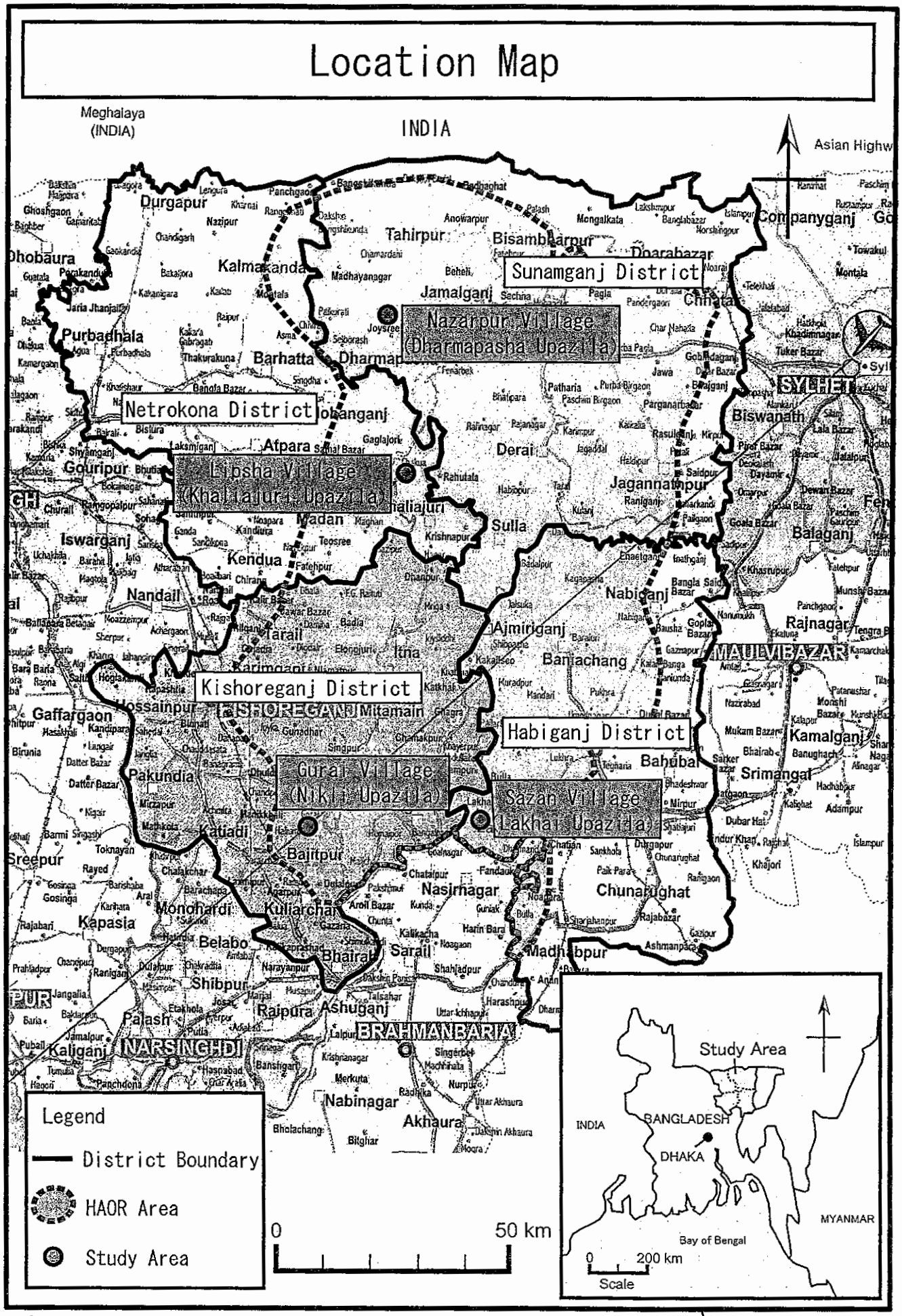
7-7. Other items to be undertaken by the Bangladesh side are:

(1) Embankment for expansion of homestead areas, and

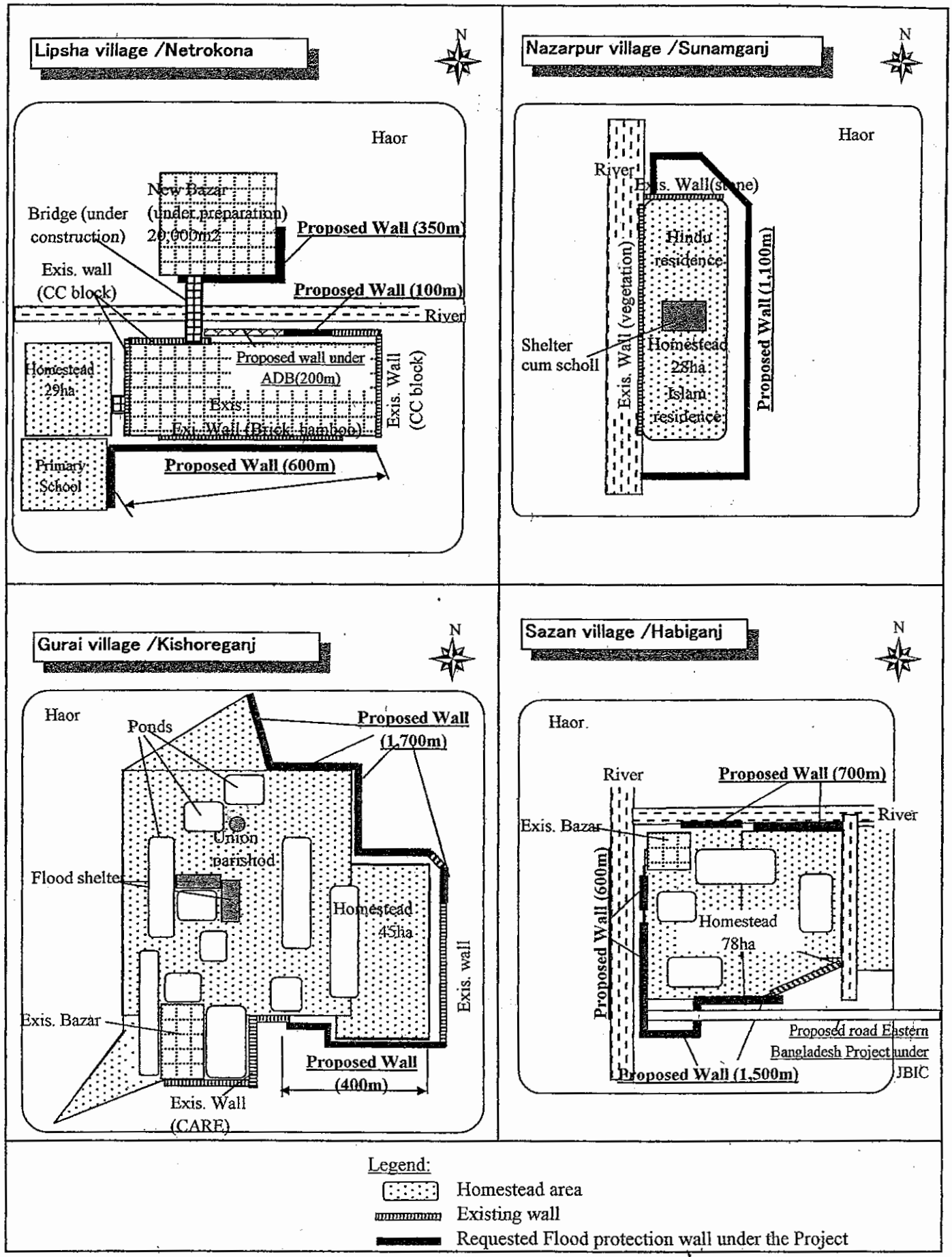
(2) Non-structural measures to support the livelihood development by providing training, education and other services together with flood-proofing.

END

Location Map



Location of requested Wave Protection Wall



For a better tomorrow for all.
Japan International Cooperation Agency

JICA (GR) -0321/2005
March 22, 2006

Mr. Zahangir Alam
Project Director
Local Government Engineering Department (LGED)
LGED Bhaban (12th Level)
Agargaon, Dhaka.

Subject: Procedure of Environment Assessment on the Project for Improving the Living Standard of Vulnerable People of the Haor Areas of the Peoples Republic of Bangladesh

Dear Mr. Zahangir Alam,

We would like to inform you that the consultant team of the 'Basic Design Study Team on the Project for Improving the Living Standard of Vulnerable People of the Haor Areas of the Peoples Republic of Bangladesh' had a discussion with Deputy Director, Department of Environment (DOE), Dhaka Division, Poribesh Bhaban, Dhaka on March 21, 2006 where the team found the following points on environment assessment:
1) Procedure to obtain Environmental Clearance Certificate (ECC) is as described in Annex.
2) Consultation of Ecological Critical Area (ECA) by Ministry of Environment is needed before ECC procedure starts, because the projects sites are located within Haor area.
3) The project is probably classified into Red Category in accordance with Schedule-1 (Item No.66. construction/reconstruction/ expansion/ of flood control embankment, polder, dike etc.) as mentioned in "The Environment Conservation Rules (ECR), 1997" issued by DOE.
4) Implementing agency (LGED) of the project, therefore, should prepare EIA including EMP as well as IEE for approval by DOE for implementation of the project.
5) Item 7-4 in the Minutes of Discussions signed on March 02, 2006 for the captioned Project is to be clarified accordingly, if necessary.

You are kindly requested to confirm the above points with DOE and to prepare EIA including EMP for approval by DOE in case that the project is classified into RED, before JICA dispatches a mission to Bangladesh to explain the draft Basic Design report at end of June 2006.

Your prompt actions on the above matter will be highly appreciated.

Yours Sincerely

永友紀章

Noriaki Nagatomo
Additional Resident Representative

Cont'd P/2

Attachment: Procedure of issuing Environmental Clearance certificate, prepared by the consultant of the captioned project by assessing ECR and hearing person of DOE concerned.

Copy to:

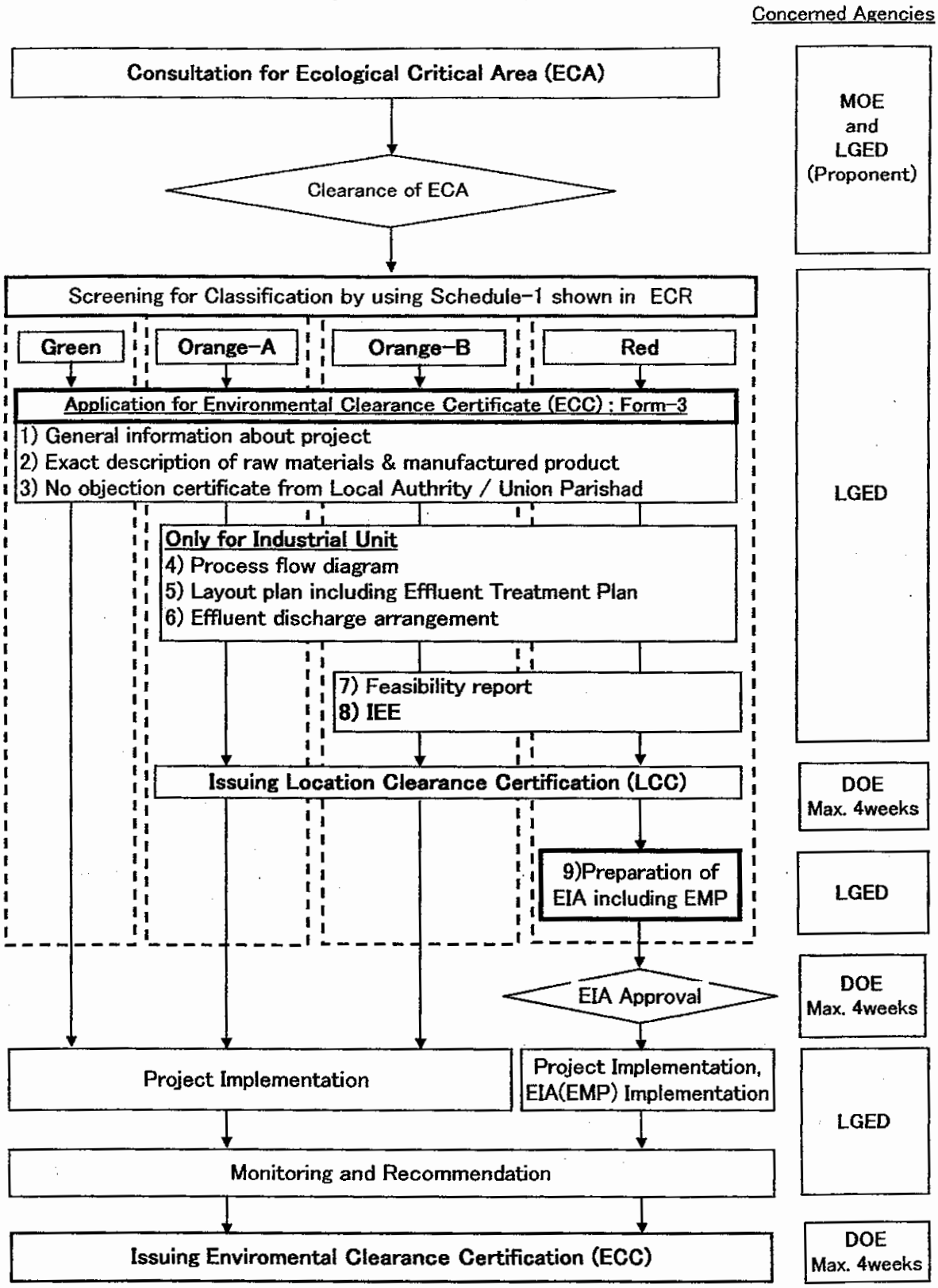
1. Mr. Shahidul Hassan
   Chief Engineer
   LGED Bhaban
   Agargaon,
   Sher-e-Bangla Nagar, Dhaka.

2. Mr. Kazimitsu Tsumura
   Chief Consultant
   Consultant Team
   'Basic Design Study Team on the Project for Improving the Living Standard of Vulnerable People of the Haor Areas of the Peoples Republic of Bangladesh'
   Dhaka.

3. Mr. Susumu Sugatani
   JICA Expert
   LGED Bhaban
   Agargaon, Dhaka.

Flow of Issuing Environmental Clearance Certificate

(Remarks: Following Procedure requires for each Project site)



ECR: Environment Conservation Rules, 1997
ECA: Ecological Critical Area
IEE: Initial Environmental Examination
EMP: Environmental Management Plan
ECC: Environmental Clearance Certificate
ETP: Effluent Treatment Plan
MOE: Ministry of Environment

Appendix-5 Other Relevant Data

5-1 Precipitation and wind velocity

Date of precipitation and wind velocity in Mymenthingh are applied for the design.

(a) Precipitation (1970～2002)

Table 1 Monthly precipitation in Mymenthingh (1970-2002)

年	1月	2月	3月	4月	5月	6月	7月	8月	9月	10月	11月	12月	Total
1970	23	0	6	117	176	570	323	207	242	274	8	0	1,946
1971	****	****	****	****	****	****	****	369	897	445	58	0	1,769
1972	0	20	35	89	127	625	418	130	204	6	0	0	1,654
1973	24	15	****	114	284	262	162	121	****	****	****	****	982
1974	0	0	0	0	0	0	526	106	217	0	0	0	849
1975	****	****	****	8	3	****	****	17	****	****	****	****	28
1976	0	8	0	84	237	394	577	475	195	135	0	0	2,105
1977	12	119	0	327	729	794	250	176	189	196	36	19	2,847
1978	0	0	46	119	405	509	475	124	213	33	0	0	1,924
1979	0	2	6	45	195	184	220	125	100	52	18	11	958
1980	2	11	16	84	723	289	309	464	214	209	0	0	2,321
1981	12	48	51	280	369	103	683	262	278	22	0	79	2,187
1982	0	2	65	124	276	689	582	337	243	28	8	0	2,354
1983	9	3	66	115	512	112	413	865	281	453	0	11	2,840
1984	13	0	15	28	476	512	689	257	468	221	0	0	2,679
1985	9	37	2	190	260	94	251	250	357	104	0	5	1,559
1986	0	4	0	402	195	285	673	270	665	377	86	14	2,971
1987	3	0	20	136	258	379	403	512	385	95	17	1	2,209
1988	0	45	115	94	734	587	586	411	309	195	120	13	3,209
1989	6	17	2	23	267	340	752	171	406	284	0	6	2,274
1990	0	83	67	116	390	529	477	237	319	213	7	1	2,439
1991	2	15	44	77	679	603	322	238	735	520	0	77	3,312
1992	6	36	0	20	156	270	380	155	318	241	1	1	1,584
1993	69	13	44	183	350	811	512	478	524	229	0	0	3,213
1994	8	59	123	77	202	251	227	323	202	132	0	0	1,604
1995	10	19	29	81	285	565	682	528	230	115	101	0	2,645
1996	0	14	18	42	171	210	291	276	307	291	0	0	1,620
1997	1	12	31	172	131	396	523	417	485	8	11	21	2,208
1998	9	11	68	161	299	176	755	517	270	50	31	0	2,347
1999	0	0	1	108	415	211	401	349	175	513	1	0	2,174
2000	18	13	74	320	461	468	150	257	385	120	0	0	2,266
2001	0	11	16	156	358	408	183	227	356	222	11	0	1,948
2002	6	0	41	260	389	578	443	204	255	132	87	0	2,395

(b) Wind velocity

Distribution of daily mean wind velocity from 1970 to 2002 is tabulated in table 2.

