Appendix 10 : Collection of Environmental and Social Consideration Data and Information for Medium-term EZ Candidate Site

JICA PROJECT TEAM

SCREENING (ENVIRONMENTAL AND SOCIAL CONSIDERATION WORKS) FOR PROPOSED SEVEN (7) CANDIDATE SITES OF ECONOMIC ZONE AT MATARBARI/MAHESKHALI AND MAINLAND (CHAKARIA & COX'S BAZAR) AREAS

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1. SCREENING – ENVIRONMENTAL & SOCIAL CONSIDERATIONS

1.1 Screening

Screening is the first and the simplest tier of proposed alternative Economic Zone (EZ) site evaluation from the environmental and social point of view. It helps identify the alternative sites for EZ which is likely to cause environmental and social problems.

The aim of the screening is to find out current ecological/environmental and social conditions prior to the final selection of proposed EZ sites. The screening provides a concise assessment of the existing environmental and social conditions and would identify the sensitivity and risk involved as per the Screening Checklist.

The screening provides a concise assessment of the existing environmental and social conditions and would identify the sensitivity and risk involved as per the Screening Checklist.

1.2 Methodology

The following methods were used for screening process

- **Site Reconnaissance and Field Visit**

The Consultant team visited all alternative sites from third week of September. The team comprises with JICA Team and DevCon officials including Team Leader, Environmental Engineer, Social Expert, Infrastructure Expert and Field Enumerators. During reconnaissance visit the team met the local officials of government (UNO, AC land etc.) to seek their opinion on the economic zone options.

The Team visited Cox's Bazar Sadar (Location No. 2) and Chakaria (Location No. 3)

- **Consultation with local Government Officials to seek their opinion**

A series of meetings were held with local government officials and different stakeholders such as UNO Cox's Bazar (Sadar), AC Land Maheskhali Upazila, Maheskhali Upazila Executive Officer, Assistant Land, Union Land Office, Harbang, Chakaria, Land Officer, Kalarmarchara Union, Maheskhali, Land Officer and Land Surveyor, Cox's Bazar Sadar, Forest officer, Cox's

Bazar Forest range etc. etc. to share with them about the proposed location options of the proposed economic zone and seek opinion on these. All Govt. Officials expressed their opinion on the seven alternative locations and provided relevant mouza maps, Location boundary, Quantity of land etc. to facilitate decision making of the project selection.

<table>
<tr><td>
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<tr><td colspan="2">Meeting with Mr. Shahidul Islam, Upazilla Nirbahi Officer, Sadar, Cox's Bazar and JICA Team at Hotel Premises</td></tr>
<tr><td> </td><td> </td></tr>
<tr><td>Meeting with Mr. Md. Noman Hossain, Assistant Commissioner (Land), Maheskhali, at Ghoraghat Jetty</td><td>Meeting with JICA Team at Ghoraghat Jetty, Maheskhali</td></tr>
<tr><td> </td><td> </td></tr>
<tr><td>Meeting with AC Land Maheskhali and JICA Team at Uttar Nolbila, Kalarmarchara, Location 5</td><td>Meeting with Assistant Land Officer, Union Land office, Harbang, Chakaria, Location 3</td></tr>
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- **Secondary Sources**

Secondary sources of the data for the project area of the 7 alternative site options have been taken into consideration for preparation of this report. The secondary data is mainly drawn from Community Report, Cox's Bazar, published by Bureau of Statistics (BBS) according to Population Census 2011, Annual Flood Report, 2014, Flood Forecasting and Warning Centre, BWDB; Preparation of Disaster Management Plan, Maheskhali Upazilla, published by Resource Integration Centre (RIC), July 2014.

- **Preparation of Screening Checklist**

The screening checklist has been prepared using the Important Environmental Components (IECs) based on JICA Guidelines on Environment and Social considerations.

1.3 Description of Various Candidate Sites

JICA team has proposed the following 3 alternate Matarbari sites for Economic Zone. (Figure 1). They are

1. Maheshkhali South (Fakiragaon)
2. Cox's Bazar North –
3. Chakaria North

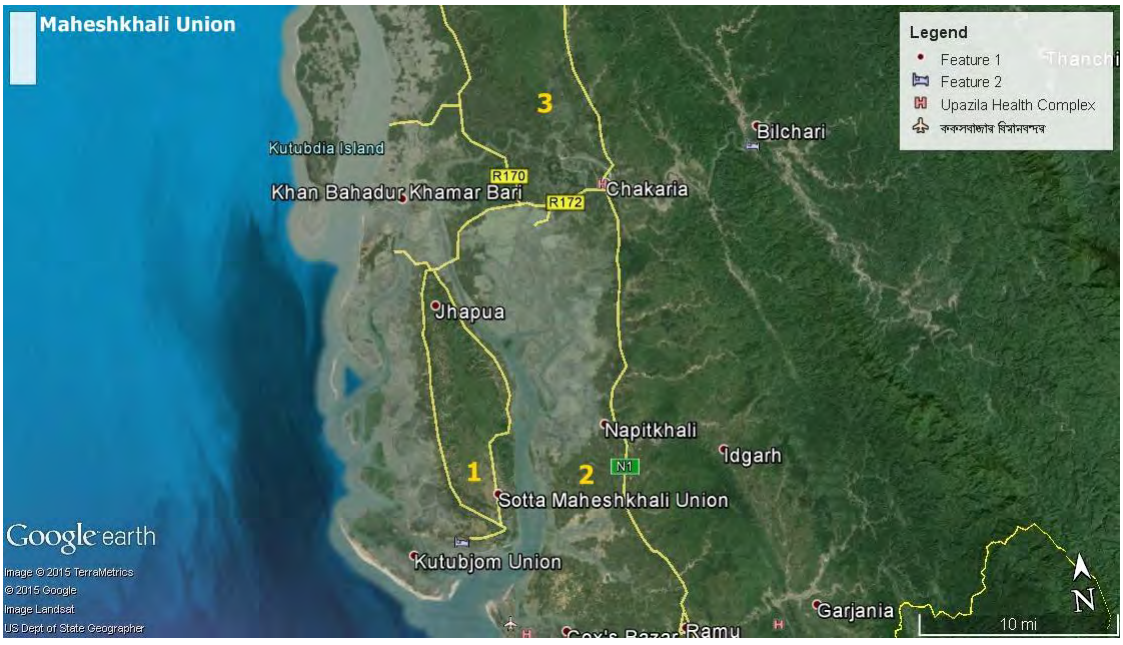


Figure 1: Selected Candidate Sites proposed by JICA

BEZA selected the following 4 proposed sites which includes (Figure -2)

4. Maheskhali EZ-1,
5. Maheskhali EZ-2, (Kalarmarchara)
6. Maheskhali EZ-3, Dhalghata

7. Cox's Bazar Free Trade Zone (Kutubjom)

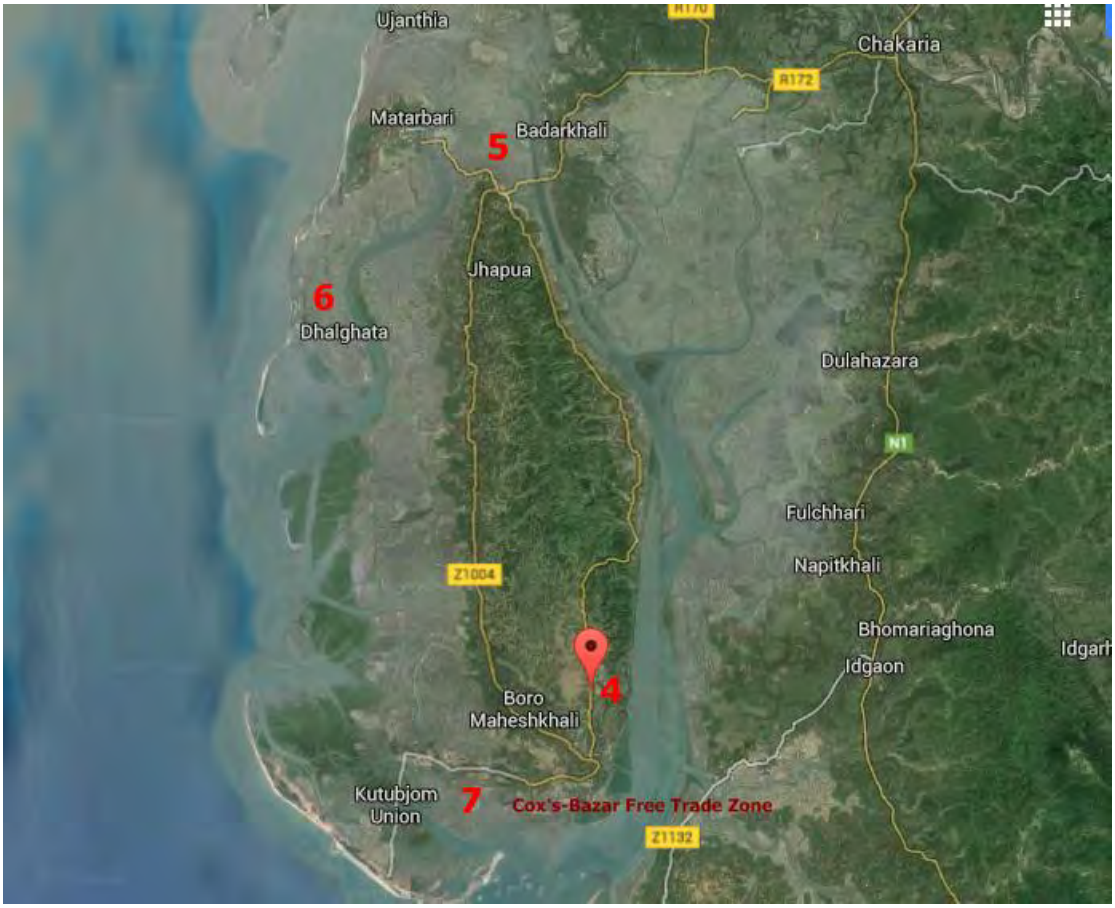


Figure 2: Selected Candidate Sites proposed by BEZA

Detail description of each candidate sites are discussed below:

1.3.1 Candidate No. 1 Maheskhali South (Fakiragaon)

The Maheskhali South consists of Pahar mouza. About 30,000 acres of land covers under this mouza which fall reserve forest area under Chittagong forest range. This mouza starts from Adinath Mandir and ends in Jakua mouza under Kalarmarchara.

This area is about 1.5 km away from Maheskhali Sadar and about 25 km away from Cox's Bazar. The Bay of Bengal is about 2 km west, Maheskhali Channel is about 2 km south and Maheskhali Khal is about 1 km east of the proposed location.

Though the area under reserve forest jurisdiction so finally the area has been discarded from economic zone by the AC Land, Maheskhali Upazilla.

Figure 3 shows Map of the proposed location, social mapping (sketch map) are attached in Annex 1 show and the following photographs show salient features of proposed location.

Figure 3: Proposed Maheskhali South location (Candidate No. 1)

Reserve Forest which fall the proposed Candidate 1 (Maheskhali South)	Adinath Mandir which is adjacent to the proposed Candidate 1
Reserve Forest area comprises of Pahar mouza which is inside the proposed Candidate 1.	

1.3.2 Candidate No. 2- Cox'sBazar North (Chaufaldandi)

Location

The proposed site is located in Chaufaldandi union of Cox's Bazar Sadar Upazilla under Cox's Bazar district. It is about 2 km away from the Union parishad and about 10 km away from Cox's Bazar as well as Upazilla Sadar. The proposed site has an area of 970.13 acres comprises of Chaufaldandi mouza distributed over three villages named Sikder para, Kamar para and Natun Mohal. It is bounded in north by Pokkhali UP and Pokkhali village, in South by Chaufaldandi village and Chaufaldandi river, in the east some portion of Pokkhali village and Mohon bila village under Jalalabad UP and there is a paved road and Maheskhali channel in the west.

Road Network

There are paved road and brick soling road from Cox's Bazar Sadar to reach the project area. But this road is narrow and there are many settlement from both sides of this road. Resettlement issues may arise due to road widening. On the other hand, there is a paved road at Eidgaon which meets in Chittagong-Cox's Bazar road after crossing Chakaria which is about 5 km away from the project area. Figure 4 shows Map of the proposed project location.

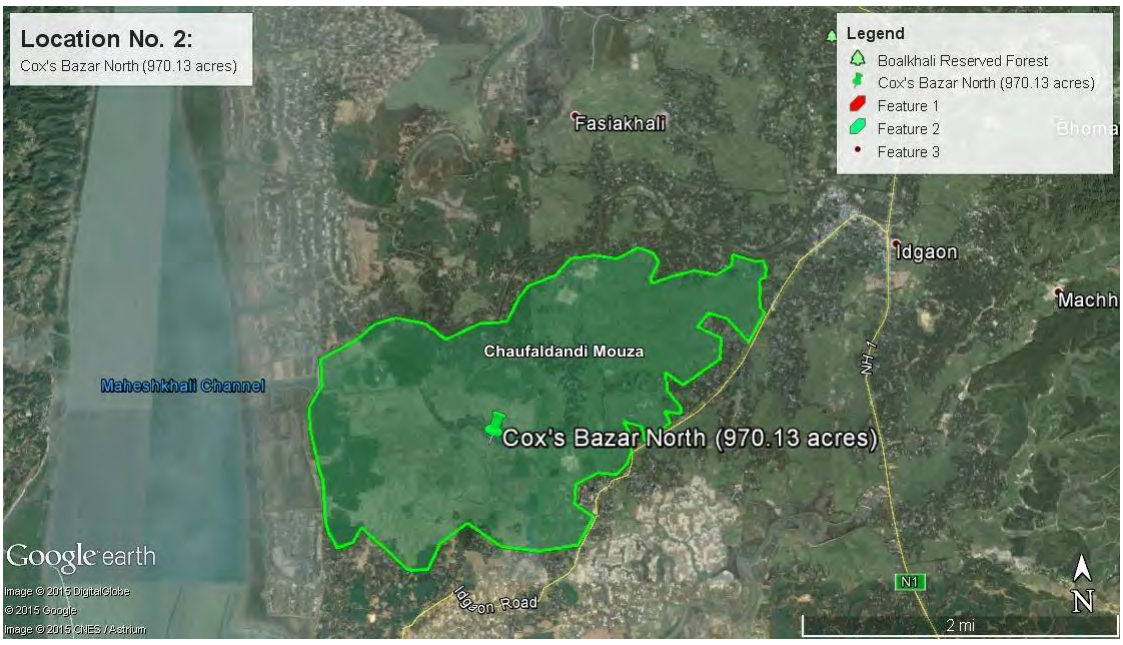


Figure 4: Proposed Cox's Bazar North location (Candidate No. 2)

Key Findings of Baseline Status

Salient features of project influence area in the social and environmental views are

summarized in Table 1.

Table 1: Summary of important features of the scheme area

Sl.	Parameter	Description
Environmental Setting		
1	Climate	The climate of the project area is tropical monsoon with hot summer and cool dry winter. The closest meteorological station of Bangladesh Meteorological Department (BMD) is located in Cox's Bazar. Average monthly maximum temperature of Cox's Bazar varies in the range of 31.03 ^{0}C to 35.87 ^{0}C and minimum average monthly temperature varies from 12.9 ^{0}C – 23.9 ^{0}C. The annual average rainfall is 4269 mm.
2	Ecologically Critical Area	No ecologically Critical areas found in the periphery of the project area.
	Reserve/Protected Forests	No Reserve/Protected Forests found in the periphery of the project area. There is a forest area which is about 1500 m south from the project area.
	Vegetation	Major trees include eucalyptus, betel nut, Babla, coconut, mango, jackfruit etc.
	Wild Life Sanctuary	There are no fish/wild life sanctuary within the project boundary.
	Topography	The general topography of the project area is plain. Land is relatively flat. The project area is about 4 ft low from the existing road level.
3	Principal crops	Most of the agricultural lands are double cropped and the main crop is paddy. There is irrigation facilities for producing crops.
4	Major Water Bodies	Bainar khal passes within the project area which connect Maheskhali channel about 300 m away from the project area. There are plenty water in the monsoon period but no water in the dry period. The depth of khal is about 8 ft and the length is about 120 ft. There is salinity in the water so no used in irrigation purpose. River Chaufaldandi passes about 350 m away from the project area. Water is available whole the year but there is fluctuation in the water table during tidal period. The depth of the river is about 30/40 ft and the width is about 500/600 ft.
5	Flooding	There is no major flooding during the last 10 years. The project area was flood affected during 1991. The agriculture land was affected but road and settlement were not flooded.
6	Seismicity	The project area falls in Zone II, i.e. medium intensity seismic zone of the country.(Ref: Bangladesh National Building Code).
7	Environmental Hotspots	There is no environmental hotspots within the project area.
8	Major Settlement	Three villages named Sikder para, Kamar para and Natun Mahal
9	Major Industries/ Business Entrepreneurs	There is no major industry exists within 1 km of the project area which creates environmental pollution. But there are shrimp, salt and fish farming within the project area.
10	Attractive Site	There is no attractive or historical site available within 1 km of the project area.
Socioeconomic Profile		

Sl.	Parameter	Description	
1	Land Ownership	Type of Land	Quantity
		Khas Land	53.31 acre
		Other Govt. Land	26.92 acre
		Private land	889.90
		Total	970.13 acre
2	Population	The project area consists of Chaufaldandi mouza where total population is 29796 nos[1]. Among them 14447 nos. male and 14349 nos. female	
3	Household	5202 nos.	
4	Average Household Size	5.5 persons / HH	
5	Density	1958 persons/ sq. Km	
6	Sex Ratio (male/Female)	101 male against 100 female	
7	Landuse Pattern	Agricultural Land	
8	Major Occupation Pattern among HH Members	Major source of income are fish cultivation, salt and shrimp farming. The economic condition within 1 km of the project area is satisfactory.	
9	Household Monthly Income	Average Highest Income	Tk. 27000
		Average Lowest Income	Tk. 7000
10	Indigenous people	No indigenous people within the project boundary area but adjacent to project location, there are about 70/80 Rakaine families reside. Major income source are small cottage, weaving, unauthorized alcohol business.	
11	Water Supply	There is no potable water within depth of 600-700 ft causing salinity problem. There is no salinity about 800-900 depth of deep tube well but still iron concentration is high within this depth.	
12	Electricity	About 80% households of the scheme area have electricity connection. Some households also use solar electricity. There are about 20 nos. electricity pole within the project area.	
13	Sources of Construction Materials	**Materials**	**Availability**
		Sand	Available at Kotakali in Chakaria which is about 15 km away from the project area
		Cement	Available at Eidgaon which is about 5 km away from the project area
		Bricks	There is Brick field at southeast corner of the project area

Social mapping are attached in Annex 2 and the following photographs show salient features of proposed location.

[1] Population and Housing Census, 2011, Community Series, Cox's bazar

Project Location (Candidate 2)

Road condition and its site features

Some temporary structures are located adjacent to the road which may be removed during road widening.

1.3.3 Candidate No. 3- Chakaria North

Location

The proposed site is located in Harbang and Baraitali union of Chakaria Upazilla under Cox's Bazar district. It is about 1.5 km away from the Baraitali Union parishad and 1 km away from the Harbang UP and about 9 km away from Chakaria and about 70 km away from Cox's Bazar. The proposed site has an area of 900.89 acres comprises of Baraitali, Paharchanda and Harbang mouza distributed over two villages named PaharChanda and Harbang. It is bounded in north by Harbang UP and Paharchanda village; in South by Baraitali Up and Dengakata village and Matamohori river; in the east Pahartali village and Chittagong-Cox's Bazar Highway and Machnia Kata village in the west.

Road Network

There are wide paved road starting from Cox's Bazar Sadar to ending boundary of the project area. There is well connected road communication from the project area. Chakaria-Magnama Highway (22 ft wide) passes inside the project boundary. Figure 5 shows Map of the proposed project location.

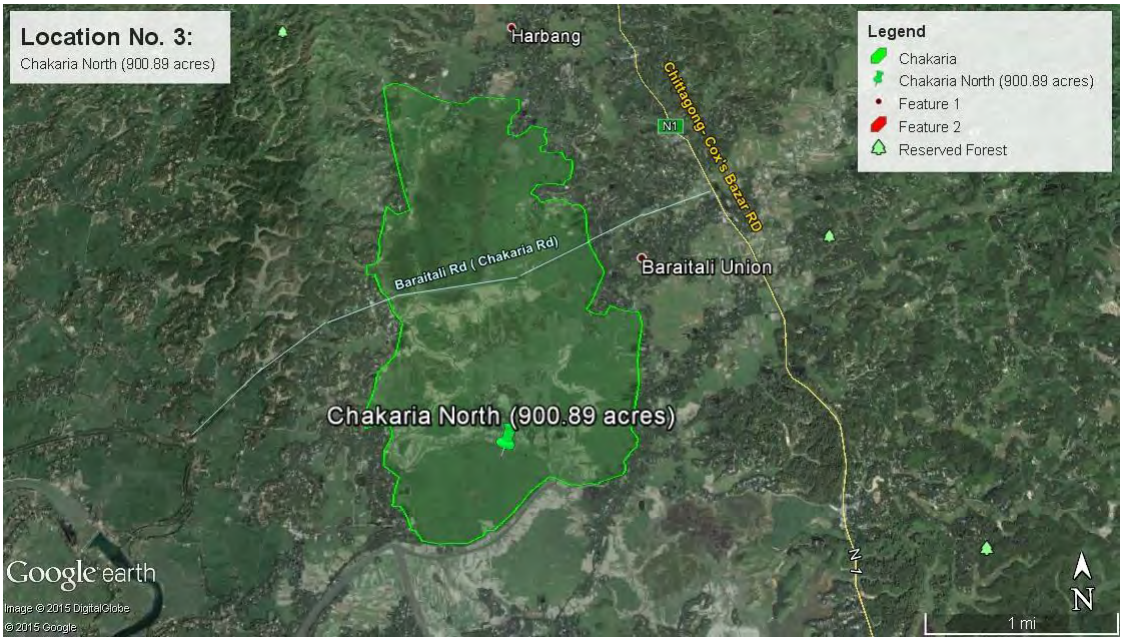


Figure 5: Proposed Chakaria North location (Candidate No. 3)

Key Findings of Baseline Status

Salient features of project influence area in the social and environmental views are summarized in Table 2.

Table 2: Summary of important features of the scheme area

Sl.	Parameter	Description
Environmental Setting		
1	Climate	The climate of the project area is tropical monsoon with hot summer and cool dry winter. The closest meteorological station of Bangladesh Meteorological Department (BMD) is located in Cox's Bazar. Average monthly maximum temperature of Cox's Bazar varies in the range of 31.03 ^{0}C to 35.87 ^{0}C and minimum average monthly temperature varies from 12.9 ^{0}C – 23.9 ^{0}C. The annual average rainfall is 4269 mm.
2	Ecologically Critical Area	No ecologically Critical areas found in the periphery of the project area.
	Reserve/Protected Forests	No Reserve/Protected Forests found in the periphery of the project area.
	Vegetation	Major trees include Eucalyptus, Gargan, Shisho, Turmeric, Mango, betel nut, Mehogoni etc. are found both sides of the road along the project area.
	Wild Life Sanctuary	There are no fish/wild life sanctuary within the project area .
	Topography	The general topography of the project area is plain. The project area is about 7 ft low from the existing road level. For implementation of the project, about 5/6 ft land filling is required.
3	Principal crops	Most of the agricultural lands are double cropped (Aus and Boro) and the main crop is paddy. There are also watermelon, Cucumber, Bitter guard, ladies finger etc. are grown in the project area.

Sl.	Parameter	Description	
		irrigation facilities for producing crops.	
4	Major Water Bodies	Harbang Chori Khal and Sonaitori Khal passes inside the project area and join together about 5 km south and finally falls at Matamohuri river. There are no tidal effect in these khals. There is a dam in the khal during dry period for supplying water for agriculture purpose.	
5	Flooding	There is no major flooding during the last 10 years. The project area was flood affected during 1991. The agriculture land and shrimp farming was affected. There is no major water logging inside the project area. The largest flood event in the past suggested that about 3 m height embankment might be necessary to protect the site from flooding.	
6	Seismicity	The project area falls in Zone II, i.e. medium intensity seismic zone of the country.(Ref: Bangladesh National Building Code).	
7	Environmental Hotspots	There is no environmental hotspots within the project area. About 1 km, there are 10 mosque, 4 Mandir is available.	
8	Major Settlement	Three villages named Harbang, Baraitali and Paharchanda	
9	Major Industries/ Business Entrepreneurs	There is no major industry exists within 1 km of the project area which creates environmental pollution.	
10	Attractive Site	There is no attractive or historical site available within 1 km of the project area.	
Socioeconomic Profile			
1	Land Ownership	Type of Land	Quantity
		Khas Land	73.06 acre
		Private land	827.83
		Total	900.89 acre
2	Population	The project area consists of Harbang, Baraitali and Paharchanda mouza where total population is 61008 nos[2]. Among them 30676 nos. male and 30322 nos. female	
3	Household	11973 nos.	
4	Average Household Size	5.23 persons / HH	
5	Density	1353 persons/ sq. Km	
6	Sex Ratio (male/Female)	103 male against 100 female	
7	Landuse Pattern	Agricultural Land	
8	Major Occupation Pattern among HH Members	Major source of income are agriculture, service, remittance, fishing etc. The economic condition within the project area is satisfactory.	
9	Household Monthly Income	Average Highest Income	Tk. 30000
		Average Lowest Income	Tk. 6000
10	Indigenous people	No indigenous people within the project boundary area but about 800 Rakaine family live within 200 m at Harbang mouza.	
11	Water Supply	There is potable water within depth of 20/30 ft but iron concentration is high and salinity and arsenic is less. The tubewell which is installed about 600/700 ft depth causing iron and salinity problems. There are some ponds (medium and small) available which water is used for bathing, washing and cooking purposes.	

[2] Population and Housing Census, 2011, Community Series, Cox's bazar

Sl.	Parameter	Description	
12	Electricity	There are electric transmission lines at the west side, about 400 m away from the national highway. These lines are main transmission lines connecting Chittagong and Cox's Bazar. (It might be 120 KV high voltage lines). There is no transformer substation near the site but there is one located in Chakaria city about 9 km away from the project site.	
13	Sources of Construction Materials	Materials	Availability
		Sand	Sand is available at Bhandarir deba in Harbang union which is about 7 km north from the project area.
		Cement	Cement is available at Chakaria bazaar which is about 8 km away from the project area.
		Bricks	There are three brick fields at Harbang Doal Mara 5 km north from the project area.

Social mapping are attached in Annex 3 and the following photographs show salient features of proposed location.

Project Site (Candidate 3) with Land Features at Baraitoli and Paharchanda village

Project site (Candidate 3) with Land Features at Harbang village	Existing road bridge across the khal

1.3.4 Candidate No. 4- Maheskhali EZ-1

Location

The proposed site is located in Choto Maheskhali Union of Maheskhali Upazilla under Cox's Bazar district. It is about 1.0 km away from the Choto Maheskhali Union Parishad and about 3.5 km away from the Maheskhali Upazilla and about 40 km away from Cox's Bazar. The distance from Cox's Bazar by river is about 4 km and the road distance from Chakaria via Badarkhali is about 30km.

The proposed site has an area of 1438.52 acres comprises of Choto Maheskhali, Pahar Thakurtola, Thakurtola and Gorokghata mouza distributed over four villages. It is bounded in north by Shaplapur UP and Dineshpur village; in South by Maheskhali Pourashava,; in the east Bakkhali village and Boro Maheskhali in the west.

Road Network

The distance from Cox's Bazar by river is about 4 km and the road distance from Chakaria via Badarkhali is about 30km. Most of the road are bituminous but very narrow and there are heavy settlement and agricultural land on both sides of the project area. Communication system of project area between Chittagong and Mongla port and other parts of the country is suitable.

Figure 6 shows Map of the proposed project location.

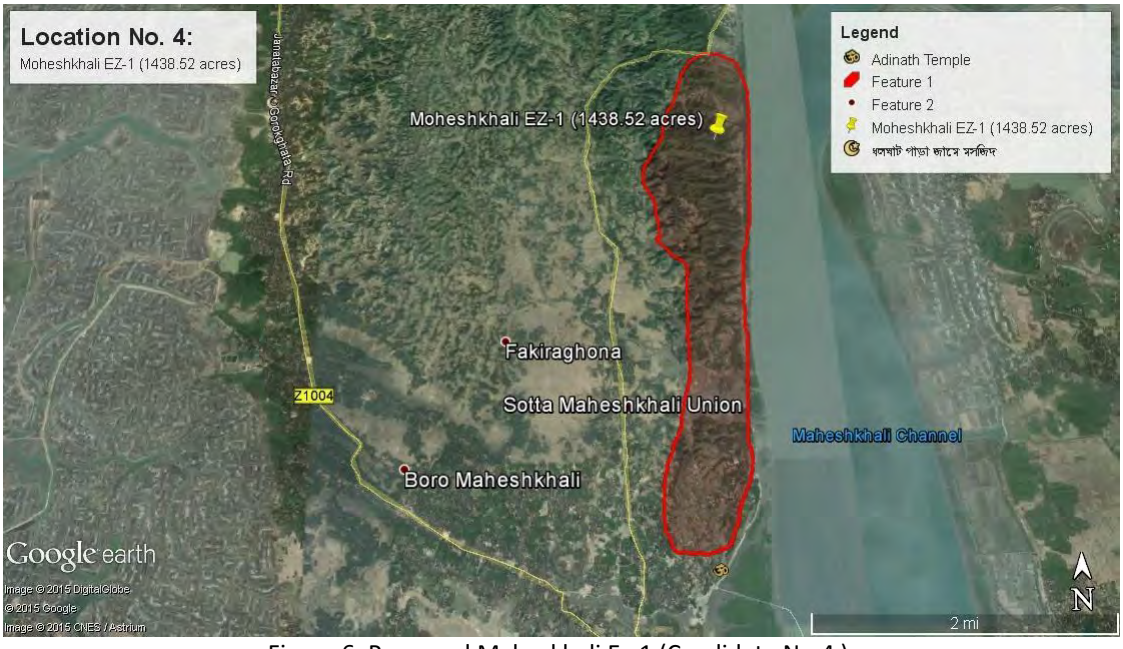


Figure 6: Proposed Maheskhali Ez-1 (Candidate No.4)

Key Findings of Baseline Status

Salient features of project influence area in the social and environmental views are summarized in Table 3.

Table 3: Summary of important features of the scheme area

Sl.	Parameter	Description
Environmental Setting		
1	Climate	The climate of the project area is tropical monsoon with hot summer and cool dry winter. The closest meteorological station of Bangladesh Meteorological Department (BMD) is located in Cox's Bazar. Average monthly maximum temperature of Cox's Bazar varies in the range of 31.03 ^{0}C to 35.87 ^{0}C and minimum average monthly temperature varies from 12.9 ^{0}C – 23.9 ^{0}C. The annual average rainfall is 4269 mm.
2	Ecologically Critical Area	No ecologically Critical areas found in the periphery of the project area.
	Reserve/Protected Forests	No Reserve/Protected Forests found in the periphery of the project area. Reserve Forest starts from Pahar Mouza which is adjacent to Thakurtola.
	Vegetation	Major trees include Eucalyptus, Babul tree, , betel nut, Mehogoni, Goava etc. are found within the project area.
	Wild Life Sanctuary	There are no fish/wild life sanctuary surrounding the project area.
	Topography	The general topography of the project area is hilly. There are some hillock land and some are char land. For implementation of the project, about 4 ft land filling is required for protection of flood.
3	Principal crops	Most of the agricultural lands are double cropped (Boro, Irri, Pyjam, Sonali Hybrid etc.) and the main crop is paddy. There are also cultivation on Cucumber, Ladies finger, Bringle, Raddish, Vegetables etc.
4	Major Water Bodies	Two Khals locally known as "Baruna and Ulbunia khal pass inside the project area and fall in Maheskhali Channel. Maheskhali Channel is about 1500 m southeast corner of the project area and ultimately joins into Bay of Bengal. Bay of Bengal is about 3500 m southwest corner of the project area.
5	Flooding	There is no major flooding during the last 10 years. In 1991, there was a flood but there is no effect on the project area.
6	Seismicity	The project area falls in Zone II, i.e. medium intensity seismic zone of the country.(Ref: Bangladesh National Building Code).
7	Environmental Hotspots	There are two mosque and two mandir and two primary school within the project boundary which may be affected. There are 12 mosque, 6 mandir including Adinath is available within 1 km of the project area.
8	Major Settlement	Four villages named Gorokghata, Choto Maheskhali, Pahar Thakurtola and Thakurtola.
9	Major Industries/	Salt farming and Shrimp farming is available within 400 m west and

Sl.	Parameter	Description	
	Business Entrepreneurs	south direction of the project area.	
10	Attractive Site	Adinath Mandir is about 250 m south to the project area.	
Socioeconomic Profile			
1	Land Ownership	Type of Land	Quantity
		Khas Land	538.52 acre
		Char land	900.00 acre
		Total	1438.52 acre
2	Population	The project area consists of Choto Maheskhali, Pahar Thakurtola, Thakurtola and Gorokghata mouza where total population is 20,000 nos[3]. Among them 10578 nos. male and 9422 nos. female	
3	Household	3200 nos.	
4	Average Household Size	5.4 persons / HH	
5	Density	2293 persons/ sq. Km	
6	Sex Ratio (male/Female)	112 male against 100 female	
7	Landuse Pattern	Agriculture, Salt and Shrimp farming	
8	Major Occupation Pattern among HH Members	Major source of income are fishing, salt and shrimp farming, Dry fish and Betel nut cultivation. The economic condition within the project area is not satisfactory.	
9	Household Monthly Income	Average Highest Income	Tk. 20000
		Average Lowest Income	Tk. 6000
10	Indigenous people	No indigenous people within the project area.	
11	Water Supply	There is potable water within depth of 100-150 ft in shallow tubewell. Iron and arsenic concentration is not so much. Deep tube well could not installed around 150-600ft due to salinity problems. There are some ponds (medium and small) available which water is used for bathing, washing purposes.	
12	Electricity	The project area is near in Maheskhali island where various power plant is under implementation. So, in future there is no problem for electricity supply according to demand of the various industries within Economic zones.	
13	Sources of Construction Materials	Materials	Availability
		Sand	Sand and Cement is available at Maheskhali Sadar which is about 3.5 km away from the project area.
		Cement	
		Bricks	There is one brick field withgin 1 km away from the project area where bricks are to be procured.

Social mapping are attached in Annex 4 and the following photographs show salient features of proposed location.

[3] Population and Housing Census, 2011, Community Series, Cox's bazar

Project Site (Candidate 4) with Land use pattern at Choto Maheskhali village

Household are to be affected at Choto Maheskhali village (Candidate 4)

Fishing trawler at Thakurtola near project area (Candidate 4)

1.3.5 Candidate No. 5- Maheskhali EZ-2 (Kalarmarchara)

Location

The proposed site is located in Kalarmarchara Union of Maheskhali Upazilla under Cox's Bazar district. It is situated in north-east corner of the Maheskhali island. It is about 4.0 km away from the Union Parishad and about 24 km away from the Maheskhali Upazilla and about 28 km away from Cox's Bazar. The distance from Cox's Bazar by river is about 4 km. Chakaria is about 18 km from the project area. It is connected with Chakaria over Badarkhali bridge.