Table 2 Distribution of daily mean wind velocity from 1970 to 2002 (day/month)

Daily mean wind velocity w(m/s)	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	total	Jul to Aug
w<1	25.7	20.0	16.3	9.8	10.9	9.4	9.8	11.5	15.8	23.6	26.5	28.2	207.5	21.3
1<w<2	4.4	6.0	9.5	8.0	7.4	8.5	9.4	10.1	8.5	5.3	2.8	2.4	82.3	19.5
2<w<3	0.7	1.7	3.4	6.8	6.8	6.7	7.5	5.9	3.9	1.3	0.5	0.4	45.6	13.4
3<w<4	0.1	0.3	1.2	3.2	4.2	3.2	2.7	2.1	1.2	0.5	0.1	0.0	18.8	4.8
4<w<5	0.1	0.0	0.5	1.3	1.2	1.6	1.0	0.8	0.3	0.3	0.1	0.0	7.2	1.8
5<w<7.5	0.0	0.0	0.1	0.8	0.4	0.6	0.6	0.4	0.2	0.0	0.0	0.0	3.1	1.0
7.5<w<10	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.3	0.1
W>10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.2	0.1

5-2 Water level

Water Level Record at Khaliajuri Hydrological Station (1/4) 1975 ~1982

Y	M	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
	J	2.71	2.71	2.68	2.59	-	-	-	-	-	-	-	2.44	2.46	2.44	2.58	2.39	2.36	2.35	2.26	2.24	2.14	2.12	2.09	2.09	2.11	2.14	2.20	2.27	2.38	2.50	2.50
	F	2.46	2.43	2.33	2.15	2.01	1.97	1.95	1.94	2.00	2.03	2.11	2.18	2.20	2.29	2.33	2.29	2.30	2.20	2.18	1.86	1.77	1.77	1.83	2.01	2.09	2.15	2.27	2.38			
	M	2.44	2.44	2.44	2.44	2.29	2.10	2.07	1.98	1.95	2.01	2.04	2.07	2.23	2.26	2.18	2.18	2.19	2.19	2.16	2.07	2.07	1.98	1.95	2.01	2.01	2.04	2.18	2.19	2.29	2.35	2.33
	A	2.32	2.24	2.19	2.10	1.98	2.04	2.19	2.19	2.59	2.65	2.71	2.77	2.99	2.99	3.12	3.20	3.29	3.29	3.29	3.20	3.14	3.08	3.06	3.11	3.20	3.35	3.44	3.54	3.57	3.63	
	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
75	J	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	J	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	S	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
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	M	1.95	2.03	2.13	2.16	2.19	2.35	2.53	2.83	3.08	3.23	3.44	3.57	3.54	3.57	3.54	3.55	3.55	3.55	3.49	3.46	3.29	3.23	3.08	2.96	2.87	2.74	2.70	2.67	2.71	2.74	2.76
	A	2.71	2.74	2.65	2.59	2.48	2.47	2.42	2.45	2.44	2.65	2.93	3.17	3.38	3.57	3.69	3.78	3.83	3.87	3.86	3.84	3.81	3.75	3.67	3.63	3.60	3.57	3.54	3.55	3.57	3.57	
	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
76	J	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
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	F	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	M	1.95	1.89	1.83	1.98	2.00	2.18	2.41	2.38	2.41	2.47	2.56	2.50	2.35	2.26	2.21	2.23	2.38	2.53	2.64	2.68	2.73	2.79	2.74	2.77	2.53	2.51	2.41	2.27	2.29	2.36	2.45
	A	2.62	2.80	3.23	3.63	3.78	3.90	4.02	4.12	4.18	4.24	4.25	4.27	4.28	4.36	4.42	4.50	4.59	4.62	4.63	4.65	4.68	4.72	4.74	4.79	4.82	4.77	4.76	4.79	4.85	4.94	
	M	5.00	5.08	5.17	5.23	5.30	5.40	5.46	5.50	5.52	5.53	5.53	5.52	5.62	5.65	5.73	5.76	5.81	5.88	5.96	6.01	6.02	6.04	6.07	6.07	6.07	6.01	6.02	6.05	6.11	6.17	6.22
	J	6.26	6.31	6.36	6.40	6.45	6.49	6.55	6.68	6.72	6.75	6.77	6.84	6.86	6.86	6.86	6.86	6.87	6.87	6.90	6.92	6.95	7.00	7.01	7.04	7.06	7.13	7.22	7.25	7.25	7.22	
77	J	7.21	7.21	7.21	7.19	7.18	7.16	7.15	7.13	7.12	7.12	7.12	7.13	7.21	7.24	7.30	7.29	7.27	7.27	7.27	7.24	7.24	7.21	7.18	7.22	7.21	7.22	7.22	7.22	7.24	7.24	7.21
	A	7.19	7.19	7.16	7.13	7.09	7.07	7.04	7.03	7.01	7.00	7.00	7.01	7.03	7.06	7.15	7.25	7.29	7.30	7.29	7.27	7.27	7.27	7.27	7.27	7.29	7.29	7.36	7.50	7.53	7.50	7.50
	S	7.48	7.45	7.44	7.39	7.36	7.33	7.27	7.22	7.18	7.13	7.07	7.03	7.00	6.93	6.97	6.92	6.87	6.81	6.77	6.71	6.75	6.72	6.69	6.63	6.57	6.51	6.46	6.42	6.36	6.31	
	O	6.29	6.23	6.20	6.23	6.25	6.29	6.33	6.34	6.33	6.31	6.28	6.23	6.22	6.19	6.14	6.11	6.07	6.01	5.94	5.91	5.84	5.75	5.69	5.64	5.55	5.50	5.47	5.41	5.35	5.27	5.23
	N	5.18	5.11	5.03	4.97	4.88	4.85	4.80	4.76	4.72	4.69	4.63	4.62	4.57	4.53	4.50	4.47	4.39	4.34	4.28	4.24	4.19	4.13	4.08	4.04	4.01	3.93	3.87	3.83	3.76	3.72	
	D	3.67	3.63	3.55	3.49	3.43	3.35	3.32	3.31	3.28	3.29	3.35	3.38	3.38	3.35	3.32	3.28	3.20	3.14	3.03	2.97	2.93	2.88	2.87	2.85	2.84	2.84	2.88	2.91	2.84	2.77	2.77
	J	2.74	2.67	2.62	2.50	2.47	2.44	2.45	2.47	2.53	2.56	2.62	2.59	2.55	2.53	2.45	2.44	2.36	2.30	2.23	2.16	2.13	2.15	2.13	2.13	2.15	2.15	2.18	2.23	2.23	2.20	2.12
	F	2.10	2.16	2.04	2.06	2.04	2.13	2.23	2.27	2.32	2.41	2.32	2.20	2.29	2.16	1.98	1.98	1.86	1.77	1.74	1.78	1.89	1.91	2.03	2.07	2.18	2.13	2.18	2.21			
	M	2.26	2.16	2.13	2.10	2.07	2.09	1.97	2.04	2.13	2.23	2.29	2.32	2.23	2.13	2.07	1.97	1.86	1.86	1.74	1.77	1.83	1.89	1.98	2.06	2.13	2.32	2.38	2.38	2.35	2.41	2.33
	A	2.29	2.15	2.13	2.10	2.15	2.23	2.32	2.35	2.44	2.45	2.42	2.38	2.38	2.41	2.30	2.35	2.29	2.30	2.44	2.59	2.65	2.71	2.74	2.80	2.87	2.88	2.90	2.87	2.80	2.77	
	M	2.67	2.61	2.62	2.71	2.80	2.96	3.05	3.17	3.25	3.26	3.26	3.26	3.23	3.32	3.31	3.37	3.38	3.35	3.49	3.75	4.12	4.24	4.42	4.56	4.66	4.83	4.98	5.15	5.24	5.43	5.50
78	J	5.56	5.67	5.76	5.79	5.87	5.90	5.91	5.97	6.02	6.29	6.36	6.40	6.60	6.66	6.71	6.71	6.69	6.71	6.75	6.72	6.71	6.72	6.77	6.83	6.92	7.09	7.12	7.03	7.06	7.03	
	J	7.03	7.00	6.97	6.97	7.00	7.01	7.01	7.00	6.97	6.98	6.93	6.90	6.87	6.84	6.84	6.95	7.01	7.03	7.04	7.04	7.03	7.01	7.03	7.03	7.00	7.03	7.09	7.15	7.16	7.18	7.19
	A	7.18	7.16	7.12	7.15	7.15	7.15	7.13	7.12	7.12	7.13	7.12	7.12	7.07	7.04	7.03	7.03	7.00	6.97	6.92	6.87	6.87	6.86	6.87	6.84	6.81	6.77	6.75	6.74	6.69	6.63	6.58
	S	6.58	6.54	6.49	6.46	6.49	6.55	6.58	6.58	6.58	6.60	6.61	6.60	6.61	6.60	6.61	6.58	6.58	6.57	6.55	6.51	6.49	6.46	6.43	6.42	6.46	6.52	6.48	6.43	6.39	6.34	
	O	6.31	6.26	6.22	6.20	6.16	6.11	6.07	6.02	5.97	5.93	5.88	5.84	5.81	5.78	5.75	5.72	5.67	5.62	5.62	5.53	5.49	5.43	5.37	5.30	5.24	5.14	5.06	5.00	4.92	4.88	4.80
	N	4.71	4.65	4.59	4.53	4.44	4.36	4.30	4.24	4.15	4.08	4.01	3.93	3.89	3.86	3.81	3.80	3.78	3.72	3.72	3.69	3.67	3.60	3.51	3.43	3.38	3.32	3.31	3.29	3.28	3.26	
	D	3.26	3.25	3.34	3.34	3.23	3.17	3.11	3.06	2.97	2.91	2.85	2.84	2.85	2.85	2.85	2.84	2.82	2.80	2.77	2.70	2.62	2.56	2.50	2.45	2.41	2.45	2.47	2.48	2.50	2.52	2.61
	J	2.64	2.65	2.62	2.62	2.18	2.45	2.32	2.23	2.20	2.23	2.26	2.29	2.32	2.38	2.32	2.32	2.35	2.36	2.32	2.29	2.26	2.23	2.04	1.98	1.95	2.04	2.01	2.26	2.35	2.41	2.47
	F	2.50	2.47	2.35	2.26	1.98	1.81	1.83	1.94	1.92	1.94	1.98	2.00	2.06	2.04	1.98	2.20	2.23	2.20	2.18	2.20	2.04	2.00	1.86	1.86	1.91	1.98	2.00	2.23			
	M	2.26	2.26	2.23	2.24	2.20	2.04	1.97	1.95	1.75	1.84	1.81	1.89	1.94	2.16	2.13	2.23	2.24	2.36	2.45	2.48	2.48	2.41	2.24	2.26	2.13	2.26	2.41	2.53	2.62	2.68	2.74
	A	2.77	2.77	2.62	2.53	2.56	2.61	2.23	2.23	2.32	2.38	2.41	2.62	2.77	2.71	2.74	2.79	2.77	2.80	2.71	2.62	2.56	2.47	2.45	2.59	2.68	2.73	2.79	2.84	2.90	2.88	
	M	2.93	3.02	3.06	3.05	3.05	3.09	3.17	3.19	3.20	3.22	3.26	3.43	3.60	3.72	3.89	3.95	4.01	4.01	3.99	4.01	4.02	4.02	4.02	4.02	4.05	4.07	4.12	4.13	4.13	4.12	4.12
	J	4.10	4.10	4.07	4.04	4.01	3.99	3.98	3.99	4.12	4.24	4.39	4.50	4.57	4.66	4.80	4.91	5.08	5.17	5.38	5.53	5.62	5.72	5.76	5.82	5.87	5.91	5.93	5.82	5.81	5.85	
79	J	5.91	6.14	6.61	6.69	6.74	6.74	6.74	6.74	6.74	6.78	6.83	6.89	6.89	6.87	6.93	7.04	7.10	7.10	7.10	7.13	7.16	7.21	7.25	7.32	7.36	7.44	7.54	7.68	7.73	7.71	7.68
	A	7.64	7.59	7.56	7.50	7.47	7.42	7.36	7.33	7.24	7.24	7.19	7.16	7.07	7.01	7.01	6.98	6.95	6.92	6.93	6.93	6.97	6.98	7.00	6.97	7.01	7.01	6.93	6.90	6.89	6.86	6.87
	S	6.86	6.90	6.89	6.93	7.01	7.07	7.07	7.06	7.09	7.18	7.33	7.41	7.45	7.47	7.45	7.44	7.41	7.38	7.33	7.29	7.24	7.19	7.15	7.10	7.03	6.97	6.92	6.87	6.84	6.80	
	O	6.80	6.75	6.72	6.65	6.65	6.75	6.81	6.83	6.80	6.75	6.72	6.69	6.66	6.61	6.57	6.51	6.45	6.40	6.34	6.29	6.23	6.14	6.11	6.02	5.94	5.87	5.81	5.72	5.64	5.56	5.47
	N	5.44	5.37	5.29	5.21	5.12	5.06	4.97	4.89	4.80	4.71	4.62	4.51	4.42	4.31	4.22	4.15	4.07	3.95	3.89	3.83	3.75	3.69	3.64	3.60	3.60	3.52	3.48	3.43	3.35	3.37	
	D	3.37	3.37	3.37	3.37	3.37	3.37	3.34	3.29	3.26	3.20	3.14	3.05	3.02	2.96	2.94	2.93	2.93	2.94	2.91	2.96	2.90	2.90	2.84	2.74	2.71	2.65	2.62	2.59	2.53	2.52	2.52
	J	2.53	2.52	2.52	2.47	2.41	2.38	2.32	2.23	2.20	2.16	2.10	2.10	2.09	2.07	2.04	2.04	2.07	2.10	2.21	2.26	2.32	2.30	2.26	2.21	2.01	1.97	1.94	1.94	1.97	1.98	2.01
	F	2.03	2.04	2.04	2.03	2.06	2.07	2.04	2.04	1.83	1.78	1.80	1.65	1.65	1.71	1.72	2.01	2.07	2.20	2.32	2.32	2.29	2.23	2.07	1.98	1.92	1.83	1.80	1.83	1.92		
	M	2.04	2.10	2.12	2.26	2.33	2.39	2.44	2.44	2.41	2.23	2.07	2.06	2.01	2.10	2.13	2.23	2.38	2.50	2.50	2.44	2.53	2.41	2.44	2.23	2.20	2.07	1.95	1.94	2.01	2.04	2.12
	A	2.07	2.10	2.29	2.26	2.30	2.32	2.35	2.26	2.27	2.32	2.35	2.39	2.38	2.65	2.79	2.85	2.87	2.87	2.84	2.85	2.85	2.77	3.02	3.32	3.54	3.66	3.72	3.78	3.84	3.90	
	M	3.93	3.99	3.99	3.98	4.05	4.12	4.15	4.24	4.31	4.36	4.37	4.42	4.48	4.60	4.69	4.83	4.97	5.09	5.18	5.30	5.38	5.43	5.47	5.49	5.50	5.52	5.55	5.52	5.53	5.59	5.62
	J	5.70	5.79	5.78	5.79	5.82	5.91	5.94	5.96	5.97	6.07	6.22	6.26	6.29	6.34	6.37	6.40	6.46	6.54	6.60	6.65	6.63	6.63	6.61	6.60	6.60	6.58	6.58	6.57	6.54	6.52	
80	J	6.52	6.52	6.52	6.52	6.52	6.52	6.49	6.51	6.51	6.51	6.49	6.48	6.46	6.46	6.49	6.57	6.60	6.68	6.74	6.80	6.83	6.86	6.86	6.83	6.83	6.92	6.92	6.95	6.97	7.00	7.01
	A	7.01	7.03	7.04	7.04	7.07	7.07	7.16	7.19	7.18	7.18	7.19	7.19	7.19	7.21	7.22	7.27	7.32	7.35	7.35	7.30	7.29	7.33	7.30	7.29	7.29	7.25	7.25	7.24	7.22	7.19	7.18
	S	7.13	7.12	7.12	7.10	7.07	7.04	7.00	6.97	6.92	6.89	6.89	6.89	6.89	6.90	6.89	6.87	6.87	6.86	6.83	6.80	6.77	6.74	6.74	6.77	6.74	6.72	6.72	6.72	6.69	6.66	
	O	6.61	6.58	6.54	6.51	6.51	6.46	6.42	6.37	6.34	6.31	6.25	6.20	6.16	6.08	6.04	5.97	5.91	5.84	5.81	5.84	5.90	5.94	5.97	6.02	6.04	6.04	6.04	6.02	6.01	5.99	5.94
	N	5.94	5.91	5.88	5.79	5.70	5.67	5.61	5.54	5.46	5.40	5.32	5.26	5.17	5.11	5.03	4.96	4.87	4.80	4.70	4.62	4.53	4.45	4.39	4.35	4.29	4.21	4.13	4.07	4.01	3.94	
	D	3.86	3.77	3.71	3.65	3.60	3.55	3.54	3.52	3.51	3.48	3.46	3.29	3.26	3.21	3.15	3.09	3.03	2.98	2.97	2.97	3.00	2.98	3.00	3.01	2.97	2.94	2.84	2.75	2.66	2.59	2.51
	J	2.42	2.42	2.43	2.45	2.48	2.48	2.54	2.55	2.54	2.49	2.48	2.43	2.40	2.33	2.28	2.25	2.17	2.22	2.30	2.30	2.33	2.36	2.39	2.36	2.28	2.25	2.17	2.05	1.96	1.93	1.91
	F	1.95	1.93	1.95	1.96	2.02	2.05	2.20	2.19	2.17	2.11	2.05	1.99	1.91	1.95	1.87	1.90	1.93	2.04	2.07	2.07	2.08	2.07	2.04	2.02	2.01	1.98	1.95	1.93			
	M	1.78	1.87	1.99	2.02	2.14	2.17	2.23	2.42	2.52	2.54	2.51	2.45	2.33	2.14	1.93	1.91	1.91	1.90	1.93	2.07	2.17	2.22	2.20	2.27	2.19	2.13	2.14	2.08	2.11	1.99	1.99
	A	2.02	2.17	2.25	2.51	2.69	3.00	3.18	3.24	3.21	3.15	3.09	3.15	3.00	3.01	2.98	3.06	3.18	3.36	3.59	3.65	3.74	3.79	3.80	3.80	3.80	3.73	3.67	3.55	3.50	3.39	
	M	3.51	3.41	3.44	3.48	3.51	3.55	3.51	3.50	3.48	3.50	3.48	3.48	3.51	3.51	3.73	3.82	3.91	4.03	4.11	4.19	4.26	4.32	4.40	4.49	4.57	4.61	4.64	4.70	4.81	4.90	5.07
	J	5.27	5.40	5.47	5.44	5.53	5.61	5.72	5.75	5.78	5.79	5.82	5.82	5.81	5.79	5.78	5.76	5.73	5.76	5.76	5.73	5.70	5.67	5.67	5.65	5.67	5.67	5.69	5.79	5.94	6.13	
81	J	6.31	6.40	6.55	6.68	6.72	6.78	6.80	6.78	6.80	6.77	6.77	6.75	6.77	6.74	6.74	6.77	6.90	6.95	7.01	7.04	7.04	7.03	7.01	7.03	7.01	7.04	7.13	7.24	7.32	7.38	7.47
	A	7.56	7.57	7.54	7.54	7.53	7.50	7.47	7.44	7.41	7.41	7.38	7.35	7.35	7.32	7.30	7.27	7.25	7.24	7.21	7.19	7.18	7.16	7.16	7.19	7.25	7.25	7.25	7.24	7.25	7.25	7.25
	S	7.25	7.27	7.33	7.36	7.35	7.32	7.32	7.38	7.44	7.41	7.38	7.41	7.47	7.47	7.47	7.44	7.38	7.35	7.32	7.25	7.22	7.16	7.10	7.04	7.00	6.92	6.89	6.83	6.77	6.74	
	O	6.72	6.69	6.65	6.58	6.49	6.43	6.37	6.28	6.22	6.16	6.08	6.01	5.94	5.87	5.79	5.76	5.67	5.61	5.55	5.49	5.44	5.32	5.18	5.15	5.06	4.97	4.88	4.82	4.72	4.63	4.57
	N	4.50	4.42	4.36	4.27	4.15	4.05	3.99	3.90	3.86	3.80	3.75	3.75	3.76	3.76	3.75	3.67	3.61	3.54	3.46	3.43	3.40	3.37	3.34	3.29	3.26	3.23	3.20	3.17	3.12	3.09	
	D	3.05	3.00	2.97	2.91	2.84	2.74	2.72	2.68	2.72	2.89	3.10	3.18	3.10	3.04	2.92	2.83	2.80	2.74	2.66	2.60	2.49	2.46	2.43	2.43	2.49	2.51	2.48	2.45	2.43	2.45	2.43
	J	2.37	2.31	2.27	2.22	2.19	2.16	2.19	2.20	2.23	2.28	2.28	2.22	2.28	2.20	2.10	2.10	1.98	1.93	1.79	1.85	1.88	1.90	1.88	1.91	1.95	1.98	2.01	2.04	2.04	2.04	2.01
	F	1.70	1.81	1.82	1.82	1.85	1.88	1.85	1.90	2.07	2.07	2.10	2.10	2.13	2.10	2.05	1.95	1.95	1.85	1.88	1.78	1.82	1.85	1.88	1.91	1.95	2.01	1.98	2.04			
	M	2.01	1.98	1.99	1.82	1.88	1.82	1.67	1.76	1.82	1.88	1.95	1.98	2.04	2.01	1.95	1.81	1.75	1.82	1.78	1.70	1.61	1.64	1.61	1.76	1.75	1.95	2.07	2.13	2.19	2.20	2.22
	A	2.31	2.46	2.69	3.07	3.29	3.50	3.62	3.68	3.79	3.90	3.94	3.96	3.97	3.94	3.90	3.88	3.85	3.80	3.77	3.76	3.76	3.80	3.87	3.91	3.97	4.00	4.05	4.03	4.03	4.05	
	M	4.03	4.02	4.06	4.09	4.14	4.17	4.19	4.22	4.23	4.25	4.28	4.31	4.35	4.37	4.38	4.37	4.35	4.32	4.31	4.29	4.28	4.28	4.26	4.26	4.23	4.22	4.19	4.17	4.15	4.14	4.14
	J	4.11	4.05	4.03	4.08	4.12	4.12	4.11	4.12	4.22	4.37	4.52	4.67	4.83	5.15	5.31	5.53	5.69	5.83	5.95	6.17	6.33	6.47	6.50	6.53	6.61	6.75	6.75	6.78	6.78	6.81	
82	J	6.82	6.84	6.84	6.84	6.87	6.99	7.02	7.05	7.08	7.10	7.13	7.14	7.19	7.23	7.26	7.26	7.20	7.17	7.16	7.16	7.14	7.17	7.17	7.20	7.22	7.28	7.29	7.28	7.28	7.26	7.25
	A	7.20	7.22	7.36	7.54	7.61	7.62	7.64	7.65	7.64	7.59	7.56	7.53	7.48	7.44	7.39	7.35	7.29	7.25	7.21	7.16	7.13	7.10	7.07	7.04	6.98	6.95	6.92	6.89	6.87	6.86	6.83
	S	6.80	6.75	6.72	6.68	6.65	6.60	6.57	6.54	6.51	6.49	6.46	6.46	6.54	6.58	6.71	6.81	6.86	6.86	6.84	6.83	6.81	6.80	6.78	6.77	6.74	6.71	6.68	6.60	6.55	6.51	
	O	6.49	6.46	6.42	6.39	6.34	6.28	6.22	6.19	6.13	6.05	5.99	5.93	5.85	5.81	5.75	5.67	5.58	5.52	5.43	5.35	5.30	5.24	5.21	5.17	5.11	5.03	4.97	4.92	4.85	4.76	4.65
	N	4.57	4.51	4.45	4.40	4.34	4.27	4.21	4.16	4.13	4.08	3.99	3.96	3.90	3.86	3.83	3.81	3.80	3.75	3.72	3.69	3.66	3.61	3.55	3.49	3.44	3.37	3.29	3.22	3.20	3.19	
	D	3.07	3.08	3.04	3.03	2.99	2.96	2.90	2.82	2.76	2.70	2.67	2.66	2.65	2.64	2.63	2.61	2.59	2.59	2.55	2.54	2.52	2.49	2.44	2.40	2.37	2.31	2.27	2.29	2.35	2.39	2.40