The proposed site has an area of 826.86 acres comprises of Uttar Nolbila mouza distributed over three villages. It is bounded in north by Matarbari UP and Pekua UP; in South by Shaplapur UP; in the east Maheskhali Khal and Badarkhali UP and Uttar Nolbila village and Kalarmarchara UP in the west.

Road Network

The proposed area is well road network. The area is easy to access whole the country by road through Maheskhali via Chakaria. There is road communication from project area to Chakaria through Badarkhali bridge.

Figure 7 shows Map of the proposed project location.

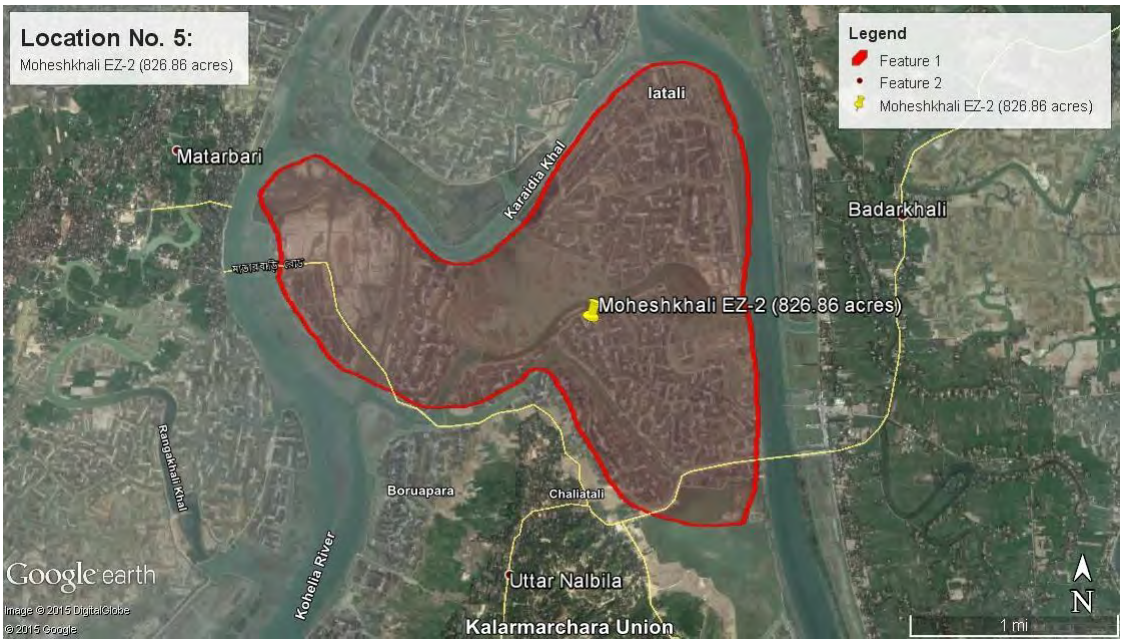


Figure 7: Proposed Maheskhali EZ-2 (Candidate No.5)

Key Findings of Baseline Status

Salient features of project influence area in the social and environmental views are summarized in Table 4.

Table 4: Summary of important features of the scheme area

Sl.	Parameter	Description
Environmental Setting		
1	Climate	The climate of the project area is tropical monsoon with hot summer and cool dry winter. The closest meteorological station of Bangladesh Meteorological Department (BMD) is located in Cox's Bazar. Average monthly maximum temperature of Cox's Bazar varies in the range of 31.03 ^{0}C to 35.87 ^{0}C and minimum average monthly temperature varies from 12.9 ^{0}C – 23.9 ^{0}C. The annual average rainfall is 4269 mm.
2	Ecologically Critical Area	No ecologically Critical areas found in the periphery of the project area.
	Reserve/Protected Forests	No Reserve/Protected Forests found in the periphery of the project area. There are forest area at Pekua which is about 0.5 km away

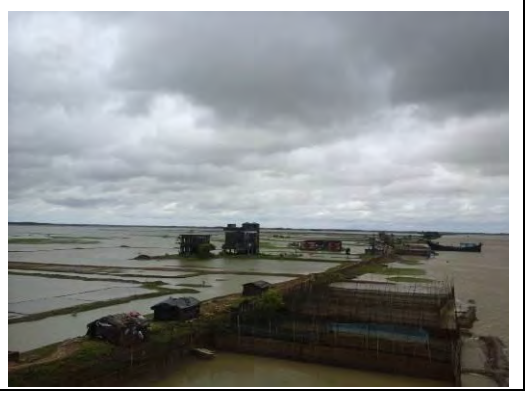
Sl.	Parameter	Description	
		from the project area. Reserve Forest at Pahar Mouza which is about 2 km away from the project area.	
	Vegetation	Major trees include Eucalyptus, Akashi, Mehogoni , Sagun, Rain tree, Gargan, Cotton, Banyan tree, Coconut, betel nut etc. etc. are found within the project area.	
	Wild Life Sanctuary	There are no fish/wild life sanctuary surrounding the project area.	
	Topography	The general topography of the project area is plain. The land is about 5 ft low to the existing road. So, no need for major land filling.	
3	Principal crops	About 90% land is cultivated by shrimp and salt and rest 10% land is cultivated by Paddy. Paddy is roping in two times of the year Shrimp farming starts from July to November and Salt farming from November to March.	
4	Major Water Bodies	A narrow local khal named Daradia passes inside the project area and join with Kohelia river and Maheskhali channel. Badarkhali Channel passes by the side of the project area where water is flowing throughout the year. During tidal effect, water layer is fluctuated.	
5	Flooding	There is no major flooding during the last 10 years. In 1991, there was a flood and road is inundated upto 5 ft.	
6	Seismicity	The project area falls in Zone II, i.e. medium intensity seismic zone of the country.(Ref: Bangladesh National Building Code).	
7	Environmental Hotspots	There are 7 mosque, 3 and 1 graveyard within 1 km of the project area.	
8	Major Settlement	One village- Uttar Nolbila.	
9	Major Industries/ Business Entrepreneurs	Salt farming and Shrimp farming is available within the project area.	
10	Attractive Site	There is one Pagoda at Barua which is about 1 km west to the project area.	
Socioeconomic Profile			
1	Land Ownership	Type of Land	Quantity
		Private Land	415.61 acre
		Khas land	117.32 acre
		Total	532.93 acre
2	Population	The project area consists of Uttar Nolbila mouza where total population is 7435 nos[4]. Among them 3807 nos. male and 3628 nos. female	
3	Household	1436 nos.	
4	Average Household Size	5.5 persons / HH	
5	Density	1697 persons/ sq. Km	
6	Sex Ratio (male/Female)	105 male against 100 female	
7	Landuse Pattern	Salt and Shrimp farming, Agriculture	
8	Major Occupation Pattern among HH Members	Major source of income are salt and shrimp farming and betel leaf plantation. Most of the land within the project area is cultivated by salt and shrimp farming by the local people for their livelihood.	
9	Household Monthly Income	Average Highest Income	Tk. 20000
		Average Lowest Income	Tk. 4000

[4] Population and Housing Census, 2011, Community Series, Cox's bazar

Sl.	Parameter	Description	
10	Indigenous people	No indigenous people within the project area.	
11	Water Supply	Major source of water within 1 km area of the project site is tube well. The water is available within depth of 70/80ft which is iron and salinity affected. Potable water is available within 600/700 ft depth of well.	
12	Electricity	The project area is near in Maheskhali Island. Matarbari Coal plant and Hoanok Power plant is about 1-3 km within the project area. So, in future there is no problem for electricity supply according to demand of the various industries within Economic zones.	
13	Sources of Construction Materials	Materials	Availability
		Sand	Sand and Cement is available at Chaliatoli Bazaar which is about 2 km away east to the project area.
		Cement	
		Bricks	Bricks are available in the brick field at Harbong mouza of Chakaria which is about 30 km away of the project area.

Social mapping are attached in Annex 5 and the following photographs show salient features of proposed location.

Project Site (Candidate 5) with surrounding features at uttar nolbila village



Road side Petrol pump may be removed due to project implementation at Uttar Nolbila (Candidate 5)	Temporary structures (Jupri household) are to be removed during project implementation (Candidate 5)

1.3.6 Candidate No. 6- Maheskhali EZ-3 (Dhalghata)

Location

The proposed site is located in Dhalghata Union of Maheskhali Upazilla under Cox's Bazar district. It is situated in Matarbari island. It is about 2.0 km away from the Union Parishad and about 35 km (both road and river) far away from the Maheskhali Upazilla and about 45 km away from Cox's Bazar. Chakaria is about 30km away from the project area through Badharkhali bridge.

The proposed site has an area of 676.58 acres comprises of Dhalghata mouza. It is bounded in north by Sapmarar del; in South by Kohelia river channel and Bay of Bengal; in the eastKohelia river and Kalarmarchara UP and Kutubdia channel and bay of Bengal in the west.

Road Network

The proposed area is remote and not well road network. There is brick soling road inside the project area where roads are broken due to inundated water over road. The only way to communication within the project area by foot. During monsoon period, boat is only way for communication within the project area.

Figure 8 shows Map of the proposed project location.

Figure 8: Proposed Maheskhali EZ-3 (Candidate No.6)

Key Findings of Baseline Status

Salient features of project influence area in the social and environmental views are summarized in Table 5.

Table 5: Summary of important features of the scheme area

Sl.	Parameter	Description
Environmental Setting		
1	Climate	The climate of the project area is tropical monsoon with hot summer and cool dry winter. The closest meteorological station of Bangladesh Meteorological Department (BMD) is located in Cox's Bazar. Average monthly maximum temperature of Cox's Bazar varies in the range of 31.03 ^{0}C to 35.87 ^{0}C and minimum average monthly temperature varies from 12.9 ^{0}C – 23.9 ^{0}C. The annual average rainfall is 4269 mm.
2	Ecologically Critical Area	No ecologically Critical areas found in the periphery of the project area.
	Reserve/Protected Forests	No Reserve/Protected Forests found in the periphery of the project area.
	Vegetation	Major trees include Jau, Eucalyptus, Sishu, Kishnochura, Date, Mango etc. are found within the project area.
	Wild Life Sanctuary	There are no fish/wild life sanctuary surrounding the project area. Within 1 km, there is kutubdia channel where fish sanctuary is available.
	Topography	The general topography of the project area is plain. The land is about 5 ft high to the existing road. About 10 ft land filling is required for flood protection.
3	Principal crops	Due to salinity problems, no crops are cultivated. Shrimp cultivation starts from July to November and Salt farming starts from November to March.
4	Major Water Bodies	The area for the proposed project location is bounded by estuary. Kohelia river is only 300 m east which depth is 50/60 ft and wide is 300 ft. Water is available whole of the year; but during tidal effect, water level is fluctuated. Bay of Bengal is about 3 km south to the project area.
5	Flooding	The project area is disaster prone area. In 1991, there are water surge where water raise up to 18 ft within the project area. For the protection of the area due to flooding, upto 10 ft land filling is required.
6	Seismicity	The project area falls in Zone II, i.e. medium intensity seismic zone of the country.(Ref: Bangladesh National Building Code).
7	Environmental Hotspots	There are 6 mosque, 1 mandir, 4 school within 1 km of the project area.
8	Major Settlement	One village- Dhalghata.
9	Major Industries/ Business Entrepreneurs	No major industry. Salt farming and Shrimp farming is available within the project area.
10	Attractive Site	There is no attractive site within 1 km of the project area.
Socioeconomic Profile		

Sl.	Parameter	Description	
1	Land Ownership	Type of Land	Quantity
		Private Land	288.00 acre
		Khas land	225.29 acre
		Other Govt land (water Development and power Development)	163.29 acre
		Total	676.58 acre
2	Population	The project area consists of Dhalghata mouza where total population is 12877 nos[5]. Among them 6688 nos. male and 6189 nos. female	
3	Household	2250 nos.	
4	Average Household Size	5.7 persons / HH	
5	Density	6441 persons/ sq. Km	
6	Sex Ratio (male/Female)	108 male against 100 female	
7	Landuse Pattern	Salt and Shrimp farming	
8	Major Occupation Pattern among HH Members	Major source of income are salt and shrimp farming and fishing into deep sea, Their occupational pattern is not satisfactory due to the natural calamities.	
9	Household Monthly Income	Average Highest Income	Tk. 12000
		Average Lowest Income	Tk. 6000
10	Indigenous people	No indigenous people within the project area.	
11	Water Supply	Water is available within 700/800 ft deep tubewell. Due to the expensive for deep tubewell installation, most of the people drink water upto 450 ft depth of water where acute salinity problem. Major source of water within 1 km area of the project site is tube well. Ponding water is not used due to salinity problems. .	
12	Electricity	No electricity is available within 1 km of the project area. After implementation of Matarbari coal power plant, electricity may be available in future.	
13	Sources of Construction Materials	Materials	Availability
		Sand	Sand and Cement is available at Maheskhali Upazilla which is about 35 km and at Chakaria which is about 30 km away from the project area. For land filling dredged materials may be used from river Kuhelia which is about 300m from the project area.
		Cement	
		Bricks	Bricks are available in the brick field at Choto Maheskhali which is about 30 km away from the project area.

Social mapping are attached in Annex 6 and the following photographs show salient features of proposed location.

[5] Population and Housing Census, 2011, Community Series, Cox's bazar

Project Site (Candidate 6) with broken brick soling road

Kohelia river is flowing within 300 m from the project area (Candidate 6)

Temporary structures are to be displaced during road construction (Candidate 6)

1.3.7 Candidate No. 7- Cox's Bazaar Free Trade Zone (Kutubjom)

Location

The proposed site is located in Kutubjom Union of Maheskhali Upazilla under Cox's Bazar district. It is about 1.5 km away from the Kutubjom Union Parishad and about 3 km away from the Maheskhali Upazilla and about 50 km away from Cox's Bazar. The distance from Cox's Bazar by river is about 6 km and the road distance from Chakaria via Badarkhali is about 35km.

The proposed site has an area of 9939.11 acres (4021.36 hector) comprises of Ghatibhanga, Kutubjom, Sonadia and Hamidardia mouza distributed over four villages. The area covers 3126.14 acre under Hamidardia and Kutubjom mouza; about 5658.63 acres under Gotibanga mouza and about 1154.34 acre (467 hector) under Sonadia island. It is bounded in north by Puti Bila nad Fakira Ghata village under Boro Maheskhali UP and Delarpara village under Kutubjom; in South by Bay of Bangle; in the east Boro Maheskhali mouza under Boro Maheskhali UP and Maheskhali Channel and Bay of Bangle in the west.

Road Network

The distance from Cox's Bazar by river is about 6 km and the road distance from Chakaria via Badarkhali is about 35km. Most of the road are bituminous but very narrow and there are heavy settlement and agricultural land on both sides of the project area. Communication system of project area between Chittagong and Mongla port and other parts of the country is suitable.

Figure 9 shows Map of the proposed project location.

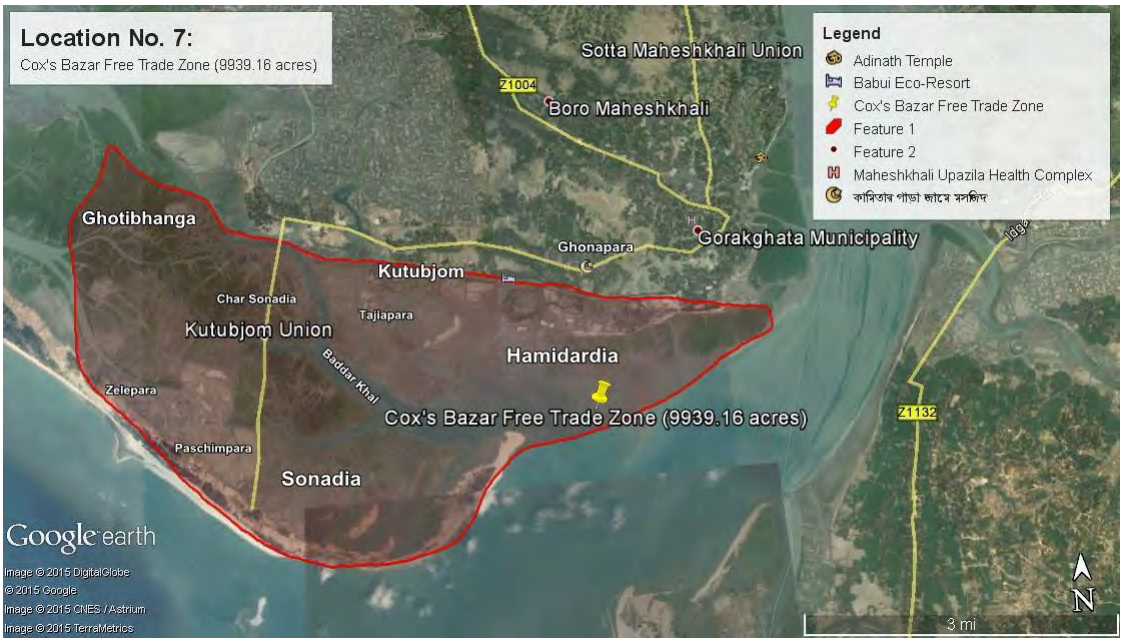


Figure 9: Proposed Cox's Bazaar Free Trade Zone (Candidate No.7)

Key Findings of Baseline Status

Salient features of project influence area in the social and environmental views are summarized in Table 6.

Table 6: Summary of important features of the scheme area

Sl.	Parameter	Description
Environmental Setting		
1	Climate	The climate of the project area is tropical monsoon with hot summer and cool dry winter. The closest meteorological station of Bangladesh Meteorological Department (BMD) is located in Cox's Bazar. Average monthly maximum temperature of Cox's Bazar varies in the range of 31.03 ^{0}C to 35.87 ^{0}C and minimum average monthly temperature varies from 12.9 ^{0}C – 23.9 ^{0}C. The annual average rainfall is 4269 mm.
2	Ecologically Critical Area	Among four mouza (Ghatibhanga, Kutubjom, Sonadia and Hamidardia), Sonadia island (4915 hector area) is declared

Sl.	Parameter	Description	
		ecologically critical areas by vide Gazette notification dated 19 April, 1999, No. pabama-4/7/87/99/245 under section 5 of the Environment Conservation Act, 1995. Gazette Notification of Respondent No. 1 dated 03 May, 1999 No.-pabama-4/7/87/99 excluding part of the reserve forest area of Sonadia island (2,794.04hector) in Sonadia-Ghotibhanga mauja, under Kutubjom union from the list of ecologically critical areas.	
	Reserve/Protected Forests	No Reserve/Protected Forests found in the periphery of the project area. A forest area found under Cox's Bazar Forest range which is 1.5 km away from Ghatibhanga mouza.	
	Vegetation	Major trees include Eucalyptus, Babul tree, betel nut, Mehogoni, Mango, Goava, Jacfruit, Coconut etc. are found within the project area.	
	Wild Life Sanctuary	There are no fish/wild life sanctuary surrounding the project area.	
	Topography	The general topography of the project area is plain land. There are some hillock land and major part are char land. For implementation of the project, about 8 ft land filling is required for protection of flood.	
3	Principal crops	Most of the agricultural lands are single cropped (Boro, Irri, Pyjam, Sonali Hybrid etc.) and the main crop is paddy. There are also cultivation on Cucumber, Ladies finger, Raddish, Vegetables etc.	
4	Major Water Bodies	Two Khals locally known as "Baddar, Majherdhar and Noachira khal pass inside the project area and fall in Maheskhali Channel. Maheskhali Channel is about 3000 m east corner of the project area and ultimately joins into Bay of Bengal.	
5	Flooding	There is no major flooding during the last 10 years. In 1991, there was a flood but there is no effect on the project area.	
6	Seismicity	The project area falls in Zone II, i.e. medium intensity seismic zone of the country.(Ref: Bangladesh National Building Code).	
7	Environmental Hotspots	Within the project boundary no educational and religious institution found. There are 13 mosque, 7 government primary school, 2 high schools is available within 1 km of the project area.	
8	Major Settlement	Four villages named Ghatibhanga, Kutubjom, Sonadia and Hamidardia mouza.	
9	Major Industries/ Business Entrepreneurs	Salt farming and Shrimp farming is available within 250/300 m north and east direction of the project area.	
10	Attractive Site	No attractive site found within project area.	
Socioeconomic Profile			
1	Land Ownership	Type of Land	Quantity
		Khas Land	1484.77 acre
		Char land	8454.34 acre
		Total	9939.11 acre
2	Population	The project area consists of Ghatibhanga, Kutubjom, Sonadia and Hamidardia mouza where total population is 30,637 nos[6]. Among them 15766 nos. male and 14871 nos. female	
3	Household	5367 nos.	
4	Average Household Size	5.6 persons / HH	
5	Density	1006 persons/ sq. Km	
6	Sex Ratio	108 male against 100 female	

[6] Population and Housing Census, 2011, Community Series, Cox's bazar

Sl.	Parameter	Description	
	(male/Female)		
7	Landuse Pattern	Agriculture, Salt and Shrimp farming	
8	Major Occupation Pattern among HH Members	Major source of income are fishing, salt and shrimp farming, Dry fish and Betel nut cultivation. The economic condition within the project area is not satisfactory.	
9	Household Monthly Income	Average Highest Income	Tk. 17000
		Average Lowest Income	Tk. 5000
10	Indigenous people	No indigenous people within the project area.	
11	Water Supply	There is potable water within depth of 10-15 ft in shallow tubewell. Iron and arsenic concentration is not so much. Due to fresh water found at depth of 10-15ft, so Deep tube well need not installed. There are some ponds (medium and small) available which water is used for bathing, washing purposes.	
12	Electricity	Accept the Sonadia mouza, all other mouza have electricity. In the Sonadia mouza, 70% of population use solar power. The project area is near in Maheskhali island where various power plant is under implementation. So, in future there is no problem for electricity supply according to demand of the various industries within Economic zones.	
13	Sources of Construction Materials	Materials	Availability
		Sand	Sand and Cement is available at Choto Maheskhali which is about 3 km away from the project area.
		Cement	
		Bricks	Bricks are available at Choto Maheskhali which is about 9 km away from the project area.

Social mapping are attached in Annex 7 and the following photographs show salient features of proposed location.

Project Site (Candidate 7) with Land use pattern at Gotibanga village

Temporary and illegal katcha Household may be removed at Gotibanga mouza during project implementation (Candidate 7)	Road Condition of the project area near at Gotibanga mouza (Candidate 7)

1.4 Screening Checklists Results

The screening checklists during field study focused on environmental issues and concerns. The current Socio-economic environmental aspects were also adequately considered particularly land acquisition, involuntary resettlement, poverty reduction etc. The purpose was to initially identify potentially affected environmental and social components vis-à-vis activities of the EZ development project during its implementation, assuming without mitigation measures. The results of screening is shown in Table 7.

Table 7: Results of Screening

Item	***Location/Name of Candidate Economic Zone (EZ)***						
	(1) Maheskhali South	***(2) Cox's Bazar North***	***(3) Chakaria North***	***(4) Maheskhali EZ-1***	***(5) Maheskhali EZ-2 (Kalarmarchara)***	***(6) Maheskhali EZ-3 (Dhalghata)***	***(7) Cox's Bazar Free Trade Zone (Kutubjom)***
Social Environment							
Land Acquisition	All area covers under Reserve Forest Area	970.13 acres of land comprising 53.31 acre khas land, 26.92 acre other Govt. land and 889.90 acre private land	900.89 acres of land comprising 827.83 acres private land and 73.06 acres khas land	1438.52 acres of land comprising 538.52 acres khas land and 900 acre char land	826.86 acres of land comprising 185.01 acre khas land and 641.85 acre private land	676.58 acres of land comprising 225.29 acre khas land, 163.29 acre other Govt. land (water development and power development board) and 288.00 acre private land	9939.11 acres of land comprising 1484.77 acre khas land and 8454.34 acre char land
Involuntary Resettlement	Not Applicable	About 25/30 temporary structures (Jupri and tin shed) along the road may be displaced due to road widening.	About 25/30 temporary structures would be relocated at Baraitoli mouza for project implementation	About 250/300 temporary households (semi pucca and kutcha) would be relocated among 4 mouza due to project implementation .	About 10/15 temporary house (jupri) at uttar nolbila would be relocated; There is a petrol pump inside the project area which may be displaced due to	About 30/35 temporary house (jupri type) would be relocated at Dhalgota mouza for project implementation	About 200/250 temporary and illegal house (kutcha type) would be relocated within the project area.

Item	*Location/Name of Candidate Economic Zone (EZ)*						
	(1) Maheskhali South	*(2) Cox's Bazar North*	*(3) Chakaria North*	*(4) Maheskhali EZ-1*	*(5) Maheskhali EZ-2 (Kalarmarchara)*	*(6) Maheskhali EZ-3 (Dhalghata)*	*(7) Cox's Bazar Free Trade Zone (Kutubjom)*
					project implementation .		
Local economics, such as employment, livelihood, etc.	-	Livelihood will be disturbed. New scope of livelihood will generated	Same as in the left	Same as in the left	Same as in the left	Same as in the left	Same as in the left
Land use and utilization of local resources	-	Land use pattern is mostly agricultural and local sandy would be used (which is about 15 km away at Chakaria) for earth filling; Extent of impact is unknown at this stage	Land use pattern is mostly agricultural and local sandy would be used (which is about 7 km away at Harbong) for earth filling (about 5/6 ft); Extent of impact is unknown at this stage	Land use pattern is agriculture, salt and shrimp farming; local sandy would be used (which is about 3.5 km away at Maheskhali Sadar) for earth filling (about 4 ft); Extent of impact is unknown at this stage	Land use pattern is agricultural, salt and shrimp farming; local sandy would be used (which is about 2 km away at Chaliatoli bazaar) for earth filling (nominal filling); Extent of impact is unknown at this stage	Land use pattern is agricultural, salt and shrimp farming; local sandy would be used (which is about 30 km away at Chakaria) for earth filling (about 10 ft); Extent of impact is unknown at this stage	Land use pattern is agricultural, salt and shrimp farming; local sandy would be used (which is about 3 km away at Choto Moheshkhal)i for earth filling (about 8 ft); Extent of impact is unknown at this stage
Poor, indigenous, or ethnic people	-	No indigenous or ethnic	No indigenous or ethnic	Some poor and hard core poor	No indigenous or ethnic	Some poor and hard core poor	No indigenous or ethnic

Item	***Location/Name of Candidate Economic Zone (EZ)***						
	(1) Maheskhali South	***(2) Cox's Bazar North***	***(3) Chakaria North***	***(4) Maheskhali EZ-1***	***(5) Maheskhali EZ-2 (Kalarmarchara)***	***(6) Maheskhali EZ-3 (Dhalghata)***	***(7) Cox's Bazar Free Trade Zone (Kutubjom)***
		minorities are found there.	minorities are found there.	households are found in the project locations. No indigenous or ethnic minorities are found there	minorities are found there	households are found in the project locations. No indigenous or ethnic minorities are found there	minorities are found there
Cultural Heritage	-	There is no cultural heritage	There is no cultural heritage	Adinath Mandir is about 250 m south to the project area	There is no cultural heritage	There is no cultural heritage	There is no cultural heritage
Local conflicts of interest	-	Local conflicts may take place among the workers. Local administration and the project authority will take care of them	*Same as in the left*	*Same as in the left*	*Same as in the left*	*Same as in the left*	*Same as in the left*
Accident	-	Accidents are very common at construction. However, preparing of a	*Same as in the left*	*Same as in the left*	*Same as in the left*	*Same as in the left*	*Same as in the left*

Item	***Location/Name of Candidate Economic Zone (EZ)***						
	(1) Maheskhali South	***(2) Cox's Bazar North***	***(3) Chakaria North***	***(4) Maheskhali EZ-1***	***(5) Maheskhali EZ-2 (Kalarmarchara)***	***(6) Maheskhali EZ-3 (Dhalghata)***	***(7) Cox's Bazar Free Trade Zone (Kutubjom)***
		proper construction and traffic management plan, it is possible to minimize the impact					
Infectious diseases such as HIV/AIDS	-	Many outside construction workers will move in the site and there is a chance of spread of HIV/STD transmission. However, these can be minimized through proper measures including campaign/education of residence/work	*Same as in the left*	*Same as in the left*	*Same as in the left*	*Same as in the left*	*Same as in the left*

Item	***Location/Name of Candidate Economic Zone (EZ)***						
	(1) Maheskhali South	***(2) Cox's Bazar North***	***(3) Chakaria North***	***(4) Maheskhali EZ-1***	***(5) Maheskhali EZ-2 (Kalarmarchara)***	***(6) Maheskhali EZ-3 (Dhalghata)***	***(7) Cox's Bazar Free Trade Zone (Kutubjom)***
		ers and provision of safety goods					
Gender	-	Almost all households are headed by male. Male population is slightly higher that female population. Gender issues would be taken care of during project implementation	*Same as in the left*	*Same as in the left*	*Same as in the left*	*Same as in the left*	*Same as in the left*
Children's rights		Children's right would be taken in to account during project implementation ; Child laboring would be strictly prohibited in the project civil	*Same as in the left*	*Same as in the left*	*Same as in the left*	*Same as in the left*	*Same as in the left*

Item	*Location/Name of Candidate Economic Zone (EZ)*						
	(1) Maheskhali South	*(2) Cox's Bazar North*	*(3) Chakaria North*	*(4) Maheskhali EZ-1*	*(5) Maheskhali EZ-2 (Kalarmarchara)*	*(6) Maheskhali EZ-3 (Dhalghata)*	*(7) Cox's Bazar Free Trade Zone (Kutubjom)*
		works.					
Natural Environment							
Topography	-	The general topography of the project area is plain. Land is relatively flat. The project area is about 4 ft low from the existing road level. Proposed development may change the Topography.	The general topography of the project area is plain. The project area is about 7 ft low from the existing road level. For implementation of the project, about 5/6 ft land filling is required. . Proposed development may change the Topography.	The general topography of the project area is hilly. There are some hillock land and some are char land. For implementation of the project, about 4 ft land filling is required for flood protection. Proposed development may change the Topography.	The general topography of the project area is plain. The land is about 5 ft low to the existing road. So, no need for major land filling. Proposed development may not change the Topography	The general topography of the project area is plain. The land is about 5 ft high to the existing road. About 10 ft land filling is required for flood protection. Proposed development may change the Topography	The general topography of the project area is plain land. There are some hillock land and major part are char land. For implementation of the project, about 8 ft land filling is required for protection of flood. Proposed development may change the Topography
Soil Erosion	-	Increased in soil erosion is expected during	*Same as in the left*	*Same as in the left*	*Same as in the left*	*Same as in the left*	*Same as in the left*

Item	***Location/Name of Candidate Economic Zone (EZ)***						
	(1) Maheskhali South	***(2) Cox's Bazar North***	***(3) Chakaria North***	***(4) Maheskhali EZ-1***	***(5) Maheskhali EZ-2 (Kalarmarchara)***	***(6) Maheskhali EZ-3 (Dhalghata)***	***(7) Cox's Bazar Free Trade Zone (Kutubjom)***
		construction					
Hydrology	-	Extent of impact is unknown at this stage	*Same as in the left*	*Same as in the left*	*Same as in the left*	*Same as in the left*	*Same as in the left*
Biota and ecosystems	Reserve Forest Area	The proposed location is not encroaching any ecological sensitive areas and isolate fish breeding ground. But some trees timber as well as fruit bearing trees will be felled before construction. Necessary permits and approval will be obtained prior to cutting	*Same as in the left*	Reserve Forest starts from Pahar Mouza which is adjacent to Thakurtola. There are no fish/wild life sanctuary surrounding the project area	No Reserve/Protected Forests found in the periphery of the project area. Reserve Forest at Pahar Mouza which is about 2 km away from the project area. There are no fish/wild life sanctuary surrounding the project area	No Reserve/Protected Forests found in the periphery of the project area. Within 1 km, there is kutubdia channel where fish sanctuary is available.	The proposed location is not encroaching any ecological sensitive areas and isolate fish breeding ground.
Pollution							
Air Pollution	-	May tentatively cause some air	Same as in the left	Same as in the left	Same as in the left	Same as in the left	Same as in the left

Item	*Location/Name of Candidate Economic Zone (EZ)*						
	(1) Maheskhali South	*(2) Cox's Bazar North*	*(3) Chakaria North*	*(4) Maheskhali EZ-1*	*(5) Maheskhali EZ-2 (Kalarmarchara)*	*(6) Maheskhali EZ-3 (Dhalghata)*	*(7) Cox's Bazar Free Trade Zone (Kutubjom)*
		pollution during construction period					
Water Contamination	-	Increased risk of water pollution from oil, grease and fuel spills, and other materials from vehicles during construction	Same as in the left	Same as in the left	Same as in the left	Same as in the left	Same as in the left
Soil Pollution	-	Fuel can be leaked into the ground from storage/heavy equipment. Countermeasures for fuel leak can minimize impact.	Same as in the left	Same as in the left	Same as in the left	Same as in the left	Same as in the left
Waste	-	Improper solid waste disposal in construction camps and work sites , may create impact to	Same as in the left	Same as in the left	Same as in the left	Same as in the left	Same as in the left

Item	***Location/Name of Candidate Economic Zone (EZ)***						
	(1) Maheskhali South	***(2) Cox's Bazar North***	***(3) Chakaria North***	***(4) Maheskhali EZ-1***	***(5) Maheskhali EZ-2 (Kalarmarchara)***	***(6) Maheskhali EZ-3 (Dhalghata)***	***(7) Cox's Bazar Free Trade Zone (Kutubjom)***
		local populations.					
Noise and Vibration	-	May tentatively cause some noise/vibration by equipment during construction period	Same as in the left	Same as in the left	Same as in the left	Same as in the left	Same as in the left

1.5 Screening Findings and Evaluation

Based on the field visit and reconnaissance survey and screening results, evaluation of all seven options has been summarized in the following:

Candidate No. 1 Maheskhali South (Fakiragaon)

Though the area under reserve forest jurisdiction so finally the area has been discarded from economic zone by the AC Land, Maheskhali Upazilla.