Water Level Record at Khaliajuri Hydrological Station (2/4) 1983 ~1990

Y	M	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
	J	2.41	2.39	2.39	2.34	2.25	2.18	2.12	2.14	2.10	2.09	2.10	2.09	2.08	2.09	2.17	2.23	2.09	2.12	2.10	1.99	1.84	1.87	1.85	1.84	1.79	1.92	1.95	2.03	2.11	2.12	2.23
	F	2.26	2.18	2.10	1.99	1.87	1.73	1.66	1.61	1.58	1.64	1.59	1.69	1.79	1.79	1.92	2.01	1.88	1.99	1.99	1.92	1.84	1.84	1.66	1.84	1.82	1.86	2.01	2.12			
	M	2.18	2.29	2.34	2.31	2.23	2.14	1.96	1.92	1.81	1.84	1.98	2.04	2.17	2.35	2.44	2.58	2.62	2.62	2.62	2.64	2.86	2.96	3.19	3.36	3.52	3.65	3.74	3.82	3.85	3.87	3.85
	A	3.79	3.74	3.66	3.58	3.52	3.44	3.37	3.32	3.38	3.57	3.70	3.87	3.92	3.94	4.04	4.07	4.07	4.02	4.00	3.95	3.86	3.78	3.75	3.70	3.70	3.71	3.81	3.87	3.94	4.09	
	M	4.25	4.31	4.36	4.42	4.52	4.63	4.66	4.71	4.76	4.80	4.87	4.95	5.05	5.15	5.18	5.23	5.29	5.33	5.41	5.44	5.49	5.50	5.50	5.52	5.54	5.54	5.53	5.52	5.51	5.48	5.45
83	J	5.43	5.41	5.38	5.38	5.36	5.34	5.36	5.37	5.38	5.40	5.39	5.39	5.37	5.35	5.42	5.54	5.58	5.70	5.78	5.83	5.85	5.90	5.98	6.02	6.10	6.12	6.16	6.17	6.20	6.25	
	J	6.32	6.42	6.52	6.74	6.85	7.00	7.03	7.03	7.02	6.99	6.97	6.95	6.91	6.90	6.88	6.87	6.90	6.90	6.88	6.85	6.82	6.82	6.83	6.84	6.85	6.91	6.98	7.08	7.14	7.17	7.20
	A	7.19	7.15	7.16	7.37	7.40	7.40	7.43	7.41	7.40	7.38	7.37	7.35	7.33	7.32	7.27	7.22	7.18	7.15	7.12	7.10	7.10	7.21	7.32	7.45	7.55	7.64	7.65	7.66	7.63	7.62	7.60
	S	7.57	7.55	7.52	7.51	7.48	7.47	7.45	7.57	7.62	7.70	8.04	8.05	8.02	7.96	7.96	7.98	7.96	7.94	7.92	7.90	7.91	7.92	8.00	7.88	7.83	7.76	7.74	7.71	7.65	7.70	
	O	7.55	7.48	7.43	7.38	7.33	7.27	7.25	7.19	7.15	7.11	7.14	7.09	7.05	6.97	6.88	6.82	6.78	6.76	6.72	6.69	6.67	6.64	6.59	6.54	6.49	6.45	6.39	6.33	6.24	6.15	6.10
	N	6.01	5.96	5.96	5.79	5.71	5.64	5.56	5.49	5.42	5.34	5.28	5.23	5.15	5.07	5.00	4.95	4.88	4.81	4.74	4.68	4.63	4.56	4.51	4.47	4.42	4.47	4.32	4.26	4.20	4.15	
	D	4.10	4.05	4.01	3.97	3.93	3.89	3.85	3.81	3.76	3.72	3.67	3.62	3.57	3.53	3.45	3.40	3.35	3.30	3.25	3.32	3.33	3.33	3.29	3.28	3.25	3.20	3.16	3.15	3.10	3.09	3.05
	J	3.05	3.04	3.05	3.08	3.05	3.02	3.00	2.94	2.90	2.87	2.79	2.74	2.67	2.60	2.63	2.59	2.67	2.71	2.78	2.56	2.61	2.62	2.62	2.54	2.44	2.33	2.20	2.15	2.12	2.11	2.10
	F	2.11	2.12	2.11	2.15	2.21	2.21	2.17	2.12	2.14	2.07	2.06	2.04	1.89	1.88	1.89	1.94	1.99	2.09	2.11	2.25	2.26	2.29	2.20	1.99	1.83	1.63	1.55	1.61	1.66		
	M	1.79	1.79	1.84	1.97	2.05	2.03	2.11	2.17	2.19	2.17	2.07	2.05	2.12	2.07	2.12	2.09	2.10	2.22	2.52	2.53	2.51	2.44	2.32	2.27	2.14	2.07	2.09	2.07	2.14	2.13	2.19
	A	2.35	2.52	2.69	2.84	2.90	3.10	3.26	3.37	3.40	3.32	3.24	3.08	3.00	2.92	2.89	3.01	3.07	3.16	3.27	3.42	3.43	3.44	3.39	3.29	3.22	3.14	3.12	3.11	3.15	3.20	
	M	3.29	3.38	3.46	3.55	3.62	3.72	3.76	3.83	3.90	3.93	4.01	4.12	4.22	4.37	4.52	4.66	4.79	4.86	4.94	5.03	5.14	5.26	5.55	5.87	6.43	6.70	6.80	6.85	6.85	6.83	6.80
84	J	6.79	6.75	6.69	6.67	6.60	6.61	6.63	6.61	6.60	6.57	6.55	6.52	6.50	6.49	6.48	6.50	6.70	6.80	6.89	6.95	7.01	7.02	7.06	7.06	7.05	7.03	7.01	6.98	6.96	6.94	
	J	6.91	6.89	6.87	6.87	6.88	6.88	6.92	7.08	7.28	7.45	7.54	7.60	7.65	7.73	7.79	7.79	7.77	7.75	7.71	7.72	7.74	7.82	7.92	8.03	8.05	8.07	8.10	8.13	8.13	8.07	8.04
	A	8.00	7.96	7.93	7.91	7.89	7.82	7.76	7.68	7.62	7.54	7.48	7.43	7.36	7.31	7.26	7.21	7.19	7.15	7.15	7.13	7.08	7.01	6.98	6.97	6.97	6.98	6.95	6.93	6.89	6.86	6.84
	S	6.82	6.80	6.79	6.82	6.87	6.97	7.05	7.08	7.10	7.08	7.08	7.08	7.08	7.11	7.46	7.80	7.89	8.00	8.01	8.02	8.00	7.95	7.83	7.75	7.68	7.63	7.57	7.53	7.45	7.39	
	O	7.30	7.24	7.18	7.12	7.08	7.08	6.96	6.90	6.82	6.73	6.64	6.57	6.49	6.35	6.35	6.28	6.21	6.15	6.07	6.00	5.96	5.92	5.87	5.81	5.77	5.72	5.78	5.63	5.58	5.54	5.48
	N	5.43	5.37	5.30	5.24	5.17	5.10	5.03	4.97	4.89	4.83	4.75	4.70	4.63	4.55	4.50	4.41	4.34	4.25	4.19	4.14	4.08	4.04	4.01	3.96	3.92	3.89	3.85	3.80	3.75	3.68	
	D	3.63	3.59	3.54	3.49	3.44	3.42	3.38	3.41	3.36	3.35	3.31	3.29	3.28	3.23	3.27	3.30	3.25	3.20	3.15	3.12	3.08	3.07	3.06	3.05	3.03	3.02	2.97	2.91	2.95	2.77	2.70
	J	2.65	2.60	2.59	2.58	2.55	2.53	2.55	2.57	2.58	2.57	2.55	2.55	2.51	2.38	2.29	2.31	2.22	2.23	2.23	2.30	2.27	2.28	2.31	2.32	2.29	2.28	2.28	2.27	2.21	2.20	2.21
	F	2.09	2.02	1.99	2.09	2.11	2.28	2.41	2.50	2.53	2.55	2.50	2.39	2.37	2.33	2.21	1.98	2.00	2.08	2.16	2.19	2.23	2.22	2.22	2.27	2.28	2.34	2.36	2.32			
	M	2.27	2.25	2.31	2.40	2.32	2.47	2.64	2.74	2.82	2.89	2.78	2.68	2.67	2.54	2.45	2.47	2.49	2.58	2.98	3.18	3.48	3.61	3.67	3.72	3.79	3.73	3.65	3.56	3.48	3.57	3.73
	A	3.73	3.72	3.70	3.69	3.66	3.60	3.55	3.52	3.64	3.73	3.86	3.95	4.05	4.15	4.24	4.30	4.34	4.37	4.38	4.40	4.45	4.49	4.43	4.44	4.50	4.52	4.54	4.57	4.57	4.53	
	M	4.49	4.44	4.43	4.46	4.49	4.52	4.47	4.44	4.42	4.37	4.30	4.23	4.17	4.12	4.07	4.07	4.07	4.05	4.02	4.02	4.03	4.03	4.00	3.96	3.96	3.96	4.04	4.18	4.41	4.52	4.65
85	J	4.80	4.94	5.09	5.27	5.47	5.69	5.94	6.17	6.30	6.39	6.42	6.45	6.46	6.46	6.48	6.54	6.55	6.64	6.64	6.65	6.65	6.65	6.65	6.65	6.66	6.67	6.69	6.72	6.75	6.77	
	J	6.78	6.75	6.74	6.72	6.72	6.72	6.72	6.77	6.87	6.97	7.01	7.03	7.04	7.05	7.05	7.04	7.02	7.00	7.02	7.03	7.04	7.06	7.07	7.08	7.17	7.20	7.22	7.40	7.51	7.52	7.51
	A	7.47	7.45	4.72	7.41	7.38	7.34	7.31	7.28	7.24	7.20	7.14	7.08	7.04	7.01	6.97	6.95	6.92	6.90	6.89	6.86	6.88	6.89	6.91	7.01	7.06	7.05	7.00	6.96	6.92	6.87	6.83
	S	6.82	6.80	6.77	6.75	6.74	6.72	6.74	6.73	6.71	6.67	6.64	6.62	6.63	6.62	6.61	6.60	6.57	6.54	6.52	6.50	6.48	6.51	6.50	6.47	6.44	6.48	6.48	6.47	6.47	6.46	
	O	6.43	6.42	6.38	6.34	6.30	6.27	6.23	6.19	6.14	6.09	6.03	5.97	5.91	5.88	5.81	5.75	5.69	5.66	5.62	5.60	5.56	5.50	5.46	5.41	5.37	5.31	5.27	5.22	5.16	5.10	5.03
	N	4.97	4.92	4.85	4.77	4.72	4.68	4.62	4.55	4.51	4.39	4.32	4.27	4.21	4.21	4.15	4.11	4.07	4.03	3.97	3.93	3.88	3.82	3.76	3.71	3.67	3.62	3.59	3.55	3.52	3.40	
	D	3.35	3.30	3.23	3.18	3.11	3.04	2.98	2.95	3.00	3.00	3.05	3.08	3.06	3.03	3.04	2.99	2.92	2.82	2.75	2.67	2.61	2.50	2.45	2.45	2.49	2.50	2.51	2.52	2.50	2.50	2.51
	J	2.44	2.41	2.34	2.31	2.26	2.25	2.25	2.29	2.28	2.28	2.33	2.28	2.38	2.36	2.28	2.20	2.14	2.11	1.98	1.89	1.90	1.90	1.89	1.92	1.95	2.00	2.04	2.09	2.10	2.08	2.06
	F	2.14	2.19	2.06	2.02	1.94	1.87	1.91	1.95	2.01	2.06	2.07	2.06	2.08	2.06	2.08	2.05	1.93	1.71	1.66	1.64	1.60	1.66	1.76	1.86	1.94	2.03	2.05	2.05			
	M	2.11	2.14	2.08	2.01	1.91	1.91	1.75	1.87	1.90	2.01	2.10	2.16	2.11	2.20	2.23	2.19	2.15	2.06	2.00	1.79	1.81	1.80	1.81	1.90	1.97	2.05	2.15	2.26	2.39	2.45	2.51
	A	2.31	2.36	2.25	2.09	2.08	2.10	2.16	2.29	2.56	2.57	2.57	2.66	2.69	2.96	3.14	3.34	3.64	3.86	4.02	4.11	4.13	4.15	4.16	4.20	4.22	4.23	4.24	4.21	4.16	4.12	
	M	4.08	4.06	4.04	4.02	4.06	4.18	4.24	4.27	4.27	4.26	4.26	4.24	4.21	4.17	4.14	4.11	4.08	4.08	4.05	3.97	3.87	3.85	3.85	3.84	3.83	3.81	3.79	3.77	3.71	3.66	3.52
86	J	3.31	3.23	3.15	3.08	3.04	3.03	3.04	3.08	3.11	3.20	3.29	3.32	3.40	3.48	3.54	3.60	3.67	3.72	3.76	3.86	3.96	4.04	4.12	4.17	4.25	4.35	4.39	4.45	4.54	4.63	
	J	5.17	5.33	5.48	5.60	5.71	5.82	5.91	5.99	6.05	6.16	6.29	6.33	6.35	6.36	6.34	6.35	6.36	6.36	6.34	6.35	6.34	6.34	6.36	6.41	6.48	6.58	6.68	6.72	6.74	6.75	6.75
	A	6.77	6.82	6.85	6.85	6.84	6.84	6.80	6.78	6.75	6.70	6.68	6.66	6.62	6.60	6.59	6.58	6.56	6.53	6.49	6.44	6.44	6.46	6.49	6.54	6.61	6.65	6.66	6.65	6.64	6.62	6.62
	S	6.60	6.63	6.64	6.64	6.61	6.59	6.57	6.56	6.57	6.54	6.57	6.60	6.63	6.67	6.70	6.73	6.76	6.76	6.74	6.71	6.69	6.67	6.64	6.61	6.58	6.56	6.55	6.55	6.55	6.55	
	O	6.54	6.54	6.52	6.50	6.48	6.47	6.54	6.67	6.84	6.90	6.92	6.92	6.92	6.91	6.91	6.90	6.89	6.87	6.84	6.81	6.77	6.74	6.69	6.64	6.60	6.55	6.49	6.39	6.34	6.29	6.22
	N	6.15	6.09	6.01	5.94	5.87	5.81	5.74	5.69	5.65	5.64	5.63	5.59	5.56	5.54	5.50	5.45	5.42	5.38	5.34	5.30	5.26	5.22	5.18	5.12	5.05	4.98	4.92	4.84	4.77	4.68	
	D	4.62	4.55	4.50	4.44	4.37	4.29	4.23	4.19	4.15	4.08	4.01	3.96	3.91	3.87	3.82	3.76	3.74	3.70	3.66	3.63	3.59	3.52	3.52	3.39	3.32	3.28	3.19	3.10	3.02	2.91	2.92