Candidate No.2 Cox's Bazaar North (Chaufaldandi)

- As the Maheskhali Channel is flowing only 300 m far away from the project area, so, the goods could be transfer very easily from different parts of the world
- The proposed area is plain land
- 33 KVA electricity system is available in 1.5 km south of the project area
- Provision of Gas would be very easily available there
- There is a paved road at Eidgaon which meets in Chittagong-Cox's Bazar road after crossing Chakaria which is about 5 km away from the project area.
- No major settlement on both sides of the road so that road widening could be done easily
- About 25/30 temporary structures (Jupri and tin shed) along the road may be displaced due to road widening.
- No major common property resources (school, mosque etc.) within the project area

Candidate No.3 Chakaria North

- Plain land
- There is wide road (about 22ft) inside the project area
- Land is about 6 ft low to existing road level
- Road communication is good between Chittagong and Cox's bazar
- 33 KVA electricity line passes adjacent to the project area
- There is no permanent structures like residential, institutional, religious
- No major trees within the project area
- Construction materials are easily available
- There is a khal inside the project area which is suitable for drainage system

Candidate No.4 Maheskhali EZ- 1

- Most of the road are bituminous but very narrow and there are heavy settlement and agricultural land on both sides of the project area
- Reserve Forest starts from Pahar Mouza which is adjacent to Thakurtola.
- There are two mosque and two mandir and two primary school within the project boundary which may be affected

Candidate No.5 Maheskhali EZ- 2

- Communication by road from Chakaria is easy access
- Wide paved road
- Electricity is easily available
- No permanent structures like residential, religious and institutions within the project area
- Major land filling is not required
- No major trees is available within the project area

Candidate No.6 Maheskhali EZ- 3

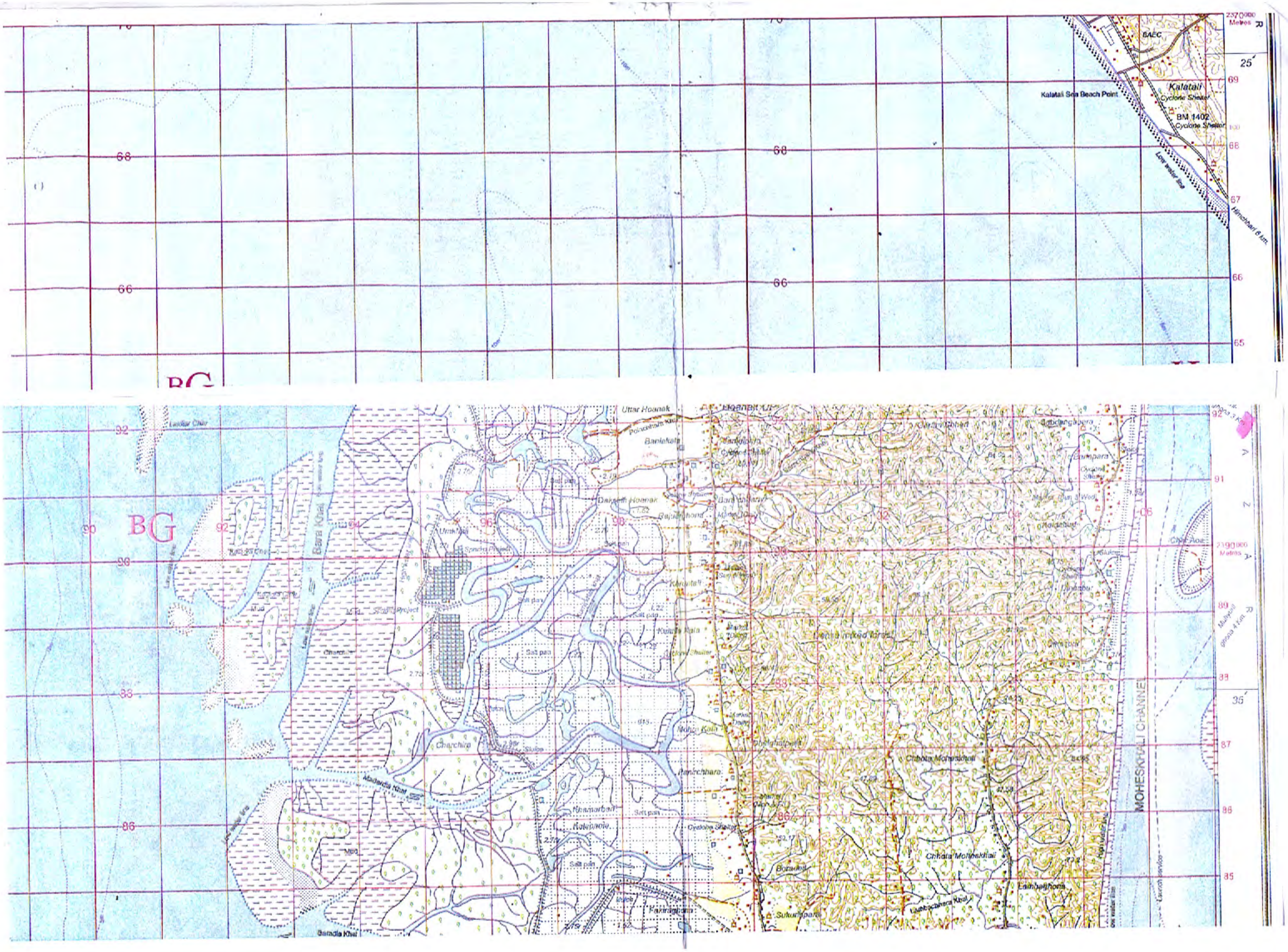
- Communication system is not good
- Natural disaster may arise easily due to surrounded by Bay and river channel
- No electricity nearby the project area
- Internal road system is not good
- Embankment will be built around the project area before implementation
- Major land filling is required

Candidate No.7 Cox's Bazaar Free trade Zone

- Area covers khas and char land; land acquisition is not major problem
- No permanent settlement there
- Total project area comprises of 4021.36 hector of area including Sonadia island which is about 467 hector. Sonadia island (one of the mouza) of the proposed location is included in ECA area (only closely connected area of reserve forest within the island which is about 2794 hector is excluded from the ECA area) by gazette notification. Proposed project area which belongs to Sonadia mouza does not fall Reserve forest area. So, if we excluded those area from our project; remaining 3554.31 hector area does not fall either ECA or Reserve Forest area.

ANNEXES

KUTUBDIA CHANNEL
KOHELIA RIVER
Matarbari UP
Dhalghat UP
Kalamarchhar UP
Shaplapur UP
Badarkhali UP
Utter Sikdarpara
Purba Matarbari
Sikdarpara
Tilamahirpara
Noapara
Sardarpara
Mogdeil
Saiberdeil
Dakshin Sairerdeil
Nasir Mohammeddeil
Kishrabunia
Dhalghat
Suturierdeil
Sammaradeil
Bagunbunia
Pandiderdeil
Guriakhalideil
Nalunghona
Utter Sairerdeil
Khamarbari
Modhukhali
Kalgarh
Panirchhara
Utter Nalbila
Boruapara
Chalitali
Unuskhali
Jhapua
Kalamarchhara
Sonapara
Nonachhari
Adharghona
Mijirpara
Hoanakdellapara
Hariarchhara
Chon khola
Dense mixed forest
Latali
Demusia
Majherpara
Paschim Darbeshkata
Darbeshkata
Nayapara
Paschim Wetamhoni
Badarkhali
Pukuriapara
Satodaliapara
Matarbarpara
Bhemakhali Pare
Khaspara
Tuliakhali
Chhariuapara
Zabbernagar
Lambakhalipara
Dalimakhali
Uttar Saitmara
Mognamapara
Mamabhagnepara
Azamnagar
Nepirkhalipara
Muhuriganepara
Ramsur
Damirchhari
Banachhari
Mithachhari
Maulovikata
Saighorpara
Mukbeki
Nidan Tarani
Saharierpara
Kukurbagarpara
Latifer Khal
Demusia Khal
Launch Service
Ferry
Main power line
Power line
Low water line
High water line
Mud
Salt pan
Sluice
Market (Daily)
Cyclone Shelter
Police Camp
PO
PTO
T&T
RH(Wapda)
Dispy
Hensher Char
Jhapua Khal
Noriachhari Khal
Hajarchhara Khal
Mamabhagnepara Khal
Bichertali Khal
Kutubdia 6 Km.
Anzalkhali 8 Km.
Ujania 6 Km.
Bangla Bazar 4 Km.
Chaitaria 11.5 Km.
Cheramdwip 5 Km.
90 000 Metres
24 00 000 Metres
50'
55'
0'
45'
92°
21°
40'



Kalatali Sea Beach Point
Kalatali
Cyclone Shelter
BM 1402
Cyclone Shelter
Low water line
Himchhari 6 km
Uttar Hoanak
Banlekata
Dakshin Hoanak
Bara Khal
Charchira
Madardia Khal
Khamarbari
Kalapania
Panirchhara
Chhota Moheskhali
Lambaghona
Lambachhara Khal
Sukuripara
Fakiraghona
Boradeli
Dense mixed forest
MOHESKHALI CHANNEL
Salt pan
Cyclone Shelter
Sluice
Mud
Garadia Khal

7

Char Ghatibhanga

Ghatibhanga

Forest office

Gurakhapram

Tajlakata

Kutubjum

Char Sonadia

SONADIA ISLAND

Zalapara

Baddar Khal

Paschimpara

Salt Pan

Pachapara

GPS 286

SONADIA ISLAND

Low water line

High water line

Mud

Baraidia

Sluice

Mogirkata

Bara Moheskhali UP

Fatiraghona

Jagiraghona

Putiville

Moheskhali

Dhalarpara

Market (Daily)

Cyclone Shelter

Bujrukpara

Kutubjum UP

Ghonapara

Rakhainjpara

Hamidachandip

HAMIDARDIA ISLAND

BG BH

Mohesh Khali Channel

Chhota Moheskhali UP

Dhulajalapara

Cyclone Shelter

Gachhagram

Mohanpara

Minjpara

Monupara

Hijalukpara

Bara Moheskhali

Kolatpara

Shepalipara

Katghatapara

Mohinidell

Thakurda

Adinath Temple

Deuberi

Pahar Thakurtola

Elipara Patpara

Buddist Temple

Launch Ghat

Gorakhpara

Rakhainjpara

Chhota Moheskhali

Dashkin Halbila

Jalipara

Red Crescent Cyclone Shelter

Panchpartiona

Rastarpara

Kawarpara

Pandara

Mamunpara

Halchalapara

Konapara

Kulapara

Hindupara

Khurushkul

Kuliapara

Uttar Nunialchhara

Dakshin Nunialchhara

Nazirtek

Kalubalapara

Menupara

Mehedipara

GPS 288 A

Sanitipara

Airport

Launchghat

BAKKHALI RIVER

COX'S BAZAR

Paurashava

Paurasava

Paschimpara

Kalatala

Teknaf

Teknaf

Teknaf

Jhautala Sea Beach Point

Baliar Chhara

Mohazmpara

Uttar Romaliarchhara

Baksarghona

Rumali Chhara

Dakshin Romaliarchhara

Salbal Sea Beach Point

Sakatpar

Lighthouse

BM 1401

Launch Service

Low water line

High water line

Mud

Sluice

Salt pan

Cyclone Shelter

Market (Daily)

Forest office

GPS

Mosque

Temple

Hospital

T & T Office

Police Station

Post Office

Bus Stand

Light House

Launch Service

Delipara 1 km.

Bhanukhali 4 km.

Towaipara 1 km.

Ramu 11 km.

P M Khali 5 km.

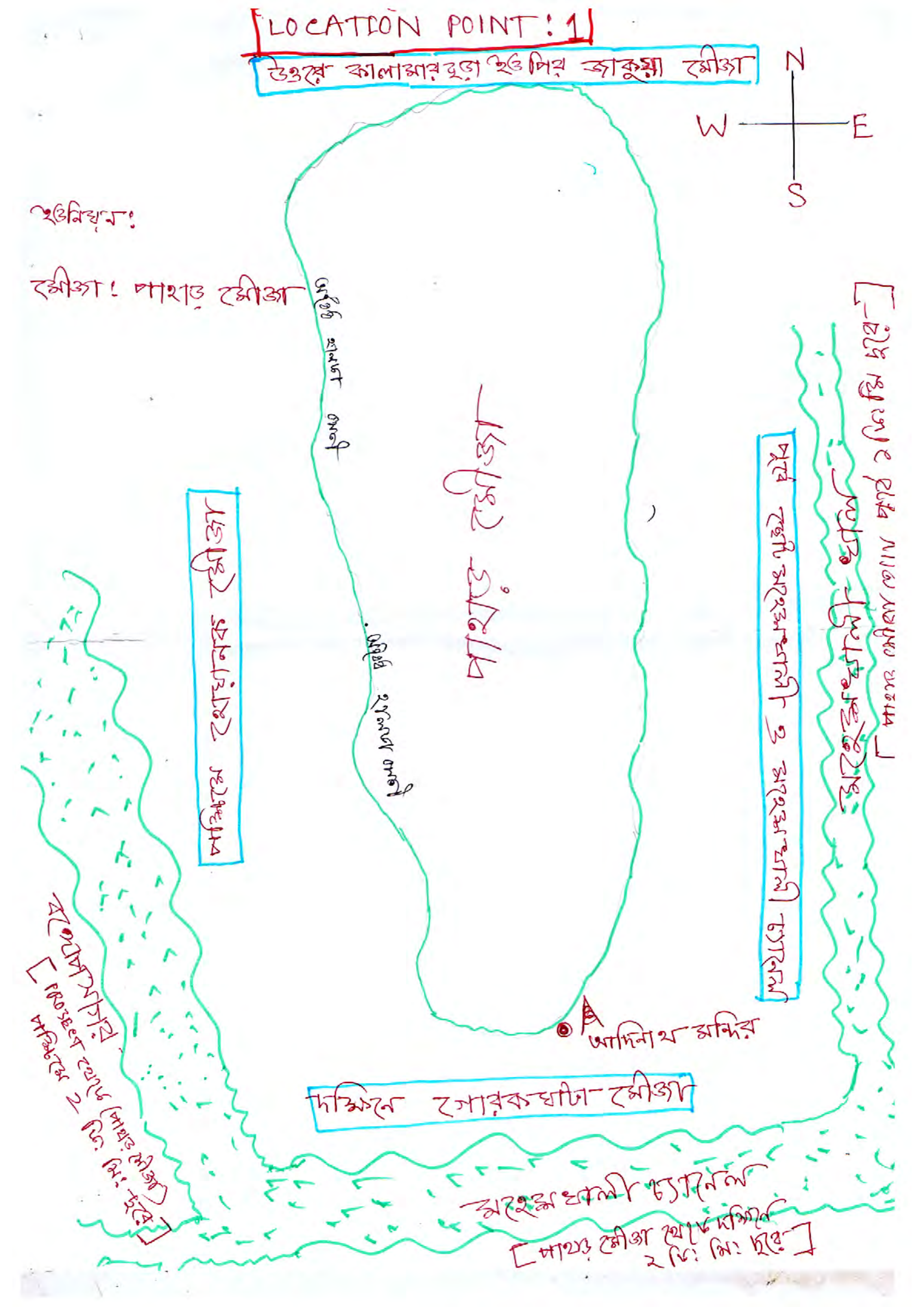
21° 30'

2380000 Metres

84 82 80 78 76 74 72 90 92 94 96 98 00 02 04 06 08

83 81 79 77 75 73 71

ANNEX 1


LOCATION POINT : 1
উত্তরে কালামারবুড়া ইউপির জাকুয়া মৌজা
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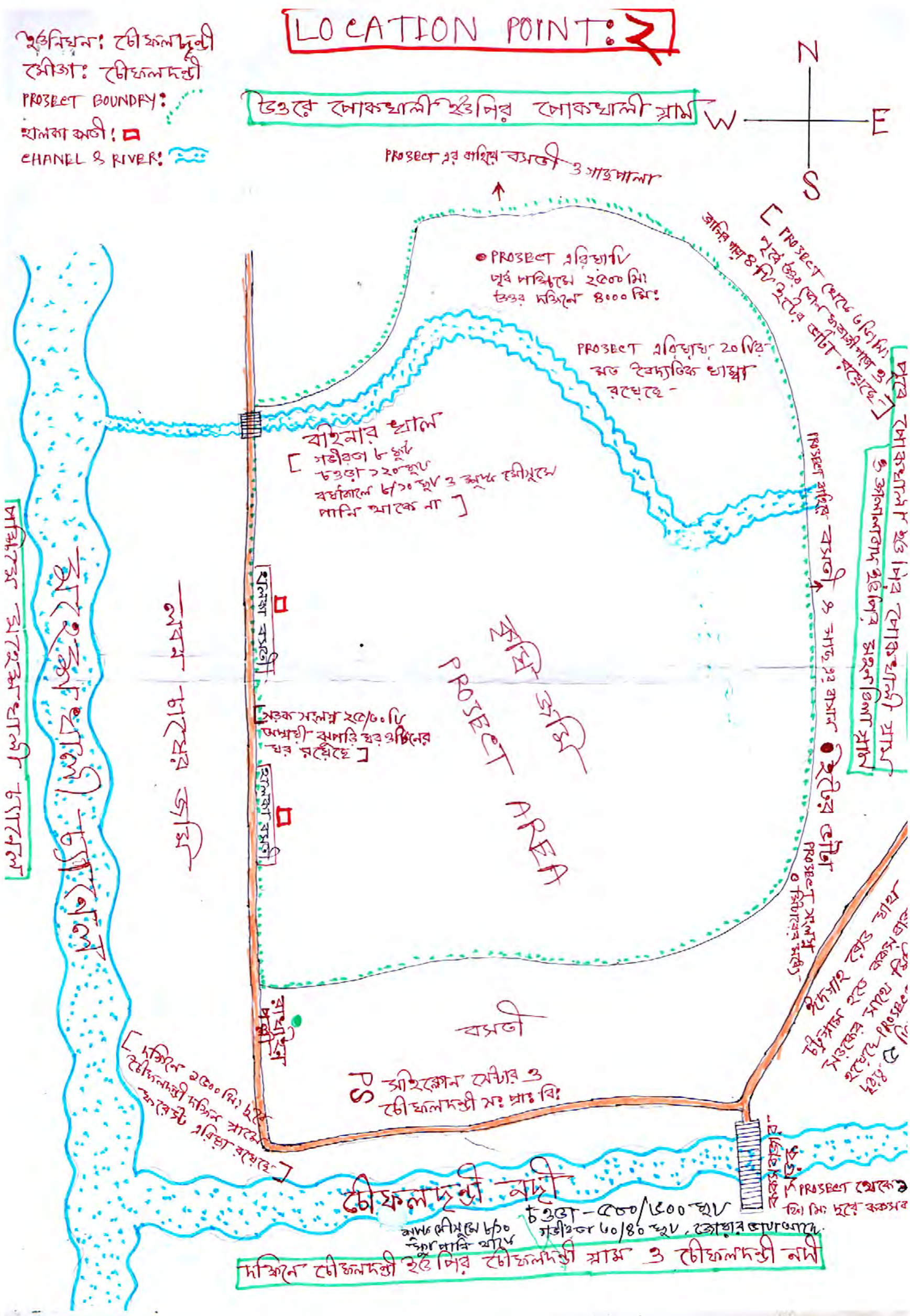
ইউনিয়ন:
মৌজা: পাহাড় মৌজা
পাহাড় মৌজা
পশ্চিমে হোয়ানক মৌজা
পূর্বে ছোট মহেশখালী ও মহেশখালী চ্যানেল
আদিনাথ মন্দির
দক্ষিনে গোরকঘাটা মৌজা
মহেশখালী চ্যানেল
[পাথড় মৌজা থেকে দক্ষিনে ২ কি: মি: দূরে]

ANNEX 2


LOCATION POINT: ২
ইউনিয়ন: চৌফলদন্ডী
মৌজা: চৌফলদন্ডী
PROJECT BOUNDRY:
হালকা বসতী:
CHANEL & RIVER:
উত্তরে পোকখালী ইউপির পোকখালী গ্রাম
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PROJECT এর বাহিরে বসতী ও গাছপালা
PROJECT এরিয়াটি পূর্ব পশ্চিমে ২৫০০ মি: উত্তর দক্ষিণে ৪০০০ মি:
PROJECT এরিয়ায় ২০টির মত বৈদ্যুতিক খাম্বা রয়েছে
বাহিনার খাল
[গভীরতা ৮ ফুট চওড়া ১২০ ফুট বর্ষাকালে ৮/১০ ফুট ও শুষ্ক মৌসুমে পানি থাকে না]
[সড়ক সংলগ্ন ২৫/৩০টি অস্থায়ী ঝুপড়ি ঘর ওটিনের ঘর রয়েছে]
হালকা বসতী
হালকা বসতী
বৃষ্টি জমি
PROJECT AREA
বসতী
PS সাইক্লোন সেন্টার ও চৌফলদন্ডী সঃ প্রাঃ বিঃ
[দক্ষিণে ২৫০০ মি: দূরে চৌফলদন্ডী দক্ষিণ গ্রামে ফরেস্ট এরিয়া রয়েছে]
চৌফলদন্ডী নদী
চওড়া - ৫০০/৬০০ ফুট
শুষ্ক মৌসুমে ৮/১০ ফুট পানি থাকে
গভীরতা ৬০/৪০ ফুট, জোয়ার ভাটা আছে
দক্ষিনে চৌফলদন্ডী ইউপির চৌফলদন্ডী গ্রাম ও চৌফলদন্ডী নদী
পশ্চিমে সাইক্লোন খালী চ্যানেল
সাইক্লোন খালী চ্যানেল
লবন চাষের জমি
পূর্বে পোকখালী ইউপির পোকখালী গ্রাম ও জলালাবাদ ইউপির মহুলডিলা গ্রাম
PROJECT বাহিরে বসতী ও গাছ এর বাগান
ইটের ভাটা
PROJECT সংলগ্ন মিটারের মধ্যে
ইদগাহ রোড যায় চট্টগ্রাম হতে কক্সবাজার সড়কের সাথে মিলিত হয়েছে PROJECT দূরত্ব ৫ মি
কক্সবাজার সড়ক
PROJECT থেকে ১ কি: মি: দূরে কক্সবাজার

ANNEX 3

LOCATION POINT : 3

ইউনিধন: বড়ইতলী ও হারবাং

দীঘা: বড়ইতলী, পশ্চরচান্দা ও হারবাং

উত্তরে হারবাং পশ্চর চান্দা

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বড়ঘোপাড়া
PROJECT থেকে
মি: উত্তরে

বাঁধাইকৃত মাটির পাকা রাস্তা
PROJECT থেকে ২০০ মি: দূরে

চকরিয়া-কক্সবাজার সড়ক

চকরিয়া-কক্সবাজার রেলপথ

চকরিয়া-কক্সবাজার রেলপথ

বসতবাড়ি

কবরী

হারবাং বাজার
[PROJECT থেকে ৩০/৪০ মিটার
আনুমানিক ৭/৮ মিনিট
বর্ষাকালে ১০/১২ মিনিট
স্পীড বোটযোগে ১/২ মিনিট]

PS-শ্রীফলতলা সেটার ও ব্রংসাকাটা:
প্রায় ৫ মি:

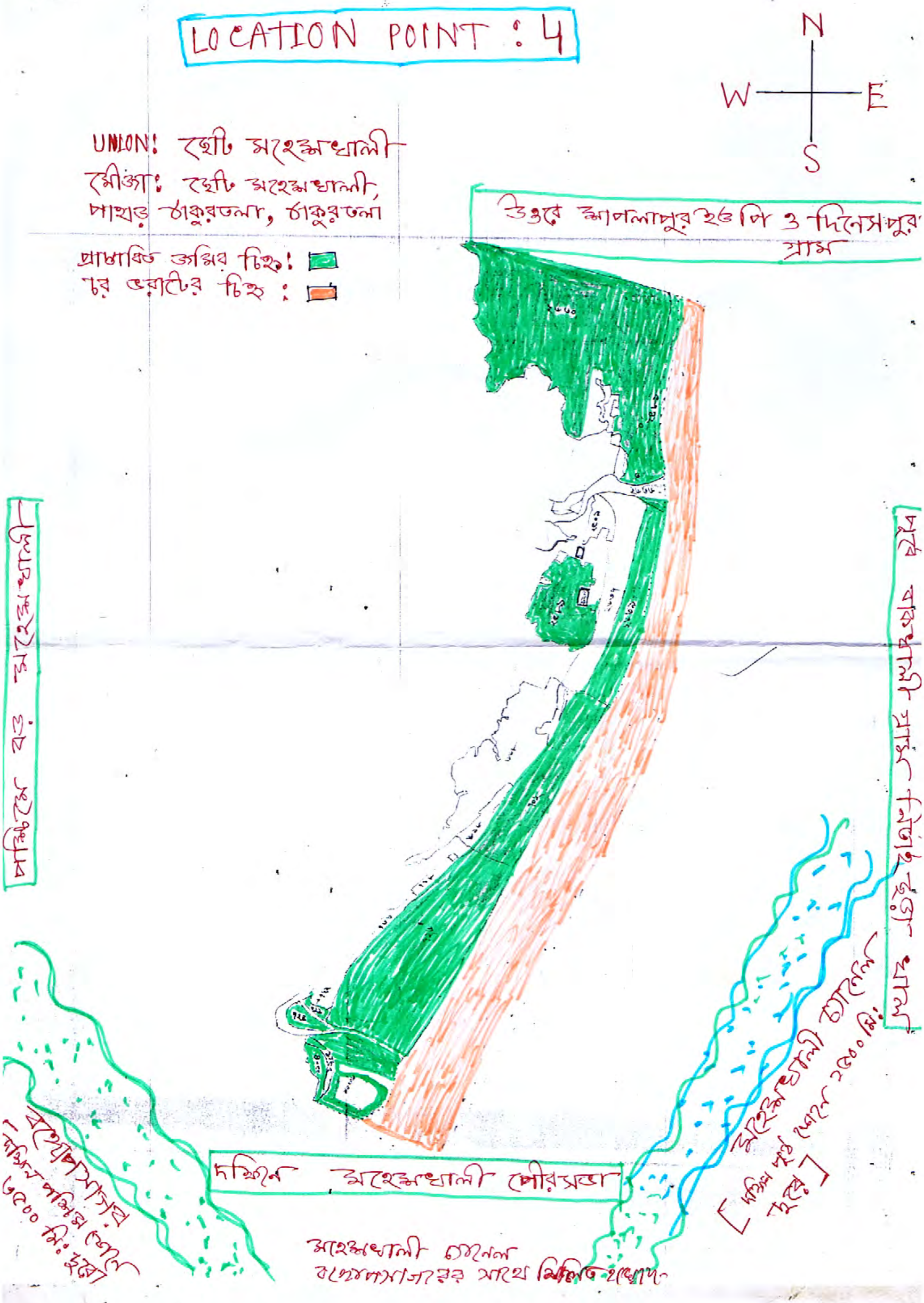
মাতামুহুরী নদী

[PROJECT থেকে ৩ কি: মি: দূরে]

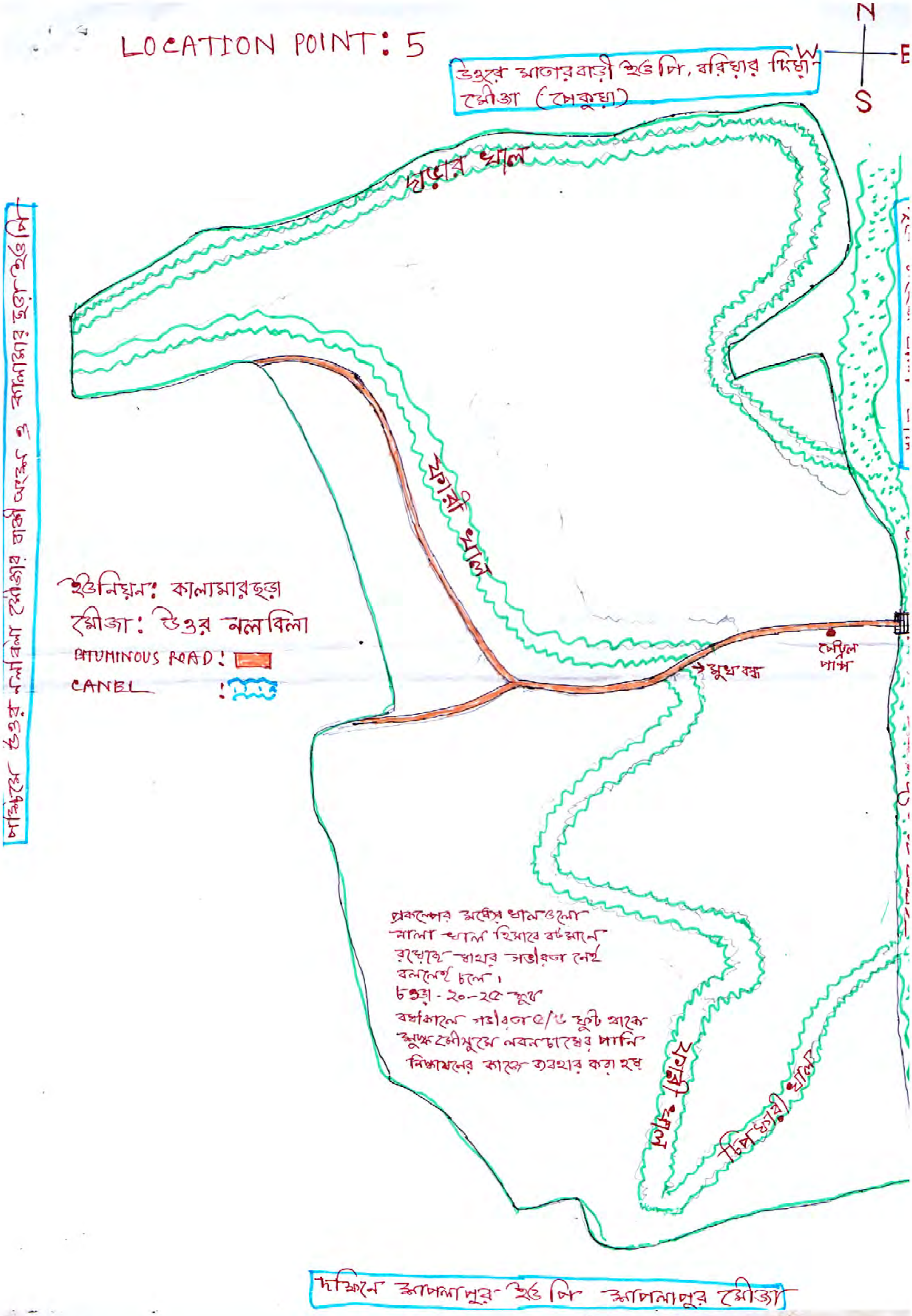
দক্ষিণে বড়ইতলী ব্রংসাকাটা

ANNEX 4

LOCATION POINT : 4



ANNEX 5


LOCATION POINT: 5
N
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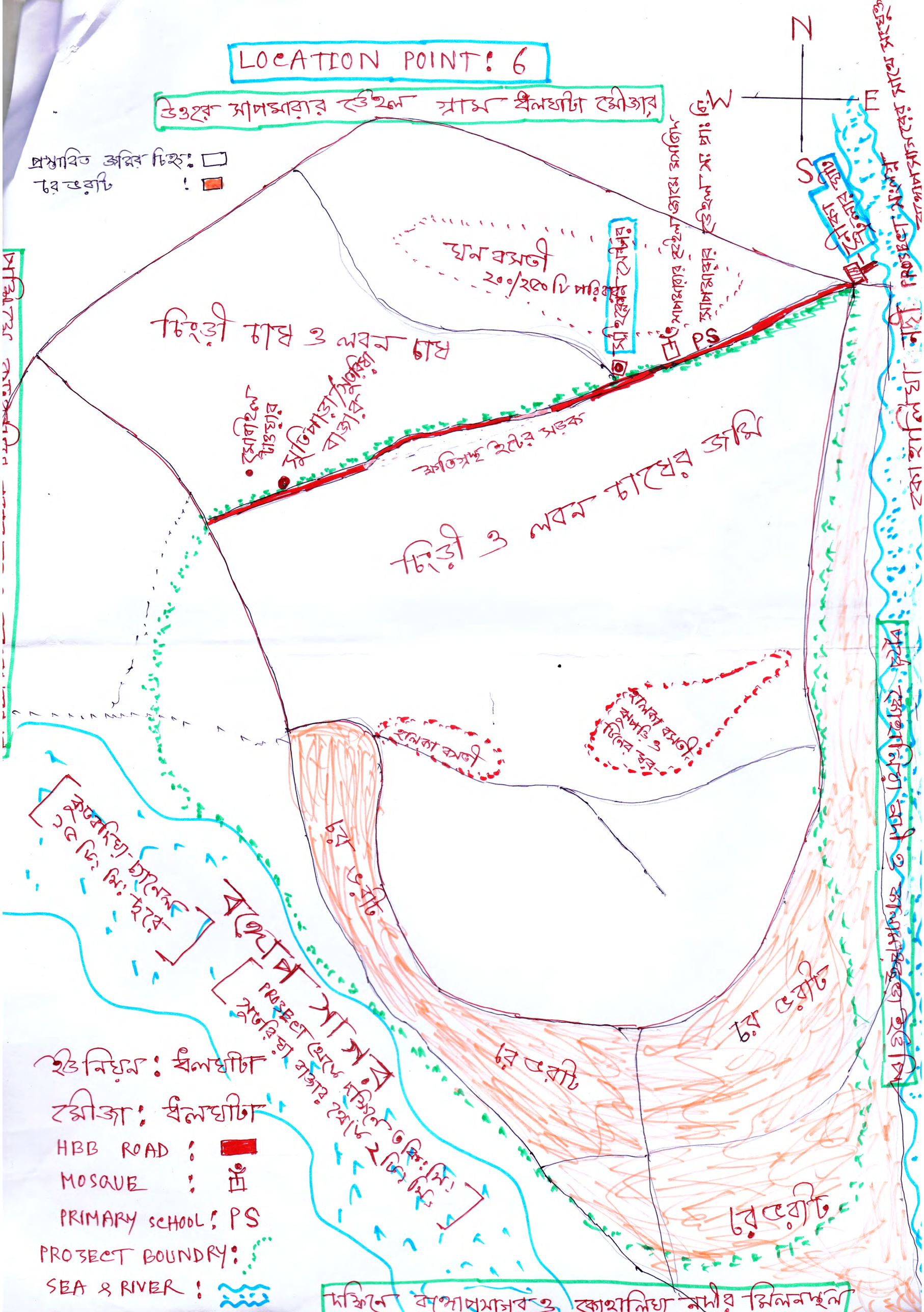
উত্তরে মাতারবাড়ী ইউপি, বরিয়ার দিয়া মৌজা (পেকুয়া)
পশ্চিমে উত্তর নলবিলা মৌজার বাকী অংশ ও কালামার ছড়া ইউপি
পড়ার খাল
ফারী খাল
ইউনিয়ন: কালামার ছড়া
মৌজা: উত্তর নলবিলা
BITUMINOUS ROAD:
CANEL:
মুখ বন্ধ
পেট্রল পাম্প
প্রকল্পের মধ্যের খালগুলো নালা খাল হিসাবে বর্তমানে রয়েছে যাহার গভীরতা নেই বললেই চলে।
চওড়া - ২০-২৫ ফুট
বর্ষাকালে গভীরতা ৫/৬ ফুট থাকে
শুষ্ক মৌসুমে লবনচাষের পানি নিষ্কাষনের কাজে ব্যবহার করা হয়
চিপফারী খাল
দক্ষিনে শাপলাপুর ইউপি শাপলাপুর মৌজা

ANNEX 6


LOCATION POINT: 6
উত্তরে সাপমারার ভেইল গ্রাম ধলঘাটা মৌজার
প্রস্তাবিত জমির চিহ্ন:
চর ভরাট :
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ঘন বসতী
২০০/২৫০ টি পরিবার
সাপমারার ভেইল জামে মসজিদ
সাপমারার ভেইল সঃ প্রাঃ বিঃ
PS
চিংড়ী চাষ ও লবন চাষ
সোবাইল টাওয়ার
সুতিপাড়া/সুতরিয়া বাজার
ক্ষতিগ্রস্থ ইটের সড়ক
চিংড়ী ও লবন চাষের জমি
হালকা বসতী
হালকা বসতী ঝুপড়ি ও টিনের ঘর
চর ভরাট
চর ভরাট
চর ভরাট
চর ভরাট
কুতবদিয়া-চ্যানেল ১৫ কিঃ মিঃ দূরে
বঙ্গোপসাগর
PROJECT থেকে দক্ষিণে ৩ কিঃ মিঃ সুতরিয়া বাজার থেকে ২ কিঃ মিঃ
ইউনিয়ন: ধলঘাটা
মৌজা: ধলঘাটা
HBB ROAD :
MOSQUE :
PRIMARY SCHOOL: PS
PROJECT BOUNDRY:
SEA & RIVER :
দক্ষিনে বঙ্গোপসাগর ও কোহালিয়া নদীর মিলনস্থল

ANNEX 7

LOCATION POINT: 7

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ইউনিয়ন: কুতুবজোম
জেলা: কক্সবাজার
উপজেলা: মহেশখালী
মৌজা: ঘাটভাঙ্গা, কুতুবজোম, হামিদুরদ্বীপ

- প্রস্তাবিত খাস জমির চিহ্ন:
- চরওয়াট জমির চিহ্ন:

Project for Development of Economic Zones and Capacity Enhancement of Bangladesh Economic Zones Authority

Report
On
Collection of Environmental and Social Data and Information for Economic Zones (EZ) Candidate Sites

Submitted to:

JICA Study Team
World Business Association
& Oriental Consultants Co., Ltd.

Prepared by:

Site Assessment Team
YOUNG CONSULTANTS

Environmental and Social Data and Information
For JICA EZ Survey Team, 2016

1. Latest Applicable Legal, Regulatory and Policy Frameworks in Bangladesh

1.1 Environmental laws, rules and regulations

Table 1.1 (a) Laws, Rules & Regulation Related to the Environment

Statute	Outline
National Environmental Policy, 1992	The policy sets out the basic framework for environmental action together with a set of broad sectoral guidelines for action. Maintaining ecological balance of the country biodiversity and environment for sustainable development. Ensure sustainable and environmentally sound measurement of natural resources.
The National Forest Policy, 1994	The National Forestry Policy of 1994 is the revised version of the National Forest Policy of 1977 in the light of the National Forestry Master Plan. The major targets of the Policy are to conserve the existing forest areas; bring about 20% of the country's land area under the forestation program, and increase the reserve forest land by 10% by the year 2015 through coordinated efforts of GO-NGOs and active participation of the people. The need for amendments of the existing forestry sector related laws and adopt new laws for sector activities has been recognized as important condition for achieving the policy goals and objectives. The Forest Policy also recognizes the importance of fulfilling the responsibilities and commitments under international multilateral environmental agreements.
Environmental Conservation Act, 1995	Conservation of environment, improvement of environmental standards and control, mitigate environmental pollution. This Act authorizes the Department of Environment (DoE) as the regulatory body and enforcement agency of all environmental related activities. The act addresses the issues like declaration of Ecologically Critical Areas, Procedure for obtaining Environmental Clearance Certificates, Environmental regulations for development activities, Standards for quality of air, water, noise, and soils for different areas and for different Purposes, Acceptable limits for discharging and emitting waste, Formulation of environmental guidelines to control and mitigate environmental pollution, conservation and improvement of environment.
National Environmental Management Action Plan, 1995	NEMAP was developed to identify of key environmental issues affecting Bangladesh and actions requires halting or reducing the rate of environmental degradation. Besides, NEMAP also developed to identify the natural environment and conservation of habitats and bio-diversity. Overall, the improvement of the quality of life of the people could be achieved.
Environmental Conservation Rules (ECR), 1997	The Environment Conservation Rules provides rules under the Environment Conservation Act, 1995. The ECR prescribes guidelines for development project categorization based on anticipated impacts or pollution load, processes and requirements for obtaining environmental clearance, through an Environmental Clearance Certificate (ECC), Initial Environmental Examination (IEE) and Environmental Impact Assessment (EIA), as well as formulating an Environmental Management Plan (EMP), Environmental quality standards for air, surface water, groundwater, drinking water, industrial effluents, emissions,

Statute	Outline
	noise and vehicular exhausts.
EIA Guidelines for Industries, 1997	This guideline has been prepared by DoE on the basis of the work done by various types of Industry projects as well as on the requirements of the Environment Conservation Rules (1997). On ground of this, the EIA Guidelines specifically covers industry projects and shows how the EIA for Industry projects in Bangladesh should be implemented. The EIA guidelines comprises contents like: introduction to EIA in Bangladesh, criteria for locating industrial plants, steps involved in conducting IEE, steps involved in conducting EIA, review of an EIA report.
The National Water Policy, 1999	The National Water Policy of 1999 was adopted to ensure efficient and equitable management of water resources, proper harnessing and development of surface and ground water, availability of water to all concerned and institutional capacity building for water resources management. It has also addressed issues like river basin management, water rights and allocation, public and private investment, water supply and sanitation and water needs for agriculture, industry, fisheries, wildlife, navigation, recreation, environment, preservation of wetlands, etc.
Environmental Court Act, 2000	Establishes environmental courts and procedure to make rules for the protection of environmental pollution. Environmental Courts are set up at district level constitute by one judge and upon consultation with supreme court. However, the Government may establish courts outside the districts. The Court has the power to penalize under section 5A of this Act for offenses relating to pollution.

Table 1.1 (b): Other Relevant Legislations

Act/ Law/ Audience	Brief description	Responsible agency
Environment Court Act, 2000 and subsequent amendments in 2002	Describes environment related legal proceedings	Ministry of Environment and Forest (MOEF)
The Vehicle Act, 1927 The Motor Vehicles Ordinance, 1983	Provides rules for exhaust emission, air and noise pollution and road and traffic safety	Bangladesh Road Transport Authority (BRTA)
The Removal of Wrecks and Obstructions in inland Navigable Water Ways Rules 1973	Rules for removal for wrecks and obstructions	Bangladesh Water Transport Authority
Water Supply and Sanitation Act, 1996	Regulate the management and control of water supply and sanitation in urban areas	Ministry of Local Government, Rural Development and Cooperatives
The Ground Water Management Ordinance 1985	Describe the management of ground water resources and licensing of tube wells	Upazilla Parishad
The Forest Act, 1927 and subsequent amendments in 1982 and 1989	Regulates the protection of forests reserves, protected forests and village forests	Ministry of Environment and Forest
The Private Forests Ordinance Act, 1959	Deals with the conservation of private forests and afforestation of wastelands.	Ministry of Environment and Forest
Bangladesh Wild Life (Preser-	Describes the preservation of wildlife	Ministry of Environ-

vation) Act, 1974	sanctuaries, parks, reserves	ment and Forest
The Protection and Conservation of Fish Act 1950 subsequent amendments in 1982	Deals with the protection/ conservation of fishes in Government owned water bodies	Department of Fishery
The Embankment and Drainage Act 1952	Describes the protection of embankments and drainage facilities	Ministry of Water Resources
The Antiquities Act 1968	Describes the preservation of cultural heritage, historic monuments and protected sites.	Department of Archaeology.
The Land Acquisition Act, 1894 and The Acquisition and Requisition of Immovable Property Ordinance 1982 and subsequent amendments in 1994, 1995 and 2004	Describes procedures and provides guidelines to acquisition and requisition of land	Ministry of Land
Bangladesh Labour Law, 2006	Deals with the occupational rights and safety of factory workers; provision of comfortable work environment and reasonable working conditions	Ministry of Labor

Table 1.1 (c): Relevant Occupational Health and Safety Laws and Rules

Title	Overview
Bangladesh Labor Act, 2006	Provides for safety of work force during construction period. The Act provides guidance of employer's extent of responsibility and the workmen's right to compensation in case of injury caused by accident while working.
Water Supply and Sewerage Authority Act, 1996	The Act calls for ensuring water supply and sewerage system to the public, preservation of system, and other related health and environmental facilities for the community.
Labor Relations under Labor Laws, 1996 (Revisions to scattered Acts and Ordinances to formulate a unified code.)	General concerns during the Project implementation that the project manager must recognize labor unions.
Public Health (Emergency Provisions) Ordinance, 1994	Calls for special provisions with regard to public health. In case of emergency, it is necessary to make special provisions for preventing the spread of disease, safeguarding the public health, and providing adequate medical service, and other services essential to the health of respective communities and workers during the construction related work.
Bangladesh Factory Act, 1979	Workplaces provisions, this Act and Labor Laws require medical facilities, first aid, and accident and emergency arrangements, and childcare services to be provided to the workers at workplace.
The Employees State Insurance Act, 1948	Health, injury and sickness benefit should be paid.
The Employer's Liability Act, 1938	Covers accidents, risks and damages with respect to employment injuries.
Maternity Benefit Act, 1950	Framed rules for female employees entitled to various benefits for maternity

Source: Bangladesh Government Rules and Regulation book

Table 1.1 (d): Compliance under national law

Wildlife (protection and	The Wildlife (protection and safety) Act 2012, passed in Parliament on

safety) Act 2012	8th July, 2012. Under this act, the hunting, trapping, killing of wildlife are strictly prohibited. After the establishment of this Act, a board will be formed with the concerned members recommended by the Government. There are certain provisions kept in this Act, e.g. entrance, management, rules and regulation of the protected area etc. If any person without license performs any kind of trade, he will be jailed for at least a year. The details of the Act shall be further discussed in the EIA report.
The Forest Act, 1927 and Amendment Act 2000	The Forest Act of 1927 provides for reserving forests over which the government has an acquired property right. This act has made many types of unauthorized uses or destruction of forest produce punishable. The Government may assign any village community its right to or over any land, which has constituted a reserved forest. According to the Act the government may prohibit certain activities in the declared reserved forest area such as any intervention kindles, keeps or carries any fire; trespasses or pastures cattle, or permits cattle to trespass; causes any damage by negligence in felling any tree or cutting or dragging any timber; etc. The Supplementary Rules of 1959 empowered the concerned governmental bodies to restrict totally and for a specified period, the shooting, hunting or catching of various birds, animals and reptiles in the controlled and vested forests. The Private Forest Ordinance of 1959 provides for the conservation of private forests and for the forestation, in certain cases, of wastelands in Bangladesh.
The Penal Code, 1860	The Penal Code of 1860 has some valid provisions related to pollution management, environment protection and protection of health and safety. Some of these are: Section 277: Falling Water or Public Spring or Reservoir; Section 278: Making Atmosphere Noxious to Health; Section 284: Negligent Conduct with Respect to Poisonous Substance; Section 285: Negligent Conduct with Respect to Fire or Combustible Matter; and Section 286: Negligent Conduct with Respect to Explosive Substance. (Chapter XIV of offences affective Public health, safety, convenience, decency and morals).
The Acquisition and Requisition of Immovable Property Ordinance (1982)	This Ordinance has replaced the Land Acquisition Act of 1894 and the East Bengal (Emergency) Requisition of Property Act of 1948. The Ordinance governs acquisition and requisition by the government of immovable property for any public purpose or in the public interest. It may be noted that contrary to the previous Acts (i.e. Act XIII of 1948), this Ordinance deals only with immovable property. The Ordinance has well-defined procedures regarding payment of compensation for an acquired piece of land. If, for example, the land is used for rice growing, then an amount equivalent to approximately 1.5 times the market value of a given variety of rice (e.g., paddy) that is currently being (or could be) produced annually is fixed as a yearly lease value. In case of outright purchase (carried out on a 99-year lease), the compensation-value of acquired land varies widely according to the locality, soil fertility, and access to transportation and related infrastructure factors. The current compensation and resettlement provisions are however inadequate both in terms of timing of payments and quantum. The procedures involved are cumbersome and time consuming and often causes hindrance to the smooth execution of the project. Legal provisions covering adequate compensation to the project affected persons, particularly disadvantaged groups such as women and squatters and such other vulnerable groups are yet to be framed.

The Protection and Conservation of Fish Rules, 1985	These are a set of rules in line with the overall objectives of the Fish Act. Section 5 of the Rules requires that "No person shall destroy or make any attempt to destroy any fish by explosives, gun, bow and arrow in inland waters or within coastal waters". Section 6 of the Rules states:-"No person shall destroy or make any attempt to destroy any fish by poisoning of water or the depletion of fisheries by pollution, by trade effluents or otherwise in inland waters". Therefore, the new bridge construction will need to be carried in such a manner that the activities do not cause damage to the inland waters or within coastal waters fisheries.

1.2 Environmental Norms and Criteria

1.2.1 Ambient Air

Air Quality

Following table shows the air quality standard in Bangladesh as well as the IFC/ EHS (2007) Air quality standard.

Table 1.2.1 (a): Ambient Air Quality Standards

Parameter	IFC/WB guidelines (µg / m^3)	Bangladesh guidelines2 (µg / m^3)
SPM	-	200 (8 hr average)
PM10	150 (24 hours average)	50 (Annual average) 150 (24 hours average)
PM25	75 (24 hours average)	15 (Annual average) 65 (24 hours average)
SO2	125 (24 hours average)	365 (24 hours average) 80 (Annual average)
NO2	200 (1 hour average)	100 (Annual average)
Pb	-	0.5 (Annual average)
O_3		235 (1 hour average) 157 (8 hours average)
Note: New version of the World Bank Group EHS Guidelines for General Environmental Guidelines, April 2007 Ministry of Environment and Forest, Notification related Environment Conservation Rules, 1997, Schedule 2, 16th July 2005		

Table 1.2.1 (a): DoE Standards for Ambient air quality

Pollutants	Objective	Average
CO	10 mg/m3 (9 ppm)	8 hours(a)
	40 mg/m3 (35 ppm)	1 hour(a)
Pb	0.5 µg/m3	Annual
NOx	100 µg/m3 (0.053 ppm)	Annual
PM10	50 µg/m3	Annual (b)
	150 µg/m3	24 hours (c)
PM2.5	15 µg/m3	Annual
	65 µg/m3	24 hours
O3	235 µg/m3 (0.12 ppm)	1 hour (d)

	157 µg/m3 (0.08 ppm)	8 hours
SO2	80 µg/m3 (0.03 ppm)	Annual
	365 µg/m3 (0.14 ppm)	24 hours (a)
(Source:http://case.doe.gov.bd/file_zone/reports_publications/monthly_reports/Monthly_Report_August_15.pdf)		

Air Quality Standard

In accordance with standards specified Schedule-2 (Environmental Conservation rule- 1997) the Air Quality Standards for Bangladesh describes on the below table:

Table 1.2.1 (c): Area Wise Standards for Air

(Density unit: µg / m^3)

Categories of Area	**Suspended Particulate Matters (SPM)**	**Sulphur dioxide (SO_2)**	**Carbon Monoxide (CO)**	**Oxides Nitrogen**
Industrial and mixed	500	120	5000	100
Commercial and mixed	400	100	5000	100
Residential and rural	200	80	2000	80
Sensitive	100	30	1000	30
Notes: (1) At national level, sensitive area includes monuments, health centre, hospital, archaeological site, educational institution, and government designated areas. (2) Industrial units located in areas not designated as industrial areas shall not discharge pollutants which may contribute to exceeding the standard for air surrounding the areas specified at residential and sensitive categories.				

1.2.2 Water Quality Standard

Table: 1.2.2 (a): Standards for inland surface water

Sl. No.	**Best Practice based classification**	**Parameter**			
		pH	**BOD mg/l**	**DO mg/l**	**Total Coliform No./100**
a.	Source of drinking water for supply only after disinfecting	6.5-8.0	5 2 or less	6 or above	50 or less
b.	Water usable for recreational activity	6.5 – 8.5	3 or less	5 of more	200 or less
c.	Source of drinking water for supply after conventional treatment	6.5 – 8.5	6 of less	6 or more	5000 or less
d.	Water usable by fisheries	6.5 – 8.5	6 of less	5 or more	---
e.	Water usable by various process and cooling industries	6.5 – 8.5	10 or less	5 or more	5000 or less
f.	Water usable for irrigation	6.5 – 8.5	10 or less	5 or more	1000 or less

(Source: ECR, 97)

Table 1.2.2 (b): Water quality standard (EHS)

Pollutant	General EHS guideline of IFC (Indicative Values for Treated Sanitary Sewage Discharges) (mg/l)
pH	6-9
BOD	30
COD	125
SS	150
n-hexane (mineral oil)	-
n-hexane (animal and vegetable fats	10
Residual chlorine	-
Phenols	-
Copper	-
Zinc	-
Dissolved iron	-
Dissolved manganese	-
Chromium	-
Cadmium	-
Total cyanogen	-
Total coliform bacteria	
Nitrogen	10 MPN6/100ml
Phosphorus	2 MPN6/100ml

(Source: ECR, 97)

1.2.3 Soils

Standard level of soil physical properties

Parameter Name	Standard Level
Texture class	Loamy
Moisture percentage (%)	2.5-3.5
Bulk density (gm/cm^3)	0.05-1.00
Water holding capacity (%)	9.00-9.5

1.2.4 Noise Standards

The standards for Noise in Bangladesh shall be determined in accordance with standards specified in Schedule-4 (Environmental Conservation Rule-1997) which is revised by GOB in 2006 and published as gazette form.

Table 1.2.4 (a): Noise Standards

Sl. No.	Category of areas	Standards determined at dBase unit	
		Day (from 6 am to 9 pm)	Night (from 9 pm to 6 am)
1.	Silent zone	50	40
2.	Residential area	55	45
3.	Mixed area (mainly residential area, and also simultaneously used for commercial and industrial purpose)	60	50
4.	Commercial area	70	60
5.	Industrial area	75	70

1. Area up to a radius of 100 m around hospitals or educational institutions or special institutions/ establishments identified / to be identified by the Government is designated as Silent Zones where use of horns of vehicles or other audio signals, and loudspeakers are prohibited.
2. The standards shown in the table are based on revised data published by GoB in September 2006 as a gazette (Regd. No. DA-1)

Table 1.2.4 (b): Noise quality standard (EHS guideline)

Receptor	One hour Laeq (dB)	
	Daytime (007.00-22.00)	Nighttime (22.00-07.00)
Residential, institutional and educational	55	45
Industrial and commercial	70	70

Source: IFC.2007.Environmental, Health, and Safety (EHS) Guidelines GENERAL EHS GUIDELINE

1.3 Emission and Discharge Criteria

1.3.1 Exhausted Gasses

Standards for Gaseous Emission from Industries or Projects

Sl. No.	**Parameters**	**Standard present in a unit of mg/Nm^3**
1. Particulate		
(a)	Power plant with capacity of 200 Megawatt or above	150
(b)	Power plant with capacity less than 200 Megawatt	350
2.	Chlorine	150
3.	Hydrochloric acid vapor and mist	350
4.	Total Fluoride F	25
5.	Sulfuric acid mist	50
6.	Lead particulate	10
7.	Mercury particulate	0.2
8.	Sulfur dioxide	kg/ton acid
(a)	Sulfuric acid production (DCDA* process)	4
(b)	Sulfuric acid production (SCSA* process)	10
	Sulfuric Acid Dispersion: Lowest height (in Meter) of stack	Stake Height (in Meter)
(a)	Coal Based Power Plant	
	1. 500 Megawatt or above	275
	2. 200 to 500 Megawatt	220
	3. Less than 200	$14(Q)^{0.3}$
(b)	Boiler	
	1. Steam per hour up to 15 tons	11
	2. Seam per	$14(Q)^{0.3}$
	(* DCDA: Double Conversion, Double Absorption; SCSA: Single Conversion, Single Absorption.) [Q = Emission of Sulfur dioxide (kg/hour)]	

1.3.2 Waste Water

Table 1.3.2 (a): Standards for Sewage Discharge

Parameter	Unit	Standard Limit
BOD	miligram/l	40
Nitrate	"	250
Phosphate	"	35
Suspended Solids (SS)	"	100
Temperature	Degree Centigrade	30
Coliform	number per 100 ml	1000

Notes:
(1) This limit shall be applicable to discharges into surface and inland waters bodies.
(2) Sewage shall be chlorinated before final discharge.

(Source: ECR, 97)

Table 1.3.2 (b): Standards for Waste from Industrial Units or Projects Waste

Sl. No.	Parameter	Unit	Places for determination of		
			Inland Surface Water	Standards Public Sewerage system connected to treatment at second stage	Irrigated Land
1.	Ammonical Nitrogen (as elementary N)	mg/l	50	75	75
2.	Ammonia (as free ammonia)	,,	5	5	15
3.	Arsenic (as)	,,	0.2	0.05	0.2
4.	BOD_5 at 20^oC	,,	50	250	100
5.	Boron	,,	2	2	2
6.	Cadmium (as CD)	,,	0.50	0.05	0.05
7.	Chloride	,,	600	600	600
8.	Chromium (as total Cr)	,,	0.5	1.0	1.0
9.	COD	,,	200	400	400
10.	Chromium (as hexavalent Cr)	,,	0.1	1.0	1.0
11.	Copper (as Cu)	,,	0.5	3.0	3.0
12.	Dissolved Oxygen (DO)	,,	4.5 – 8	4.5 – 8	4.5 – 8
13.	Electro-conductivity (EC)	micro mho/ cm	1200	1200	1200
14.	Total Dissolved Solids	,,	2,100	2,100	2,100
15.	Fluoride (as F)	,,	2	15	10
16.	Sulfide (as S)	,,	1	2	2
17.	Iron (as Fe)	,,	2	2	2
18.	Total Kjeldahl Nitrogen	,,	100	100	100
19.	Lead (as Pb)	,,	0.1	1.0	0.1
20.	Manganese (as Mn)	,,	5	5	5
21.	Mercury (as Hg)	,,	0.01	0.01	0.01
22.	Nickel (as Ni)	,,	1.0	2.0	1.0
23.	Nitrate (as elementary N)	mg/l	10.0	Not yet Fixed	10
24.	Oil and Grease	,,	10	20	10

Sl. No.	Parameter	Unit	Places for determination of		
			Inland Surface Water	**Standards Public Sewerage system connected to treatment at second stage**	**Irrigated Land**
25.	Phenolic Compounds (as C6H5OH)	,,	1.0	5	1
26.	Dissolved Phosphorus (as P)	,,	8	8	15
27.	pH		6 – 9	6 – 9	6 – 9
28.	Selenium (as Se)	mg/l	0.05	0.05	0.05
29.	Zinc (as Zn)	Degree	5	10	10
30.	Total Dissolved Solids	,,	2,100	2,100	2,100
31.	Temperature	Centigrade	40-45	40-45	40-Summer 45-Winter
32.	Suspended Solids (SS)	mg/l	150	500	200
33.	Cyanide (as Cn)	,,	0.1	2.0	0.2
34.	Radioactive substance To be specified by Bangladesh Atomic Energy Commission				

Notes:
(1) These standards shall be applicable to all industries or projects other than those specified under the heading "Standards for sector-wise industrial effluent or emission."
(2) Compliance with these standards shall be ensured from the moment an industrial unit starts trial production, and in other cases, from the moment a project starts operation.
(3) These standards shall be inviolable even in case of any sample collected instantly at any point of time. These standards may be enforced in a more stringent manner if considered necessary in view of the environmental conditions of a particular situation.
(4) Inland Surface Water means drains/ponds/tanks/water bodies/ ditches, canals, rivers, springs and estuaries.
(5) Public sewerage system means treatment facilities of the first and second stage and also the combined and complete treatment facilities.
(6) Irrigable land means such land area which is sufficiently irrigated by waste water taking into consideration the quantity and quality of such water for cultivation of selected crops on that land.
(7)Inland Surface Water Standards shall apply to any discharge to a public sewerage system or to land if the discharge does not meet the requirements of the definitions in notes 5 and 6 above.

(Source: ECR, 97)

1.3.3 Solid Waste

It is estimated that approximately 13,332 tons of waste is produced per day in the urban areas of Bangladesh, which is over 4.86 million tons annually. It is projected that this amount will grow up to 47,000 tons/day and close to 17.2 million tons per year by 2025, due to growth both in population and the increase in per capita waste generation. Waste collection rate ranges from 44.30% to 76.47% in major cities. Based on the present total urban population, per capita waste generation rate is found at 0.41 kg/capita/day in urban area. (Source: National 3R Strategy of Bangladesh, 2010)

Table 1.3.3: Waste Scenarios of Bangladesh – at a Glance

Category	Statistics	Data Source
Total Volume of Wastes (tons/yr)		
Total volume of municipal solid wastes	4,866,505 (2005) = 13,332.89tons/day x 365 3,000 tons/day in Dhaka (2005)	Waste Concern (2005) JICA (2005)

Category	Statistics	Data Source
Agricultural Waste	65 million metric ton per year	Waste Concern and Swiss
Industrial waste (hazardous) from seven selected sectors*	109.47 million/cubic meter/year (waste water) 0.113 million ton/year (sludge) and 26, 884 tons/year (solid waste)	Waste Concern and ADB (2008)
Hazardous Medical Waste	12,271 metric ton per year (2007)	Waste Concern and ADB
Waste Per Capita (kg/per/day)		
	Urban: 0.41 (2005) Dhaka City: 0.56 (2005) Agricultural:1.68 (based on 2008 rural population)	Waste Concern (2008) JICA (2005)
Future Waste Projections (Total Waste Generation)		
By 2025 (solid waste) 2012 (hazardous waste)	17,155,000 tons/year = 47,000tons/day x 365 0.60 kg/per/day in Urban Areas 2472.07 million/cubic meter/year (waste water), 2.81 million metric ton/year (sludge) and 53,874 metric ton/year (solid waste)	UMP (1999), as cited by Waste Concern and ADB (2008)
Solid Waste Management		
Collection of waste (% of waste generated)	44.30% - 76.47% in major urban cities 43.5% for Dhaka City	Waste Concern (2005) JICA (2005)
Solid waste disposal facilities	Mainly uncontrolled land-filling (except for the sanitary landfill at Matuail site in Dhaka, supported by JICA). No site or facility for treatment, recycling and disposal of hazardous waste.	JICA (2005)
E-Waste		
Use of electronic goods in year 2006	Mobile phones: 22,000,000 Personal computers: 600,000 Televisions: 1,252,000	Waste Concern (2008)
Recycle		
Informal Sector	120,000 urban poor from the informal sector are involved in the recycling trade chain of Dhaka City.15% of the total generated waste in Dhaka (mainly inorganic) amounting to 475 tons/day are recycled daily.	Waste Concern (2005)

(Source: National 3R Strategy of Bangladesh, 2010) *These are textile, hospital clinics, tannery, pesticides, fertilizer, oil refinery and paper and pulp)

1.4 Health and Safety System

☑ Existing Act, Rules and Regulation

The legal basis of the Medical waste management is the Bangladesh Environmental Conservation Act 1995 and Environmental Conservation Rules 1997 under which the Medical Waste (Management and Processing) Rules 2008 has been framed. In the Health Policy 2011, the hospital waste management has been given importance along with the infection control programme of healthcare facilities. A guideline has been prepared by Department of Environment in 2011 for issuing and renewal of Environmental Clearance Certificate for the healthcare facilities where some checklists are fixed both for in-house and out-house medical waste management.

☑ **Key features of the Medical Waste (Management and Processing) Rules 2008**

a) The Rules categorize medical waste into 11 types and recommend specific treatment for each type. Six color coding are recommended for storage and disposal of different types of medical waste. It also describes the standards of incineration, emission, autoclaving, effluent, microwaving, and deep burial of medical waste and disposal of radioactive materials.
b) The Rules give detailed instruction on segregation, packaging, transport and storage and treatment of medical waste.
c) Waste generator will train their staff to safely handle medical waste and inform them about the hazardous nature of these materials.
d) Waste generator shall be liable financially and legally to ensure proper handling and treatment of medical waste.
e) Rules give formats for application of license, approval of license, accident reporting, annual reporting, and appeal against the authority's decision.
f) Rules provide that in all six divisions of the country, an authority comprised of representatives nominated by the directorate of health services, divisional commissioner and DoE shall approve, renew or cancel license to agencies engaged in medical waste management.
g) Approved agencies shall ensure that all the steps in managing medical wastes do not harm public health or the environment.
h) The Rules provide penalties for violating the Rules including imprisonment and fines.
i) Rules recommend the formation of an advisory committee at the national level composed of representatives of the Ministry of Forest and Environment, the Ministry of Health and Family Welfare, specialists on healthcare, environmental management, and municipal governance, and private sector organizations to review policies and other aspects of medical waste management, and advise the government.

1.5 SEA, IEE and EIA System

Strategic Environmental Assessment (SEA) SEA is undertaken much earlier in the decision -making process than EIA -it is therefore seen as a key tool for sustainable development. Strategic Environmental Assessment aims to incorporate environmental and sustainability considerations into strategic decision making processes, such as the formulation of policies, plans and programs."

The SEA Directive sets out the information to be included in the environmental report of the Strategic Environmental Assessment, namely:

- An outline of the contents, main objectives of the plan or programme and relationship with other relevant plans and programs.
- The relevant aspects of the current state of the environment and the likely evolution thereof without implementation of the plan or programme.
- The environmental characteristics of areas likely to be significantly affected.
- Any existing environmental problems which are relevant to the plan or programme including, in particular, those relating to any areas of a particular environmental importance, such as areas designated pursuant to Directives 79/409/EEC and 92/43/EEC (the Birds and Habitats Directives).
- The environmental protection objectives, established at international, Community or Member State level, which are relevant to the plan or programme and the way those objectives and any environmental considerations have been taken into account during its preparation.
- The likely significant effects on the environment, including issues such as biodiversity, population, human health, fauna, flora, soil, water, air, climatic factors, material assets, cultural

heritage including architectural and archaeological heritage, landscape and the inter-relationship between the above factors.

- The measures envisaged to prevent, reduce and, as fully as possible, offset any significant adverse effects on the environment of implementing the plan or programme.
- An outline of the reasons for selecting the alternatives dealt with and a description of how the assessment was undertaken, including any difficulties (such as technical deficiencies or lack of know-how) encountered in compiling the required information.
- A description of the measures envisaged concerning monitoring.

A non-technical summary of the information provided under the above headings

A typical EIA report contain the following

Introduction

This chapter contains the general outline of the project including

- Project Background:
- Project related information
- Objectives
- Methodology
- Study Areas with Location and Map
- Scope of Work
- The EIA Team:
- Limitations
- Acknowledgement

Policy and Legal Consideration

In a complete EIA report, relevant national and international laws, policies and guidelines need to be addressed.

Description of the Project

This chapter mainly contained the detailed of the project including

- Types of project
- Project proponent
- Project location with layout of the project
- Operational procedure
- Site description
- Project activity
- Types of material used and the tentative outcome

Baseline Information

This chapter discussed the detailed of the project site including site assessment, present environmental condition such as Air, water, soil, and their pollution status, Status of biodiversity both flora and fauna, list of endangered species, list of historical and archeological sites in and around the project area etc. The Environmental Impact Assessment report must present relevant baseline information pertaining to the geo-physical, biological, socio -economic and cultural situation of the area under study, including any changes anticipated prior to project implementation.

The types of baseline data to be presented must be correlated to the environmental and social issues that have been identified during Scoping as being significant. For example, if the project affected area is mainly farmland and grazing land then presenting the results of an intensive bird census might make little sense. On the other hand, if the project affected area consists of relatively undisturbed natural habitats then a bird census might be the most effective tool for evaluating the conservation

value of those habitats. Similarly, if certain cultural or religious artifacts or historical sites have been identified in Scoping, then a cultural inventory is a useful tool.

Different levels of detail for certain types of baseline data will be project specific. For example, for a small run-of-the-river project on a small river a simple species list of the fishes might be sufficient for impact evaluation. On the other hand, a large-scale storage project might require a detailed study of fisheries and fish migrations, as well as the socio-economic impacts of change of lifestyle among Persons dependent on fishing.

The section on baseline data should describe the methodologies and tools used for information collection. It should differentiate between secondary and primary source of information, and it should state clearly where there were data gaps and any other limitations.

In an EIA report following items are discussed

- General Consideration
- Study Area
- Map of the study area
- Physico-Chemical Environment
- Biological Environment
- Socio-economic Condition

Environmental Impacts and Mitigation Measure
This chapter discussed the possible impacts that could be raised from the project activity in the construction and operation phase and their mitigation measure. It also includes the scoping of Impact and Impact Checklist. Based upon the issues identified in the Scoping document, the probable mitigation measures should be summarized, and their budgetary requirements should be estimated. The roles and responsibilities of concerned agencies at the central and local levels of administration in the implementation of mitigation measures proposed must also be included.

Environmental Management Plan (EMP)
A completed EMP is Essential for Taking Environmental Clearance Certificate (ECC). Detailed Environmental Mitigation Plan and Monitoring Plan also incorporate with the Environmental Management Plan.

- **Auditing Plan**

It should also be pointed out that in EPR54 Schedule -4 there is no mention of auditing. However, in EPR54 Schedule -6 it is mentioned that the EIA report should contain an auditing plan. Therefore, this should also be included in the TOR document.

- **Monitoring Plan**

This section of the TOR must outline how the monitoring plan of project construction and operation will be elaborated. Using the results from Scoping, the list of indicators for each of the potential parameters to be monitored, together with the probable roles and responsibilities of the concerned agencies, should be listed. This information can be presented in a chart. A monitoring schedule should also be included. The cost required for conducting monitoring activities should also be indicated.

- **Costs and Benefits**

This section must summarize the basic development issues or the problems that will address by the proposed activities. If possible, it should characterize the issues or the problems in a broader national context. The way in which the proposed project is expected to address and resolve issues, or solve or alleviate problems, should be explained, with emphasis on sustainability. The critical requirements for the proposed activity to be successful in the long term should be described, with emphasis on the major risks and benefits involved.

Emergency Response and Disaster Management Plan

This chapter incorporated with the possible accidental events caused by both natural and human origin and the necessary initiatives that need to be taken to combat with these events. Disaster management plan including pre disaster, disaster and post disaster should also discuss. The necessary safety measure, safety instruments, training module, worker safety and safe working practices are also enlisted.

- Emergency Response
- Six Steps in Emergency Response
- Reporting Incidents and Accidents
- Approaches to Emergency Response
- Disaster Management Plan
- Environment, Health and Safety (EHS)

Alternative Analysis

Alternate analysis of a project need to be done to compared the project with traditional one. This chapter discussed the following items.

- The "no build" scenarios
- Consideration of alternatives
- Site alternative

Stakeholder Consultation and Disclosure

This chapter discussed the following topics

- Objectives of Stakeholders Consultation
- Consultation Process
- Stakeholder Consultation Technique
- Stakeholders Consulted
- Stakeholder Concerns and Recommendations including Community Concerns and Local Government Representatives
- Disclosure

Grievance Redress Mechanism

A grievance redress mechanism and procedures is setup to provide opportunity for project affected persons to settle their complaints and grievances amicably. The established grievances redress procedures and mechanism ensures that project affected persons are provided with the appropriate compensations and that all administrative measures are in line with the law. It also allows project affected persons not to lose time and resources from going through lengthy administrative and legal procedures. Grievances are first preferred to be settled amicably.

Conclusion and Recommendation

Conclusion and Recommendation are conducted based on project findings.