	J	2.91	2.87	2.84	2.80	2.71	2.67	2.62	2.56	2.46	2.39	2.34	2.32	2.29	2.27	2.29	2.30	2.31	2.32	2.31	2.27	2.26	2.21	2.15	2.13	2.12	2.11	2.04	2.11	2.13	2.23	2.26
	F	2.27	2.29	2.27	2.29	2.26	2.22	2.09	2.03	1.89	1.82	1.88	1.93	1.95	2.00	2.05	2.12	2.18	2.22	2.23	2.24	2.12	1.97	1.92	1.83	1.84	1.90	1.94	2.02			
	M	2.01	2.03	2.13	2.05	1.97	1.92	1.75	1.77	1.79	1.84	1.94	1.96	2.07	2.06	2.12	2.21	2.25	2.33	2.37	2.43	2.47	2.45	2.42	2.17	2.09	2.05	2.09	2.11	2.09	2.23	2.25
	A	2.42	2.45	2.72	2.99	3.28	3.46	3.56	3.56	3.59	3.71	3.85	3.97	4.12	4.20	4.22	4.25	4.23	4.19	4.08	3.99	3.90	3.83	3.75	3.69	3.84	3.96	4.11	4.18	4.21	4.24	
	M	4.24	4.22	4.19	4.17	4.15	4.12	4.08	4.03	4.03	4.03	4.02	4.01	4.01	4.00	3.98	3.97	3.97	3.96	3.93	3.93	3.93	3.92	3.98	4.07	4.13	4.16	4.19	4.22	4.20	4.16	4.14
87	J	4.14	4.15	4.18	4.23	4.41	4.72	4.81	4.92	5.04	5.18	5.31	5.42	5.54	5.69	5.82	5.92	5.93	5.94	5.93	5.96	5.99	6.01	6.09	6.22	6.35	6.55	6.63	6.71	6.78	6.89	
	J	7.03	7.14	7.16	7.17	7.16	7.14	7.13	7.11	7.09	7.07	7.07	7.06	7.04	7.02	7.00	6.99	6.99	6.99	6.97	6.95	6.94	6.92	6.96	7.13	7.29	7.41	7.41	7.43	7.49	7.56	7.73
	A	7.94	8.00	8.03	8.03	8.01	7.98	7.97	7.95	7.92	7.90	7.95	8.00	8.01	8.01	7.99	7.96	7.89	7.83	7.79	7.79	7.76	7.72	7.69	7.65	7.63	7.66	7.65	7.63	7.60	7.58	7.55
	S	7.51	7.49	7.46	7.43	7.41	7.39	7.36	7.33	7.30	7.26	7.26	7.24	7.21	7.21	7.20	7.17	7.13	7.10	7.07	7.02	7.00	6.99	7.11	7.26	7.46	7.57	7.65	7.66	7.66	7.64	
	O	7.62	7.60	7.55	7.51	7.46	7.40	7.35	7.31	7.25	7.17	7.10	7.06	7.00	6.89	6.80	6.74	6.66	6.56	6.50	6.46	6.40	6.32	6.23	6.15	6.06	5.98	5.89	5.82	5.75	5.69	5.64
	N	5.54	5.47	5.41	5.35	5.29	5.22	5.15	5.09	5.02	4.95	4.89	4.82	4.77	4.72	4.67	4.62	4.52	4.47	4.46	4.44	4.42	4.40	4.37	4.34	4.30	4.27	4.22	4.17	4.12	4.07	
	D	4.01	3.97	3.93	3.88	3.83	3.80	3.76	3.72	3.67	3.63	3.59	3.56	3.54	3.52	3.46	3.40	3.37	3.34	3.35	3.37	3.38	3.36	3.36	3.37	3.35	3.28	3.21	3.13	3.07	3.00	2.93
	J	2.88	2.87	2.87	2.89	2.87	2.89	2.90	2.88	2.84	2.73	2.68	2.63	2.61	2.56	2.49	2.50	2.47	2.48	2.51	2.51	2.57	2.59	2.56	2.57	2.47	2.41	2.37	2.22	2.05	2.02	2.04
	F	2.06	2.12	2.14	2.18	2.18	2.24	2.30	2.29	2.24	2.23	2.14	2.09	2.14	2.13	2.12	2.14	2.27	2.42	2.56	2.58	2.56	2.57	2.49	2.46	2.47	2.27	2.14	2.16	2.21		
	M	2.29	2.25	2.29	2.31	2.32	2.37	2.48	2.48	2.48	2.42	2.36	2.35	2.27	2.31	2.39	2.42	2.59	2.67	2.69	2.82	2.86	2.85	2.79	2.72	2.67	2.62	2.54	2.55	2.52	2.51	2.49
	A	2.57	2.64	2.66	2.62	2.60	2.61	2.59	2.58	2.60	2.59	2.64	2.70	2.80	2.86	2.99	3.30	3.31	3.32	3.38	3.43	3.46	3.43	3.42	3.39	3.35	3.30	3.28	3.29	3.19	3.18	
	M	3.29	3.32	3.33	3.36	3.48	3.58	3.69	3.81	3.93	4.05	4.17	4.34	4.57	4.63	4.70	4.73	4.95	5.08	5.25	5.44	5.62	5.81	5.97	6.16	6.53	6.72	6.94	7.10	7.41	7.56	7.58
88	J	7.58	7.57	7.54	7.49	7.44	7.39	7.34	7.28	7.22	7.17	7.13	7.09	7.05	6.99	6.94	6.91	6.89	6.86	6.83	6.88	6.93	6.95	7.03	7.16	7.62	7.83	7.86	7.84	7.83	7.83	
	J	7.83	7.84	7.93	8.03	8.21	8.46	8.62	8.72	8.74	8.74	8.73	8.70	8.63	8.59	8.51	8.48	8.41	8.33	8.24	8.15	8.10	7.94	7.90	7.88	7.86	7.82	7.77	7.72	7.71	7.66	7.60
	A	7.51	7.46	7.44	7.41	7.38	7.35	7.32	7.29	7.25	7.23	7.32	7.37	7.42	7.50	7.60	7.63	7.63	7.62	7.60	7.58	7.62	7.66	7.84	7.92	7.96	8.07	8.20	8.41	8.46	8.45	8.42
	S	8.39	8.36	8.38	8.40	8.48	8.49	8.46	8.49	8.55	8.54	8.53	8.54	8.50	8.44	8.36	8.28	8.19	8.09	8.02	7.92	7.85	7.75	7.65	7.57	7.45	7.40	7.33	7.25	7.16	7.10	
	O	7.03	6.97	6.90	6.85	6.95	6.97	6.90	6.87	6.80	6.75	6.70	6.65	6.61	6.55	6.50	6.44	6.37	6.32	6.30	6.28	6.27	6.23	6.19	6.15	6.12	6.10	6.08	6.02	5.96	5.91	5.84
	N	5.77	5.70	5.64	5.57	5.51	5.44	5.38	5.31	5.25	5.19	5.13	5.08	5.02	4.98	4.95	4.85	4.76	4.67	4.60	4.54	4.50	4.46	4.41	4.36	4.31	4.27	4.22	4.27	4.36	4.41	
	D	4.51	4.58	4.61	4.63	4.64	4.65	4.63	4.61	4.58	4.55	4.52	4.48	4.45	4.41	4.36	4.29	4.23	4.17	4.13	4.09	4.03	3.99	3.93	3.91	3.87	3.84	3.80	3.77	3.72	3.68	3.66
	J	3.62	3.59	3.56	3.52	3.45	3.41	3.39	3.38	3.37	3.37	3.38	3.35	3.31	3.25	3.13	3.10	3.01	2.99	2.92	2.90	2.89	2.87	2.86	2.87	2.86	2.83	2.81	2.82	2.75	2.78	2.69
	F	2.50	2.47	2.46	2.45	2.56	2.68	2.71	2.73	2.73	2.74	2.68	2.58	2.51	2.39	2.24	2.15	2.07	2.16	2.23	2.31	2.40	2.47	2.50	2.49	2.58	2.62	2.60	2.59			
	M	2.49	2.49	2.45	2.44	2.36	2.35	2.30	2.27	2.22	2.20	2.22	2.20	2.20	2.21	2.21	2.21	2.20	2.15	2.16	2.17	2.18	2.19	2.20	2.27	2.31	2.40	2.57	2.65	2.70	2.72	2.65
	A	2.53	2.50	2.57	2.80	3.09	3.28	3.29	3.30	3.39	3.48	3.57	3.65	3.75	3.84	3.94	3.99	4.07	4.12	4.16	4.17	4.13	4.10	4.05	4.01	3.96	4.08	4.30	4.45	4.61	4.69	
	M	4.74	4.77	4.88	4.96	5.00	5.04	5.06	5.06	5.04	5.02	4.99	4.97	4.95	4.93	4.99	5.10	5.12	5.15	5.18	5.20	5.20	5.22	5.22	5.22	5.23	5.24	5.23	5.30	5.42	5.54	5.69
89	J	5.81	5.94	6.08	6.18	6.29	6.39	6.46	6.54	6.56	6.58	6.61	6.63	6.67	6.79	6.85	6.96	7.10	7.13	7.15	7.15	7.13	7.09	7.03	7.06	7.08	7.07	7.06	7.04	7.01	7.05	
	J	7.12	7.21	7.38	7.45	7.57	7.64	7.66	7.68	7.68	7.71	7.74	7.77	7.79	7.79	7.80	7.80	7.80	7.78	7.71	7.63	7.58	7.51	7.43	7.31	7.26	7.22	7.19	7.59	7.71	7.90	7.89
	A	7.88	7.86	7.83	7.80	7.77	7.76	7.75	7.83	7.89	7.94	7.92	7.88	7.85	7.82	7.80	7.78	7.76	7.74	7.74	7.73	7.73	7.70	7.65	7.60	7.55	7.52	7.48	7.46	7.43	7.47	7.45
	S	7.45	7.44	7.44	7.47	7.52	7.57	7.54	7.50	7.45	7.41	7.40	7.38	7.36	7.41	7.41	7.39	7.37	7.35	7.40	7.38	7.36	7.34	7.32	7.30	7.29	7.27	7.24	7.25	7.24	7.23	
	O	7.22	7.21	7.21	7.19	7.17	7.13	7.09	7.14	7.23	7.31	7.30	7.29	7.27	7.21	7.16	7.11	7.08	7.07	7.18	7.17	7.14	7.10	7.07	7.01	6.93	6.87	6.83	6.77	6.70	6.64	6.56
	N	6.49	6.45	6.39	6.33	6.26	6.21	6.17	6.10	6.03	5.96	5.91	5.85	5.76	5.68	5.89	5.50	5.42	5.24	5.12	5.02	4.92	4.82	4.78	4.72	4.62	4.52	4.42	4.30	4.18	4.12	
	D	3.87	3.83	3.79	3.76	3.73	3.70	3.64	3.60	3.56	3.53	3.49	3.46	3.42	3.39	3.33	3.26	3.24	3.18	3.09	3.09	3.02	2.97	2.92	2.87	2.82	2.82	2.77	2.75	2.68	2.66	2.65
	J	2.63	2.62	2.59	2.54	2.47	2.44	2.42	2.39	2.37	2.34	2.35	2.32	2.34	2.34	2.33	2.34	2.34	2.36	2.25	2.18	2.13	2.12	2.11	2.09	2.07	2.09	2.11	2.14	2.19	2.45	2.36
	F	2.37	2.27	2.20	2.13	2.08	1.97	1.92	1.93	1.96	2.03	2.11	2.12	2.11	2.10	2.09	2.07	2.03	1.94	1.86	1.85	1.80	1.90	1.98	2.13	2.10	2.20	2.40	2.41			
	M	2.40	2.36	2.40	2.31	2.20	2.03	1.99	2.01	2.03	2.10	2.11	2.22	2.27	2.28	2.30	2.26	2.23	2.20	2.13	2.07	2.02	2.07	2.15	2.39	2.49	2.73	2.80	2.82	2.93	2.82	2.90
	A	2.83	2.74	2.63	2.54	2.50	2.50	2.55	2.62	2.95	3.15	3.30	3.45	3.63	3.80	4.08	4.27	4.40	4.54	4.73	4.85	4.98	5.12	5.04	5.17	5.22	5.26	5.30	5.36	5.42	5.45	
	M	5.49	5.53	5.60	5.65	5.68	5.71	5.73	5.74	5.76	5.77	5.75	5.72	5.72	5.74	5.76	5.76	5.74	5.74	5.75	5.76	5.76	5.77	5.77	5.78	5.78	5.79	5.86	5.92	5.95	6.00	6.08
90	J	6.16	6.21	6.30	6.34	6.37	6.41	6.48	6.54	6.61	6.69	6.73	6.76	6.76	6.76	6.77	6.77	6.78	6.80	6.79	6.79	6.80	6.81	6.84	6.87	6.88	6.85	6.79	6.79	6.81	6.89	
	J	6.89	6.86	6.85	6.86	6.86	6.87	6.88	6.92	6.92	6.92	6.91	6.91	6.91	6.90	6.91	6.90	6.90	6.92	6.93	6.92	6.92	6.90	6.88	6.88	6.91	6.96	7.01	7.03	7.07	7.10	7.09
	A	7.07	7.05	7.03	7.02	7.01	7.01	7.00	6.97	6.98	7.01	7.05	7.12	7.13	7.12	7.11	7.09	7.07	7.05	7.02	7.00	6.97	6.96	6.96	6.95	6.96	6.95	6.95	6.96	6.95	6.92	6.85
	S	6.81	6.77	6.74	6.72	6.64	6.60	6.57	6.55	6.54	6.55	6.52	6.49	6.46	6.42	6.37	6.39	6.46	6.45	6.43	6.42	6.41	6.39	6.37	6.37	6.35	6.48	6.50	6.69	6.77	6.77	
	O	6.79	6.80	6.79	6.79	6.78	6.75	6.84	6.90	6.96	7.03	7.03	7.03	7.01	6.99	6.96	6.92	6.87	6.81	6.74	6.69	6.63	6.59	6.54	6.46	6.35	6.23	6.14	6.06	5.96	5.87	5.81
	N	5.73	5.65	5.58	5.53	5.47	5.42	5.36	5.32	5.27	5.21	5.16	5.12	5.08	5.04	4.99	4.94	4.90	4.84	4.81	4.77	4.70	4.62	4.55	4.50	4.45	4.42	4.38	4.34	4.29	4.23	
	D	4.18	4.15	4.12	4.09	4.05	4.00	3.97	3.92	3.87	3.83	3.80	3.77	3.75	3.74	3.72	3.69	3.65	3.61	3.58	3.56	3.52	3.49	3.46	3.43	3.40	3.37	3.34	3.31	3.28	3.39	3.44