Appendix

The following should be included in appendices

- Maps related to the study;
- Aerial photographs if possible;
- Sample questionnaires, checklists, matrices, charts and photographs;
- Information on the hydrology, meteorology and geology of the project area;
- Information on vegetation, forest and fauna of the project area;
- Location and brief description of sensitive sites;
- Information on water quality, noise intensity and air quality of the project area;

- Audio-visual records of the area if any;
- Information pertaining to agriculture, livestock, soil and use of fertilizers in the area;
- Information on socio-economic and cultural impacts;

Annexes

1.6 CDM System Including JI, JCM etc.

Since 2000, the CDM has allowed crediting of project-based emission reductions in developing countries. By 1 January 2005, projects submitted to the CDM amounted to less than 100 MtCO2e of projected savings by 2012 The EU ETS started in January 2005, and the following month saw the Kyoto Protocol enter into force. The EU ETS allowed firms to comply with their commitments by buying offset credits, and thus created a perceived value to projects. The Kyoto Protocol set the CDM on a firm legal footing.
By the end of 2008, over 4,000 CDM projects had been submitted for validation, and of those, over 1,000 were registered by the CDM Executive Board, and were therefore entitled to be issued CERs (Carbon Trust, 2009, p. 19). In 2010, the World Bank estimated that in 2012, the largest potential for production of CERs would be from China (52% of total CERs) and India (16%). CERs produced in Latin America and the Caribbean would make up 15% of the potential total, with Brazil as the largest producer in the region (7%).
By 14 September 2012, 4626 projects had been registered by the CDM Executive Board as CDM projects. These projects are expected to result in the issue of 648,232,798 certified emissions reductions. By 14 September 2012, the CDM Board had issued 1 billion CERs, 60% of which originated from projects in China. India, the Republic of Korea, and Brazil were issued with 15%, 9% and 7% of the total CERs.
The Himachal Pradesh Reforestation Project is claimed to be the world's largest CDM.

☑ Competent Authorities for Implementing CDM and Their Roles

Usually in Bangladesh, the government is responsible for the implementing the CDM. Government formed Designated National Authority (DNA) that comprises of National CDM Committee and National CDM board.

a. National CDM Committee: The total member of this committee was 22 where the Secretary of Ministry of Environment and Forest (MoEF) was President and DG of Department of Environment (DoE) was the Member Secretary. The Responsibility of that Committee was

1. Compiles the National CDM Strategy
2. Implement the Decision taken on CDM Board
3. Compiles Sustainable Development Standard
4. Compiles CDM Project Evaluation Guidelines
5. Give proper guideline and monitoring to CDM Secretariat
6. Give guideline for selecting CDM related project
7. Preliminary sanction of all projects developed by CDM secretariat for getting financial assistance from CDM fund and sent to the National CDM board.
8. Committee sitting on meeting in every two months but the president have right to call a meeting at any time he want.

b. National CDM Board: The national CDM Board was form with 5 members where principal secretary of govt. as a secretary and DG of DoE as Member secretary. The responsibility of that committee was

1. Coordinate and giving force of all national phase CDM activities that taken under Kyoto

Protocol.
2. Give proper guideline and monitoring to National CDM Committee
3. Approval of CDM projects after final checking that are approved by National CDM Committee
4. Ensure coordination between CDB project development and related Implementing Ministries/ organizations.
5. Committee sitting on meeting in every 3 months but the president have right to call a meeting at any time he want.

☑ **Approval Process of CDM Projects**

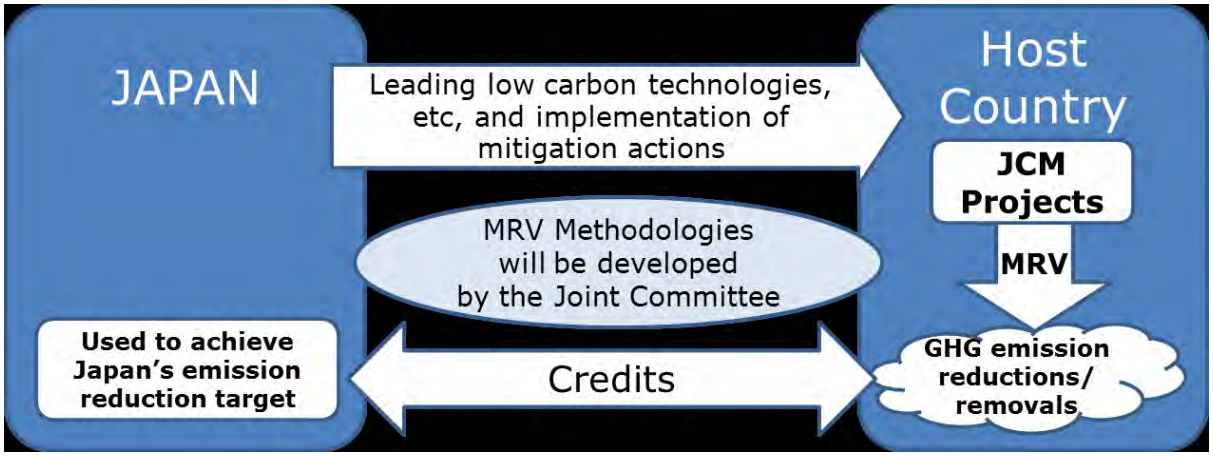
→ Entrepreneurs submit Project Idea Note (PIN)/Project Design Document (PDD) to Department of Environment (DoE) or Ministry of Environment (MoEF)
→ DoE evaluates the project; Check location and Environmental Clearance, Seek clarification (if needed)
→ Prepare a summary and place it before the National CDM Committee
→ Invite the Project proponent to depend their project before the National CDM Committee
→ If the PDD is recommended by the National CDM Committee, then it is placed before National CDM Board for approval.
→ Host Country approval letter is provided to the local entrepreneurs (by Dept. of Environment) after the approval by board.
→ Entrepreneurs take initiative for validation and registration at CDM Executive Board under UNFCCC.
→ No fee is charged to the Project proponents.

☑ **Joint Crediting Mechanism (JCM)**

The Joint Crediting Mechanism (JCM) is one of the various approaches based on Decision 1/CP.18, developed and implemented by Japan and partner countries. Japan is willing to share its experience gained through the implementation of the JCM and to make further contributions to the elaboration of the FVA under the work programme conducted by the Subsidiary Body for Scientific and Technological Advice.

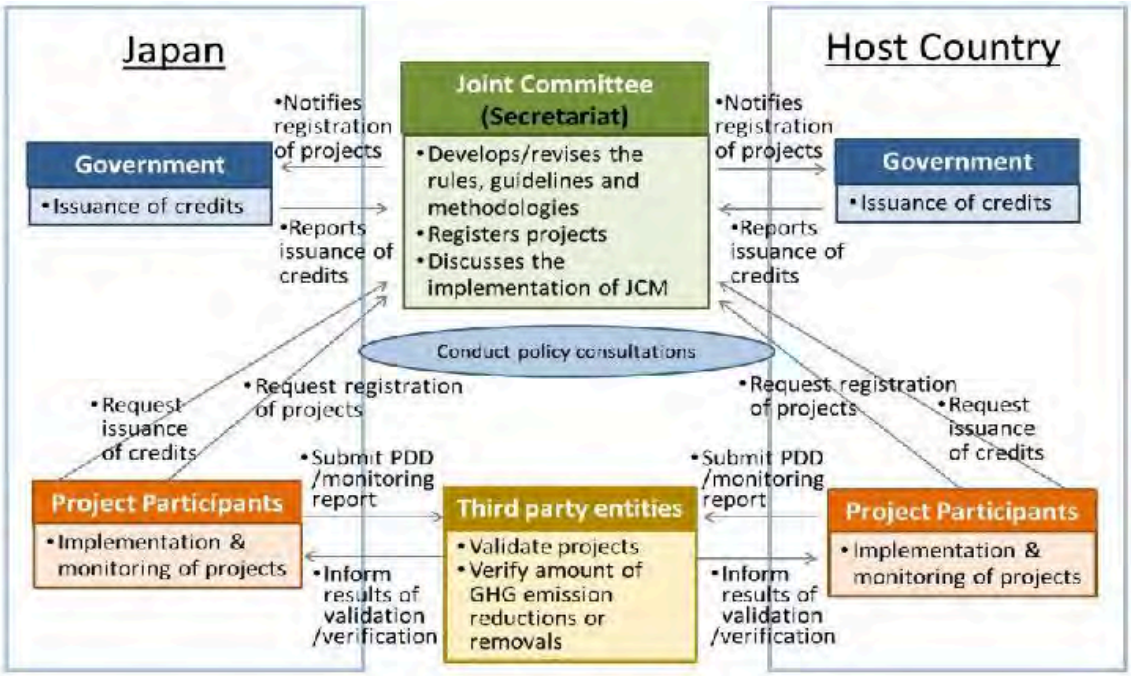
The JCM aims at facilitating diffusion of leading low carbon technologies, products, systems, services, and infrastructure as well as implementation of mitigation actions, and contributing to sustainable development of developing countries. The JCM also aims at appropriately evaluating contributions made by Japan to GHG emission reductions or removals in a quantitative manner, by applying robust measurement, reporting and verification (MRV) methodologies. Japan will use the emission reductions or removals achieved through the JCM to meet part of its emission reduction target.

☑ **Basic Concept of JCM**



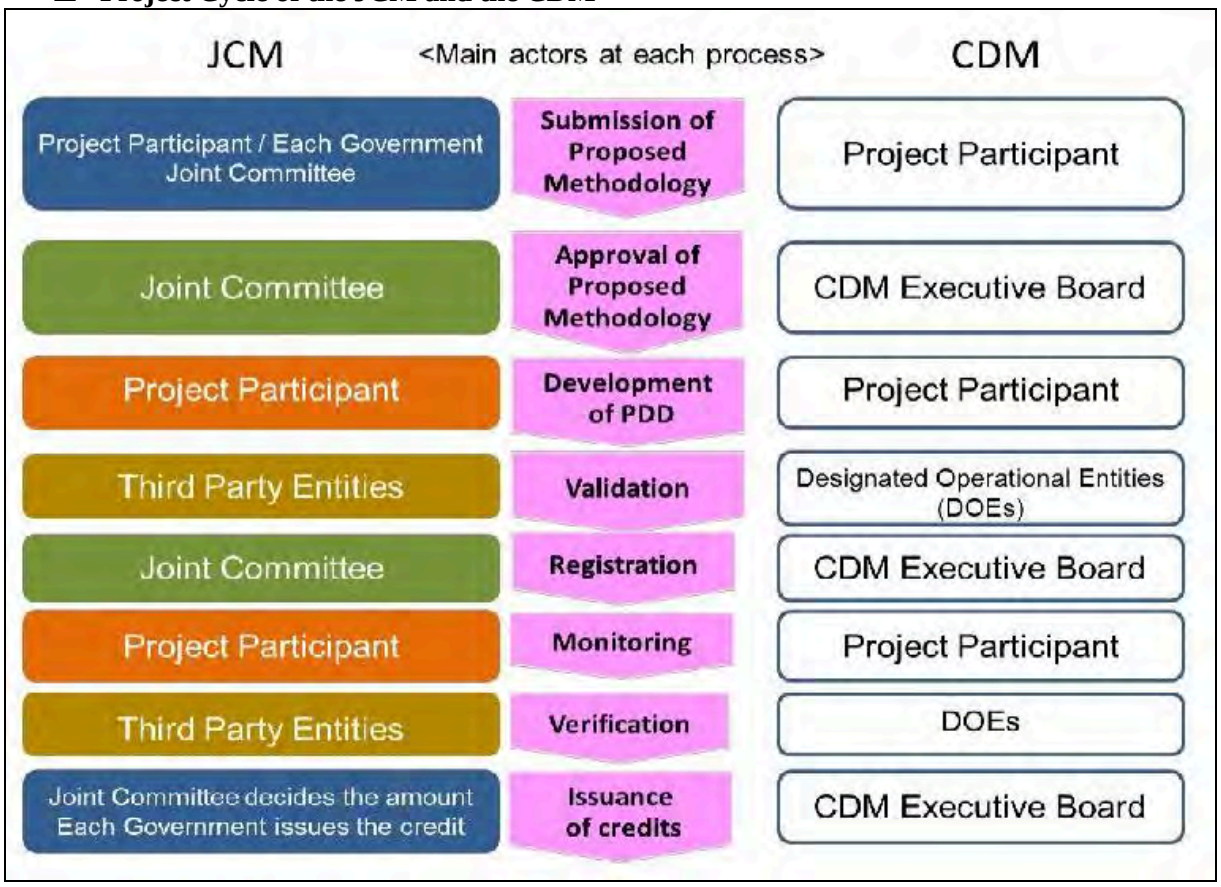
Source: http://www4.unfccc.int/submissions/Lists/OSPSubmissionUpload/53_87_130571694875317894-FVA_Japan.pdf

☑ **Schemes of the JCM**



Source:http://www4.unfccc.int/submissions/Lists/OSPSubmissionUpload/53_87_130571694875317894-FVA_Japan.pdf

☑ **Project Cycle of the JCM and the CDM**



Source:http://www4.unfccc.int/submissions/Lists/OSPSubmissionUpload/53_87_130571694875317894-FVA_Japan.pdf

☑ **Joint Implementation (JI)**

According to the Kyoto Protocol Article-VI, one Annex- B country can collect Emission Reduction Unit (ERU) from another Annex- B country under the CDM project. For achieve targeted emission reduction, the mutual trading of ERU between two Annex- B countries are known as Joint Implementation (JI).

Table 1.6 (a): Relevant International Treaties, Conventions and Protocols Signed by Bangladesh

Treaty or Convention	Date	Brief Description	Responsible Agency
On Protection of birds, Paris	1950	Protection of birds in wild state	Department of Environment/ Department of Fisheries
International Plant Protection Convention (Rome)	1951	Protection and Conservation of Plant	Department of Environment/ Ministry of Environment and Forest
Convention on oil pollution damage (Brussels)	1969	Civil liability on oil pollution damage from ships	Department of Environment/ Ministry of Shipping
Ramsar Convention	1971	Protection of wetlands	Department of Environment/ Department of Fisheries
World Cultural and Natural Heritage (Paris)	1972	Protection of major cultural and natural monuments	Department of Archaeology
CITES Convention	1973	Ban and restrictions on	Department of Environment/

Treaty or Convention	Date	Brief Description	Responsible Agency
(Washington)		international trade in endangered species of wild fauna and flora	Department of Fisheries
Bonn Convention	1979	Conservation of migratory species of wild animals	Department of Environment/ Department of Fisheries
Prevention and Control of Occupational hazards (Geneva)	1974	Protect workers against occupational exposure to carcinogenic substances and agents	Ministry of Health and Family Welfare
Occupational hazards due to air pollution, noise & vibration (Geneva)	1977	Protect workers against occupational hazards in the working environment	Ministry of Health and Family Welfare
Occupational safety and health in working environment (Geneva)	1981	Prevent accidents and injury to health by minimizing hazards in the working environment	Ministry of Health and Family Welfare
Occupational Health Services (Geneva)	1985	To promote a safe and healthy working environment	Ministry of Health and Family Welfare
Vienna convention	1985	Protection of ozone layer	Department of Environment/ Ministry of Environment and Forest
Civil liability on transport of dangerous goods (Geneva)	1989	Safe methods for transport of dangerous goods by road, railway and inland vessels	Ministry of Communication
Convention on oil pollution (London)	1990	Legal framework and preparedness for control of oil pollution	Department of Environment/ Ministry of Shipping
London Protocol	1990	Control of global emissions that deplete ozone layer	Department of Environment/ Ministry of Environment and Forest
UN framework convention On climate change (Rio de Janeiro)	1992	Regulation of greenhouse gases emissions	Department of Environment/ Ministry of Environment and Forest
Convention on Biological Diversity (Rio de Janeiro)	1992	Conservation of bio-diversity, sustainable use of its components and access to genetic resources	Department of Environment/ Ministry of Environment and Forest
International Convention on Climate Changes (Kyoto Protocol)	1997	International treaty on climate change and emission of greenhouse gases	Department of Environment/ Ministry of Environment and Forest
Protocol on biological Safety (Cartagena protocol)	2000	Biological safety in transport and use of	Department of Environment/ Ministry of Environment and Forest

☑ **Agreements/MoUs between Bangladesh and Japan:**

Over the years, Bangladesh and Japan has signed a number of agreements to strengthen and institutionalize cooperation between them. The important documents signed between the two countries are mentioned below:

- 1973: Exchange of Notes on the Dispatch of Japan Overseas Cooperation Volunteers
- 1978: Agreement for the Exchange of International Money Orders
- 1980: Agreement for Air Services
- 1980: Agreement on Air Services
- 1982: Cultural Agreement
- 1991: Convention for the Avoidance of Double Taxation and the Prevention of Fiscal Evasion with respect to Taxes on Income
- 1999: Agreement concerning the Promotion and Protection of Investment
- 2002: Agreement on Technical Cooperation
- 2004: Exchange of Notes on Debt Relief Measure
- 2005: Cultural Exchange Program
- 2005: JITCO and MOEWE signed a record of discussion on apprentice trainee.
- 2010: Joint Statement
- 2012: Exchange of Notes on Improvement of the Capacity of Public Food Storage
- 26 May 2014: Exchange of notes between the two countries were signed regarding the 35th package of the Official Development Assistance (ODA), under which Bangladesh is receiving $1.18 from Japan for a number of major projects.
- 27 May 2014: A Memorandum of Understanding (MoU) between Bangladesh Export Processing Zone Authority (BEPZA) and JETRO (Japan External Trade Organization) was signed on allocating plots for Japanese investors in EPZs. 40 industrial plots in the Export Processing Zones (EPZ) will be kept reserved exclusively for the Japanese investors.

1.7 Official Information Disclosure and Community Participations.

Check if government has made any rules under ECR 1997 for official disclosure and community participation. Otherwise the guidelines of JICA, WB and ADB direct on the issue in a following way:

☑ **Public Consultation:**

Public participation in the planning process is essential. The consultation process provides an ideal forum for checking that the affected public has been adequately consulted and their views taken into account in project preparation. The purpose of environmental screening/scoping and ESIA is to improve projects, and this, to some extent can only be achieved by involving those people directly or indirectly affected. A project that will involve temporary displacement of people from their source of livelihood will require the most extensive public participation. It will reveal new information, improve understanding and enable better choices to be made. Without consultation, legitimate issues may not be heard, leading to conflict and unsustainability of the project. There are no clear rules about how to involve the public and it is important that the process remains innovative and flexible. In practice, the views of people affected by the plan are likely to be heard through some form of representation rather than directly. It is therefore important to understand how decisions are made locally and the methods of communication in use. The views of racial minorities, women, religious minorities, political minorities and lower cast groups are commonly overlooked (World Bank, 1991). Public participation and consultation in the project was undertaken through like meetings with likely project affected

persons and regulatory officials and planned project was discussed and their inputs were documented. Techniques used involved open meetings to enable public participation. Relocating or compensating people implies effective communication or dialogue with all stakeholders. It also implies the free flow of information between project sponsors and the PAPs to promote effective consultation and participation so as to achieve the objectives of the temporary relocation.

☑ **Stakeholder Consultation Process**

The procedure provides a framework for achieving effective stakeholder involvement and promoting greater awareness and understanding of issues among all the stakeholders. The spectrum begins with informing stakeholders then escalates through consulting, involving, collaborating and finally empowering participants in consultations. Each level has a different goal and makes a correspondingly bigger promise to participants, as shown in the figure below:

-Inform

Information bulletin and meetings will be used to keep the public informed about the project. The aim is to provide the public with balanced and objective information to assist them in understanding the project, alternatives and/or solutions.

-Consult

These would be used at the start of the EIA to canvass opinion, identify issues, seek feedback and collect data. Specific techniques include:

- ✓ Seek inputs of local NGOs, experts, opinion leaders and other relevant stakeholders during scoping to streamline issues and ensure inclusiveness of all vulnerable groups;
- ✓ Involve community in reconnaissance survey;
- ✓ Conduct focus group discussions using standard Participatory techniques during baseline data collection;
- ✓ Seek inputs of local NGOs and experts when finalizing questionnaires and other survey instruments that will be used for baseline data collection;
- ✓ Conduct key informer interviews for scoping and baseline data collection

-Involve

This category involves an exchange of ideas, discussions of options and strategies rather than just a presentation of positions. The advantage is that participants can respond to new information to develop clearer understanding of the issues and needs and concerns of other participants, and the stakeholder can actually see that their input is being acted on.

-Collaboration

This embraces the above three categories. It involves an exchange of ideas, but extends stakeholder involvement to decisions. Its advantages include better solutions, acceptance and commitment to the solution by all, and greater accountability to the interested parties.

- ✓ Participation of representatives of local NGOs and interests in the impact rating process
- ✓ Participation of representatives of local NGOs and interests in the progress briefing exercise
- ✓ Participation of representatives of local NGOs and interests during the EIA review

1.8 Land Acquisition and Resettlement

☑ **Authorities for Land Acquisition & Their Role**

Ministry of Land is responsible for the land acquisition and resettlement of a large project. The ministries implementing this process by engaging of respective DC as well as the local government of that region.

Necessary land for development of EPZ was made available through ‘Acquisition’ under Acquisition and Requisition of Immovable Property Ordinance, 1982 (Ordinance No. II of 1982). The quantum of

land made available for Chittagong, Dhaka and Comilla EPZ through acquisition is 450 acres, 414 acres and 133 acres respectively.

The land Acquisition Process for EPZ is explained below:

- The Requisitioning body (Here BEPZA) with the permission from its Board of Governors will write to the concerned Deputy Commissioner (DC) of the district where the earmarked land is located to express the desire for acquisition of land.
- The DC will instruct his Land Acquisition Office/ Land Acquisition Officer to start the process of Acquisition. Part of the process will include; survey of the land, identification of the owners as per land records as available, valuation of land, structures, trees, plantations as per Land acquisition norms
- Notice will be served to the land owners and other stake holders about the intention and necessity of the land acquirement under section 3 of the Ordinance which will be followed by section 4 for filling Objection against Acquisition by the land owner, section 5 Final Decision of Acquisition by the DC, section 6 for serving Notice to Persons Interested i.e., individual interest against ownership by other heirs/amount of compensation and all other stake holders, section 7 for Award of Compensation by the Deputy Commissioner, section 10 for Payment of Compensation and section 11 for Acquisition and possession.
- As per section 4 of the Ordinance, if the asking property is more than 50 bigha (16.33 acres) of land, the Deputy Commissioner need to move for getting Government approval before proceeding for Acquisition.
- As per section 8 of the Ordinance the Compensation of the land shall be determined on the basis of average price of other land in the vicinity of earmarked land with 50% compensation as TOP UP on the actual price.
- The price assessment of other structures, trees, plantation shall have to be made on market price basis by the Department of Public Works (PWD) as per requisition of DC.
- As per section 7, the Requisitioning body shall have to deposit the assessed amount of compensation with the DC within 60 days of the assessment of compensation.
- As per section 14 and 15 of the Ordinance the Government will facilitate Acquisition of land for a person/body other than the Govt. body, in this case the requiring private sector or others need to pay the entire cost of acquisition including normal administrative charge imposed by the DC. As per section 17 of the said Ordinance, in future the Acquired Property cannot be used other than the purpose it was acquired. **(Information source: Acquisition and Requisition of Immovable Property Ordinance, 1982 (Ordinance No. II of 1982).**

As per Acquisition and Requisition of Immovable Property Ordinance 1982 (Ordinance No. II of 1982), if a requiring body of land could not use the acquired land purpose fully as it was predetermined for long time, the Govt. can take back the land on de-requisition basis and can use the said land in the same manner for other purpose as suits (section 17).

1.9 Material Dredging From River and Sea

Dredging is a fundamental activity for most, but not all, ports and harbors. The Central Dredging Association states that "in its simplest form dredging consists of the excavation of material from the sea, river or lakebed, and the relocation of the excavated material elsewhere for disposal" (IADC/CEDA 1997). In ports and harbors dredging can be undertaken to meet a number of different objectives, which include the following:

- Navigation: to maintain or improve/extend navigable depths in ports, harbors, marinas and shipping channels which is usually a statutory requirement for port and harbor authorities.
- Flood control: to improve drainage or sea defense.
- Construction and reclamation: in support of coastal development or for the provision of foundations for civil engineering works, for example barrages, bridge piers and pipelines.

- Mining/Aggregate: to win minerals and aggregate materials from underwater locations (Aggregate extraction is the subject of a further report of the UK Marine SACs Project).
- Beach nourishment: to supply material to reinstate or improve the performance of a beach as a sea defense or an amenity.
- Environmental: to improve and clean up the environment, generally for the removal of contaminated sediments which is commonly called remedial dredging

The regulatory authority for dredging and extraction of soil lies with the Ministry Of Land. The government department for the development work can go for dredging like bringing navigability in the river channel, damming river for protection work, etc. The stake holder for the dredging is the following:

-**Inland Water Transport Authority (IWTA)**: maintenance of navigational channel and improvement.

-**Bangladesh Water Development Board (BWDB**): River protection, embankment and irrigation projects.

Moreover department of environment has overall responsibility to approve projects and recommend mitigation measure if any project propose to dredge river and sea. The other concern is the use of spoils if it be used for filling purpose and rising of land without degrading the formation of river channel. Most restriction lies with the degradation of environment. Permission is sought from the Ministry Of Land for on Project to Project basis. EIA is must for dredging projects.

2. Existing and Present Natures and Social Environments at Project Sites

2.1 Physical Environment Baseline Conditions

2.1.1 Ambient Air

It is expected that the air quality of Maheshkhali would be within the ambient air quality standard (Following Tables) as there is no significant pollution source within the close proximity. Moreover, frequent rainfall clear the regular air. In rainy days, air pollutants are not detectable. During field investigation, torrential rainfall influences the air quality significantly. Secondary data sources revealed that no significiant amount of SPM, SOx and NOx could be detected during assessment in July, 2012.

Table 2.1.1 (a): Summary Air Quality measured during July, 2012 at different CAMS operated under DoE.

Sampling Location	**SPM (µg/m^3)**	**SPM (µg/m^3)**	**SOx (µg/m^3)**	**NOx (µg/m^3)**
Moheshkhali Municipality	ND	ND	ND	ND
Sonadia eastern Zone	ND	ND	ND	ND
Kalarmar Chara Bazar	ND	ND	ND	ND
Hoanok Primary School	ND	ND	ND	ND
Cox's Bazar Sea Beach	ND	ND	ND	ND
Standard Limit	**Below 200**	**Below 80**	**Below 80**	**Below 80**
ND= Not Detected				

2.1.2 Meteorology and Climate

The climate of Bangladesh is subtropical and influenced by the annual south west monsoon. The project area lies in the South-eastern Climate Zone and shows tropical monsoon climate with three prominent seasons - Summer/Pre-monsoon - March to May; Rainy season/monsoon - June to October; and winter season - November to February. Monsoon comes in the month of June and recedes in the month of late October. During this period, air becomes more humid, rainfall increases, and heavy rains with thunderstorm occur. This period is locally called as "Kalbaaishakhi". Sometimes the rain falls with hail. The monsoon period is considered to last from the May to October when more than

85% of the total annual rainfall occurs.

The responsible authority for collecting climate data is Bangladesh Meteorological Department and the department has several data collection station that collects data for temperature, rainfall, wind speed etc. The nearest climatic data collection point of the project area of Cox's Bazar, Kutubdia and Teknaf. Based on these stations following data was achieved for assessing the climatic condition of selected project site.

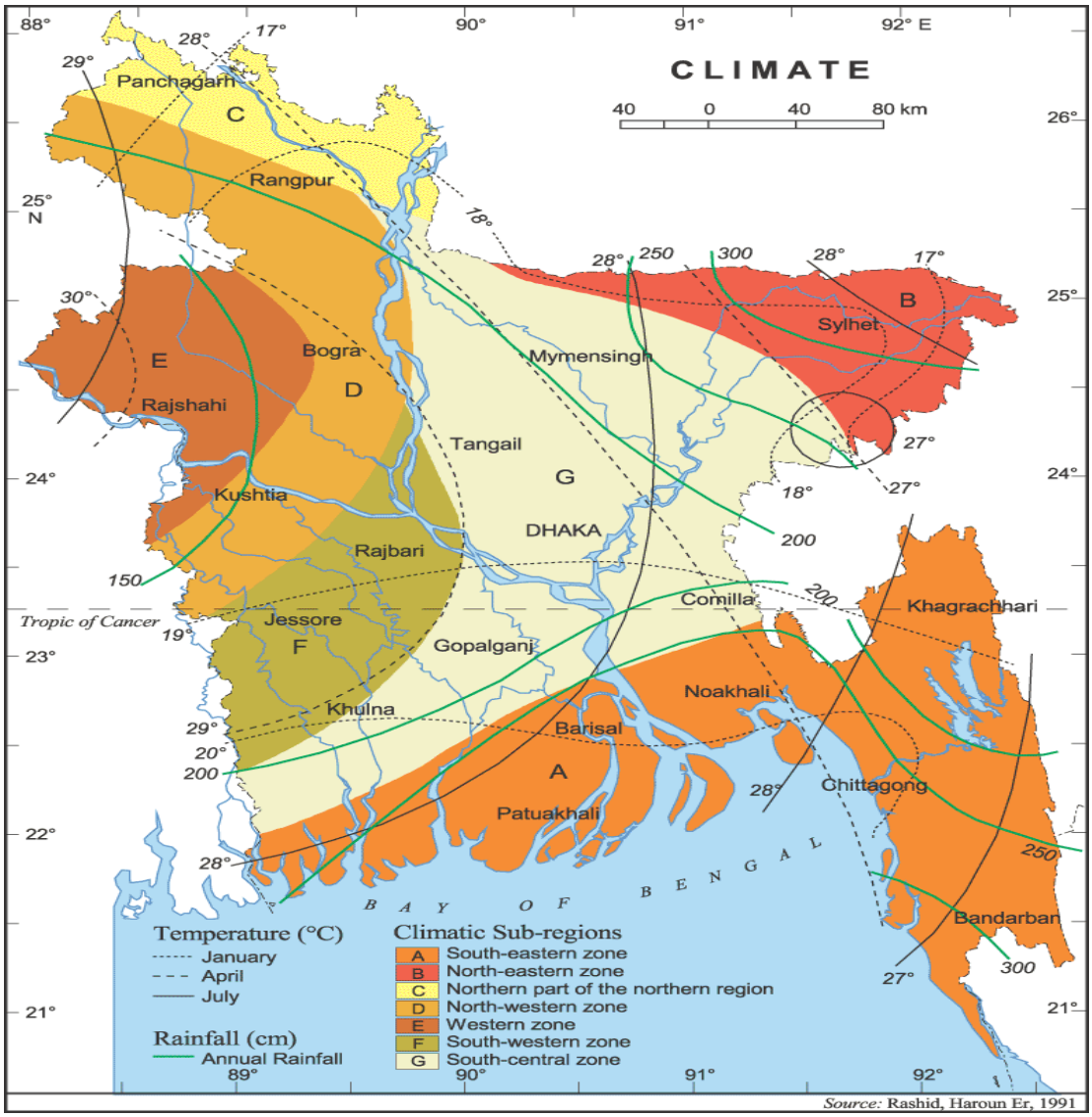


Figure 2.1.2 (a): Map showing the climatic region of Bangladesh

☑ ***Ambient Air Temperature***

Bangladesh have six season and based on these season its temperature is varies with the season. The average minimum and maximum range of temperature in winter (dry season) is 15^0C to 30^0C. March and April consider as pre-monsoon season when highest temperature reached, average 32^0C. The nearest data collection point of BMD near sites 8 & 9 is Cox's bazar and Teknaf. The normal maximum and minimum temperature of that place are showing in the following table.

Normal Maximum & Minimum Temperature (°C) for Site-8&9

Station Name	January		February		March		April		May		June		July		August		September		October		November		December	
	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
Cox's Bazar	26.7	15.0	28.5	17.0	30.9	20.7	32.1	23.9	32.3	25.1	30.7	25.2	30.0	25.1	30.2	25.0	30.9	25.0	31.6	24.3	30.0	21.1	27.5	16.5
Kutubdia	25.5	14.9	27.4	17.3	29.9	21.2	31.5	24.0	32.3	25.1	30.9	25.2	30.1	25.3	30.5	25.5	31.0	25.3	31.3	24.3	29.2	20.7	26.3	16.6
Teknaf	27.2	15.1	28.8	17.1	30.8	20.6	31.9	23.9	32.1	25.2	30.3	25.2	29.8	25.0	30.0	24.9	30.7	24.9	31.4	24.0	30.2	21.1	28.1	17.0
Country	25.2	12.5	27.8	15.1	31.6	19.6	33.2	23.1	32.9	24.5	31.9	25.6	31.1	25.6	31.4	25.7	31.5	25.4	31.5	23.6	29.5	19.2	26.4	14.2

(Source: *Bangladesh Meteorological Department*)

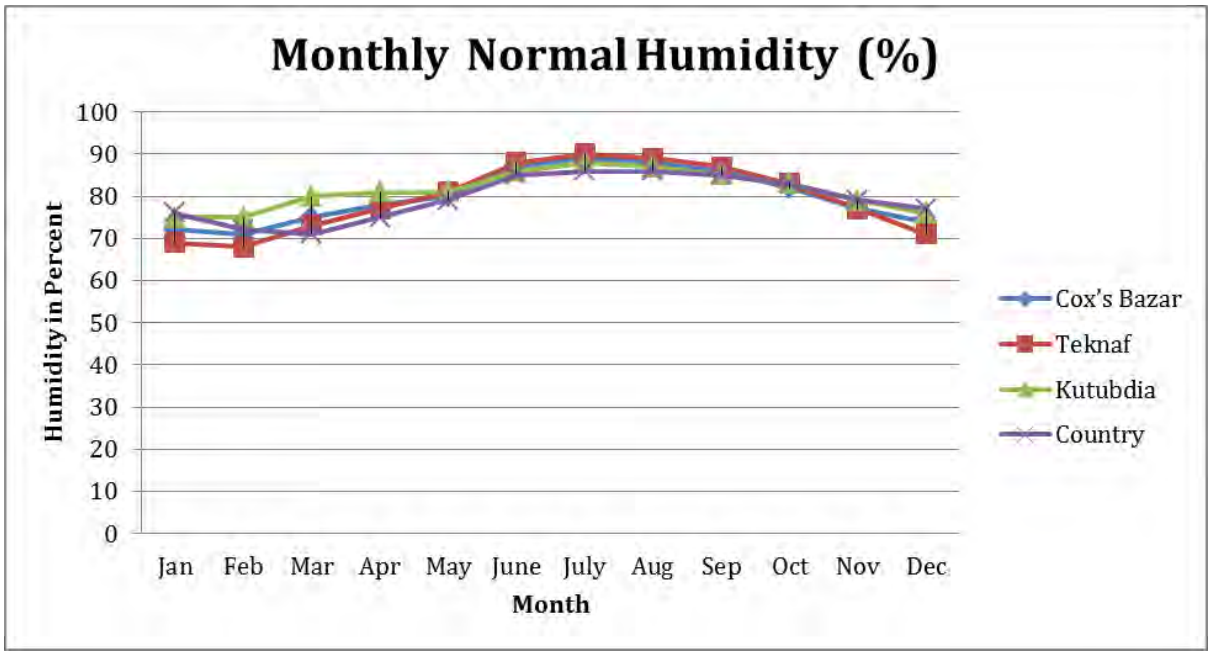
☑ ***Humidity***

In the monsoon season the air becomes more humid due to the heavy rainfall and in the dry season the humidity found low. The average humidity of the country is around 75%. Data from BMD station near the project sites following data revealed that the humidity found higher in the month of July and lowest in the month of February.