Water Level Record at Khaliajuri Hydrological Station (3/4) 1991 ~1998

Y	M	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
91	J	3.42	3.39	3.33	3.30	3.28	3.23	3.27	3.28	3.24	3.19	3.12	3.04	3.02	3.01	2.99	2.98	2.96	2.93	2.90	2.86	2.87	2.89	2.85	2.77	2.66	2.59	2.58	2.49	2.44	2.46	2.52
	F	2.54	2.72	2.87	2.95	2.92	2.80	2.82	2.80	2.71	2.64	2.57	2.58	2.54	2.53	2.54	2.55	2.49	2.52	2.57	2.59	2.63	2.52	2.46	2.48	2.48	2.50	2.52	2.59			
	M	2.56	2.54	2.55	2.53	2.54	2.60	2.67	2.51	2.43	2.40	2.39	2.29	2.34	2.36	2.43	2.47	2.59	2.68	2.74	2.79	2.76	2.82	2.69	2.56	2.42	2.41	2.44	2.46	2.49	2.52	2.86
	A	3.09	3.28	3.44	3.65	3.80	4.07	4.22	4.41	4.55	4.55	4.53	4.47	4.43	4.39	4.37	4.36	4.36	4.29	4.20	4.12	3.96	3.86	3.85	3.75	3.64	3.67	3.73	3.74	3.80	4.00	
	M	4.23	4.43	4.65	5.00	5.24	5.36	5.51	5.61	5.75	5.85	6.03	6.27	6.44	6.62	6.82	6.92	7.06	7.17	7.24	7.30	7.37	7.38	7.38	7.44	7.44	7.44	7.44	7.43	7.45	7.46	7.49
	J	7.49	7.46	7.51	7.52	7.56	7.55	7.54	7.54	7.53	7.51	7.51	7.57	7.61	7.65	7.73	7.81	7.89	7.94	7.94	7.91	7.91	7.91	7.92	7.94	7.92	7.90	7.88	7.87	7.86	7.83	
	J	7.76	7.69	7.65	7.61	7.58	7.53	7.49	7.36	7.31	7.28	7.24	7.21	7.22	7.19	7.18	7.15	7.13	7.13	7.13	7.11	7.09	7.07	7.04	6.98	6.93	6.89	6.85	6.80	6.79	6.78	6.78
	A	6.78	6.78	6.78	6.88	7.01	7.03	7.03	7.02	6.99	6.98	6.97	6.93	6.92	6.90	6.92	6.89	6.85	6.82	6.75	6.70	6.65	6.60	6.61	6.60	6.62	6.61	6.62	6.60	6.62	6.56	6.57
	S	6.65	6.82	7.06	7.13	7.13	7.15	7.18	7.22	7.24	7.26	7.28	7.28	7.26	7.26	7.24	7.22	7.18	7.15	7.12	7.11	7.08	7.04	7.07	7.08	7.20	7.37	7.35	7.30	7.25	7.21	
	O	7.15	7.10	7.04	6.98	6.92	6.88	6.84	6.80	6.75	6.71	6.65	6.57	6.58	6.69	6.85	6.97	6.95	6.89	6.84	6.79	6.72	6.68	6.58	6.51	6.45	6.38	6.30	6.21	6.14	6.05	5.96
	N	5.88	5.83	5.79	5.75	5.69	5.65	5.61	5.56	5.52	5.47	5.42	5.34	5.27	5.20	5.15	5.08	5.01	4.95	4.90	4.84	4.79	4.74	4.70	4.64	4.60	4.55	4.50	4.44	4.39	4.34	
	D	4.27	4.21	4.15	4.10	4.05	3.99	3.95	3.90	3.86	3.83	3.79	3.75	3.70	3.65	3.58	3.50	3.43	3.40	3.36	3.39	3.40	3.37	3.38	3.49	3.63	3.75	3.71	3.70	3.68	3.68	3.68
92	J	3.65	3.66	3.57	3.52	3.44	3.38	3.41	3.40	3.40	3.41	3.28	3.21	3.15	3.12	3.08	3.09	3.08	3.05	3.04	3.03	3.02	3.03	3.08	3.04	3.03	3.01	3.00	2.92	2.79	2.76	2.71
	F	2.65	2.67	2.73	2.75	2.78	2.75	2.74	2.73	2.75	2.63	2.47	2.35	2.28	2.19	2.13	2.19	2.31	2.36	2.36	2.35	2.35	2.40	2.41	2.31	2.23	2.24	2.20	2.16	2.09		
	M	2.05	2.06	2.24	2.25	2.26	2.28	2.34	2.37	2.38	2.37	2.35	2.32	2.28	2.25	2.15	2.23	2.36	2.47	2.56	2.73	2.92	3.14	3.41	3.63	3.77	3.98	4.08	4.11	4.11	4.06	3.95
	A	3.85	3.72	3.59	3.50	3.41	3.29	3.22	3.20	3.16	3.17	3.16	3.21	3.22	3.26	3.32	3.46	3.57	3.65	3.73	3.79	3.76	3.78	3.84	3.89	3.86	3.78	3.68	3.58	3.49	3.40	
	M	3.36	3.31	3.28	3.37	3.45	3.55	3.58	3.59	3.62	3.64	3.66	3.67	3.63	3.60	3.57	3.70	3.86	4.35	4.59	4.61	4.63	4.65	4.65	4.68	4.71	4.73	4.76	4.78	4.82	4.85	4.88
	J	4.89	4.90	4.91	4.92	4.91	4.90	4.89	4.89	4.90	4.91	4.97	5.03	5.12	5.22	5.33	5.47	5.56	5.64	5.67	5.69	5.72	5.75	5.76	5.80	5.94	6.10	6.25	6.46	6.56	6.59	
	J	6.65	6.69	6.72	6.77	6.79	6.82	6.85	6.89	6.98	7.00	6.97	6.97	6.97	6.97	6.99	7.04	7.05	7.00	6.97	6.95	6.94	6.92	6.89	6.86	6.84	6.81	6.78	6.76	6.71	6.65	6.63
	A	6.61	6.59	6.57	6.55	6.54	6.60	6.63	6.65	6.65	6.62	6.59	6.55	6.52	6.48	6.46	6.42	6.38	6.36	6.33	6.31	6.28	6.26	6.23	6.21	6.19	6.28	6.27	6.26	6.23	6.24	6.24
	S	6.26	6.23	6.20	6.18	6.17	6.15	6.11	6.09	6.06	6.05	6.04	6.08	6.12	6.17	6.19	6.19	6.22	6.22	6.20	6.19	6.16	6.12	6.08	6.05	6.00	6.01	6.04	6.08	6.17	6.38	
	O	6.49	6.49	6.46	6.42	6.37	6.34	6.29	6.25	6.18	6.13	6.07	6.02	6.05	6.12	6.14	6.11	6.09	6.07	6.05	6.03	6.00	5.98	5.96	5.93	5.90	5.87	5.84	5.80	5.77	5.70	5.64
	N	5.59	5.54	5.49	5.44	5.39	5.31	5.24	5.17	5.11	5.04	4.98	4.91	4.85	4.78	4.73	4.69	4.62	4.57	4.51	4.46	4.40	4.36	4.28	4.24	4.18	4.13	4.08	4.03	3.98	3.94	
	D	3.90	3.84	3.78	3.75	3.71	3.68	3.62	3.58	3.55	3.53	3.50	3.47	3.43	3.39	3.36	3.32	3.26	3.22	3.18	3.15	3.10	3.09	3.08	3.05	3.04	3.03	3.02	2.99	2.96	2.90	2.84
93	J	2.77	2.73	2.68	2.65	2.62	2.63	2.60	2.65	2.75	2.92	3.02	3.06	3.02	2.94	2.84	2.78	2.70	2.60	2.55	2.54	2.55	2.53	2.50	2.48	2.49	2.33	2.25	2.12	2.09	2.07	2.08
	F	2.06	2.05	2.05	2.01	2.02	2.06	2.22	2.33	2.39	2.31	2.37	2.39	2.23	2.22	2.17	2.20	2.38	2.94	3.47	3.72	3.92	4.10	4.22	4.27	4.27	4.22	4.15	4.08			
	M	3.97	3.87	3.72	3.57	3.48	3.35	3.23	3.12	3.04	2.98	2.94	2.85	2.79	2.69	2.62	2.63	2.64	2.66	2.70	2.71	2.72	2.76	2.88	2.92	3.12	3.27	3.45	3.62	3.68	3.63	3.52
	A	3.42	3.29	3.20	3.08	3.02	3.01	2.97	2.94	2.91	2.88	2.97	3.04	3.10	3.07	3.00	2.97	2.95	2.96	2.95	2.92	2.91	2.88	2.91	2.92	2.98	3.17	3.27	3.37	3.45	3.55	
	M	3.64	3.73	3.94	4.12	4.33	4.56	4.82	4.93	4.99	5.05	5.10	5.17	5.25	5.32	5.43	5.61	5.73	5.91	6.01	6.12	6.23	6.28	6.31	6.30	6.28	6.27	6.26	6.22	6.19	6.16	6.14
	J	6.12	6.10	6.09	6.06	6.13	6.21	6.32	6.44	6.57	6.66	6.76	6.90	7.05	7.10	7.13	7.14	7.15	7.20	7.40	7.62	7.62	7.65	7.65	7.64	7.61	7.60	7.57	7.55	7.59	7.66	
	J	7.70	7.72	7.74	7.74	7.79	7.82	7.81	7.78	7.77	7.72	7.68	7.62	7.55	7.48	7.44	7.39	7.36	7.51	7.63	7.85	8.09	8.15	8.15	8.15	8.08	8.04	8.00	7.97	7.92	7.88	7.84
	A	7.79	7.74	7.71	7.69	7.69	7.69	7.72	7.73	7.74	7.70	7.67	7.64	7.61	7.55	7.49	7.45	7.37	7.34	7.31	7.29	7.27	7.26	7.29	7.32	7.31	7.27	7.30	7.31	7.29	7.26	7.23
	S	7.27	7.31	7.31	7.28	7.25	7.20	7.16	7.13	7.07	7.03	6.99	6.95	6.91	6.87	6.84	6.80	6.75	6.70	6.67	6.64	6.61	6.57	6.54	6.50	6.47	6.53	6.61	6.63	6.62	6.63	
	O	6.65	6.65	6.69	6.72	6.69	6.66	6.62	6.57	6.53	6.48	6.41	6.36	6.32	6.27	6.22	6.16	6.11	6.06	6.02	5.97	5.91	5.84	5.77	5.72	5.68	5.61	5.53	5.45	5.37	5.30	5.24
	N	5.17	5.11	5.06	5.01	4.96	4.90	4.84	4.78	4.72	4.66	4.59	4.52	4.46	4.41	4.36	4.31	4.26	4.21	4.16	4.11	4.03	3.95	3.89	3.84	3.79	3.73	3.68	3.64	3.59	3.56	
	D	3.54	3.53	3.51	3.45	3.39	3.33	3.27	3.22	3.17	3.16	3.13	3.11	3.11	3.10	3.10	3.10	2.99	2.94	2.93	2.85	2.78	2.72	2.65	2.58	2.57	2.58	2.61	2.66	2.68	2.71	2.72
94	J	2.72	2.70	2.70	2.68	2.59	2.53	2.44	2.44	2.43	2.44	2.46	2.47	2.46	2.47	2.41	2.46	2.58	2.53	2.38	2.18	2.13	2.05	2.04	2.06	2.11	2.18	2.28	2.32	2.38	2.41	2.43
	F	2.48	2.44	2.40	2.27	2.26	2.19	2.18	2.15	2.21	2.26	2.28	2.28	2.28	2.20	2.17	2.13	2.14	2.15	2.13	2.05	2.04	2.06	2.00	2.05	2.03	1.96	2.15	2.15			
	M	2.18	2.13	2.12	2.13	2.12	2.13	2.17	2.03	1.88	1.86	1.88	1.90	1.93	2.02	2.23	2.42	2.52	2.48	2.47	2.50	2.71	3.06	3.23	3.59	3.92	4.12	4.29	4.54	4.81	4.81	4.84
	A	4.91	5.00	5.04	5.08	5.07	5.07	5.07	5.07	5.04	4.97	4.90	4.86	4.79	4.71	4.64	4.57	4.50	4.42	4.31	4.35	4.36	4.34	4.36	4.38	4.44	4.46	4.47	4.42	4.35	4.26	
	M	4.20	4.17	4.14	4.10	4.08	4.06	4.10	4.19	4.28	4.34	4.39	4.41	4.41	4.40	4.42	4.44	4.46	4.47	4.47	4.46	4.43	4.40	4.39	4.46	4.52	4.58	4.61	4.66	4.72	4.86	4.96
	J	5.04	5.18	5.34	5.46	5.67	5.94	6.10	6.21	6.29	6.42	6.47	6.55	6.59	6.61	6.63	6.64	6.62	6.58	6.58	6.56	6.54	6.52	6.49	6.46	6.46	6.43	6.41	6.41	6.45	6.48	
	J	6.57	6.55	6.55	6.52	6.53	6.58	6.63	6.65	6.65	6.64	6.62	6.61	6.61	6.59	6.59	6.57	6.54	6.52	6.49	6.45	6.43	6.42	6.45	6.48	6.54	6.61	6.67	6.65	6.62	6.60	6.58
	A	6.56	6.55	6.53	6.51	6.53	6.56	6.56	6.56	6.56	6.56	6.58	6.66	6.71	6.82	6.90	6.94	6.93	6.91	6.88	6.88	6.84	6.88	6.92	6.93	6.91	6.89	6.88	6.88	6.84	6.82	6.79
	S	6.75	6.73	6.70	6.66	6.61	6.59	6.55	6.51	6.49	6.46	6.45	6.39	6.37	6.35	6.31	6.27	6.25	6.24	6.25	6.28	6.31	6.31	6.29	6.28	6.25	6.22	6.18	6.15	6.11	6.04	
	O	5.99	5.95	5.90	5.87	5.83	5.82	5.80	5.84	5.88	5.94	5.99	6.06	6.08	6.06	6.03	5.99	5.95	5.92	5.89	5.84	5.79	5.74	5.68	5.61	5.56	5.49	5.41	5.35	5.27	5.20	5.13
	N	5.07	4.99	4.95	4.89	4.82	4.76	4.70	4.65	4.58	4.50	4.44	4.39	4.32	4.26	4.21	4.14	4.07	3.98	3.93	3.89	3.84	3.78	3.74	3.66	3.59	3.54	3.49	3.45	3.39	3.32	
	D	3.32	3.33	3.33	3.32	3.31	3.27	3.22	3.13	3.11	3.03	2.94	2.86	2.81	2.75	2.75	2.80	2.82	2.85	2.86	2.85	2.83	2.82	2.78	2.71	2.73	2.66	2.61	2.57	2.56	2.55	2.56
95	J	2.64	2.66	2.68	2.64	2.65	2.57	2.55	2.50	2.39	2.28	2.24	2.23	2.20	2.19	2.17	2.16	2.20	2.30	2.31	2.32	2.30	2.34	2.35	2.32	2.22	2.04	1.98	1.97	1.99	2.07	2.13
	F	2.21	2.22	2.27	2.24	2.21	2.25	2.16	2.05	1.97	1.91	1.82	1.90	1.98	2.06	2.08	2.18	2.33	2.38	2.46	2.49	2.40	2.37	2.34	2.25	2.06	2.00	2.08	2.18			
	M	2.23	2.33	2.40	2.38	2.37	2.36	2.26	2.16	2.05	1.89	1.76	1.80	1.82	1.93	2.08	2.13	2.20	2.36	2.42	2.43	2.48	2.50	2.45	2.23	2.10	2.20	2.24	2.30	2.39	2.48	2.53
	A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	M	3.47	3.82	3.98	4.17	4.23	4.32	4.29	4.25	4.16	4.06	3.96	3.90	3.90	3.97	4.36	4.62	4.72	4.78	4.87	4.92	4.95	4.96	-	-	-	-	-	-	-	-	-
	J	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	J	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	S	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	O	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	N	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	D	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
96	J	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	F	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	A	5.05	5.21	5.29	5.32	5.35	5.34	5.32	5.31	5.27	5.21	5.13	5.08	4.97	4.82	4.69	4.59	4.50	4.42	4.37	4.46	4.62	4.72	4.81	4.88	4.94	4.92	4.88	4.84	4.79	4.77	
	M	4.93	5.12	5.24	5.34	5.34	5.35	5.36	5.38	5.43	5.51	5.56	5.58	5.60	5.62	5.67	5.72	5.75	5.79	5.86	5.91	5.98	6.03	6.06	6.10	6.12	6.17	6.21	6.21	6.26	6.30	6.36
	J	6.43	6.48	6.82	6.68	6.86	7.00	7.00	7.01	7.01	7.00	7.01	6.99	6.93	6.89	6.85	6.82	6.79	6.74	6.69	6.65	6.61	6.56	6.53	6.61	6.69	6.74	6.81	6.94	7.12	7.19	
	J	7.26	7.33	7.39	7.46	7.52	7.57	7.60	7.66	7.71	7.77	7.86	8.02	8.20	8.26	8.26	8.26	8.29	8.31	8.33	8.34	8.33	8.30	8.28	8.26	8.23	8.19	8.16	8.11	8.08	8.06	8.04
	A	8.02	8.00	7.98	7.96	7.94	7.92	7.89	7.83	7.80	7.77	7.74	7.71	7.67	7.63	7.60	7.63	7.70	7.73	7.76	7.78	7.82	7.84	7.83	7.80	7.78	7.76	7.74	7.76	7.78	7.90	7.97
	S	8.04	8.02	8.00	7.96	7.93	7.90	7.91	7.89	7.87	7.83	7.78	7.75	7.71	7.66	7.63	7.59	7.53	7.45	7.42	7.39	7.37	7.35	7.33	7.29	7.26	7.22	7.20	7.24	7.17	7.11	
	O	7.06	6.99	6.95	6.93	6.90	6.91	6.94	6.93	6.91	6.89	6.87	6.85	6.82	6.78	6.73	6.67	6.61	6.56	6.52	6.47	6.42	6.36	6.27	6.20	6.14	6.08	6.03	6.02	6.09	6.18	6.27
	N	6.37	6.44	6.51	6.51	6.53	6.54	6.54	6.52	6.48	6.43	6.38	6.32	6.27	6.19	6.14	6.08	6.03	5.98	5.93	5.86	5.78	5.70	5.62	5.56	5.50	5.44	5.37	5.33	5.31	5.29	
	D	5.22	5.16	5.11	5.06	5.01	4.95	4.91	4.89	4.79	4.72	4.67	4.59	4.46	4.43	4.38	4.34	4.29	4.25	4.21	4.16	4.15	4.16	4.18	4.19	4.21	4.21	4.22	4.22	4.23	4.22	4.23
97	J	4.30	4.27	4.24	4.18	4.13	4.12	4.13	4.19	4.20	4.17	4.12	4.15	4.13	4.15	3.99	3.87	3.78	3.69	3.57	3.57	3.59	3.69	3.70	3.69	3.60	3.64	3.59	3.59	3.59	3.56	3.53
	F	3.53	3.47	3.46	3.42	3.52	3.63	3.72	3.81	3.87	3.85	3.83	3.82	3.81	3.76	3.56	3.44	3.41	3.29	1.84	1.86	1.89	1.92	1.91	1.96	1.97	2.07	2.06	2.08			
	M	2.06	2.01	2.02	1.85	1.88	1.89	1.98	1.98	2.10	2.27	2.36	2.27	2.29	2.15	2.14	2.20	2.19	2.18	2.16	2.16	2.22	2.27	2.42	2.56	2.66	2.65	2.68	2.67	2.60	2.67	2.61
	A	2.46	2.42	2.48	2.47	2.45	2.61	2.65	2.62	2.69	2.73	2.72	2.64	2.62	2.61	2.49	2.37	2.38	2.35	2.45	2.48	2.48	2.40	2.44	2.50	2.56	2.63	2.65	2.67	2.62	2.56	
	M	2.53	2.40	2.38	2.45	2.65	2.71	2.75	2.82	2.83	2.90	2.91	2.92	2.94	2.93	2.95	2.99	2.98	2.99	3.09	3.27	3.42	3.55	3.70	3.87	4.04	4.14	4.19	4.21	4.23	4.22	4.22
	J	4.28	4.34	4.36	4.42	4.47	4.52	4.60	4.63	4.69	4.76	4.85	4.90	5.01	5.18	5.29	5.40	5.51	5.60	5.70	5.77	5.90	6.01	6.07	6.13	6.18	6.20	6.22	6.30	6.37	6.45	
	J	6.57	6.65	6.71	6.73	6.73	6.73	6.73	6.85	6.97	7.07	7.15	7.30	7.45	7.50	7.51	7.49	7.46	7.44	7.43	7.41	7.35	7.30	7.27	7.25	7.23	7.22	7.19	7.17	7.15	7.12	7.10
	A	7.07	7.01	6.97	6.92	6.87	6.83	6.79	6.74	6.76	6.83	6.89	6.96	7.00	7.04	7.07	7.08	7.04	7.01	6.99	6.97	6.94	6.90	6.85	6.80	6.77	6.74	6.70	6.66	6.64	6.62	6.61
	S	6.63	6.66	6.65	6.63	6.64	6.61	6.59	6.52	6.49	6.47	6.54	6.61	6.66	6.68	6.71	6.73	6.75	6.76	6.72	6.64	6.73	6.77	6.80	6.80	6.81	6.87	6.84	6.82	6.79	6.76	
	O	6.73	6.71	6.69	6.67	6.62	6.57	6.53	6.49	6.45	6.42	6.36	6.29	6.23	6.17	6.11	6.04	5.96	5.87	5.78	5.72	5.65	5.59	5.54	5.49	5.38	5.34	5.32	5.27	5.20	5.11	5.06
	N	5.01	4.93	4.85	4.78	4.73	4.67	4.60	4.53	4.45	4.39	4.33	4.26	4.21	4.17	4.09	4.03	3.96	3.91	3.87	3.84	3.77	3.69	3.58	3.49	3.43	3.36	3.31	3.26	3.22	3.18	
	D	3.15	3.13	3.11	3.07	3.03	2.97	2.93	2.89	2.86	2.83	2.82	2.81	2.83	2.82	2.86	2.88	2.89	2.87	2.77	2.73	2.62	2.57	2.61	2.52	2.48	2.51	2.51	2.54	2.56	2.59	2.61
98	J	2.63	2.61	2.59	2.53	2.44	2.40	2.37	2.34	2.32	2.30	2.43	2.50	2.54	2.57	2.58	2.47	2.52	2.49	2.39	2.29	2.19	2.14	2.16	2.21	2.22	2.21	2.20	2.21	2.21	2.20	2.22
	F	2.29	2.32	2.35	2.27	2.09	1.99	2.00	1.87	1.96	1.99	2.00	1.99	2.06	2.16	2.14	2.15	2.15	2.15	2.12	1.98	1.91	1.93	1.93	2.02	2.14	2.19	2.21	2.27			
	M	2.27	2.38	2.37	2.25	2.08	1.99	1.89	1.86	1.88	1.91	1.95	2.02	2.18	2.25	2.28	2.26	2.17	2.11	2.00	1.95	2.03	2.05	2.08	2.12	2.53	2.92	3.33	3.53	3.66	3.74	3.74
	A	3.75	3.66	3.56	3.38	3.23	3.01	2.93	2.94	2.96	3.00	3.05	3.18	3.27	3.44	3.55	3.57	3.50	3.42	3.32	3.27	3.35	3.48	3.54	3.63	3.73	3.85	4.02	4.06	4.04	4.00	
	M	3.93	3.85	3.77	3.67	3.60	3.54	3.49	3.45	3.50	3.62	3.72	3.79	3.90	3.85	3.78	3.72	3.66	3.57	3.53	3.49	3.38	3.58	3.99	4.39	4.53	4.61	4.67	4.69	4.74	4.76	-
	J	4.92	4.99	5.06	5.10	5.15	5.25	5.39	5.54	5.74	5.99	6.10	6.23	6.39	6.48	6.60	6.70	6.78	6.85	6.89	6.93	6.96	6.98	7.00	7.00	6.99	6.96	6.92	6.86	6.84	6.81	
	J	6.78	6.75	6.72	6.70	6.68	6.66	6.72	6.79	6.83	6.84	6.87	6.92	7.00	7.14	7.19	7.26	7.32	7.41	7.57	7.70	7.80	7.92	7.99	8.07	8.12	8.14	8.13	8.12	8.11	8.10	8.09
	A	8.11	8.12	8.14	8.17	8.04	8.00	7.96	7.93	7.90	7.88	7.87	7.86	7.87	7.90	7.94	7.96	7.99	8.01	8.03	8.01	7.98	7.96	7.93	7.95	8.00	8.01	8.01	8.02	8.05	8.08	8.11
	S	8.19	8.14	8.14	8.16	8.18	8.17	8.14	8.11	8.06	8.03	8.01	7.98	7.95	7.91	7.88	7.85	7.77	7.73	7.66	7.58	7.51	7.44	7.38	7.31	7.23	7.16	7.06	6.94	6.81	6.66	
	O	6.58	6.48	6.41	6.33	6.28	6.21	6.11	6.01	5.94	5.87	5.82	5.77	5.69	5.62	5.57	5.52	5.47	5.44	5.39	5.43	5.48	5.51	5.54	5.56	5.57	5.55	5.53	5.51	5.49	5.44	5.41
	N	5.36	5.33	5.28	5.24	5.18	5.12	5.07	5.01	4.95	4.88	4.81	4.77	4.74	4.71	4.69	4.66	4.60	4.56	4.53	4.48	4.45	4.41	4.41	4.47	4.51	4.50	4.48	4.46	4.44	4.40	
	D	4.36	4.31	4.28	4.24	4.19	4.14	4.08	4.04	3.99	3.92	3.82	3.74	3.65	3.54	3.48	3.44	3.42	3.40	3.38	3.35	3.31	3.28	3.26	3.24	3.18	3.11	3.06	3.00	3.01	2.99	3.01

Water Level Record at Khaliajuri Hydrological Station (4/4) 1999 ~2005

Y	M	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
99	J	3.01	3.02	3.01	2.97	2.95	2.99	3.00	2.98	2.98	2.80	2.71	2.63	2.65	2.64	2.74	2.78	2.80	2.80	2.85	2.85	2.89	2.90	2.89	2.80	2.63	2.51	2.50	2.47	2.50	2.57	2.61
	F	2.66	2.68	2.72	2.76	2.74	2.73	2.73	2.74	2.71	2.67	2.46	2.38	2.32	2.34	2.48	2.47	2.61	2.63	2.61	2.62	2.74	2.77	2.79	2.71	2.56	2.42	2.44	2.44			
	M	2.43	2.42	2.39	2.39	2.40	2.44	2.47	2.48	2.49	2.55	2.54	2.52	2.53	2.56	2.54	2.57	2.59	2.73	2.85	2.84	2.81	2.75	2.65	2.71	2.72	2.70	2.69	2.74	2.89	2.88	2.86
	A	2.88	3.02	3.06	3.08	3.04	3.03	3.02	2.94	2.94	2.75	2.56	2.63	2.69	2.93	2.99	3.19	3.43	3.57	3.58	3.60	3.62	3.58	3.57	3.67	3.67	3.78	3.88	3.93	4.09	4.38	
	M	4.53	4.53	4.62	4.77	4.91	5.01	5.08	5.12	5.15	5.17	5.19	5.22	5.25	5.27	5.29	5.29	5.26	5.24	5.22	5.20	5.18	5.18	5.18	5.22	5.31	5.37	5.41	5.50	5.58	5.67	5.74
	J	5.93	6.08	6.26	6.33	6.44	6.54	6.58	6.63	6.67	6.71	6.71	6.72	6.73	6.73	6.71	6.69	6.68	6.71	6.74	6.74	6.92	7.03	7.09	7.14	7.21	7.29	7.33	7.41	7.51	7.65	
	J	7.80	7.84	7.86	7.87	7.86	7.83	7.85	7.90	8.02	8.08	8.15	8.17	8.20	8.19	8.17	8.18	8.23	8.26	8.33	8.40	8.47	8.52	8.54	8.52	8.42	8.32	8.25	8.21	8.18	8.14	8.11
	A	8.12	8.10	8.08	8.06	8.03	7.97	7.92	7.87	7.83	7.85	7.90	7.94	7.99	8.04	8.07	8.05	8.00	7.95	7.95	7.99	8.03	8.04	8.05	8.02	8.01	8.03	8.06	8.10	8.09	8.07	8.08
	S	8.08	8.06	8.05	8.03	8.01	7.98	7.96	7.94	7.93	7.91	7.90	7.89	7.92	7.90	7.87	7.85	7.83	7.81	7.78	7.76	7.75	7.73	7.69	7.65	7.61	7.57	7.53	7.48	7.43	7.40	
	O	7.36	7.31	7.26	7.23	7.21	7.18	7.14	7.16	7.16	7.14	7.11	7.07	7.04	7.00	6.97	6.94	6.90	6.89	6.93	6.95	6.99	6.96	6.93	6.91	6.87	6.84	6.81	6.78	6.75	6.71	6.68
	N	6.62	6.58	6.55	6.52	6.48	6.45	6.40	6.34	6.30	6.24	6.17	6.13	6.08	6.03	5.98	5.91	5.85	5.76	5.71	5.65	5.60	5.54	5.46	5.41	5.36	5.31	5.28	5.21	5.16	5.09	
	D	5.01	4.96	4.89	4.84	4.79	4.75	4.70	4.65	4.60	4.56	4.51	4.48	4.43	4.38	4.30	4.26	4.21	4.14	4.04	4.01	4.10	4.16	4.21	4.19	4.18	4.12	4.09	4.04	3.99	3.91	3.82
00	J	3.72	3.74	3.75	3.74	3.73	3.73	3.73	3.70	3.68	3.67	3.67	3.65	3.68	3.70	3.71	3.72	3.72	3.73	3.59	3.58	3.54	3.46	3.41	3.38	3.35	3.23	3.15	2.98	3.00	2.89	2.87
	F	2.81	2.78	2.76	2.75	2.72	2.66	2.63	2.59	2.56	2.57	2.56	2.55	2.57	2.58	2.56	2.57	2.58	2.59	2.60	2.59	2.60	2.61	2.73	2.73	2.74	2.67	2.64	2.63	2.58		
	M	2.60	2.61	2.63	2.63	2.69	2.73	2.77	2.77	2.78	2.78	2.90	2.94	2.98	3.10	3.13	4.04	4.09	4.16	4.18	4.18	4.20	4.21	4.20	3.99	3.88	3.81	3.72	3.65	3.62	3.60	3.55
	A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4.32	4.47	4.62	4.74	
	M	4.88	4.98	5.09	5.18	5.27	5.32	5.37	5.45	5.52	5.61	5.66	5.73	5.76	5.78	5.78	5.77	5.76	5.78	5.80	5.83	5.86	5.89	5.93	6.01	6.08	6.19	6.29	6.38	6.49	6.55	6.59
	J	6.62	6.65	6.67	6.68	6.71	6.78	6.82	6.86	6.89	6.92	6.96	7.00	7.07	7.12	7.16	7.19	7.20	7.17	7.13	7.06	7.03	7.07	7.12	7.19	7.22	7.31	7.33	7.28	7.26	7.26	
	J	7.25	7.23	7.20	7.17	7.14	7.12	7.10	7.10	7.11	7.12	7.10	7.06	7.03	7.01	6.98	6.95	6.91	6.88	6.86	6.84	6.81	6.78	6.75	6.71	6.68	6.65	6.63	6.61	6.61	6.62	6.68
	A	6.77	6.86	7.01	7.11	7.15	7.15	7.16	7.17	7.18	7.19	7.21	7.25	7.33	7.37	7.40	7.43	7.45	7.47	7.49	7.52	7.52	7.48	7.45	7.41	7.38	7.35	7.31	7.28	7.23	7.18	7.14
	S	7.11	7.08	7.07	7.06	7.06	7.05	7.03	7.04	7.05	7.07	7.06	7.05	7.05	7.03	7.03	7.08	7.10	7.13	7.16	7.19	7.17	7.14	7.12	7.14	7.15	7.13	7.11	7.09	7.06	7.04	
	O	7.01	6.98	6.95	6.91	6.86	6.83	6.80	6.76	6.70	6.63	6.56	6.48	6.33	6.29	6.23	6.18	6.11	6.03	5.97	5.89	5.81	5.72	5.67	5.60	5.54	5.51	5.46	5.42	5.37	5.46	5.43
	N	5.43	5.42	5.39	5.36	5.33	5.29	5.24	5.15	5.12	5.07	5.03	4.98	4.95	4.90	4.86	4.79	4.74	4.69	4.64	4.59	4.52	4.47	4.40	4.34	4.29	4.23	4.17	4.11	4.06	4.02	
	D	3.97	3.92	3.85	3.78	3.67	3.61	3.55	3.51	3.47	3.47	3.40	3.33	3.28	3.30	3.29	3.28	3.27	3.25	3.16	3.10	3.03	2.96	2.96	2.95	2.98	3.00	2.98	2.97	2.93	2.91	2.84
01	J	3.70	3.62	3.57	3.56	3.53	3.51	3.47	3.46	3.48	3.52	3.56	3.58	3.60	3.58	3.50	3.41	3.34	3.28	3.27	3.25	3.24	3.21	3.23	3.24	3.33	3.36	3.31	3.30	3.28	3.25	3.24
	F	3.21	3.13	3.08	3.08	3.02	3.12	3.15	3.25	3.39	3.35	3.37	3.43	3.38	3.24	3.11	2.99	2.90	2.97	2.96	2.95	3.08	3.21	3.26	3.29	3.30	3.42	3.58	3.76			
	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	M	4.97	5.01	5.02	4.96	4.91	4.86	4.83	4.94	5.02	5.14	5.23	5.34	5.44	5.55	5.66	5.76	5.86	5.98	6.12	6.22	6.32	6.43	6.54	6.65	6.76	6.88	7.01	7.11	7.23	7.32	-
	J	7.30	7.22	7.14	7.05	7.01	6.96	6.88	6.85	6.75	6.72	6.75	6.77	6.60	6.71	6.82	6.92	7.03	7.01	6.97	6.91	6.89	6.89	6.87	6.86	6.81	6.77	6.73	6.68	6.66	6.63	
	J	6.64	6.64	6.62	6.59	6.55	6.53	6.52	6.52	6.53	6.53	6.51	6.50	6.49	6.49	6.48	6.46	6.44	6.43	6.44	6.45	6.48	6.48	6.46	6.46	6.47	6.48	6.56	6.75	6.85	7.02	-
	A	7.23	7.26	7.26	7.25	7.23	7.19	7.16	7.14	7.11	7.10	7.06	7.04	6.98	6.94	6.89	6.84	6.78	6.73	6.67	6.64	6.64	6.61	6.57	6.55	6.57	6.70	6.74	6.76	6.69	6.69	-
	S	6.70	6.74	6.73	6.71	6.69	6.69	6.70	6.71	6.71	6.70	6.69	6.68	6.66	6.64	6.64	6.66	6.69	6.72	6.75	6.73	6.73	6.73	6.72	6.70	6.68	6.63	6.57	6.54	-	-	-
	O	6.43	6.40	6.36	6.38	6.40	6.40	6.39	6.40	6.38	6.36	6.40	6.43	6.39	6.37	6.38	6.35	6.29	6.26	6.23	6.20	6.18	6.16	6.11	6.05	5.99	5.93	5.86	5.82	5.79	5.73	5.69
	N	5.66	5.64	5.61	5.58	5.55	5.53	5.51	5.48	5.45	5.41	5.37	5.34	5.30	5.28	5.26	5.25	5.22	5.20	5.17	5.14	5.09	5.04	4.96	4.91	4.86	4.80	4.75	4.71	4.66	4.60	
	D	4.54	4.49	4.45	4.40	4.35	4.32	4.26	4.20	4.17	4.11	4.05	3.98	3.89	3.81	3.75	3.70	3.65	3.61	3.53	3.44	3.39	3.33	3.26	3.18	3.13	3.10	3.09	3.12	3.10	3.08	3.03
02	J	3.03	3.01	3.00	2.99	2.96	2.88	2.83	2.80	2.78	2.69	2.67	2.66	2.67	2.68	2.71	2.66	2.67	2.69	2.67	2.70	2.58	2.56	2.46	2.43	2.44	2.45	2.48	2.49	2.58	2.56	2.58
	F	2.53	2.59	2.59	2.60	2.37	2.30	2.31	2.29	2.31	2.32	2.33	2.38	2.43	2.45	2.48	2.49	2.50	2.40	2.38	2.34	2.20	2.10	2.14	2.25	2.36	2.41	2.42	2.51			
	M	2.77	2.78	2.76	2.77	2.68	2.64	2.44	2.33	2.18	2.24	2.28	2.40	2.48	2.57	2.62	2.55	2.54	2.53	2.51	2.51	2.47	2.23	2.17	2.27	2.40	2.52	2.90	3.02	3.09	3.10	3.06
	A	3.05	2.95	2.94	2.92	2.87	2.79	2.72	2.70	2.77	2.87	3.20	3.45	3.47	3.45	3.39	3.51	4.13	4.60	4.86	4.94	4.99	5.01	4.99	4.97	4.96	4.96	5.01	5.08	5.13	5.18	
	M	5.20	5.22	5.25	5.30	5.36	5.39	5.40	5.42	5.44	5.52	5.60	5.68	5.78	5.86	5.89	5.93	6.00	6.01	6.01	6.05	6.08	6.13	6.22	6.30	6.39	6.45	6.47	6.52	6.55	6.58	6.60
	J	6.63	6.66	6.69	6.69	6.68	6.66	6.74	6.76	6.75	6.72	6.71	6.72	6.77	6.94	7.17	7.43	7.55	7.62	7.73	7.81	7.83	7.78	7.72	7.68	7.65	7.61	7.59	7.60	7.62	7.64	
	J	7.62	7.63	7.59	7.61	7.67	7.70	7.75	7.78	7.80	7.79	7.79	7.75	7.73	7.72	7.73	7.68	7.69	7.69	7.70	7.73	7.88	8.00	8.08	8.17	8.16	8.16	8.13	8.11	8.09	8.07	8.06
	A	8.08	8.14	8.13	8.13	8.10	8.07	8.04	8.00	7.98	7.97	7.98	7.97	7.96	7.92	7.90	7.87	7.85	7.83	7.80	7.79	7.78	7.76	7.74	7.73	7.73	7.71	7.69	7.66	7.63	7.59	7.54
	S	7.50	7.45	7.40	7.33	7.28	7.19	7.13	7.04	6.99	6.93	6.86	6.79	6.73	6.65	6.57	6.56	6.50	6.48	6.44	6.40	6.34	6.31	6.34	6.31	6.29	6.27	6.29	6.31	6.37	6.44	
	O	6.56	6.60	6.62	6.64	6.65	6.64	6.61	6.58	6.56	6.51	6.46	6.39	6.33	6.28	6.21	6.16	6.08	6.02	5.97	5.93	5.88	5.83	5.80	5.80	5.72	5.72	5.69	5.66	5.62	5.58	5.53
	N	5.49	5.43	5.37	5.33	5.29	5.24	5.19	5.15	5.11	5.05	5.00	5.06	5.15	5.21	5.25	5.27	5.29	5.29	5.28	5.27	5.24	5.20	5.16	5.12	5.07	5.02	4.96	4.90	4.84	4.79	
	D	4.72	4.65	4.60	4.55	4.51	4.45	4.41	4.35	4.29	4.21	4.14	4.09	4.01	3.95	3.90	3.86	3.82	3.72	3.70	3.67	3.65	3.63	3.63	3.57	3.51	3.46	3.43	3.35	3.32	3.30	3.28
03	J	3.22	3.25	3.23	3.24	3.22	3.19	3.14	3.05	3.04	2.99	2.91	2.89	2.85	2.84	2.83	2.80	2.83	2.82	2.83	2.84	2.87	2.89	2.88	2.87	2.82	2.75	2.70	2.68	2.66	2.63	2.60
	F	2.65	2.70	2.76	2.75	2.71	2.65	2.65	2.64	2.57	2.46	2.40	2.40	2.40	2.52	2.60	2.65	2.78	2.74	2.79	2.82	2.82	2.78	2.73	2.52	2.38	2.35	2.40	2.38			
	M	2.41	2.59	2.68	2.75	2.80	2.73	2.72	2.65	2.58	2.49	2.42	2.35	2.25	2.30	2.35	2.63	2.72	2.84	2.95	3.00	3.04	3.06	3.00	2.75	2.62	2.55	2.52	2.55	2.65	2.66	2.75
	A	2.98	3.13	3.42	3.45	3.53	3.54	3.52	3.42	3.30	3.32	3.29	3.02	3.08	3.24	3.42	3.47	3.72	3.91	4.19	4.39	4.55	4.50	4.41	4.33	4.17	4.04	4.00	3.98	3.98	4.04	
	M	3.95	4.05	4.21	4.32	4.44	4.59	4.75	4.84	4.84	4.81	4.77	4.71	4.66	4.63	4.66	4.70	4.75	4.89	4.96	4.99	5.01	5.04	5.07	5.08	5.10	5.13	5.16	5.18	5.25	5.31	5.32
	J	5.32	5.35	5.35	5.33	5.34	5.36	5.53	5.68	5.87	6.02	6.14	6.33	6.46	6.59	6.73	6.88	6.96	7.01	7.05	7.07	7.10	7.13	7.15	7.17	7.20	7.25	7.41	7.72	7.88	8.10	
	J	8.23	8.23	8.20	8.18	8.15	8.13	8.10	8.08	8.07	8.11	8.13	8.20	8.29	8.32	8.30	8.29	8.26	8.21	8.21	8.22	8.21	8.19	8.16	8.10	8.03	7.99	7.96	7.91	7.90	7.94	7.98
	A	7.96	7.90	7.84	7.76	7.70	7.66	7.63	7.65	7.63	7.61	7.60	7.59	7.57	7.53	7.48	7.45	7.43	7.42	7.40	7.38	7.36	7.33	7.32	7.31	7.30	7.29	7.30	7.25	7.22	7.20	7.20
	S	7.19	7.18	7.15	7.11	7.10	7.08	7.07	7.05	7.03	7.00	6.98	6.97	6.98	7.00	7.00	7.01	7.02	7.03	7.02	7.04	7.03	7.00	6.96	6.94	6.93	6.93	6.93	6.97	6.94	6.92	
	O	6.95	6.87	6.85	6.84	6.82	6.80	6.78	6.76	6.79	6.86	6.89	6.95	6.98	6.99	6.96	6.94	6.91	6.88	6.84	6.81	6.77	6.71	6.65	6.60	6.55	6.49	6.45	6.41	6.35	6.31	6.25
	N	6.20	6.15	6.11	6.08	6.03	5.97	5.92	5.87	5.83	5.78	5.72	5.67	5.61	5.56	5.49	5.44	5.38	5.32	5.26	5.19	5.12	5.05	5.00	4.90	4.85	4.82	4.78	4.75	4.72	4.66	
	D	4.58	4.50	4.44	4.40	4.33	4.27	4.22	4.18	4.15	4.11	4.07	4.03	3.98	3.95	3.90	3.86	3.81	3.76	3.73	3.75	3.75	3.78	3.83	3.89	3.86	3.85	3.84	3.77	3.63	3.54	3.51
04	J	3.46	3.41	3.36	3.27	3.18	3.19	3.19	3.20	3.20	3.21	3.20	3.11	3.13	3.15	3.11	3.08	3.01	3.02	3.01	3.11	3.13	3.16	3.15	3.13	3.14	3.07	3.03	3.00	2.86	2.78	2.60
	F	2.63	2.67	2.62	2.57	2.71	2.74	2.76	2.90	2.89	2.80	2.86	2.93	2.78	2.83	2.73	2.74	2.73	2.75	2.76	2.91	3.03	2.98	3.07	3.06	3.06	2.97	2.90	2.85	2.83		
	M	2.67	2.66	2.68	2.73	2.81	2.85	2.89	2.92	2.90	2.87	2.96	2.95	2.85	2.74	2.68	2.62	2.73	2.88	2.91	3.13	3.38	3.70	4.06	4.26	4.36	4.40	4.39	4.23	4.10	4.11	4.14
	A	4.08	4.01	4.05	4.08	4.17	4.19	4.25	4.23	4.21	4.36	4.55	4.80	5.09	5.31	5.49	5.61	5.73	5.76	5.79	5.86	5.93	5.97	6.12	6.22	6.28	6.37	6.45	6.50	6.58	6.63	
	M	6.65	6.68	6.70	6.68	6.65	6.62	6.59	6.56	6.55	6.51	6.44	6.42	6.41	6.40	6.46	6.50	6.53	6.55	6.58	6.60	6.63	6.65	6.66	6.68	6.74	6.77	6.79	6.79	6.79	6.79	6.77
	J	6.76	6.76	6.81	6.82	6.84	6.93	6.90	6.87	6.84	6.82	6.78	6.75	6.71	6.67	6.65	6.64	6.64	6.67	6.71	6.80	6.88	6.98	7.08	7.19	7.24	7.28	7.33	7.37	7.40	7.45	
	J	7.49	7.52	7.52	7.52	7.55	7.68	8.01	8.15	8.33	8.45	8.59	8.63	8.66	8.65	8.66	8.67	8.70	8.81	9.22	9.48	9.55	9.53	9.50	9.49	9.45	9.41	9.38	9.36	9.30	9.25	9.22
	A	9.13	9.06	9.00	8.97	8.90	8.83	8.76	8.68	8.54	8.54	8.50	8.43	8.34	8.24	8.13	8.05	8.01	7.94	7.90	7.81	7.76	7.73	7.71	7.68	7.67	7.69	7.68	7.68	7.66	7.63	7.67
	S	7.67	7.68	7.69	7.66	7.64	7.65	7.64	7.64	7.68	7.68	7.65	7.63	7.65	7.67	7.69	7.69	7.66	7.63	7.61	7.58	7.55	7.51	7.48	7.45	7.44	7.40	7.35	7.34	7.32	7.28	
	O	7.21	7.15	7.13	7.08	7.15	7.23	7.40	7.64	7.76	7.73	7.70	7.68	7.64	7.60	7.57	7.52	7.48	7.43	7.35	7.31	7.24	7.16	7.10	7.02	6.95	6.88	6.79	6.69	6.61	6.53	6.45
	N	6.38	6.30	6.23	6.14	6.08	6.02	5.95	5.89	5.82	5.75	5.68	5.61	5.54	5.48	5.44	5.40	5.37	5.29	5.23	5.18	5.11	5.06	5.01	4.92	4.85	4.80	4.75	4.70	4.64	4.57	
	D	4.49	4.43	4.38	4.32	4.26	4.18	4.12	4.07	4.01	4.03	4.00	4.00	3.99	3.95	3.93	3.91	3.87	3.81	3.70	3.63	3.59	3.58	3.57	3.51	3.44	3.36	3.41	3.40	3.38	3.35	3.34
05	J	3.35	3.32	3.29	3.25	3.21	3.18	3.19	3.21	3.20	3.26	3.26	3.31	3.27	3.36	3.32	3.24	3.16	3.12	3.11	3.05	2.95	2.96	2.99	3.01	3.04	3.05	3.08	3.06	3.05	3.02	2.93
	F	2.91	2.90	2.94	2.85	2.82	2.81	2.87	2.91	3.11	3.13	3.18	3.24	3.28	3.30	3.23	3.21	2.98	3.03	3.06	3.07	3.08	3.03	3.01	3.11	3.13	3.15	3.17	3.28			
	M	3.23	3.26	3.19	3.15	3.18	3.13	3.12	2.98	3.11	3.33	3.51	3.65	3.61	3.64	3.61	3.51	3.42	3.16	3.03	3.06	3.44	4.16	4.38	4.49	4.66	4.80	4.85	4.93	5.11	5.17	5.22
	A	5.22	5.17	5.04	4.90	4.76	4.66	4.66	4.70	4.72	4.99	5.18	5.33	5.36	5.33	5.28	5.21	5.11	5.01	4.92	4.83	4.75	4.69	4.66	4.68	4.64	4.69	4.76	4.86	4.92	4.94	
	M	4.94	4.90	4.86	4.86	4.93	4.96	5.05	5.13	5.19	5.23	5.32	5.39	5.43	5.46	5.50	5.54	5.58	5.64	5.69	5.74	5.83	5.88	5.93	6.03	6.13	6.28	6.43	6.55	6.62	6.71	6.85
	J	6.95	7.03	7.05	7.07	7.09	7.05	7.05	7.02	7.00	6.95	6.91	6.88	6.91	6.89	6.87	6.94	6.97	6.98	6.98	6.99	7.00	7.10	7.19	7.31	7.45	7.53	7.56	7.56	7.56	7.55	
	J	7.55	7.57	7.56	7.55	7.55	7.52	7.50	7.47	7.43	7.44	7.45	7.54	7.59	7.75	7.86	7.92	7.95	8.07	8.18	8.23	8.24	8.26	8.26	8.25	8.25	8.25	8.25	8.24	8.22	8.22	8.18
	A	8.13	8.10	8.05	8.02	8.00	7.99	7.98	7.96	7.95	7.96	7.94	7.91	7.89	7.87	7.83	7.80	7.78	7.77	7.79	7.79	7.82	7.86	7.89	7.98	8.02	8.08	8.09	8.10	8.10	8.10	8.06
	S	8.03	7.99	7.98	7.96	7.92	7.86	7.83	7.77	7.72	7.69	7.67	7.62	7.57	7.52	7.46	7.36	7.24	7.15	7.07	7.05	7.07	7.06	7.05	7.11	7.17	7.17	7.15	7.13	7.14	7.12	
	O	7.10	7.10	7.07	7.10	7.09	7.09	7.07	7.05	7.02	7.00	6.98	6.95	6.91	6.85	6.76	6.71	6.66	6.62	6.58	6.54	6.50	6.52	6.57	6.59	6.63	6.65	6.69	6.69	6.70	6.69	6.68
	N	6.65	6.62	6.58	6.55	6.51	6.45	6.42	6.36	6.32	6.27	6.22	6.17	6.12	6.06	6.01	5.98	5.94	5.91	5.85	5.79	5.72	5.65	5.59	5.55	5.50	5.47	5.42	5.33	5.28	5.21	
	D																															