Table 2.1.2 (d): Monthly Normal Humidity (%) For midterm EZ Site 8&9

Station	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec
Cox's Bazar	72	71	75	78	80	87	89	88	86	82	77	74
Kutubdia	75	75	80	81	81	86	88	87	85	83	79	76
Teknaf	69	68	73	77	81	88	90	89	87	83	77	71
Country	76	72	71	75	79	85	86	86	85	83	79	77

(Source: *Bangladesh Meteorological Department)*



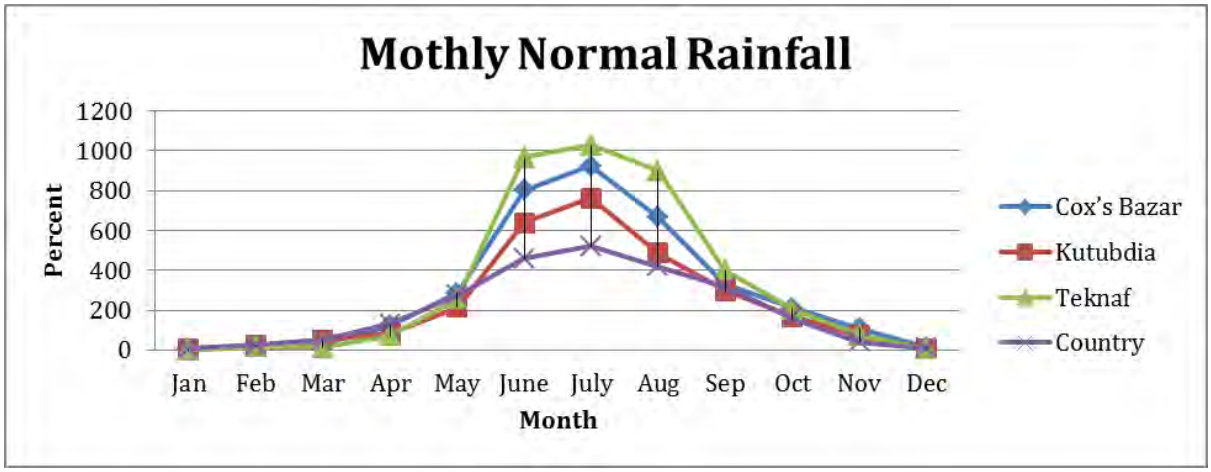
☑ ***Rainfall***

Rainy season is prominent in this region like other parts of the country. The data collection point of BMD near EZ site revealed that in the month of May to September rainfall is more frequent due to the presence of monsoon air and around 85% rainfall occurs in these months. The monthly normal rainfall for the stations adjacent to the EZ site is shown in the table below.

Table 2.1.2 (f): Monthly Normal Rainfall in mm for midterm EZ Site 8&9

Station	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec
Cox's Bazar	4.1	17.0	34.7	121.8	286.8	801.9	924.6	667.1	330.1	213.6	109.4	13.0
Kutubdia	6.5	24	51.4	85.5	215.6	638.3	763.7	488.9	299.8	169.3	71.9	9.3
Teknaf	1.9	16.5	15.3	73.0	259.9	968.1	1029.7	898.9	402.1	207.4	75.7	5.9
Country	9.0	25.5	52.4	130.2	277.3	459.4	523.0	420.4	318.2	160.3	42.3	9.6

(Source: *Bangladesh Meteorological Department*)



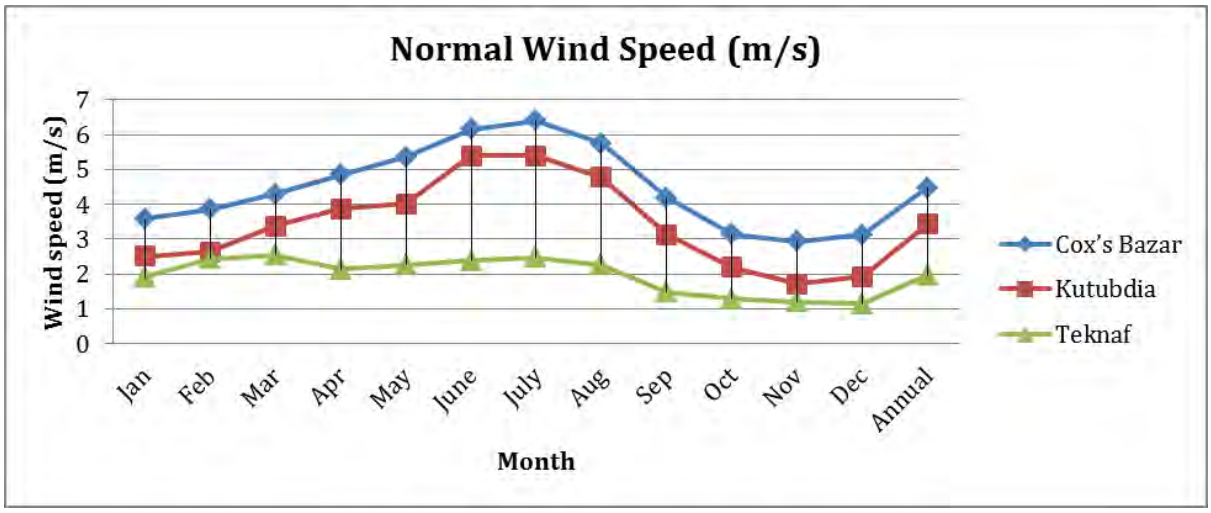
☑ ***Wind Speed and Direction***

Like the country's wind characteristics the project regions is characterized by Southerly wind from the Bay of Bengal during monsoon and Northwesterly wind from Himalaya during winter. The maximum wind speed occurs in April to July that shown in the following table for both sites.

Table 2.1.2 (h): Normal Wind Speed (m/s) for midterm EZ Site 8&9

Station	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Annual
Cox's Bazar	3.60	3.85	4.30	4.85	5.36	6.15	6.41	5.75	4.20	3.15	2.93	3.13	4.48
Kutubdia	2.52	2.64	3.38	3.88	4.02	5.4	5.4	4.78	3.13	2.19	1.72	1.93	3.43
Teknaf	1.93	2.44	2.54	2.15	2.27	2.39	2.48	2.27	1.49	1.29	1.21	1.16	1.97

(Source: *Bangladesh Meteorological Department*)



2.1.3 Extreme Weather Events

☑ ***Storm Surges & Cyclone***

Due to the geographical setting of our country, Storm surge and cyclones is more frequent in the coastal region of Bangladesh. The coastal regions of Bangladesh are subject to damaging cyclones almost every year. They generally occur in early summer (April-May) or late rainy season (October-November). Cyclones originate from low atmospheric pressures over the Bay of Bengal.

Cyclones in the South Asian Sub-Continent are presently classified according to their intensity and the following nomenclature is in use (Chowdhury, 1992):

Depression	Winds up to 62 km/h
Cyclonic Storm	Winds from 63-87 km/h
Severe Cyclonic Storm	Winds from 88-118 km/h
Severe Cyclonic Storm of Hurricane Intensity	Winds above 118 km/h

Storm surges are oscillations of the water level in a coastal or inland water body in periods ranging from a few minutes to a few days, resulting from atmospheric forces in the weather system. A storm surge is partly caused by pressure differences within a cyclonic storm and partly by high winds acting directly on the water. This result in a mass of water, a huge wave, moving at the same speed as the cyclone. In the northern Bay of Bengal, a unique combination of high tides, a funneling coastal configuration, the low flat coastal terrain and a high population density have produced some of the highest mortality figures associated with storm surges (Flierl and Robinson, 1972).

Historical Cyclones in Bangladesh

During the years 1797 to 1991, Bangladesh has been hit by 59 severe cyclones, 32 of which were accompanied by storm surges. Reference to the wind speed, surge height, loss of life, damage to crop and properties etc. A tropical cyclone forming in the Bay of Bengal has a lifetime of one week or longer. The height of the surges is limited to a maximum of 10 meters in the bay. When propagating into the shallower inland coastal areas, the heights of these waves are further reduced. The frequency of a wave (surge plus tide) with a height of about 10 m is approximately once per 20 years. A storm surge of approximately once in 5 years has a height of about 7 m (surge plus tide). Besides these exceptional surges, wind waves occur, the dimensions of which depend on wind speed and direction, fetch, water depth, and duration. Waves of 3 m height may occur under unfavorable conditions in the coastal regions (French Engineering Consortium and Bangladesh Water Development Board, 1989).

Table: Chronology of major cyclones and storm surges in Bangladesh

Sl No.	Year, Month & date	Affected Area	Nature of the Phenomena	approximate loss/damage
1	1797, May-June	Chittagong	Most severe cyclone	Every hut levelled to ground and 2 vessels sunk in the Chittagong port
2	1822, May	Barisal	Most severe cyclone	40,000 people killed and 100,00 cattle lost
3	1831, October	Barisal	Storm surge	Damage report not available
4	1872, October	Cox's Bazar	Cyclonic storm	270 people killed
5	1876, 27 Oct. to Nov. 1	Patuakhali, Noakhali and Chittagong coast	More severe storm surge of 12m height	400,000 lives were lost and enormous properties were destroyed
6	1895, October	Sunderban	Cyclonic surge	Damage report not available
7	1897, October	Chittagong and Kutubdia island	Hurricane with surge	175,000 lives were lost
8	1898, May	Teknaf	Cyclonic storm surge	Damage report not available
9	1901, November	Western Sunderban	Cyclonic storm	Damage data not available
10	1909, October	Chittagong	Cyclonic storm surge	Damage data not available
11	1909, December	Cox's Bazar	Cyclonic storm	Damage data not available
12	1911, April	Teknaf	Cyclonic storm	120,000 people killed
13	1917, May	Sunderban	Cyclonic storm	70,000 people killed
14	1919, September	Barisal	Cyclonic storm	40,000 people killed
15	1922, April	Teknaf	Cyclonic storm	Damage data not available
16	1923, May	Teknaf	Cyclonic storm	Damage data not available
17	1926, May	Cox's Bazar	Cyclonic storm	606 people killed
18	1941, May 26	Eastern Meghna estuary	Cyclonic storm	7,000 people killed
19	1948, May 17-19	Between Noakhali & Chittagong	Cyclonic storm	Damage data not available
20	1950, Nov. 15-20	Patuakhali	Cyclonic storm	Damage data not available
21	1958, May 16-19	Eastern Meghna estuary	Cyclonic storm	Damage data not available

22	1958, October 21-24	Noakhali and West Meghna estuary	Cyclonic storm	12,000 people killed
23	1960, May 25-29	Sunderban Coast (landfall at Sunderban)	Cyclonic storm, s= 3.2m and t=0.0m	106 people killed
24	1960, October 10-11	Meghna estuary (landfall at Noakhali)	Severe cyclonic storm, w=129 km/h, s=6.6m and t=1.5m.	6,000 to 11,446 people killed
25	1960, October 30-31	Chittagong coast (landfall at Chittagong)	Severe cyclonic storm, w=161 to 210 km/h, s=4.2m and t=1.8m.	70% buildings in Hatia blown-off and 8,149 lives lost
26	1961, May 6-9	Meghna estuary (landfall near Feni river)	Severe cyclonic storm, w=145 km/h, s=4.5m and t=1.2m at Galachipa.	11,468 people killed in Char Alexander and rail road damaged near Noakhali
27	1961, May 27-30	Chittagong-Noakhali coast	Cyclonic storm, w=95 to 145 km/h and total water level was 7m at Chittagong.	10,466 people killed
28	1962, October 26-30	Feni-Chittagong coast	Cyclonic storm, w=200 km/h, s=5.8m and t=0.0m.	50,000 people killed
29	1963, May 28-29	Noakhali-Cox's Bazar Coast (landfall near Chittagong)	Severe cyclonic storm, w=201 km/h, s=5m and t=0.3m at Chittagong.	11,520 people killed
30	1963, June 5-8	Sunderban	Cyclonic storm, s=3.1m and t=0.0m.	Damage data not available
31	1963, October 25-29	Teknaf	Cyclonic storm, w=105 km/h, s=2.2m and t=0.0m.	Damage data not available
32	1965, May 10-12	Barisal-Chittagong coast (landfall between Barisal and Noakhali)	Severe cyclonic storm, w=161 km/h, s=4.0m and t=1.2m.	19,270 people killed
33	1965, May 31 to June 1	Chittagong Coast (landfall near Chittagong)	Tide plus surge was 7.1m at Companyganj. At Chittagong 1.6m surge on tide.	12,000 people killed
34	1965, December 14-15	Cox's Bazar-Teknaf coast (landfall near Cox's Bazar)	Severe cyclonic storm, w=200 km/h, s=4.0m and t=0.2m.	40,000 salt beds in Cox's Bazar were inundated and 870 people were killed
35	1966, October 1	Chittagong and Sandwip (landfall near Chittagong)	Severe cyclonic storm, w=145 km/h, tide plus surge was 6-7m.	850 people killed
36	1966, December 12	Cox's Bazar	Cyclonic storm	Damage data not available
37	1967, October 11	Sunderban-Noakhali coast (landfall at Noakhali)	Cyclonic storm, w=160 km/h, s=3.0m and t=0.0m.	Damage data not available
38	1967, October 23-24	Chittagong-Cox's Bazar coast (landfall in between)	Cyclonic storm, w=130 km/h, s=2m and t=0.0m.	128 people killed
39	1969, October 11	Khulna coast	Cyclonic storm	175 people killed
40	1970, May 5-7	Chittagong-Teknaf coast (landfall at Cox's Bazar)	Cyclonic storm, w=148 km/h, s=2.3m and t=0.2m.	18 people killed
41	1970, November	Khulna-Chittagong coast	Most severe cyclonic storm,	300,000 lives lost and innumerable

	12-13	(landfall at Hatia)	w=222 km/h, s=5.5m and t=2.1m.	animals were killed, widespread damage to crops and properties
42	1971, May 7-8	Meghna estuary	Cyclonic storm, w=80 km/h.	Damage data not available
43	1971, November 5-6	Chittagong coast (landfall near Chittagong)	Cyclonic storm, w=105 km/h, s=2.1m and t=0.0m.	Damage data not available
44	1971, November 28-30	Sunderban coast	Cyclonic storm, w=110 km/h, s=1.0m and t=0.0m.	11,000 people killed
45	1973, November 16-18	Chittagong coast	Cyclonic storm, w=165 km/h, s=3.5m and t=1.0m.	Damage data not available
46	1973, December 6-9	Sunderban-Patuakhali coast (landfall at Sunderban)	Severe cyclonic storm, w=122 km/h and s=4.5m.	183 people killed
47	1974, August 13-15	Khulna coast	Cyclonic storm, w=80 km/h, s=2.5m and t=1.7m.	Damage data not available
48	1974, November 24-28	Cox's Bazar-Chittagong-off-shore Islands (landfall at Chittagong)	Severe cyclonic storm, w=161 km/h, s=3.1m and t=0.2m.	20 people killed
49	1975, May 9-12	Sunderban-Bhola-Chittagong coast	Severe cyclonic storm, w=110 km/h.	5 people killed
50	1976, October 19-20	Meghna estuary	Cyclonic storm, w=105 km/h, tide plus surge at Companygonj was 3.5m.	Damage data not available
51	1977, May 9-12	Sunderban-chittagong coast (landfall at Sunderban)	Cyclonic storm, w=113 km/h, s=0.6m and t=0.7m.	Damage data not available
52	1978, September 30 to Oct. 3	Sunderban khulna coast	Cyclonic storm, w=74 km/h.	Damage data not available
53	1983, October 15	Chittagong-Feni coast (landfall near Chittagong)	Cyclonic storm, w=122 km/h.	43 persons were killed, 1000 fishermen missing and 20% aman crops destroyed
54	1983, November 9	Chittagong-Teknaf coast (landfall between Chittagong and Cox's Bazar)	Severe cyclonic storm, w=136 km/h, s=2.5m.	300 fishermen with 50 boats missing; 2000 houses,22 institutions destroyed
55	1985 May 24-25	Noakhali-Cox's Bazar coast (landfall at Sandwip)	severe cyclonic storm, w=154 km/h, s=3.2m and t=1.8m.	11,069 people killed, 94,379 houses damaged,64 km road and 390 km embankment damaged
56	1986, November 9	Barguna-Chittagong coast	Cyclonic storm, w=110 km/h.	14 lives lost and huge damage to crops and properties
57	1988, November 29	Sunderban	Severe cyclonic storm, w=160 km/h , s=3.5m and t=1.5m.	5,708 people killed and 6,000 missing; 65,000 cattle were lost
58	1990, October 7-8	Barguna-Noakhali coast	Cyclonic storm, w=2m.	150 fishermen with 16 mechanised boats missing
59	1991, April 29	Patuakhali-Cox's Bazar coast (landfall north of Chittagong)	Most severe cyclonic storm, w=235 km/h, s=5.8m and t=1.7m.	145,000 people killed, 70,000 cattle killed, crops were damaged

w= Wind Speed s= Surge height t= Tidal height

(Source:http://www.adpc.net/casita/case_studies/coastal%20hazard%20assessment/modelling%20cyclone%20hazard%20in%20bangladesh/background_information_on_the_storm_surge_modelling.pdf)

Table 2.1.3 (a): List of Recent Cyclones and Storm Surges

Date of Landfall	Nature of Phenomenon	Landfall Area	Max. Wind Speed in kph	No. of Death	Surge Heights
26.10.1996	C.S	Sundarban	70	09	1.5-2.0 m
19.05.1997	S.C.S with a core of hurricane winds	Sitakundu	232	15	4.55 in
27.09.1997	S.C.S with a core of hurricane winds	Sitakundu	150	67	3.0-4.55m
20.05.1998	S.C.S with core of hurricane winds	Chittagong Coast near Sitakundu	173	14	0.9m
17.10.1999	S.C.S of hurricane intensity	Orissa Coast	-	-	-
25.10.1999	S.C.S of hurricane intensity	Orissa Coast	-	-	-
28.10.2000	Deep Depression (probably Cyclonic Storm)	Sundarban coast near Mongla	50-60	3	0.6-1.2m
16-10.2001	S.C.S	Andhra coast	65-85	-	-
12.11.2002	C.S	Sundarban coast near Raimangal river	65-85	2	1.5-2.1m
20.5.2003	C.S	Myanmar	65-85	-	0.9-1.5m
16.12.2003	S.C.S	Andhra coast	98-115	-	-
19.05.2004	C.S	Cox's Bazar & Akyab Coast	65-90	-	0.6-1.2m
28.10.2005	C.S	Andhra coast near Ongole.	-	-	-
10.12.2005	Cyclonic Storm (crossed land as a depression)	Tamilnadu co. near Nagapattnam.	-	-	-
29.04.2006	S.C.S with a core of Hurricane 'Mala"	Arakan coast of Myanmar between Akyab . Sandoway	-	-	-
15.05.2007	C.S "AKASH"	Chittagong & Cox's Bazar	83	-	-
15.11.2007	S.C.S "SIDR"with a core of hurricane winds	Khulna-Barisal coast near Baleshuvar river	223	3.363	4.6-6. l m
02.05.2008	S.C.S "NARGIS" with a core of hurricane winds	Myanmar coast near Bassein	-	-	-
26.10.2008	C.S "Rash."	Khulna-Barisal coast near Patharghata	-	-	1.5-2. lm
27.11.2008	C.S 'Nisha"	Tamilnadu co. near NagapatImam.	-	-	-
17.04.2009	C.S "BIJII"	Chittagong-Cox'sBazar coast near Ctg.	90	-	-
25.05.2009	C.S "AHA"	West Bengal-Khulna (Bangladesh) coast near Sagar inland of India.	92	190	2.1-2.4m
20.05.2010	S.C.S "LAILA"	NE Andhra coast of India	-	-	-

22.10.2010	V.S.C. S "GIRI"	Crossed Myanmar coast east-southeast of Sittwe			
07.11.2010	S.C.S "JAL"	Crossed north Tamilnadu and south Andhra Pradesh coast	-	-	-
30.12.2011	V.S.C.S "THANE"	Crossed the Tamil Nadu coast close to south of Cuddalore	-	-	-
31.10.2012	C.S "NILAM"	crossed north Tamilnadu coast near Mahabalipuram, south of Chennai	-	-	-
16.05.2013	C.S "VIARU"	Crossed Bangladesh coast between Chittagong and Feni	85	17	-
12.10.2013	V.S.C.S "PHAILIN"	Odisha & adjoining north Andhra Pradesh coast near Gopalpur	-	-	-
22.11.2013	S.C.S "HELEN"	Crossed Andhra Pradesh coast close to south of Machilliptnam	-	-	-
29.07.2015	C.S "COMEN"	Crossed over the Chittagong coast	75	132	
21.05.2016	C.S "ROANU"	Crossed over the Chittagong coast	100	26	

(Source: *Bangladesh Meteorological Department*). [C.S= Cyclone Storm, S.C.S= Severe Cyclone Storm, V.S.C.S= Very Severe Cyclone Storm]

☑ ***Extreme Rainfall***

Bangladesh has a subtropical monsoon climate characterized by wide seasonal variations in rainfall and about 80 percent of Bangladesh's rain falls during the monsoon season. Excessive rainfall is the driving force of flood in all over the country and landslides in the hilly areas. Following table revealed the extreme rainfall of respective stations of Bangladesh Meteorological Department (BMD).

Table 2.1.3 (b): List of Recorded Extreme Rainfall in allover Bangladesh

Stations	Amount of Rainfall (mm)	Date
Dhaka	341	13 September 2004
Mymensingh	508	26 September 1971
Tangail	305	2 September 1993
Faridpur	370	26 September 1986
Madaripur	243	12 June 1995
Chittagong	511	3 August 1983
Ambagan (Chittagong)	438	26 June 2012
Sandwip	590	14 June 2001
Sitakunda	329	9 October 1990
Rangamati	352	25 July 1960
Comilla	442	2 August 1958
Chandpur	334	15 June 1983
Maijdi Court	520	17 July 1981
Feni	420	15 July 2005
Hatiya	337	14 June 2001
Cox's Bazar	467	24 June 2015
Kutubdia	422	15 July 1998
Teknaf	481	14 June 2010
Sylhet	362	12 June 2000
Srimangal	514	6 September 1976
Rajshahi	247	21 June 2004
Ishurdi	351	10 July 1976
Bogra	279	23 June 1988
Rangpur	294	24 September 2002
Dinajpur	508	28 September 1996
Sayedpur	341	9 September 1991
Khulna	430	26 September 1986
Mongla	204	26 September 1997
Satkhira	302	26 September 1986
Jessore	281	29 June 1965
Chuadanga	257	20 July 2007
Barisal	258	10 October 1967
Patuakhali	312	9 June 1982
Khepupara	373	1 July 1995
Bhola	564	6 November 1971

(Source: *Bangladesh Meteorological Department*)

2.1.4 Seismicity

Selected project sites has fallen under the Zone-II that comprising the central part of Bangladesh represents the regions of recent uplifted Pleistocene blocks of the Barind and Madhupur Tracts, and the western extension of the folded belt. The region is also at medium risk from seismic events as it lies at the junction of three tectonic plates. In the earthquake zoning map 2.1.4 (a) 26 percent of Bangladesh falls in high risk, 38 percent moderate and 36 percent in low risk zone in terms of earthquake vulnerability. The distribution of recorded earthquakes indicate a major clustering of seismicity around the Dauki Fault and scattering of other events along other major fault systems of Bangladesh. The magnitude of the earthquakes are moderate (4-6) and majority of them are shallow depth. The historical records show that there have been some major earthquakes in Bangladesh. The 1548 earthquake had affected Sylhet and Chittagong with reports of ground rupture and hydrological changes. The 1762 earthquake had raised the Foul Island by 2.74 meters and the northwest coast of Chedua by 6.71 meters above the MSL and had caused permanent submergence of part of Chittagong. The 1897 Great India earthquake had caused extensive damage to parts of Mymensingh, Dhaka and Rajshahi. Among the recent major earthquakes, the 1997 Chittagong earthquake caused extensive damage to the adjacent areas. In the context of human exposure in seismically hazardous zones, nearly 1,330,958 people are present in these zones and Bangladesh ranks 17th among 153 nations. Similarly, the modeled amount of GDP in seismically hazardous zones puts Bangladesh 42nd among 153 countries. (Source: Bangladesh Hazard Profile, 2009)

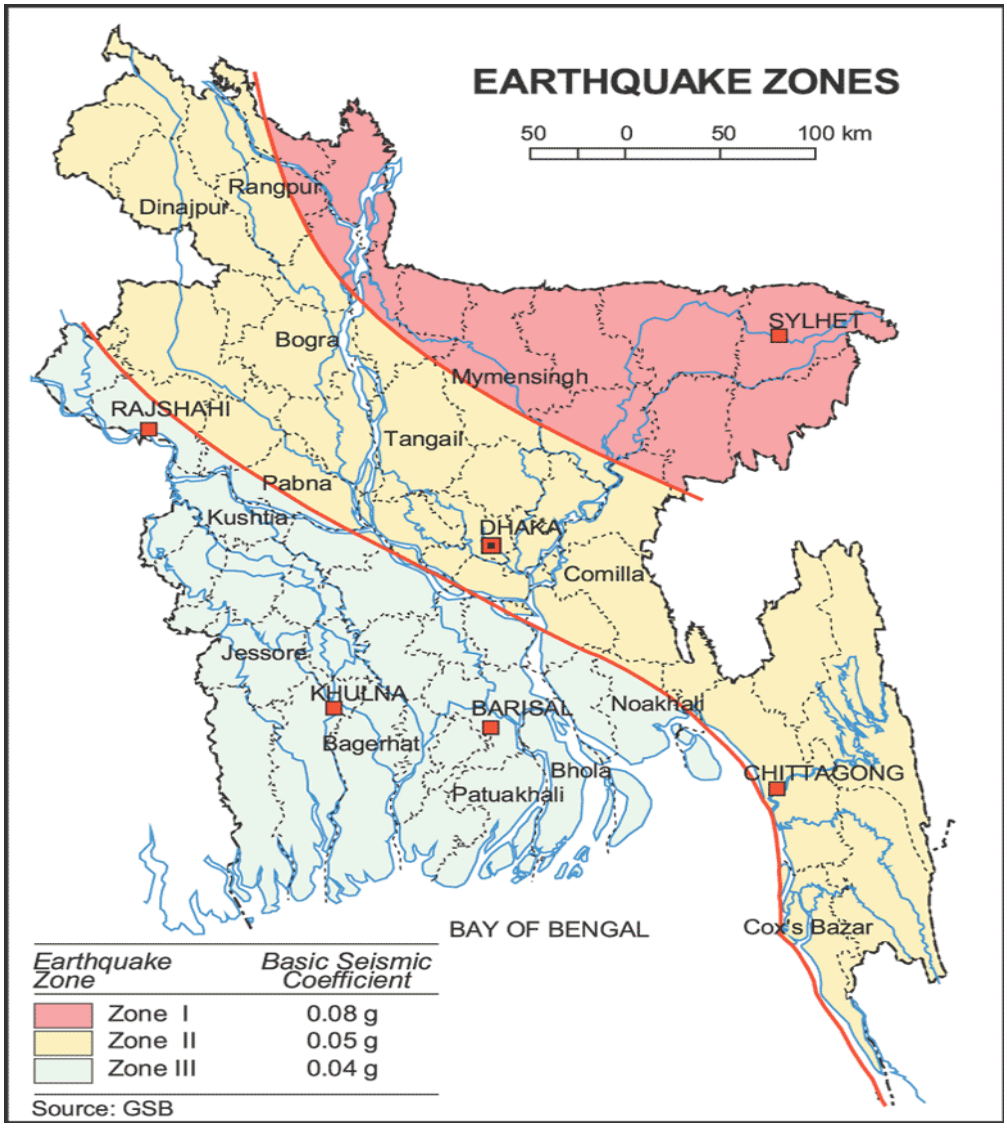


Figure 2.1.4 (a): Earthquake Zoning Map of Bangladesh, (source: GSB)

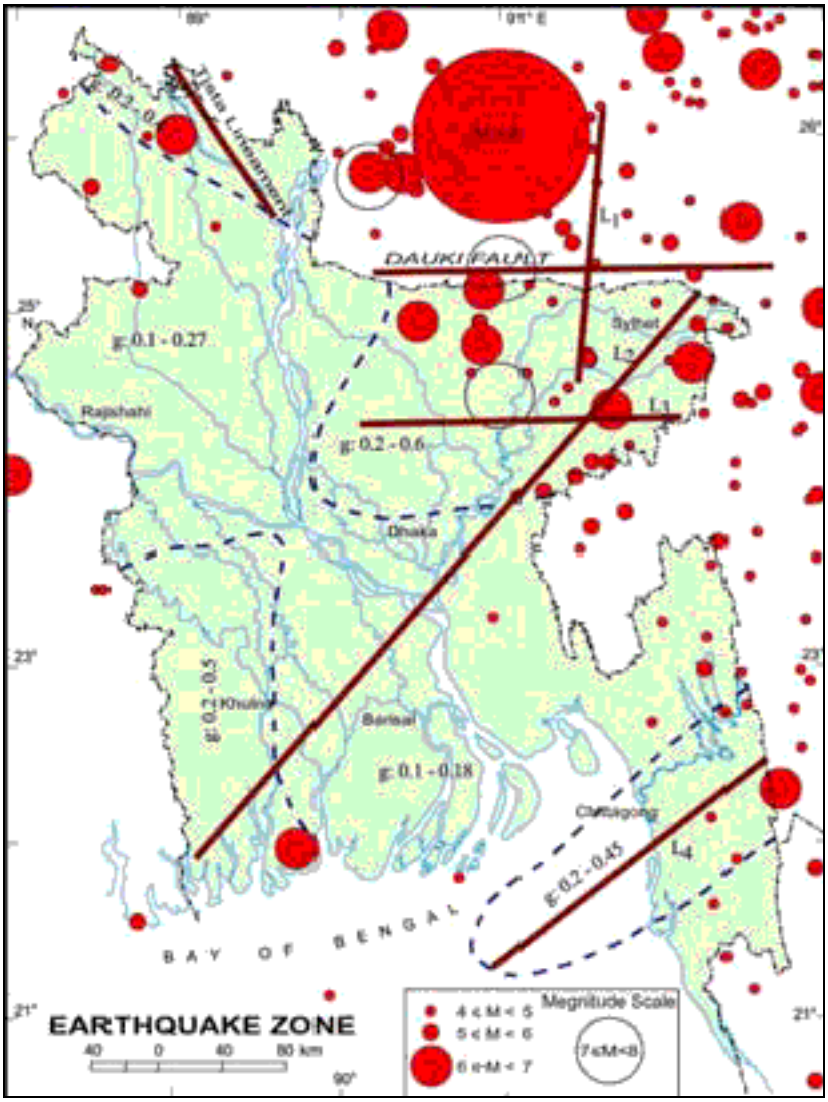


Figure 2.1.4 (b): Earthquake Distribution Map of Bangladesh

Table 2.1.4 (a): List of Recent Earthquake

Date	Time of occurrence (UTC) Hrs. Mts. Secs	Location of Epicenter		Magnitude (Richter Scale)	Distance from Dhaka (Km)	Region
		Latitude Deg. Mts.	Longitude Deg. Mts.			
28/06/2015	01 05 26.00	26° 38.40' N	90° 27.00' E	5.4	318	Assam, India
25/04/2015	06 11 27.20	28° 04.80' N	84° 51.60' E	7.5	745	Barpak, Nepal
20/04/2015	01 43 02.00	24° 07.80' N	122° 20.40' E	6.5	3,238	Taiwan
17/04/2015	22 05 50.00	26° 30.60' N	92° 36.60' E	4.9	382	Rangapara, India
15/04/2015	17 57 02.00	24° 04.20' N	95° 34.80' E	4.2	529	Myanmar
13/04/2015	07 39 27.00	39° 45.96' N	106° 25.50' E	5.3	2,327	Wuhai, China
08/04/2015	01 43 49.46	21° 46.2' N	89° 52.80' E	4.6	228	Sharankhola, Khulna
30/03/2015	23 48 31.00	04° 45.6' S	152° 33.36' E	7.5	7,435	Papua New Guinea
16/03/2015	23 17 20.80	00° 31.2' N	122° 19.80' E	6.0	4,246	Luwuk,Indonesia

Date	Time of	Location of Epicenter		Magnit	Distance	Region
23/02/2015	08 17 43.98	23° 56.24' N	91° 34.48' E	3.8	128	Tripura Region, India
22/02/2015	02 50 31.37	25° 29.24' N	91° 54.36' E	3.5	245	Assam Region, India
17/02/2015	23 06 28.80	39° 34.12' N	142° 50. 24' E	6.6	5,701	Honshu, Japan
12/02/2015	14 33 07.00	24° 4.48' N	93° 42.0' E	4.8	339	Churachandpur, India
04/02/2015	10 43 56.65	34° 9.0' N	83° 10.12' E	5.2	1,320	China Region
24/01/2015	16 11 42.50	24^0 57.00′ N	094^0 51.00′ E	4.7	470	Myanmar-India Border Region.
15/01/2015	01 33 09.30	22^0 52.80′ N	092^0 19.20′ E	4.2	220	Rangamati Region, Bangladesh
10/01/2015	19 32 01.20	14^0 46.20′ N	120^0 16.20′ E	5.8	3,283	Philippines Region
09/01/2015	02 20 42.93	26^0 44.40′ N	090^0 50.26′ E	3.8	56	Bhairab Bazar
07/01/2015	04 48 32.00	24^0 16.80′ N	121^0 39.60′ E	5.1	3,168	North of Hualian Taiwan
05/01/2015	03 19 28.00	30^0 36.00′ N	142^0 12.60′ E	5.3	5,135	Japan region
04/01/2015	05 51 27.00	29^0 18.00′ N	130^0 38.88′ E	5.1	4,029	Japan region

(Source: *Bangladesh Meteorological Department*)

Table 2.1.4 (b): List of Major Earthquake

Date	Magnitude (Richter Scale)	Source Area
10/01/1869	7.5	Cachar, India
14/07/1885	7.0	Sirajganj,Bangladesh
12/06/1897	8.7	Great Indian Earthquake
08/07/1918	7.6	Srimangal,Bangaldesh
02/07/1930	7.1	Dhubri,India
15/08/1950	8.5	Assam,Himalaya
21/03/1954	7.4	Monipur,India
08/07/1975	6.7	Assam,India
18/09/2011	6.8	Sikkim,India
25/04/2015	7.8	Pokhra, Nepal

(Source: *Bangladesh Meteorological Department*)

2.1.5 Topography and Land Use

The Cox's Bazar cliff runs from NNW to SSE direction along the shore of Bay of Bengal. The range lies on the eastern side of the Bay of Bengal. Beach runs approximately along S 35˚E. Eastern side of the cliff is accompanied by a series of hills. The highest ridge of the Cox's Bazar hill is about 82 m above the sea-level. Valleys are irregularly situated in this hill range. The height of the cliff along the beach varies within a narrow range from about 50m to 82m and these cliffs terminate abruptly against the beach presenting vertical sections.