5-3 Boring logs and result of soil mechanics test

Boring logs and result of soil mechanics test in each village are show in below,

Boring No.1：Sazan village, Habiganj District

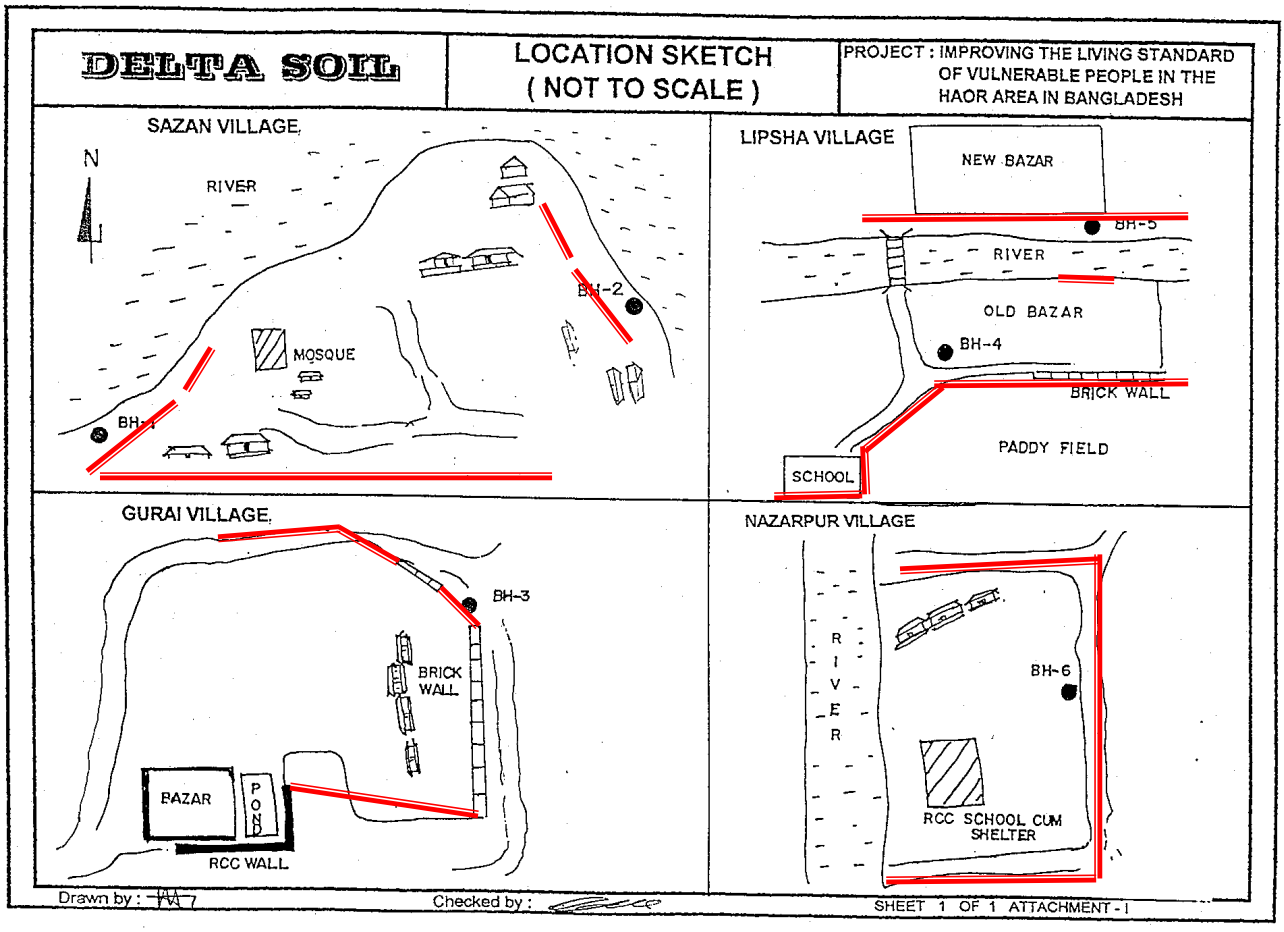
Boring No.2：Sazan village, Habiganj District

Boring No.3：Gurai village, Kishoreganj District

Boring No.4：Lipsha village, Netrokona District

Boring No.5：Lipsha village, Netrokona District

Boring No.6：Nazarpur village, Sunamganj District



Requested wave protection route

T D C L

BORING LOG

PROJECT : IMPROVING THE LIVING STANDARD OF VULNERABLE PEOPLE IN THE HAOR AREA IN BANGLADESH

LOCATION : SAZAN VILLAGE, LAKHAI UNION, LAKHAI UPAZILA, DIST. HABIGANJ.

BORE HOLE NO. 01

GROUND LEVEL R.L. : -

GROUND WATER LEVEL : - 2.8 m from EGL

DATE 03-03-2006 TIME : 1 - 30 pm

DATE	NUMBER OF SAMPLE	TYPE OF SAMPLE	DEPTH (m)	THICKNESS (m)	DESCRIPTION OF MATERIALS	LOG	DIAMETER OF BORING	BLOWS ON SPOON PER 6" PENETRATION 10 cm	10 cm	10 cm	SPT	STANDARD PENETRA-TION RESISTANCE (S P T) BLOWS PER 0.30m / 1ft	REMARKS
02-03-2006	D-1	Disturbed		2.50	Grey to light brown soft silty CLAY trace fine sand med. to high plastic.		100 mm (4") ϕ	1	0	1	2		1.0 m
	U-1	Undisturbed											
	D-2	Disturbed	2.50					1	1	1	3		2.0 m
	D-3	Disturbed	3.50	1.00	Grey loose FINE SAND & SILT non plastic.			2	2	3	7		3.0 m
	U-2	Undisturbed											
	D-4	Disturbed						1	0	0	1		4.0 m
	D-5	Disturbed						1	0	1	2		5.0 m
	D-6	Disturbed						1	1	2	4		6.0 m
	D-7	Disturbed						1	0	1	2		7.0 m
	D-8	Disturbed						2	2	4	8		8.0 m
	U-3	Undisturbed											
	D-9	Disturbed						2	3	4	9		9.0 m
	D-10	Disturbed		14.0	Grey very soft to very stiff clayey SILT with fine sand med. compress			1	1	2	4		10.0 m
	D-11	Disturbed						1	1	1	3		11.0 m
	D-12	Disturbed						2	3	5	10		12.0 m
	U-4	Undisturbed											
	D-13	Disturbed						2	2	5	9		13.0 m
	D-14	Disturbed						2	4	6	12		14.0 m
	D-15	Disturbed						3	5	6	14		15.0 m
	D-16	Disturbed						3	6	8	17		16.0 m
	D-17	Disturbed	17.5					4	5	9	18		17.0 m
	D-18	Disturbed						6	7	8	21		18.0 m
	D-19	Disturbed			Grey medium dense FINE SAND & SILT trace mica.			5	8	10	23		19.0 m
	D-20	Disturbed	20.3					6	7	13	26		20.0 m

INDEX: Disturbed / Undisturbed

Drawn by : Checked by : SHEET 1 OF 6 ATTACHMENT - II

T D C L		SUMMARY OF TEST RESULTS					SITE : SAZAN VILLAGE LAKHAI UPAZILA	
Bore Hole No.		BH - 1						
Sample No.		D - 1	U - 1	D - 3	U - 2	U - 3	U - 4	D -
Depth in meter		1.0 to 1.3	1.5 to 1.8	3.0 to 3.3	3.5 to 3.8	8.5 to 8.8	12.5 to 12.8	14. to 14.
Natural Moisture Content (%)		29.2	28.6		35.8	26.5	25.6	
Specific Gravity			2.678		2.662	2.668	2.670	
Atterberg Limits	Liquid Limit, LW	51			40	32	35	
	Plastic Limit, PW	28			28	27	25	
Density	Wet (kN/m^3)		17.88		17.47	18.51	18.79	
	Dry (kN/m^3)		13.91		12.87	14.63	14.96	
Grain Size Analysis	Gravel (%)							
	Sand (%)	5		55			16	
	Silt (%)	65		41			80	
	Clay (%)	30		4			4	
Consolidation Tests	Natural Void Ratio, e_0		0.888		1.027	0.788	0.750	
	Compression Index, C_c		0.255		0.350	0.150	0.140	
Unconfined Compression Test	Strain at failure (%)		16.0		18.0	12.0	6.0	
	Stress undist. (kPa)		31.8		22.0	119.3	131.9	
Permeablity Tests	Co-efficient of Permeability (cm^2/s)		2.75×10^{-5}		2.8×10^{-2}	3.6×10^{-4}	2.8×10^{-4}	
Direct Shear Tests	ϕ (Degree)			15.0				12.
	C (kPa)			5.0				35.
Triaxial Shear Tests	ϕ (Degree)		3.0		0.0	12.0	14.0	
	C (kPa)		25.0		21.0	33.0	30.0	

Comptd. by : Checked by : SHEET 1 OF 6

T D C L

BORING LOG

PROJECT : IMPROVING THE LIVING STANDARD OF VULNERABLE PEOPLE IN THE HAOR AREA IN BANGLADESH

LOCATION : SAZAN VILLAGE, LAKHAI UNION, LAKHAI UPAZILA, DIST. HABIGANJ.

BORE HOLE NO. 02

GROUND LEVEL R.L. : -

GROUND WATER LEVEL : - 2.6 m from EGL

DATE 04-03-2006 TIME : 8 - 30 pm

DATE	NUMBER OF SAMPLE	TYPE OF SAMPLE	DEPTH (m)	THICKNESS (m)	DESCRIPTION OF MATERIALS	LOG	DIAMETER OF BORING	BLOWS ON SPOON PER 6" PENETRATION 10 cm	10 cm	10 cm	SPT	REMARKS
03-03-2006	D-1	▨		2.70	Light brown to grey soft clayey SILT with fine sand med. compress.		100 mm (4") ϕ	1	0	1	2	1.0 m
	U-1	■										
	D-2	▨						1	0	1	2	2.0 m
	U-2	■	2.70									
	D-3	▨	3.50	0.80	Grey loose sandy SILT trace mica.			1	0	1	2	3.0 m
	D-4	▨		2.00	Grey very soft clayey SILT with fine sand med. compress.			1	0	0	1	4.0 m
	U-3	■										
	D-5	▨	5.50					1	1	1	2	5.0 m
	D-6	▨	6.50	1.00	Grey loose silty FINE SAND trace mica.			1	2	4	7	6.0 m
	D-7	▨		5.00	Grey soft to medium stiff sandy SILT trace mica low compress.			1	1	1	3	7.0 m
	U-4	■										
	D-8	▨						1	1	2	4	8.0 m
	D-9	▨						1	2	2	5	9.0 m
	D-10	▨						1	2	3	6	10.0 m
	D-11	▨	11.50					2	2	3	7	11.0 m
	D-12	▨		2.25	Grey loose sandy SILT trace mica.			2	2	4	8	12.0 m
	D-13	▨	13.75					2	3	4	9	13.0 m
	D-14	▨		6.55	Grey medium dense silty FINE SAND trace mica.			2	4	5	11	14.0 m
	D-15	▨						3	4	5	12	15.0 m
	D-16	▨						3	4	7	14	16.0 m
	D-17	▨						4	5	8	17	17.0 m
	D-18	▨						3	4	6	13	18.0 m
	D-19	▨						3	4	7	14	19.0 m
	D-20	▨	20.3					4	5	7	16	20.0 m

STANDARD PENETRA-TION RESISTANCE (S P T) — BLOWS PER 0.30m / 1ft: 10 20 30 40 50

INDEX: ▨ DISTURBED ■ UNDISTURBED

Drawn by : Checked by : SHEET 2 OF 6 ATTACHMENT - II

T D C L		SUMMARY OF TEST RESULTS			SITE : SAZAN VILLAGE, LAK LAKHAI UPAZILA, DIS				
Bore Hole No.		BH - 2							
Sample No.		D - 1	U - 1	U - 2	D - 3	U - 3	D - 6	U - 4	
Depth in meter		1.0 to 1.3	1.5 to 1.8	2.5 to 2.8	3.0 to 3.3	4.5 to 4.8	6.0 to 6.3	7.5 to 7.8	
Natural Moisture Content (%)		28.2	29.7	30.5		30.8		27.2	
Specific Gravity			2.665	2.660		2.658		2.662	
Atterberg Limits	Liquid Limit, LW	39	38	43				29	
	Plastic Limit, PW	27	28	29				26	
Density	Wet (kN/m^3)		17.69	17.85		17.99		18.20	
	Dry (kN/m^3)		13.64	13.68		13.76		14.31	
Grain Size Analysis	Gravel (%)								
	Sand (%)	9			42			22	
	Silt (%)	79			55			72	
	Clay (%)	12			3			6	
Consolidation Tests	Natural Void Ratio, e_0		0.916	0.907		0.894		0.824	
	Compression Index, C_c		0.260	0.245		0.240		0.165	
Unconfined Compression Test	Strain at failure (%)		16.0	14.0		12.0		10.0	
	Stress undist. (kPa)		23.8	27.1		40.2		75.2	
Permeablity Tests	Co-efficient of Permeability (cm^2/s)		3.8×10^{-3}	8.3×10^{-3}		6.7×10^{-2}		2.3×10^{-2}	
Direct Shear Tests	ϕ (Degree)						21.0		
	C (kPa)						2.0		
Triaxial Shear Tests	ϕ (Degree)		2.0	0.0		5.0		15.0	
	C (kPa)		23.0	25.0		20.0		32.0	

Comptd. by : Checked by : SHEET 2 OF 6 ATTACHM

T D C L

BORING LOG

PROJECT : IMPROVING THE LIVING STANDARD OF VULNERABLE PEOPLE IN THE HAOR AREA IN BANGLADESH

LOCATION : GURAI VILLAGE, GURAI UNION, NIKLI UPAZILZ, DIST. KISHOREGANJ.

BORE HOLE NO. 03

GROUND LEVEL R.L. :

GROUND WATER LEVEL : - 1.8 m from EGL

DATE 05-03-2006 TIME : 10 - 30 am

DATE	NUMBER OF SAMPLE	TYPE OF SAMPLE	DEPTH (m)	THICKNESS (m)	DESCRIPTION OF MATERIALS	LOG	DIAMETER OF BORING	BLOWS ON SPOON PER 6" PENETRATION 10 cm	10 cm	10 cm	SPT	REMARKS
04-03-2006	D-1	▨		2.75	Grey very soft clayey SILT with fine sand med. compress.		100 mm (4") ϕ	1	0	1	2	1.0 m
	U-1	■										
	D-2	▨						1	0	0	1	2.0 m
	U-2	■	2.75									
	D-3	▨	3.50	0.75	Dark grey to grey clayey SILT with fine sand med.			1	2	2	5	3.0 m
	U-3	■										
	D-4	▨						1	2	2	5	4.0 m
	U-4	■		3.00	Grey loose sandy SILT trace mica.							
	D-5	▨						1	2	2	5	5.0 m
	D-6	▨	6.50					1	2	2	5	6.0 m
	D-7	▨						4	7	8	19	7.0 m
	D-8	▨						5	8	12	25	8.0 m
	D-9	▨						6	10	13	29	9.0 m
	D-10	▨		8.00	Grey medium dense silty FINE SAND trace mica.			5	7	9	21	10.0 m
	D-11	▨						4	7	9	20	11.0 m
	D-12	▨						6	8	8	22	12.0 m
	D-13	▨						5	9	13	27	13.0 m
	D-14	▨	14.50					6	9	11	26	14.0 m
	D-15	▨						8	11	17	36	15.0 m
	D-16	▨						7	13	16	36	16.0 m
	D-17	▨		5.80	Grey dense to very dense FINE SAND trace silt trace mica.			6	16	24	46	17.0 m
	D-18	▨						7	16	26	49	18.0 m
	D-19	▨						10	18	26	54	19.0 m
	D-20	▨	20.3					8	17	28	53	20.0 m

STANDARD PENETRA-TION RESISTANCE (S P T) BLOWS PER 0.30m / 1ft — 10 20 30 40 50

INDEX ▨ DISTURBED ■ UNDISTURBED

Drawn by : Checked by : SHEET 3 OF 6 ATTACHMENT - II

T D C L	SUMMARY OF TEST RESULTS	SITE : GURAI VILLAGE, UPAZILZ, DIST.

Bore Hole No.		BH - 3						
Sample No.		D - 1	U - 1	U - 2	U - 3	D - 4	U - 4	D -
Depth in meter		1.0 to 1.3	1.5 to 1.8	2.5 to 2.8	3.5 to 3.8	4.0 to 4.3	4.5 to 4.8	10. to 10.
Natural Moisture Content (%)		30.5	32.4	29.7	26.6		26.7	
Specific Gravity			2.667	2.672	2.660		2.662	
Atterberg Limits	Liquid Limit, LW	38	41	40				
	Plastic Limit, PW	27	29	28				
Density	Wet (kN/m^3)		17.88	18.01	18.15		18.28	
	Dry (kN/m^3)		13.51	13.88	14.34		14.42	
Grain Size Analysis	Gravel (%)							
	Sand (%)	12			58			72
	Silt (%)	80			42			28
	Clay (%)	8			0			0
Consolidation Tests	Natural Void Ratio, e_0		0.935	0.887	0.818		0.810	
	Compression Index, C_c		0.270	0.250	0.165		0.155	
Unconfined Compression Test	Strain at failure (%)		18.0	16.0				
	Stress undist. (kPa)		22.0	29.1				
Permeability Tests	Co-efficient of Permeability (cm^2/s)		5.3×10^{-3}	6.2×10^{-2}	6.4×10^{-3}		8.8×10^{-3}	
Direct Shear Tests	ϕ (Degree)					18.0		32.
	C (kPa)					4.0		0.(
Triaxial Shear Tests	ϕ (Degree)		0.0	3.0	14.0		16.0	
	C (kPa)		18.0	25.0	50.0		6.0	

Comptd. by : Checked by : SHEET 3 OF 6

T D C L

BORING LOG

PROJECT : IMPROVING THE LIVING STANDARD OF VULNERABLE PEOPLE IN THE HAOR AREA IN BANGLADESH

LOCATION : LIPSHA VILLAGE, CHAKUWA UNION, KHALIAJURI UPAZILA, DIST. NETROKONA.