2.1.6 Geology and Soils

Regional Geology

In Chittagong and Chittagong Hill Tracts the Upper Tertiary sandy-argillaceous sediments have been folded into a series of long submeridional (NNW-SSE) anticlines and synclines represented in the surface topography by elongated hill ranges and intervening valleys. The folded structures are characterized by en-echelon orientation with an increasing degree of intensity and complexity toward the east. Accordingly, the folded flank is divided into three parallel almost N-S trending zones from west to east as: (a) the Western Zone is characterized by simple box-like or similar shaped anticlines with steep flanks and gentle crests separated by gentle synclines, viz. Matamuhuri anticline, Semutang anticline, etc; (b) the Middle Zone is characterized by more compressed structures, other than just simple box- like folds, with ridge like asymmetric anticlines frequently associated with faults and separated by narrow synclines viz. Sitapahar anticline, Bandarban anticline, Gilasari anticline, Patiya anticline, Changohtung anticline, Tulamura anticline, Kaptai syncline, Alikadam syncline, etc; (c) The Eastern Zone is characterised by highly disturbed narrow anticlines with steep clipping flanks and mostly associated with thrust faults, viz. Belasari anticline, Subalong syncline, Utanchatra anticline, Barkal anticline, Mowdac anticline, Ratlong anticline, Kasalong syncline, Sangu Valley syncline and few others.

Geological Structure

Tectonically, the structure belongs to the western zone of the folded flank of the Bengal Foredeep. This folded flank represents the most prominent tectonic element with general submeridional trending hills parallel to the Arakan Yoma Folded System. The 27 km hill ranges from a parallelogram along the eastern side of the island. The trend of the ranges is NNW-SSE. Average height of the hill ranges from 60 m to 100 m where the highest elevation is 86.26m above the mean sea level almost at the centre of the range. It is a simple asymmetrical anticline. The eastern flank dip towards northeast at an angle of 7° to 10°; the western flank towards west at an angle of 30° to 40° indicating asymmetry. The Neogene sedimentary sequence developed here are largely unfossiliferous and consists mainly of the alteration of shales, clays, claystones, siltstones and sandstones with occasional intra-formational conglomerates. The adjacent parts of this island were developed through the fluvial deposition with mostly coarse sediments.

Tectonic Setting of the Area

The hill ranges of Cox's Bazar and Teknaf areas are the part of the western extension of the Tertiary Folded Belt of Indo-Burman Orogeny (Figure 2). The upper Tertiary sediments of the area are arranged into long folds of sub-meridional trend. The area is characterized by a series of parallel structures which is the continuation of Arakan Yoma Anticlinorium and started to develop during Oligocene

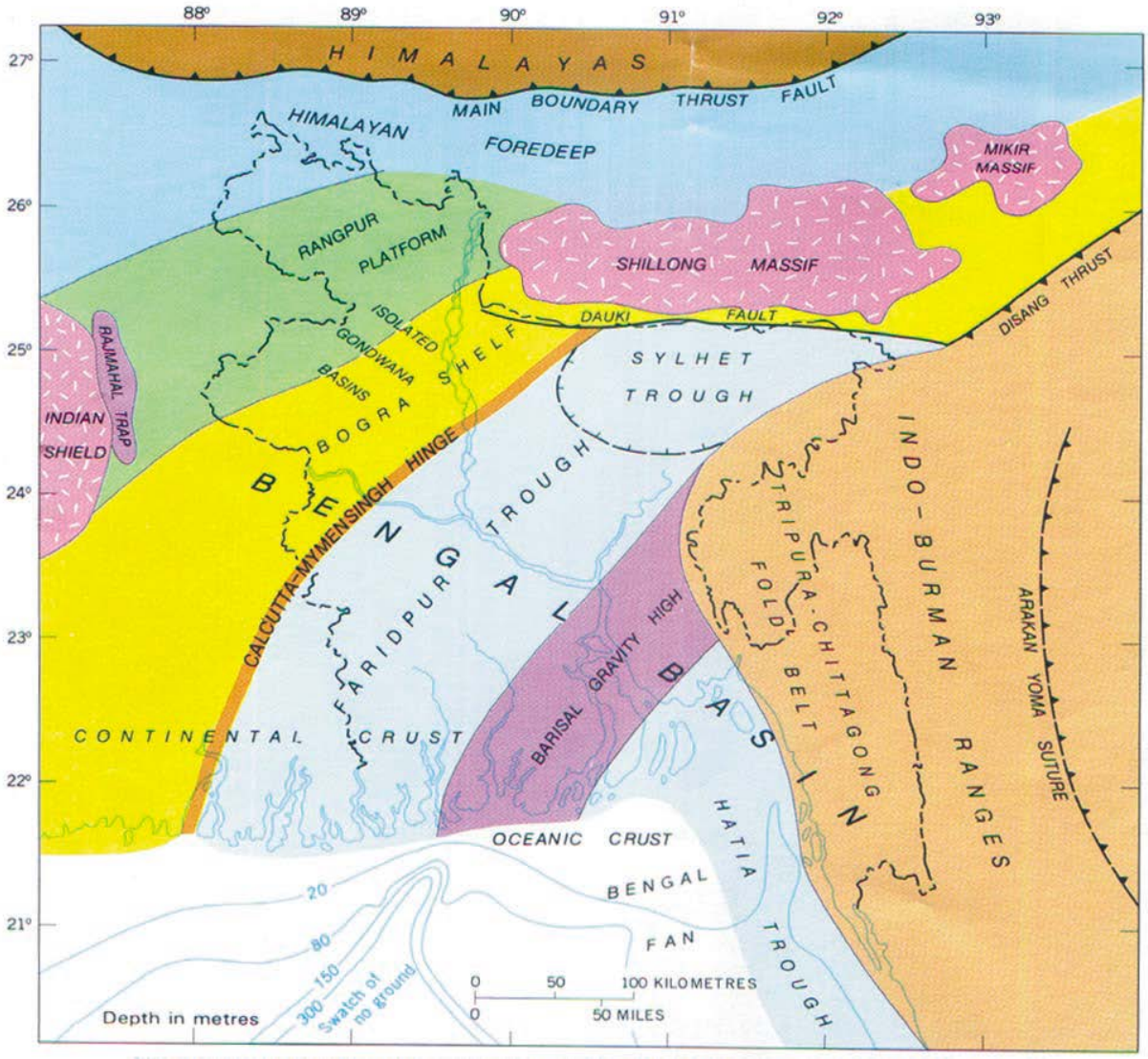


Figure: Tectonic setting of the Bengal basin

The Indian Plate moved eastward and went underneath Eurasian Plate resulting east-west trending Himalayan Rangesin the north and north-south trending folded belts of Arakan-Yoma and Naga Lushai Ranges in the east. This happened possibly during Oligocene. The ranges came into prominent during the late phases of Himalayan upliftment in Plio-Pleistocene.

The regional strike of the folds trends in NNW-SSE direction. The folding of this zone is of complex type and possesses a number of peculiarities such as box and ridge like form of anticline, striking difference in width of syncline and anticlines, and en-echelon arrangement of structures.

Figure: Geological Structures of the eastern part of Bangladesh and surroundings.

Topographic conditions

Maheshkhali is the only hilly island in Bangladesh with an area of 362.18 sq km. Total length of the island is 30 km in N-S direction with a width of 12 km in E-W direction. The length of N-S align hilly ranges is almost 27 km. About 13,684 ha of Maheshkhali Island are covered by hills and hillocks with an elevation of 60 to 100 m. The plain land covers an area of 10,803 ha which extents mostly N-S and western side of Maheshkhali Island with elevation ranging from 10 to 15 m above MSL. Remaining about 4,013 ha of Sonadia Island and the southwestern part of the Maheshkhali Island are regularly

flooded with 2-3 m tidal effects. The western and south-western on shore line of this island is vastly covered with mangrove forest which is reducing year after year. Shrimp farmer or salt farmer has mainly encroached upon the mangrove forest of the islands.

2.1.7 Hydrology and Water Resources

☑ **Surface Water**

There are few rivers namely Matamuhuri River, Moheshkhali Channel, Kohelia Channel and plenty of water bodies with small creeks and channels. Rivers originates from the Chittagong hill tracts moving westward and finally outfalled at the Bay of Bengal. About 35 km long Maheshkhali channel flowswards south widening while meeting with the Bay of Bengal. A number of rivers and khals like Bura Matherbari River, Matherbari River, Bakkhali river etc are feeding the Maheshkhali channel with huge fresh water and sediments. The nearest river is Kohelia Channel which is less than 1 km far from the Moheshkhali Site 1 (EZ Site 8) and from Moheshkhali Channel the Moheshkhali Site 2 (EZ Site 9) is onely 500 meters far. Both of the river and channel originated from Matamuhuri River and flows towards South and falls into the Bay of Bengal.

☑ **Ground Water**

Weathering, deforestation, hill cutting, landslide, debris falls, land use change and erosion of the hills are accelerating the sediment deposition on the foothills especially the western part of Maheshkhali. High porosity of surface soil and huge rainfall make opportunities to reserve enough fresh water. Geographically the average rate of recharge is about 600 mm per annum. Ground water is available from 100 ft to 450 ft for using hand tube well that may fluctuate with temporal and spatial variation. The level of salinity in ground water remains zero round the year.

Deep well boring in the foothills plain land of Maheshkhali facilitates to the communities with continuous release of fresh water. About 500ft to 800ft boring is necessary to get this highly pressured fresh water reservoir on the plain land. In addition some time, 1200ft to 1500ft boring is required to obtain deep ground water because of land elevation and aquifer status. This deep ground water is like spring water flowing continuously but varies with changing seasons. Most of the agricultural field especially betel leaf garden (bozra) depend on this water. The tidal influence is dominated with silty clay with significant slope gradient. However, saline water penetration and contamination of ground water are not found in Maheshkhali Island.

☑ **License for tube well**

The Ground Water Management Ordinance, 1985 revealed the following guidelines for water exploration through deep tubewell.

5. (1) No tube well shall be installed in any place without a license granted by the Upazila Parishad.
(2) An application for license for installation of a tube well shall be made to the Upazila Parishad in such form as may be prescribed.
(3) No application shall be entertained by the Upazila Parishad unless it is accompanied by such fee as may be prescribed.
(4) On receipt of an application for license, the Upazila Parishad shall direct the Committee Parliamentary to hold a local enquiry and submit a report on the following points, namely:-

- The aquifer condition of the soil where the tube well is to be installed;
- The Justice distance of the nearest existing tube well;

- The area likely to be benefited by the tube well;
- The likely effect on the existing tube wells including tube wells used for domestic purpose;
- The suitability of the site for installation of the tube well;
- The conditions on which a license, if any, may be granted.

(5) If, on consideration of the report of the Committee, the Upazila Parishad is satisfied that the installation of tube well applied for-

(a)Will be beneficial to the areas for which it is to be installed, or
(b) Will not have any adverse effect upon the surrounding area, or
(c) Is otherwise feasible,

It may grant the license applied for.
(6) A license granted under sub-section (5) shall be in such Bangladesh form as may be prescribed and shall be subject to such conditions as may be specified therein.
(7) Any person aggrieved by the decision of the Upazila Parishad may file an application to such authority as may be prescribed for review of the decision and the decision of that authority on such review shall be final.

2.2.1 Flora

Within the EZ Site (1 & 2) at Maheshkhali Upazila, there are various natural terrestrial habitats. The project area is similar to the character to many areas of alluvial delta in Bangladesh with mixed crop vegetation. Rice, other grains and seasonal vegetables are the main crops in this area. Other than agriculture no forestland is involved in this area. As a mix marine and high land habitats, many different types of plant species are found. From site observation, But in the adjacent area some local plant species was found and there is no forest cover or planned tree plantation area adjacent to the project site.

Table 2.2.1 (a): List of Flora of Moheshkhali EZ Site 1 & 2

Scientific Name	**Common Name**	**Status (T: Threatened, E: Endangered)**
Artocarpus heterophyllus	Jackfruit	-
Magifera indica	Mango	-
Cocos nucifera	Coconut	-
Areca catechu	Betel Nut	-
Carica papaya	Papaya	-
Litchi chinenses	Lichi	-
Ananas comosus	Pineapple	-
Shorea robusta	Sal	-
Albizzia procera	Koroy	-
Butea monosperna	Palash	-
Moringa obifera	Sajna	-
Tamarandis indica	Tetul	-
Azadirachta indica	Neem	-
Barringtonia acutangula	Hijol	-
Erythrina veriegata	Mandar	-
Anthocephalus cadamba	Kadam	-
Ficus bengalensis	Banyan	-
Delonix regia	Krishnachura	-
Polyalathia longifolia	Debdaru	-
Tecona grandis	Segun	-
Telenthera philoxeroides	Kachuripana	-

Lemna paucicastata	Khudipana	-
Lemna paucicastata	Khudipana	-
Telenthera philoxeroides	Kachuripana	-

2.2.2 Protected Areas

Protected areas refers tidal flats, Primitive Forests, Bird Sanctuaries, Game Reserves, National parks, Historic sites & ruins etc. Bangladesh has nineteen nationally designated protected areas comprising approximately 2,458 km, which is 1.66 percent of land area of the country. These include ten national parks, eight wildlife sanctuaries and one game reserve (CBD, 2010). There is no protected area in 15 km radius of project sites. The proposed EZ sites Moheshkhali 1 and Moheshkhali 2 is 16 km and 20 km far from the Sonadia Island which is one of the Environmental Critical Area (ECA) in Bangladesh.

Under the Environmental Conservation Act (ECA), ecologically sensitive and precious areas are designated as ECAs (Ecologically Critical Areas) by Department of Environment in Bangladesh in cases where an ecosystem or biodiversity area is considered to be threatened to reach a critical state. On the other hand, protected areas such as national parks and protected forests are designated by Department of Forest under the Wildlife Order and Forest Act.

ECAs focus more on the importance and diversity of species and ecosystem and target any ecologically sensitive areas except for the protected areas designated by Department of Forest. Along with the ECAs declaration, each ECAs has notifications declared by Department of Environment in which specific activities to be restricted in that ECA are specified.

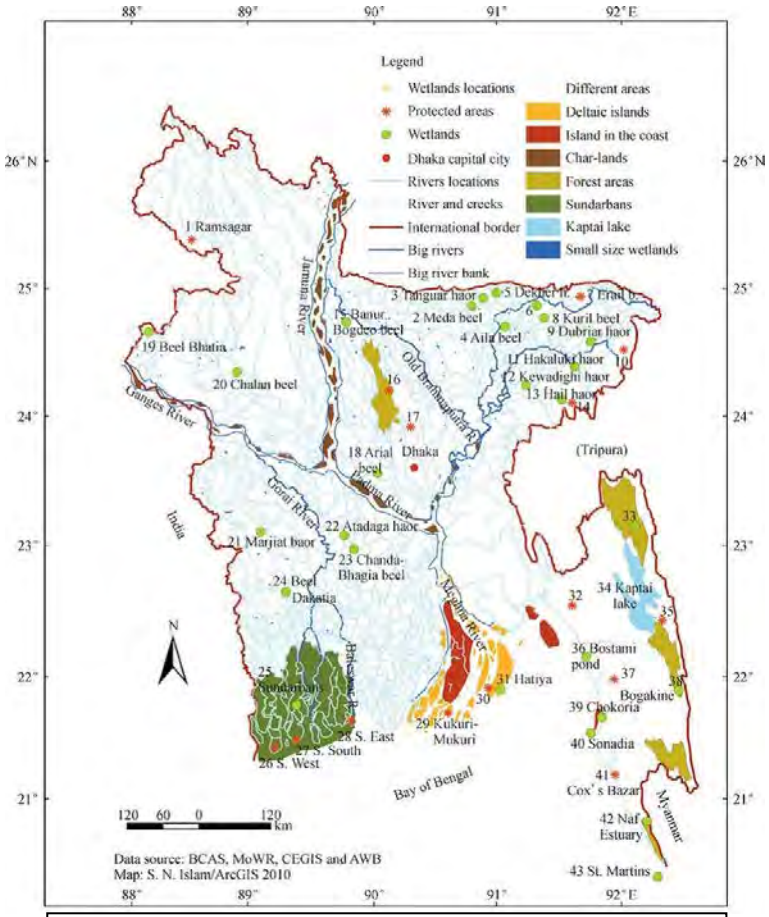


Figure 2.2.2 (a) : Location of Ecologically Critical Areas (ECA) in Bangladesh Sonadia (location 40)

Table: List of ECAs are as follows:

Sl. No.	ECA Name	Ecosystem Type	Location	Area (ha.)	Declaration
01.	Sundarbans Reserved Forest as a whole and 10 km landward periphery	Coastal Marine	Bagerhat, Khulna	292,926	30/08/1999
02.	Cox's Bazar- Teknaf Peninsula	Coastal- Marine	Cox's Bazar	20,373	19/04/1999
03.	St. Martin' Island	Marine Island with	Cox's Bazar	1,214	19/04/1999

		Coral Reefs			
04.	Sonadia Island	Marine Island	Cox's Bazar	10,298	19/04/1999
05.	Hakaluki Haor	Inland Fresh Water Wetland	Sylhet and Moulavibazar	40,466	19/04/1999
06.	Tanguar Haor	Inland Fresh Water Wetland	Sunamganj	9,979	19/04/1999
07.	Marjat Baor	Ox-bow Lake	Jhenaidah	325	19/04/1999
08.	Gulshan- Baridhara Lake	Urban Wetland	Dhaka City	101	26/11/2001
09.	Buriganga	River	Dhaka	Total area of 4 rivers is 7,607	01/09/2009
10.	Turag	River	Dhaka		01/09/2009
11.	Sitalakhya	River	Dhaka		01/09/2009
12.	Balu	River	Dhaka		01/09/2009
	Total Area Under ECA			383,105	

Source: DoE, 2012

Figure 2.2.2 (b): Map showing the protected areas of Bangladesh, (Source: CBD 4th assessment report, 2010

☑ **List of Protected areas in Bangladesh**

Table 2.2.2 (a): Protected areas of Bangladesh

Name of Protected Areas	Habitat Types	Area (ha.)	Year of Notification
National Parks			
1. Ramsagar National Park	Wetland	28	2001
2. Himchari National Park	Mixed Evergreen	1,729	1980
3. Bhawal National Park	Deciduous Forest	5,022	1974/1982
4. Madhupur National Park	Deciduous Forest	8,436	1962/1982
5. Lawachara National Park	Mixed Evergreen	1,250	1996
6. Kaptai National Park	Wetland	5,464	1999
7. Nijhum Dweep National Park	Mangrove Forest	16,352	2001
8. Meda Kacchapia National Park	High Hill Mixed Forest	396	2004
9. Shatchari National Park	Evergreen	243	2006
10. Khadim Nagar National Park	Mixed Evergreen	679	2006
Wildlife Sanctuary			
11. Char Kukri-Mukri Wildlife Sanctuary	Char land & Mangrove Forest	40	1981
12. Pablakhali Wildlife Sanctuary	High Hill Mixed Forest	42,087	1962/1983
13. Chunati Wildlife Sanctuary	Mixed Evergreen Forest	7,764	1986
14. Sundarban East Wildlife Sanctuary *	Mangrove Forest	31,227	1960/1996
15. Sundarbans South Wildlife Sanctuary *	Mangrove Forest	36,970	1996
16. Sundarbans West Wildlife Sanctuary *	Mangrove Forest	71,502	1996
17. Rema-Kalenga Wildlife Sanctuary	Mixed Evergreen forest	1,796	1996
18. Fasiakhali Wildlife Sanctuary	Mixed Forest	1302	2007
Game Reserve			
19. Teknaf Game Reserve	Mixed forest	11,615	1983

*= also designated as RAMSAR site, (Source: CBD 4th assessment report, 2010)

2.2.3 Fauna

The biodiversity condition of the selected sites is poor and the species diversity is also low because of the absence of forest cover in and at the 15 km radius of both sites. Another factor behind this is the aggression of industrial activity. However a few faunal species can able to survive that are enlisted below

Most of the people of Moheshkhali area are dependent on fishing in the Bay of Bengal. It is reported that, fish availability in the Bay of Bengal is gradually reducing. The preferred species for fishing are major and minor saline water species. In general, the country has 296 species of fish in sweet water and saline water and 511 species of sea fish, including shrimp. Since abundant of fishes were in the rivers and water bodies, it is a very good resource for fish production, but population explosion during the past decades and use of huge waters for cultivation, widespread use of pesticides in agriculture and pollution of waters by industrialization had a great impact in the decline of fish. However, the total species of fishes, 54 species were endangered critically and 12 species are designated vulnerable.

Table 2.2.3 (a): List of Fish at Maheshkhali EZ Site1 & 2

Scientific Name	**Common Name**	**Types of Fauna**
Liza subviridis	*Bata*	Fishes
Sardinella fimbriata	Khaira	"
Stolephorus tri	Kata Phasa	"
Rynchorhamphus	Ek Thute	"
Pampus chinensis	Rup Chanda	"
Aetomylaeus nichofii	Shankachile	"

Thunnus albacores	Tuna	"
Harpodon nehereus	Loittya	"
Protonibea diacanthus	Kala Poa	"
Euthynnus affiniss	Bom Maitta	"
Dasyattis kuhlii	Sapla Pata	"
Thryssa setirostris	Phasa	

According to IUCN a total of 77 species of birds in the rainy season and 103 species of birds in the dry season recorded in the Maheshkhali Island of which no threatened species has been identified. Whereas, a total of 15,933 birds of 52 species have been spotted of which 37 are migratory species in Cox's Bazar by census of aquatic bird (The Daily Star[1]) Birds unusually seen in the Sonadia Island and Moheshkhali Island are Spoon-billed sandpiper and Nordmann's greenshank, two endangered species were spotted at Sonadia Island. Alokardia and Belekardia in Sondia Island[2] and Taziakatarchar and Paikdia in Maheshkhali Island are considered as habitats of these bird species.

Table 2.2.2 (b): List of Bird species seen in EZ Sites

Scientific Name	**Common Name**	**Types of Birds**
Corvus splendens	Crow	Common
Passer domesticus	Charui	Common
Orthotomus sutorius	Tuntuni	Common
Acridotheres tristis	Bhat Shalik	Common
Copsychus saularis	Doel	Common
Streptopelia chinensis	Tila ghugu	Common
Psillacula krameri	Tia	Common
Haliaster indus	Kite	Common
Alcedo atthis	Machranga	Common
Ardeola grayii	Pond heron	Common
Cuculus microplerus	Cuckoo	Common
Oriolus xanthornus	Haldey pakhi	Common
Amaurorinus phoenicurus	Dahuk	Common
Picus myrmecophoneus	Kath thokra	Common
Tringa guttifer	Nordmann's greenshank	Endangered
Calidris pygmaea	Spoon-billed sandpiper	Endangered

Source: Site observation and consultation of local people

Mammals, Reptiles & Amphibian:

Mammals for example Bat, Jackal, Mongoose, Rat, House mouse, Fishing Cat, Jungle Cat, Gibbon etc. are mostly seen within the Proposed EZ sites. On the other hand reptiles water snake, cobra, Gharghiri snake are mostly seen within the areas. Among, amphibians bull frog, skipper frog and common toad mostly seen[3].

[1] http://www.thedailystar.net/news-detail-74002
[2] http://www.ioseaturtles.org/pom_detail.php?id=93
[3] http://www.thedailystar.net/news-detail-229288

Scientific Name	**Common Name**	**Type of Mammals, Reptiles and Amphibian**
Morenia peterci	Bengal-eyed turtle	
Chelonia mydas	Green turtle	
Lepidochelys olivacea	Olive Ridley	
Lissemys puctata	Indian flap shell turtle	
Calotes versicolor	Garden lizard	
Mabuya carinata	Common skink	
Gekko gecko	Common gecko	
Hemidactylus brooki	House lizard	
Pelamis platurus	Yellow-bellied sea snake	
Hydophis obscurus	Estuarine sea snake	
Hoplobatrachus tigerinus	Bull frog	
Euphlyctis cyanophlyctis	Skipper frog	
Kaloula pulchra)	Climber frog	

2.4 Existing (and planned) infrastructures

2.4.1 Roads

The Maheshkhali Upazia is connected with the main land by a bridge on the river Bakh-Khali. By road from Chittagong: Distance from Chittagong to Chakoria is 140 Km, and Chakoria to northern side of the Project is another 25 Km. whereas, by road from Cox's Baazar: Distance from Cox's Baazar to Chakoria is 40 Km.

Maheshkhali Upazila Parishad is located on the south-eastern part which is the nearest point of Cox's Bazaar city. Total Maheshkhali island is intra-connected with different type of road. Most of the roads are not well maintained. Maheshkhali island is connected with Chakoria Upazila through Bodarkhali bridge. Zila road enters into Maheshkhali through the eastern side, move straightly besides the western foot hills, passes through a number of Union and connects with Maheshkhali Upazila head quarter. A number of water control structure like bridges, culverts, flood pass has been constructed across this about 24 km pucca road. There is around 15 km semi pucca road used for internal communication. Eastern part of Maheshkhali is linked with this semi pucca and katcha roads. About 135 km katcha roads are used as a network in villages, crop fields, shrimp farms, salt farms, betel garden, boat stations etc.

Among ongoing road construction project taken by the government is a 44 km four lane road from Cox's Bazar to Moheshkhlali Island and a 640 meter bridge on the Kohelia River construction project to connect Matarbari Coal fired 1200 MW Power plant. The project cost would be invest BDT 6.07 billion and approximate date of accomplishment December 2019.The Roads and Highways Department (RHD) will construct to connect the island with the midland. Of the total cost the Japan International Cooperation Agency (JICA) would provide BDT 5.05 billion fund as soft loan[4].

[4] http://lankabd.com/dse/stock-market/news/Four-lane-road-to-connect-Cox%27s-Bazar-with-Maheshkhali?storyId=28794

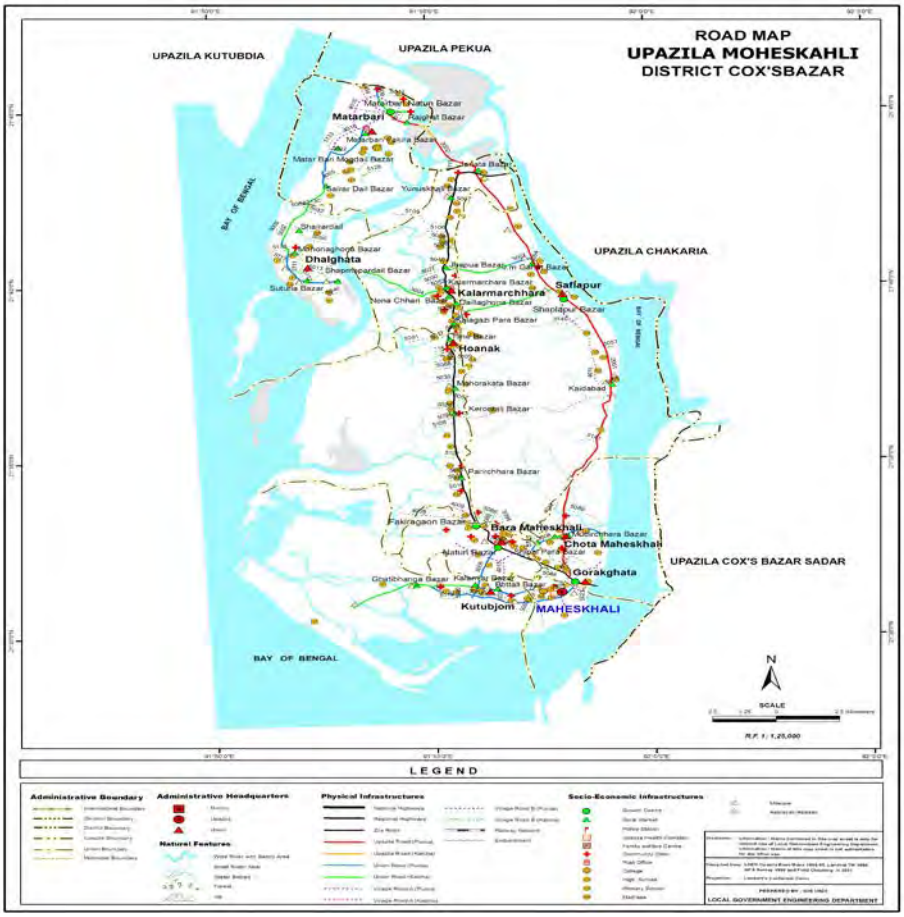


Figure 2.4.1: Road Network around Moheshkhali Site

2.4.2 Railway

Bangladesh Railway is the state-owned rail transport agency of Bangladesh that operates and maintains the entire railway network of the country since 15 November 1862. The Railway department encompasses a total 2877.10 km of railway line network (Bangladesh Railway, 2016). Also, the railway line bearing capacity of 710 million tons (per km) of goods annually (World Bank 2013). The railway sector has potential for regional connectivity provided that gauge, track structure, and signal constraints are addressed. The broad gauge rail corridors between Bangladesh and India are not active. Presently there is no rail communication in Cox's Bazar district as well as Maheshkhali Upazial. So far the only a single meter gauge train route goes up to Dohazari Railway station of Satkhania Upazial which is almost 50 km far from the Cox's Bazar District. However, Government of Bangladesh has implementing a project considered as 'First Track' Project entitled "Construction of Single Line Dual Gauge (DG) Railway Track from Dohazari to Cox's Bazar City via Ramu and Ramu to Gundum near Myanmar". This first track project started in 2010 and probable project accomplishment duration is 2022. In addition proposed Sonadia Island deep sea port is also considered for construction of necessary railway network and facilities to connect the Deep Sea port with national railway network.

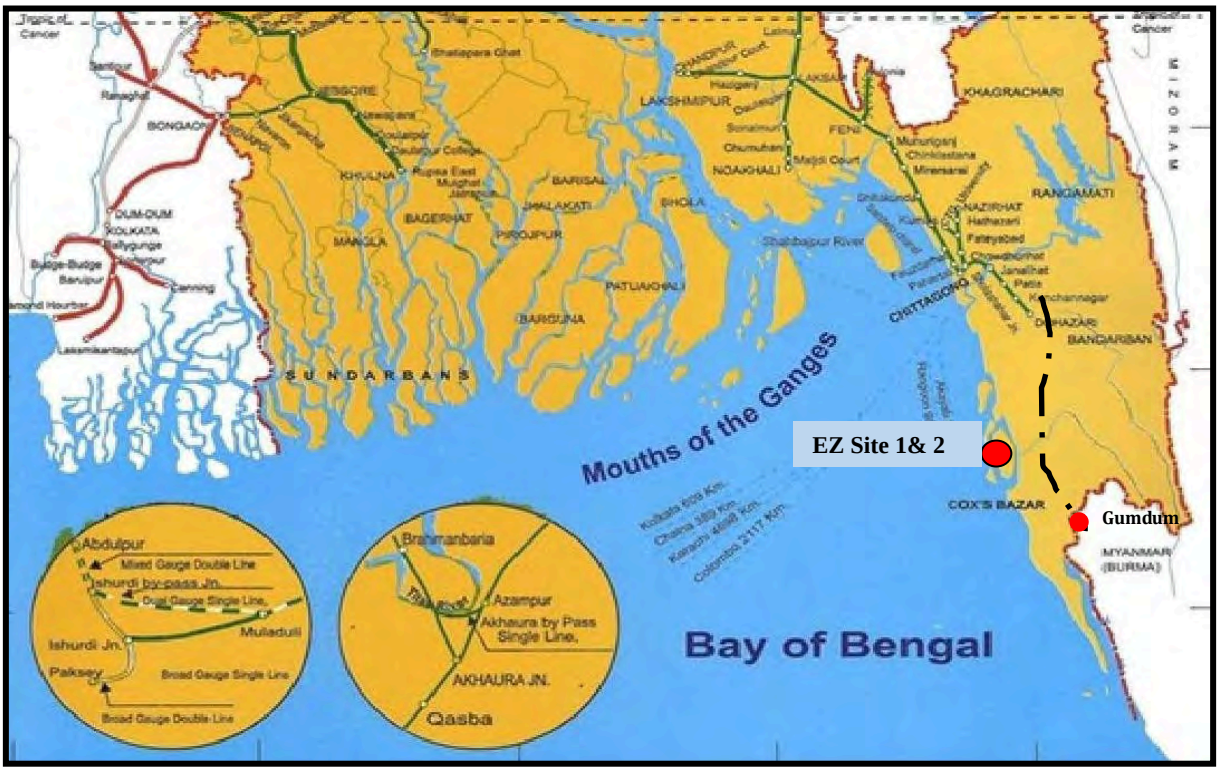


Figure 2.4.2: Map shows the railway network of Southern Part of Bangladesh, (Source: www.railway.gov.bd)

2.4.3 Ports and Harbors

No country can live in isolation in the advent of globalization and port is used as the medium to entrance in a global market by import & export of necessary goods. Currently in Bangladesh, there are 20 land ports and 3 sea ports (Chittagong, Mongla and Payra). Government planned to establish a deep sea port in Sonadia Island. Along with the land and sea port, Bangladesh has some river port and container terminal also.

The principal maritime port of Bangladesh is Chittagong, handling about 95% of the country's sea borne exports

The EZ sites located near the principal maritime port: The Chittagong Sea Port, handling about 97% or the country's sea borne exports located approximate distance is 100 km (from Maheshkhali EZ Sites). Whereas the Teknaf land port is 150 km (approx.) from Proposed EZ sites (1&2) at Maheshkhali.

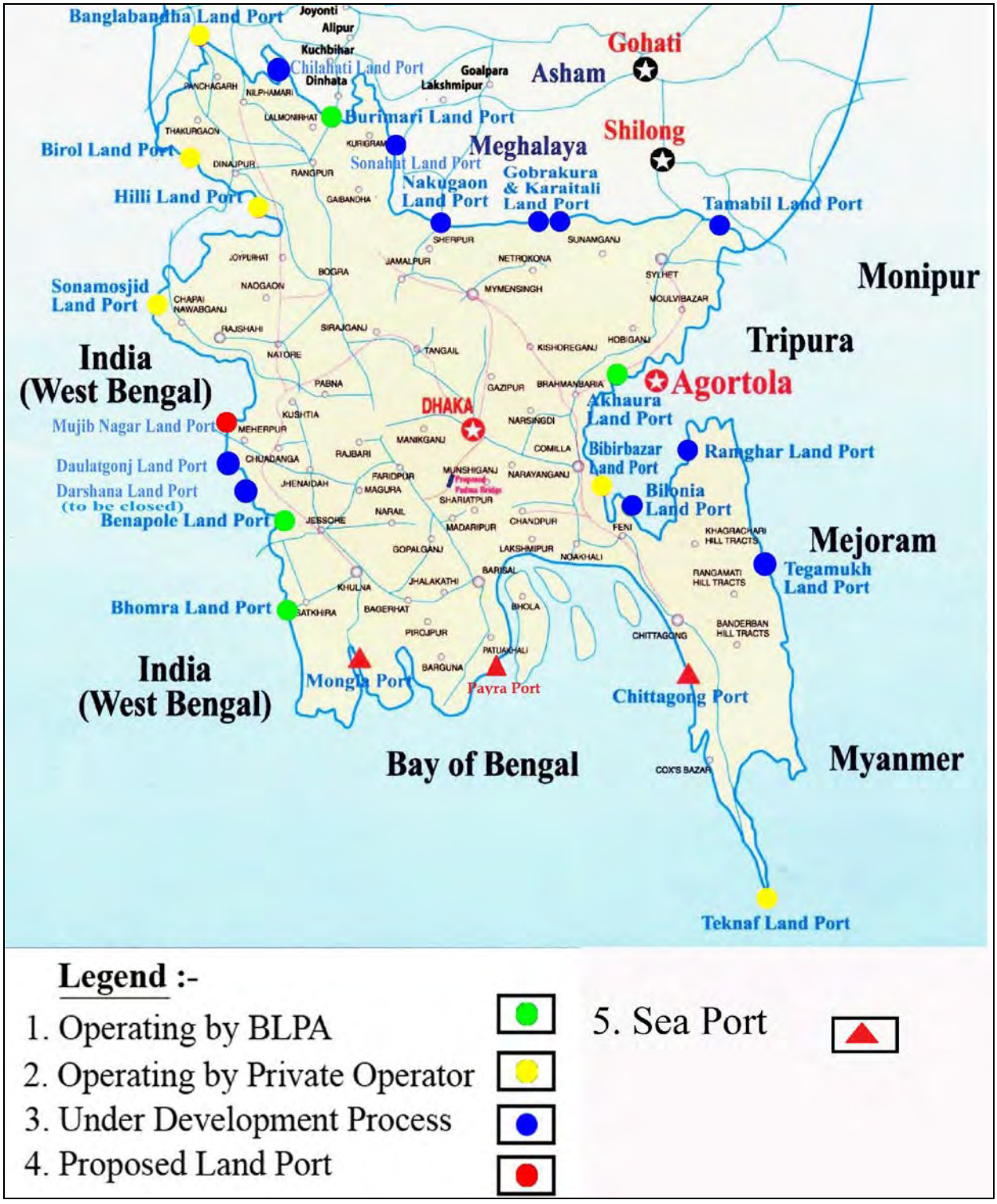


Figure 2.4.3: Map showing the ports of Bangladesh, (source: blpa.gov.bd)

2.4.4 Water Supply System

Policy implementation

Drinking water supply and sanitation is a sub sector within the broader sector of health, environment and water and as such the National Policy in this sub sector shall be made consistent with the national policy for health, environment and water.

Future investment projects in the public sector shall be made within the framework of this policy as far as practicable. Endeavors will be made to coordinate the activities of private sector and NGOs

through the Policy. Projects or activities undertaken at the level of the individual, community or organization will be coordinated by the Local Government Division within the framework of the Policy. In particular foreign aided projects where it is specifically required as a component of overall infrastructure package; LGED may undertake water supply and sanitation related activities. In such project-based cases LGED shall assist the concerned Paurasabha in the implementation and provide technical assistance.
Relevant WASAs will be responsible for water supply and sanitation in Dhaka and Chittagong city areas. Involvement of the private sector in these activities will be explored and examined.
Local Government bodies like Zilla Parisahad, Upazila Parishad, Union Parishad and Gram Parishad will be gradually provided with more scope to contribute in the activities of this sub sector.

Institutional arrangement
As regards water supply and sanitation sub-sector the Local Government Division will be responsible for overall planning, identification of investment projects and coordination of activities of agencies under it (viz. DPHE, LGED, WASAs) and local government bodies, private sector, NGOs and CBOs (community Based Organizations). But each of the relevant organizations/institutions will be responsible for its own activities. To coordinate, monitor and evaluate the activities of the sector and to determine future work programme Local Government Division will constitute a forum with representatives from relevant organizations.

Except Dhaka and Chittagong city areas DPHE will be responsible for the water supply and sanitation of the whole country. In other urban areas the Department of Public Health Engineering will solely or jointly with the Paurasabha be responsible for such services. In urban areas DPHE will be responsible for assisting the Paurasabhas and City Corporations (except in the cities of Dhaka and Chittagong) through infrastructures development and technical assistance as may be necessary. Besides, both in rural and urban areas, DPHE will increasingly collaborate with private sector, NGOs and CBOs.

2.4.5 Natural Gas Pipeline

The natural gas transmission pipeline infrastructure in Bangladesh represents a complex mechanical system that delivers about 1900 MMSCF of natural gas per day, and is made up of over 1400 km (870 miles) of pipe. This system has been developed over the last few years, and is controlled at a very low level of sophistication. (Source: GTCL.gov.bd)
Currently four companies of Petro Bangla are responsible for transmission and distribution:

1. Jalalabad Gas Transmission and Distribution Company limited (JGTDGL).
2. Titas Gas Transmission and Distribution Company limited (TGTDCL)
3. Bakharabad Gas System Limited (BGSL)
4. Paschimanchal Gas Company Limited (PGCL)

Over the last five years about 393 KM high pressure pipe line has been laid in different areas of the country. A compressed station has been installed at Muchai for boosting pressure of transmission pipe line. This has improved the pipe line pressure as well as enables the network to transmit gas from the upstream. Besides a compressor station is being commissioned and installation of another compressor station will be completed very soon.

Table 2.4.5 (a): Existing Gas Transmission and Condensate Pipelines:

Sl No.	Pipeline Name	Length (KM)	Diameter (INCH)	Transmission Capacity (MMCFD)	Pressure (PSIG)
1	North-South Gas Transmission Pipeline	175	24	330	1050
2	A-B Gas Transmission Pipeline	58.50	30	425	1000
3	Western Gas Transmission Pipeline (a) Bangabandu Bridge (b) Elenga-Nalka (c) Nalka-Baghabari	9.00 28.50 35.50	30 24 20	300 250 250	1000

4	Beanibazar- kailashtila Gas Transmission Pipeline	18	20	250	1050
5	Rasidpur-Ashugang Gas Transmission Pipe-line (a) Ashuganj-Habiganj (b) Rasidpur-Habiganj	54.00 28.00	30 30	500 500	1050 1050
6	Nalka-Bogra Gas Transmission Pipeline(a) Nalka-Hatikumrul (b) Hatikumrul-Bogra	6.00 54.00	30 20	425 225	1000 1000
7	Monohordi-Dhanua Elenga Pipeline (1st Phase)	51.00	30	750	1000
8	Bakhrabad-Demra Gas Transmission Pipe-line	68.72	20	250	1000
9	Bakhrabad-ChittagongGas Transmission Pipeline	174.65	24	300	1000
10	Ashugang-Elenga Gas Transmission Pipeline	124.00	24	330	960
11	Ashugang-Monohardi Gas Transmission Pipeline	37.00	30	425	1000
12	Dhaka Clean Fuel (GTCL Part) Gas Trans-mission Pipeline	60.00	20	425	1000
13	Bonpara-Rajshahi Gas Transmission Pipeline Project.	53.00	12	450	1000
14	Hatikumrul-Bheramara Gas Transmission Pipeline Project (Section A & B)	78	30	400	1000
15	Construction of 24" Dia 8 km Gas Transmis-sion Pipeline from Titas Gas Field to AB Pipeline Project	8.00	24	330	1050
16	Construction of Gas Transmission Pipeline from Srikail Gas Field (Location-2) to A-B Pipeline Project	1.50	20	250	1000
17	Construction of Bibiyana-Dhanua Gas Transmission Pipeline.	137	36	640	1000
18	Bakhrabad-Siddhirganj Gas Transmission Pipeline Project.	60.00	30	450	1000
19	Construction of Gas Transmission Pipeline from Titas Gas Fields (Location C-B-A) to intake point of Titas-AB Pipeline at Chaya-baria.	7.7	10	250	1000
20	Gas Transmission Capacity Expansion-(Ashuganj to Bakhrabad).	61	30	450	1000
21	**Total**	**1388.07**	-	-	-

(Source: www.gtcl.org.bd/about_pipeline.php)

Table 2.4.5 (b): Existing Condensate Pipeline:

Sl No.	Pipeline Name	Length (KM)	Diameter (INCH)	Transmission Capacity (Barrel/Day)	Pressure (PSIG)
1	North-South Condensate Pipeline	175	6.625	5000	150-250
1	Beanibazar- kailashtila Condensate Pipe-line	18	4	2000	150-250
1	**Total**	193	-	-	-

(Source: www.gtcl.org.bd/about_pipeline.php)

Figure 2.4.5 (a): Gas Transmission Pipeline System in Bangladesh, (Source: www.gtcl.org.bd)

☑ Planned LNG Terminal

Import of LNG Expedited Power & Energy Supply Augmentation (special act) Act 2010 the Government has taken necessary steps for installation of a Floating storage and Regasification Unit (FSRU) at Moheshkhaly on Built-Own Operate -Transfer (BOOT).This FSRU we have an LNG storage capacity of 13800 Cubic meters which will be able to supply about 500 MMscf of gas per day. Presently negotiation is in progress for finalizing contract with a qualified LNG terminal developer. It is expected that on completion of negotiation terminal use agreement will be sign soon and it will be possible to comments supplying re-gasified LNG through this facilities by middle of the year 2016. A 30" dia 90 km long high pressure gas transmission pipeline will be constructed for transport that gas from Moheshkhaly to Chittagong Ring-main. (Source: Petro Bangla)

2.4.6 Power Plants and Power Transmission Lines

☑ **Power Generation Company in Bangladesh**

- ✓ Bangladesh Power Development Board (BPDB)
- ✓ Ashuganj Power Station Company Ltd. (APSCL)
- ✓ Electricity Generation Company of Bangladesh (EGCB)
- ✓ North West Power Generation Company Ltd. (NWPGCL)
- ✓ Independent Power Producers (IPPs)

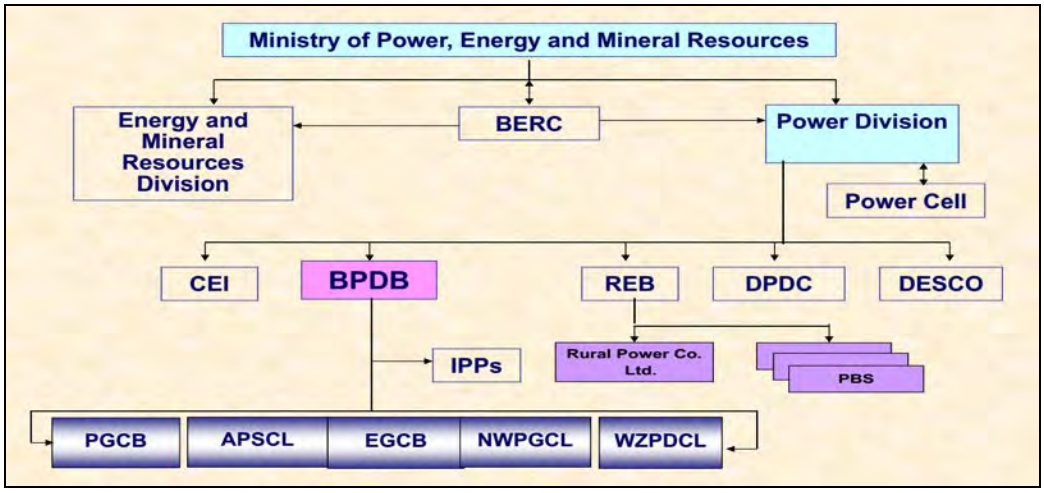
☑ **Transmission**

- ✓ Power Grid Company of Bangladesh Ltd (PGCB)

☑ **Distribution**

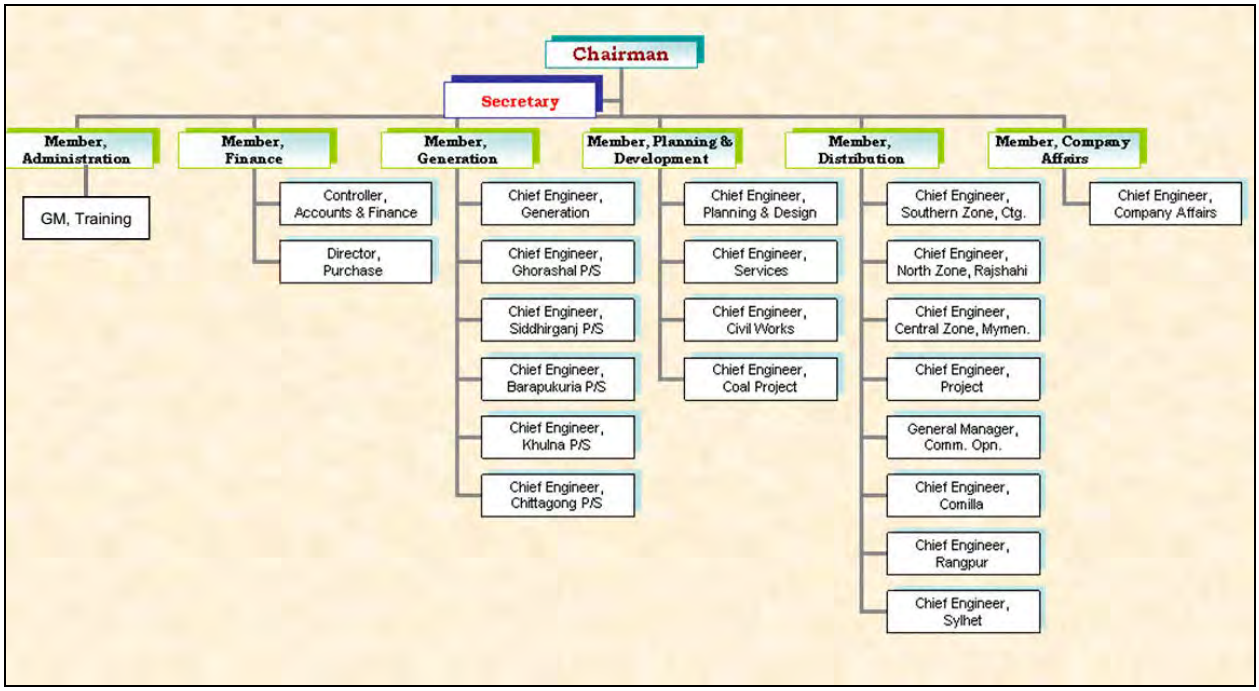
- ✓ Bangladesh Power Development Board (BPDB)
- ✓ Dhaka Power Distribution Company (DPDC)
- ✓ Dhaka Electric Supply Company Ltd (DESCO)
- ✓ West Zone Power Distribution Company (WZPDC)
- ✓ Rural Electrification Board (REB) through Rural Co-operatives

☑ **Present Structure of Power Sector**



(Source: BPDB, 2011)

☑ **Managemernt Structure of BPDB**



(Source: BPDB, 2011)

☑ **Power Generating Stations of Bangladesh**

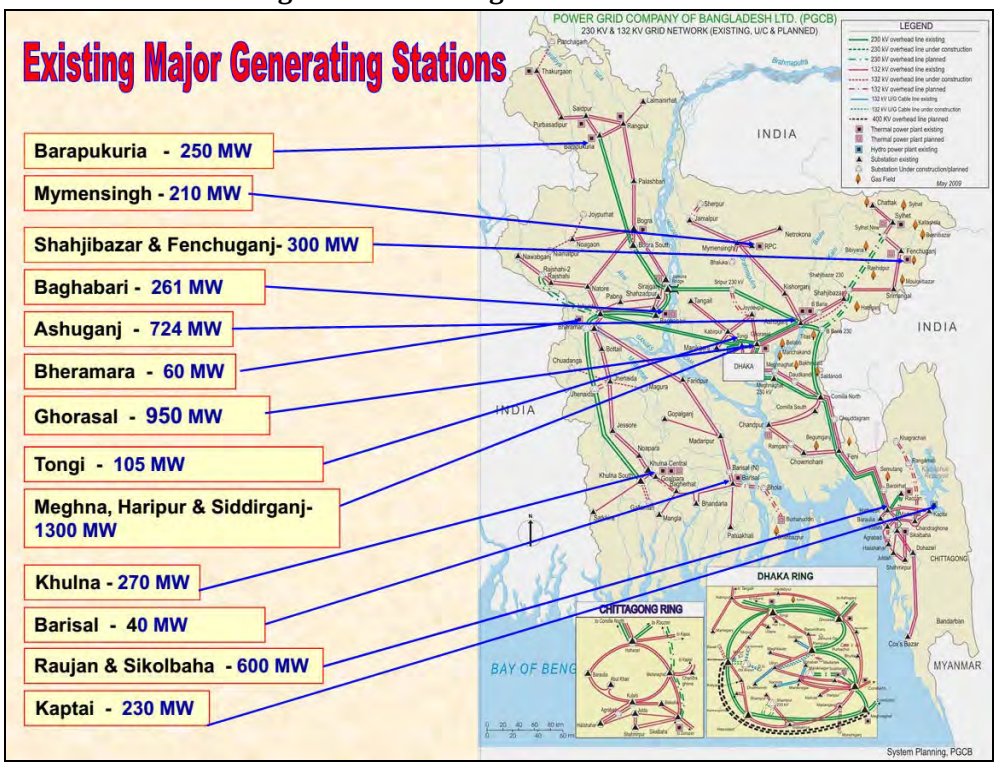


Figure 2.4.6: Power Generation Stations in Bangladesh, (Source: www.gtcl.org.bd)

☑ **Functions of BPDB**

- ✓ Partially integrated public utility
- ✓ Generates power
- ✓ Purchaser & seller of power as a "Single Buyer"
  - Prepare least cost generation expansion plan

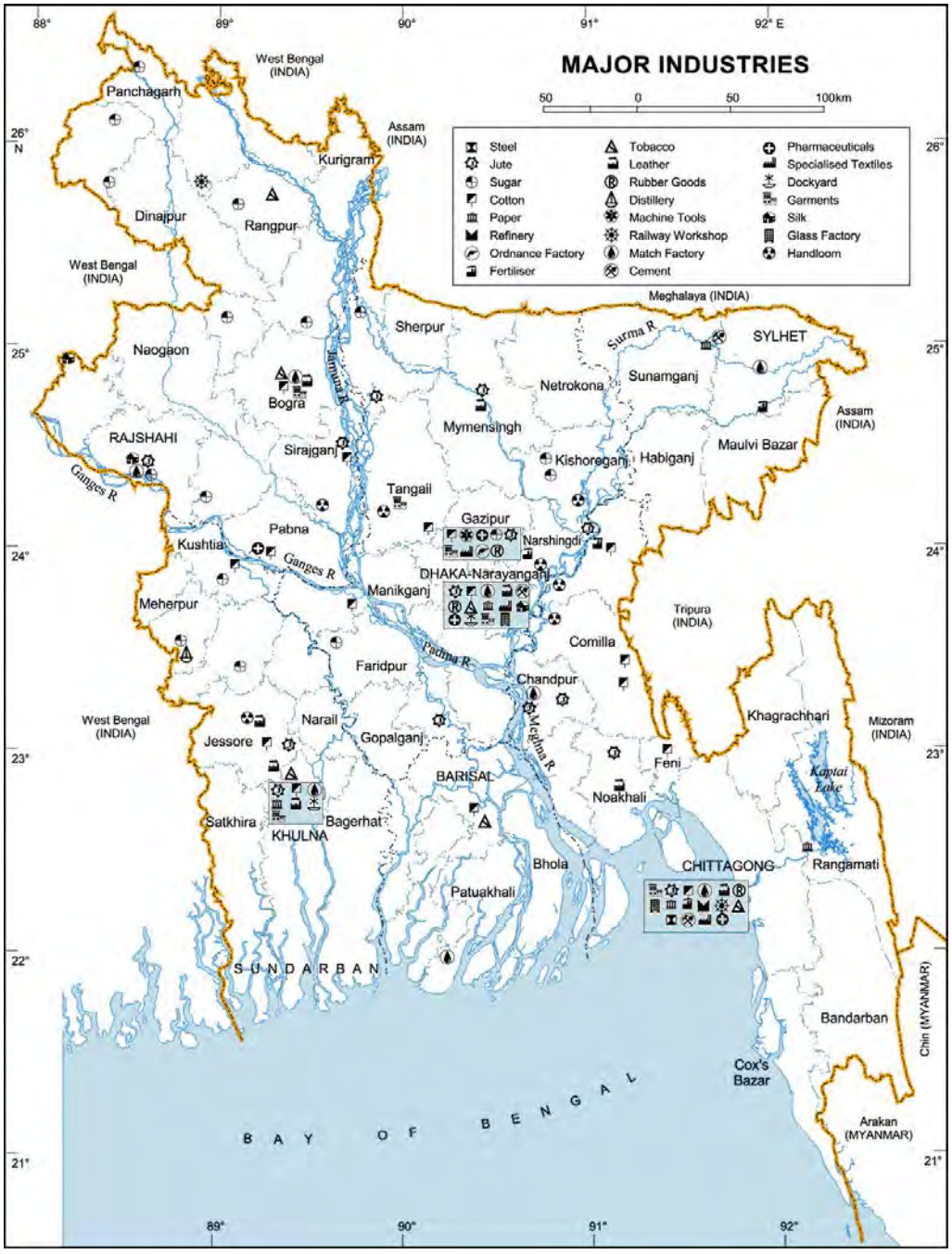
- Construct most of public sector power plants according to least cost plan
- Conduct procurement process for Private Power (IPPs)
- Purchase electricity from generators (public and private)
- Sell to distributors

✓ Distribution business in nation-wide urban areas, except Dhaka and West Zone

2.4.7 Industries and Industrial Park

Chittagong is second largest city of Bangladesh that encompasses huge influx of industries in various industrial parks, industrial estates, government and private export processing zones (EPZ), Bangladesh Small and Cottage Industries Corporation (BSCIC) area and few upcoming Economic Zones. Chittagong EPZ, Karnaphuli EPZ, Korean EPZ, Saad Musa Industrial Park, Chittagong BSCIC etc. are mentionable. Within these industrial parks and EPZ's in Chittagong Division there are steel mill industries, ship breaking industries, textile, oven, finishing, garments and manufacturing industries, machine tool factories, glass factories, jute, cotton, paper, refinery, chemical industries, dockyard, pharmaceutical, power production industries are mostly located and run their activities very successfully.

Figure2.4.7: List of Government EPZ in Bangladesh



2.4.8 Waste Treatment Plants and Facilities

Textile industries (fabric dyeing and chemical treatment industries) are classified according to the Environmental Conservation Rules 1997 as Red category industries, and therefore an ETP must be designed and constructed to treat plant effluent. The effluent from the plant must meet the national effluent discharge quality standards, including the "Quality Standards for Classified Industries", before discharge to the environment. These quality standards must be ensured at the moment of beginning trial production. The waste discharge standards differ according to the final disposal place of the effluent. It is the DOE's mandate to enforce this legislation, and this guide provides the tools required to assess the ETPs proposed by textile industries in the EMP/EIA.

There are various types of ETPs and their design will vary depending on the quantity and quality of the effluent, amount of money available for construction, operation and maintenance, and the amount of land available. There are three mechanisms for treatment which are: Physical, Chemical and Biological. These mechanisms will often be used together in a single ETP. There are generally four levels of treatment, as described below:

• **Preliminary:** Removal of large solids such as rags, sticks, grit and grease that may result in damage to equipment or operational problems (Physical);
• **Primary**: Removal of floating and settable materials, i.e. suspended solids and organic matter (Physical and Chemical);
• **Secondary:** Removal of biodegradable organic matter and suspended solids (Biological and Chemical); and
• **Tertiary:** Removal of residual suspended solids / dissolved solids (Physical, Chemical and Biological)
There are many ways of combining the operations and processes in an ETP:
• A properly designed biological treatment plant, which typically includes screening, equalization, pH control, aeration, and settling, can efficiently satisfy BOD, pH, TSS, oil and grease requirements. However the compounds in industrial effluent may be toxic to the microorganisms so pretreatment may be necessary. Most dyes are complex chemicals and are difficult for microbes to degrade so there is usually very little colour removal.

• Another option is a physico-chemical treatment plant, which typically includes screening, equalization, pH control, chemical storage tanks, mixing unit, flocculation unit, settling unit and sludge dewatering. This type of treatment will remove much of the colour depending on the processes used. It can be difficult to reduce BOD and COD to meet effluent standards and it is not possible to remove TDS.

• Most often, physico-chemical treatment will be combined with biological treatment. The typical components of such a plant are screening, equalization, pH control, chemical storage, mixing, flocculation, primary settling, aeration, and secondary settling. The physico-chemical treatment always comes before the biological treatment units. Using a combination of treatments will generally reduce pollutant levels to below the discharge standards.

• Another form of biological treatment is the reed bed, which can be used with a settling tank, or in combination with other treatment processes It presents a natural method of treating effluent which is often lower in capital, operation and maintenance costs. Reed beds can contribute to a reduction in colour, a decrease in COD, an increase dissolved oxygen and a reduction in heavy metals, but function best with some form of pretreatment.

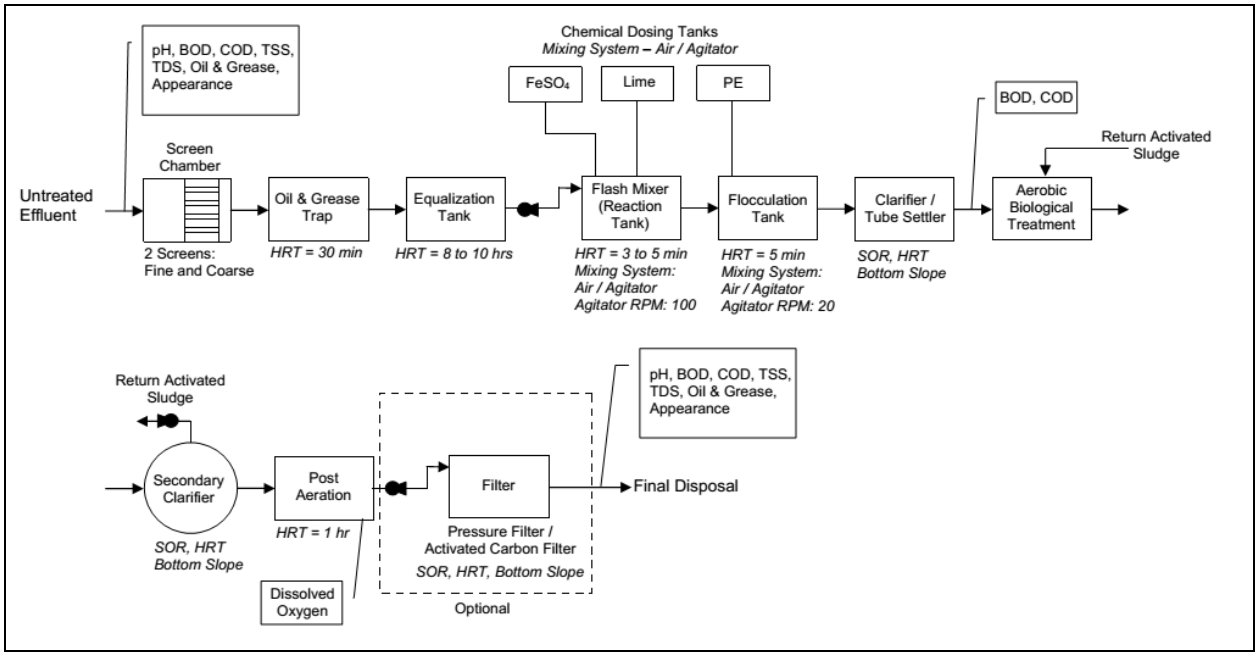


Figure 2.4.8 (a): Flow Diagram for Effluent Treatment Plant and Parameters – Dyeing, Printing Cotton and Blended Textile Products. (Source: ETP Assessment Guideline, DoE)

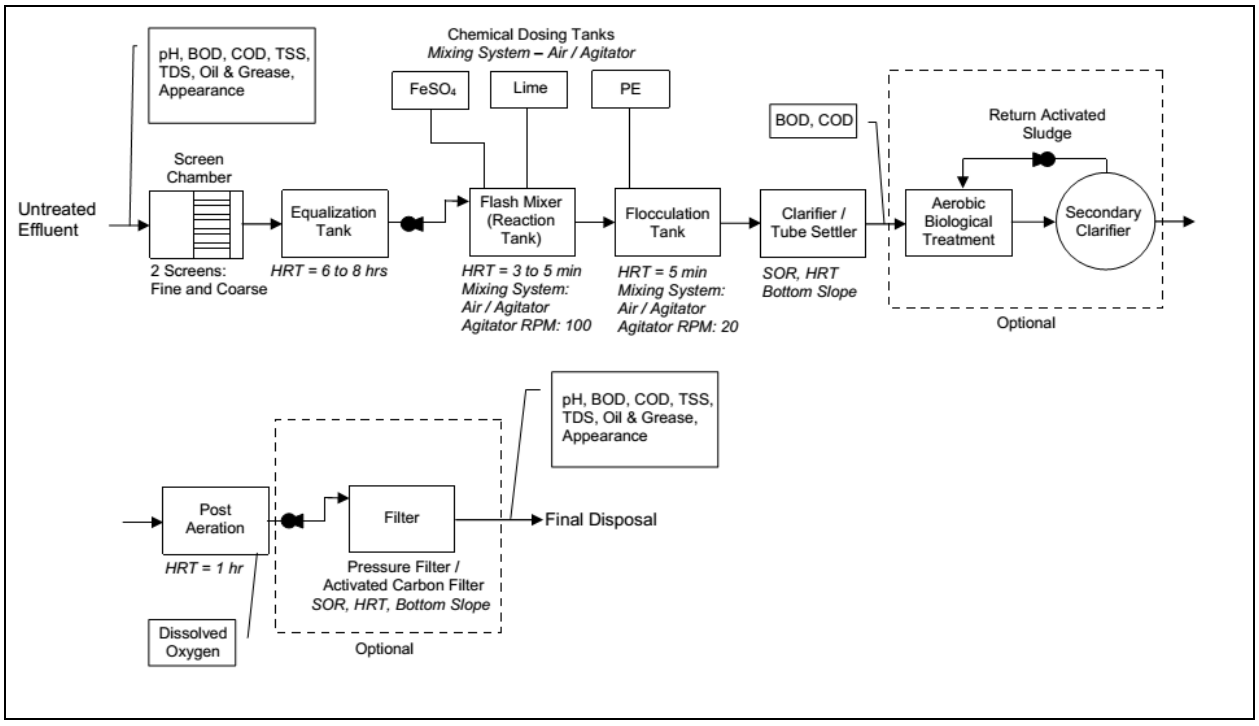


Figure 2.4.8 (a): Flow Diagram for Effluent Treatment Plant and Parameters – Garment Washing Unit, (Source: ETP Assessment Guideline, DoE)

1.2	Environmental norms and criteria	
1.2.1	Ambient air	State them briefly on tables, etc. If not available in Bangladesh, state applicable ones applied by the World Bank or other international authorities.
1.2.2	Waters – Rivers, lakes, seas, groundwater, etc.	
1.2.3	Soils	
1.2.4	Noise and vibration	
1.3	Emission and discharge norms and criteria	
1.3.1	Exhausted gases	
1.3.2	Waste water	
1.3.3	Solid wastes	
1.4	Health and safety systems	
1.5	SEA, IEE and EIA systems	The process and procedure shall be illustrated comprehensively, stating competent authorities, applicants, estimated durations for each process, etc. TOR (or S/W) requested for SEA, IEE and EIA studies especially for projects such as EZ (Economic Zone), IE (industrial Estates), etc. (or Table of contents for SEA, IEE and EIA study reports).
1.6	CDM system including JI, JCM, etc.	Who are competent authorities? What are their roles? International treaties participated by Bangladesh and bilateral agreement between Bangladesh and Japan. Policies, rules and regulation on CO_2 emission in Bangladesh
1.7	Official information disclosure and community participations	State briefly about their laws rules and regulations in Bangladesh
1.8	Land acquisition and resettlement	Who are competent authorities? What are their roles? What are the stakeholders' obligations and responsibilities?
1.9	Material dredging from rives and sea	Licenses, pollution controls, avoidance of riverside & coastal changes, competent authorities, sand discharge pipe networks, etc. In Bangladesh
1.10	Updating of Profile on Environmental and Social Considerations	
1.10.1	Updating of "Profile on Environmental and Social Considerations in Bangladesh, July 2012, JICA" and its Supplement	Review and renewal of the following documents: a. Profile on Environmental and Social Considerations in Bangladesh, July 2012, JICA; and b. Profile on Environmental and Social Considerations in Bangladesh, Supplement, July 2122, JICA
1.10.2	Gaps among JICA, WB and Bangladesh environmental laws, rules and regulations	Review and renew of Tables-G1, G2 and G3 on Profile on "Environmental and Social Considerations in Bangladesh, Supplement, July 2012, JICA"

2. Existing and Present Natures and Social Environments at Project Sites		
2.1	Physical Environment Baseline Conditions	
2.1.1	Ambient Air	Polluted conditions and pollutants including odor in/near each project site

2.1.2	Meteorology and Climate	Ambient air temperature, humidity, rain, wind, thunder, etc. in each project site. Design rainfall and wind speed in Bangladesh.
2.1.3	Extreme Weather Events such as heavy rain, flood, storm surge, etc.	100-years storms in each project site Previous large storm and frequency in each site
2.1.4	Seismicity	Design seismic factors, previous large earthquake, frequency, seismic intensity, magnitude, damages, etc. in each project site
2.1.5	Topography and land use	Description of topographies and land use maps for each project site
2.1.6	Geology and Soils	Polluted conditions and pollutants in each project site
2.1.7	Hydrology and Water Resources – Surface water/Groundwater	Polluted conditions and pollutants in each projects site; Groundwater well spacing and water development regulations in Bangladesh; Land subsidence due to pumping groundwater
2.2	Biological Environmental Baseline Conditions	
2.2.1	Vegetation and Flora	Brief descriptions and distribution maps
2.2.2	Protected Areas such tidal flats, primitive forests, bird sanctuaries, game reserves, national parks, historic sites & ruins, etc.	Protected area and species distribution maps. Are the project sites inside or adjacent to areas established/protected by fishery rights and piscaries?
2.2.3	Fauna	Brief descriptions and distribution maps
2.3	Socio-Economic Environment Baseline Conditions	
2.3.1	Population and Demography	Divisions, districts and upazila which each project site belong to.
2.3.2	Aboriginal/indigenous peoples	Populations and maps showing areas which such peoples are living.
2.3.3	Livelihood and Poverty	Brief description of inhabitants living in/around each project site
2.3.4	Noise	Noise in each project site
2.4	Existing (and planned) infrastructures	
2.4.1	Roads	Road maps around each project site
2.4.2	Railway	Railway maps and nearest stations around each project site
2.4.3	Ports and harbors	Port and harbor maps and nearest export and inland port and harbors each project site
2.4.4	Water supply system	Water sources and water treatment and supply systems. Nearest connection points of existing water systems, available water rate, etc.
2.4.5	Natural gas pipeline	Gas pipeline route maps: Pipe diameters, design pressures of pipelines, booster compressor stations, etc. in Bangladesh including planned energy infrastructures such as LNG import terminals (Land-based, etc.), pipelines, etc.)
2.4.6	Power plants and power transmission lines	Existing/planned electricity grid maps near each EZ site and tie-in/connection points of 33 kV for supplying to each EZ project site.

2.4.7	Industrial and industrial parks	Maps showing industries and industrial parks in Bangladesh
2.4.8	Waste treatment plants and facilities	Available industrial waste treatment plants and facilities such as oily wastes, medical and toxic, hazardous & radioactive materials near each project sites including nearest cement plants
2.5	Houses and people to be resettled including involuntarily resettlement	Estimated nos. of houses and people to be resettled by each EZ project. Any ot*her compens*ation assets except lands.

Table Comparison between GoB , World Bank, JICA and ADB Guidelines