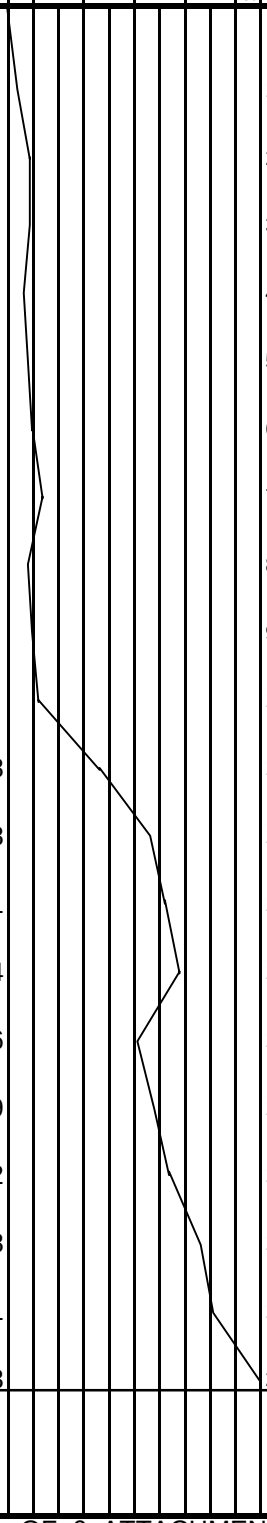
BORE HOLE NO. 04

GROUND LEVEL R.L. : -

GROUND WATER LEVEL : - 1.3 m from EGL

DATE 06-03-2006 TIME : 12 - 30 pm

DATE	NUMBER OF SAMPLE	TYPE OF SAMPLE	DEPTH (m)	THICKNESS (m)	DESCRIPTION OF MATERIALS	LOG	DIAMETER OF BORING	BLOWS ON SPOON PER 6" PENETRATION 10 cm	10 cm	10 cm	SPT	STANDARD PENETRA-TION RESISTANCE (S P T) BLOWS PER 0.30m / 1ft	INDEX DISTURBED / UNDISTURBED	REMARKS
05-03-2006	D-1	▨					100 mm (4") ϕ	1	0	1	2			1.0 m
	U-1	■												
	D-2	▨						1	1	2	4			2.0 m
	U-2	■		5.50	Grey soft silty CLAY trace fine sand high plastic.									
	D-3	▨						1	1	2	4			3.0 m
	D-4	▨						1	1	1	3			4.0 m
	U-3	■												
	D-5	▨	5.50					1	1	2	4			5.0 m
	D-6	▨		2.00	Grey loose sandy SILT trace mica.			1	2	2	5			6.0 m
	D-7	▨	7.50					2	2	3	7			7.0 m
	D-8	▨						1	1	2	4			8.0 m
	U-4	■												
	D-9	▨		3.25	Grey soft to medium stiff clayey SILT with fine sand med. compress.			1	2	2	5			9.0 m
	D-10	▨	10.75					1	2	3	6			10.0 m
	D-11	▨						4	6	8	18			11.0 m
	D-12	▨						5	8	15	28			12.0 m
	D-13	▨						5	9	17	31			13.0 m
	D-14	▨						6	10	18	34			14.0 m
	D-15	▨		9.55	Grey medium dense to very dense silty FINE SAND trace mica.			5	8	13	26			15.0 m
	D-16	▨						6	9	14	29			16.0 m
	D-17	▨						7	9	16	32			17.0 m
	D-18	▨						8	12	18	38			18.0 m
	D-19	▨						8	13	20	41			19.0 m
	D-20	▨	20.3					10	18	25	53			20.0 m



Drawn by : Checked by : SHEET 4 OF 6 ATTACHMENT - II

T D C L	SUMMARY OF TEST RESULTS	SITE : LIPSHA VILLAGE, CHA KHALIAJURI UPAZILA,

Bore Hole No.		BH - 4								
Sample No.		D - 1	U - 1	U - 2	D - 3	U - 3	D - 6	D - 8	U - 4	
Depth in meter		1.0 to 1.3	1.5 to 1.8	2.5 to 2.8	3.0 to 3.3	4.5 to 4.8	6.0 to 6.3	8.0 to 8.3	8.5 to 8.8	
Natural Moisture Content (%)		30.7	28.6	28.4	28.8	27.4		27.2	27.3	
Specific Gravity			2.682	2.680		2.675			2.670	
Atterberg Limits	Liquid Limit, LW	52			52			36	39	
	Plastic Limit, PW	26			27			27	28	
Density	Wet (kN/m^3)		18.10	18.19		18.32			18.48	
	Dry (kN/m^3)		14.08	14.17		14.38			14.52	
Grain Size Analysis	Gravel (%)									
	Sand (%)	8					52	12		
	Silt (%)	62					48	81		
	Clay (%)	30					0	7		
Consolidation Tests	Natural Void Ratio, e_0		0.868	0.834		0.823			0.804	
	Compression Index, C_c		0.210	0.175		0.160			0.155	
Unconfined Compression Test	Strain at failure (%)		12.0	14.0		12.0			8.0	
	Stress undist. (kPa)		61.1	54.2		72.2			84.1	
Permeability Tests	Co-efficient of Permeability (cm^2/s)		6.5×10^{-5}	2.4×10^{-5}		2.6×10^{-4}			4.6×10^{-3}	
Direct Shear Tests	ϕ (Degree)						16.0			
	C (kPa)						2.0			
Triaxial Shear Tests	ϕ (Degree)		0.0	6.0		0.0			8.0	
	C (kPa)		27.0	32.0		36.0			42.0	

Comptd. by : Checked by : SHEET 4 OF 6 ATTAC

T D C L

BORING LOG

PROJECT : IMPROVING THE LIVING STANDARD OF VULNERABLE PEOPLE IN THE HAOR AREA IN BANGLADESH

LOCATION : LIPSHA VILLAGE, CHAKUWA UNION, KHALIAJURI UPAZILA, DIST. NETROKONA.

BORE HOLE NO. 05

GROUND LEVEL R.L. : -

GROUND WATER LEVEL : - 1.8 m from EGL

DATE 06-03-2006 TIME : 3 - 00 pm

DATE	NUMBER OF SAMPLE	TYPE OF SAMPLE	DEPTH (m)	THICKNESS (m)	DESCRIPTION OF MATERIALS	LOG	DIAMETER OF BORING	BLOWS ON SPOON PER 6" PENETRATION 10 cm	10 cm	10 cm	SPT	STANDARD PENETRA-TION RESISTANCE (S P T) BLOWS PER 0.30m / 1ft	INDEX DISTURBED / UNDISTURBED	REMARKS
05-03-2006	D-1			3.50	Light brown to grey very loose sandy SILT non plastic.		100 mm (4") ϕ	1	0	0	1			1.0 m
	U-1													
	D-2							1	0	1	2			2.0 m
	U-2													
	D-3		3.50					1	0	1	2			3.0 m
	U-3			5.00	Grey very loose to loose silty FINE SAND trace mica.									
	D-4							1	1	1	3			4.0 m
	D-5							1	1	2	4			5.0 m
	D-6							1	1	3	5			6.0 m
	D-7							1	1	3	5			7.0 m
	D-8		8.50					1	2	4	7			8.0 m
	D-9			2.00	Grey medium dense FINE SAND with semi decomposed wood			2	3	6	11			9.0 m
	U-4													
	D-10		10.50					3	5	7	15			10.0 m
	D-11			9.80	Grey medium dense to very dense silty FINE SAND trace mica.			5	8	9	22			11.0 m
	D-12							5	8	10	23			12.0 m
	D-13							6	10	12	28			13.0 m
	D-14							5	9	13	27			14.0 m
	D-15							4	6	8	18			15.0 m
	D-16							8	12	15	35			16.0 m
	D-17							9	14	16	39			17.0 m
	D-18							10	15	22	47			18.0 m
	D-19							11	16	26	53			19.0 m
	D-20		20.3					12	18	28	58			20.0 m

Drawn by : Checked by : SHEET 5 OF 6 ATTACHMENT - II

T D C L	SUMMARY OF TEST RESULTS	SITE : LIPSHA VILLAGE, C KHALIAJURI UPAZI

Bore Hole No.		BH - 5						
Sample No.		D - 1	U - 1	U - 2	D - 4	U - 3	U - 4	D -
Depth in meter		1.0 to 1.3	1.5 to 1.8	2.5 to 2.8	4.0 to 4.3	3.5 to 3.8	9.5 to 9.8	12. to 12.
Natural Moisture Content (%)		27.6	28.2	25.8			24.8	
Specific Gravity			2.673	2.670		2.665	2.650	
Atterberg Limits	Liquid Limit, LW							
	Plastic Limit, PW							
Density	Wet (kN/m^3)		17.65	17.96			18.67	
	Dry (kN/m^3)		13.77	14.28			15.0	
Grain Size Analysis	Gravel (%)							
	Sand (%)	53			68			85
	Silt (%)	44			32			15
	Clay (%)	2			0			0
Consolidation Tests	Natural Void Ratio, e_0		0.903	0.833				
	Compression Index, C_c		0.215	0.165				
Unconfined Compression Test	Strain at failure (%)							
	Stress undist. (kPa)							
Permeability Tests	Co-efficient of Permeability (cm^2/s)		5.7×10^{-2}	4.3×10^{-2}		8.1×10^{-2}	1.6×10^{-1}	
Direct Shear Tests	ϕ (Degree)				14.0			33.
	C (P S I)				4.0			0.(
Triaxial Shear Tests	ϕ (Degree)		12.0	15.0		12.0	30.0	
	C (kPa)		5.0	2.0		5.0	2.0	

Comptd. by : Checked by : SHEET 5 OF 6

T D C L

BORING LOG

PROJECT : IMPROVING THE LIVING STANDARD OF VULNERABLE PEOPLE IN THE HAOR AREA IN BANGLADESH

LOCATION : NAZARPUR VILLAGE, JOYSREE UNION, DHARMAPASHA UPAZILA, DIST. SUNAMGANJ.

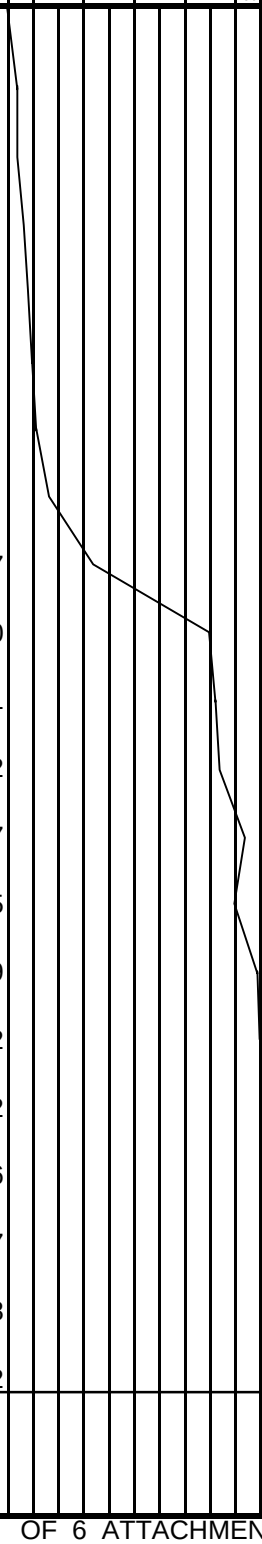
BORE HOLE NO. 06

GROUND LEVEL R.L. : -

GROUND WATER LEVEL : - 1.3 m from EGL

DATE 07-03-2006 **TIME : 3 - 30 pm**

DATE	NUMBER OF SAMPLE	TYPE OF SAMPLE	DEPTH (m)	THICKNESS (m)	DESCRIPTION OF MATERIALS	LOG	DIAMETER OF BORING	BLOWS ON SPOON PER 6" PENETRATION 10 cm	10 cm	10 cm	SPT	STANDARD PENETRA-TION RESISTANCE (S P T) BLOWS PER 0.30m / 1ft	INDEX DISTURBED / UNDISTURBED	REMARKS
06-03-2006	D-1			3.50	Grey soft silty CLAY trace fine sand high plastic.		100 mm (4") ϕ	1	0	1	2			1.0 m
	U-1													
	D-2							1	0	1	2			2.0 m
	U-2													
	D-3		3.50					1	1	1	3			3.0 m
	U-3			2.00	Grey soft to medium stiff clayey SILT with fine sand med. compress.									
	D-4							1	1	2	4			4.0 m
	D-5		5.50					1	2	2	5			5.0 m
	D-6			3.00	Grey loose to medium dense sandy SILT trace mica.			1	2	3	6			6.0 m
	U-4													
	D-7							2	2	4	8			7.0 m
	D-8		8.50					3	5	9	17			8.0 m
	D-9			11.80	Grey dense to very dense silty FINE SAND trace mica.			7	12	21	40			9.0 m
	D-10							7	14	22	41			10.0 m
	D-11							7	14	21	42			11.0 m
	D-12							8	15	24	47			12.0 m
	D-13							8	14	23	45			13.0 m
	D-14							9	15	25	49			14.0 m
	D-15							9	17	26	52			15.0 m
	D-16							9	18	25	52			16.0 m
	D-17							10	20	26	56			17.0 m
	D-18							11	18	28	57			18.0 m
	D-19							12	20	26	58			19.0 m
	D-20		20.3					13	21	28	62			20.0 m



Drawn by : Checked by : SHEET 6 OF 6 ATTACHMENT - II

T D C L	SUMMARY OF TEST RESULTS	SITE : NAZARPUR VILLAGE, JOY DHARMAPASHA UPAZILA,

Bore Hole No.		BH - 6							
Sample No.		D - 1	U - 1	U - 2	U - 3	D - 4	D - 6	U - 4	
Depth in meter		1.0 to 1.3	1.5 to 1.8	2.5 to 2.8	3.5 to 3.8	4.0 to 4.3	6.0 to 6.3	6.5 to 6.8	
Natural Moisture Content (%)		32.2	31.8	30.4	28.3	27.5		26.2	
Specific Gravity			2.681	2.680	2.670			2.664	
Atterberg Limits	Liquid Limit, LW	55	53	54		42			
	Plastic Limit, PW	28	27	26		28			
Density	Wet (kN/m^3)		18.01	18.04	18.19			18.66	
	Dry (kN/m^3)		13.67	13.83	14.18			14.79	
Grain Size Analysis	Gravel (%)								
	Sand (%)	5				12			
	Silt (%)	64				80			
	Clay (%)	31				8			
Consolidation Tests	Natural Void Ratio, e_0		0.922	0.899	0.845			0.767	
	Compression Index, C_c		0.250	0.235	0.205			0.150	
Unconfined Compression Test	Strain at failure (%)		18.0	16.0	8.0				
	Stress undist. (kPa)		33.6	45.0	68.2				
Permeability Tests	Co-efficient of Permeability (cm^2/s)		5.3×10^{-4}	2.3×10^{-5}	8.3×10^{-4}			3.6×10^{-3}	
Direct Shear Tests	ϕ (Degree)						20.0		
	C (P S I)						5.0		
Triaxial Shear Tests	ϕ (Degree)		0.0	2.0	8.0			18.0	
	C (kPa)		26.0	28.0	22.0			4.0	

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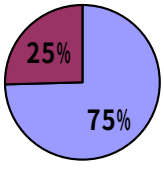
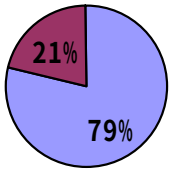
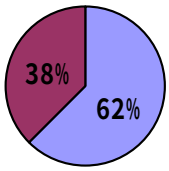
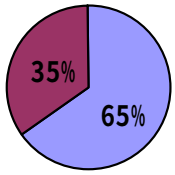
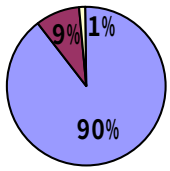
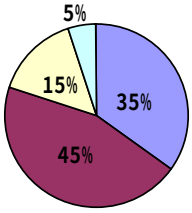
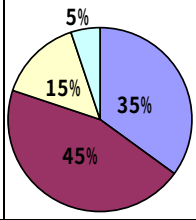
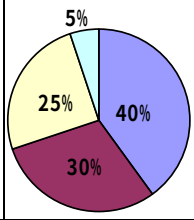
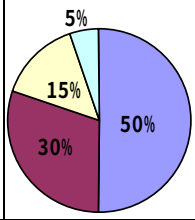
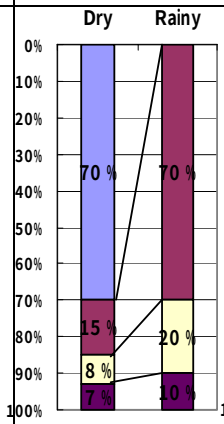
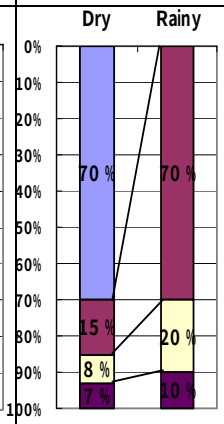
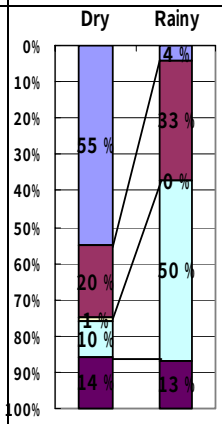
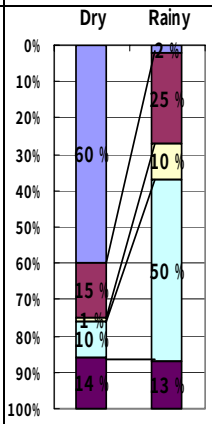
5-4 Baseline survey

Sammary of Beseline Survey

	Sazan Village Lakhai Union Lakhai Upazila Habiganj District	Gurai Village Gurai Union Nikli Upazila Kishoreganj District	Lipsha Village Chakuwa Union Khaliajuri Upazila Netrokona District	Nazarpur Village Joysree Union Dharmapasha Upazila Habiganj District	Whole of Bangladesh
Population (Total 35,000)	11,000 Male：6,000 Female：5,000	14,000 Male：8,000 Female：6,000	8,000 Male：4,100 Female：3,900	2,000 Male：1,200 Female：900	138.1 milion
Household (Total 5,250)	1,800 (6.1people/house)	2,200 (6.4 people/house)	1,050 (7.6 people/house)	200 (10.0 people/house)	—
Area of mounds (Total 82ha)	27ha	40ha	13ha (including Bazar)	1.3ha	144 thousand km^2 (Total area)
Popuration density (population/mound area) (Average 42,780 人/km^2)	40,740 /km^2	35,000 /km^2	61,540 /km^2	153,850 /km^2	980/km^2 (population/ total area)
Religion Moslem Hindu Others					
Access in the dry season (From Dakha)	Only vehicle (4 hr)	Only vehicle (3.5 hr)	Vehicle, Rikshaw, Bout (6.5 hr)	Vehicl, Rikshaw, Boat (7.0 hr)	—
Land use Landless 0-0.67 ha 0.67-1.34 ha over 1.34 ha					—
Occupation Agriculture Fishery Commerce Out of work Others					—
Annual Cost burden against wave erosion (Annual Average: 1,500Tk/household)	1,200 Tk/household	1,300 Tk/ household	2,900 Tk/ household	600 Tk/ household	—

5-5 Schmidt hammer test

For confirming existing concrete and retaining wall, Schmidt hammer test was carried out in Gurai, Sazan and Lipsha villages, except Nazarpur village where no retaining wall is existed. The results of this test are tabulated as below.

The result of Schmidt hammer test

Structure type	Vil-lage	Rebound Number				Direc-tion	Stren gth	Remarks
		1	2	3	Ave			
Bricklaying retaining wall	Sazan	21	16	14	17	H	3	Southern part of the village, joint at the south end of existing retaining wall （constructed 25 years ago）
		0	16	17	11	H	—	Southern part of the village, joint at the center part of existing retaining wall （constructed 25 years ago）
		40	42	40	41	H	365	Northern part of the village, bricks of existing wall （constructed 30 years ago by Holland）
		22	34	15	24	H	130	Joint of above retaining wall
		27	32	34	31	H	220	Crest mortar of Foot protection of above retaining wall (new construction）
RCC retaining wall	Gnrai	35	36	38	36	H	290	West end of southern RCC retaining wall by CARE, 1.2 m from ground level
		29	22	23	25	H	140	Center part of southern RCC retaining wall by CARE, 1.2 m from ground level
		35	36	32	34	H	260	East end of southern RCC retaining wall by CARE, 1.2 m from ground level
		29	32	37	33	H	245	Back side of center part of eastern RCC retaining wall by CARE, 0.3 m below from crest of retaining wall
Stairs of RCC retaining wall		25	33	26	28	V	220	Stair of eastern RCC retaining wall by CARE, 0.3 m below from crest of retaining wall
Bricklaying retaining wall		22	20	24	22	V	145	Crest mortar of brick column for stair
		16	12	14	14	H	—	Joint of brick column for stair, full limit of rebound number is around 15
		24	29	32	28	H	180	Front mortar of brick column for stair
		12	12	10	11	H	—	Front mortar of brick column for stair, full limit of rebound number is around 15
		41	44	46	44	H	415	Front brick of column for stair
		32	34	33	33	H	245	Backside mortar of bricklaying retaining wall abutted to RCC retaining wall by CARE
		12	16	28	19	H	6	Joint of above retaining wall
Joint of retaining wall	Lipsha	12	0	21	11	H	—	Joint of bricklaying retaining wall in southern side of bazaar, full limit of rebound number is around 15
Stairs of ghat		33	39	39	37	H	305	Stars made by bricks
Abutment of bridge		27	38	32	32	H	230	Concrete of abutment of bridge under construction
Building of Primary School		33	26	35	31	H	220	Foundation concrete of retaining wall constructed in 1999 for the primary school, 1.2 m from ground level
		27	30	21	26	H	160	Concrete stair constructed in 1999 in the primary school
		32	30	33	32	H	230	Concrete column for corridor constructed in 1999 in the primary school
		31	30	29	30	H	205	Concrete for corridor constructed in1987 in the primary school

- Direction: H: Horizontal, V: Vertical
- Strength = concert strength (kg/cm^2)
- No Schmidt hammer test was carried out because of no retaining wall in Nazarpur village