

Ministry of Power, Energy and Mineral Resources
People's Republic of Bangladesh

Preparatory Survey on Chittagong Area Coal Fired Power Plant Development Project in Bangladesh

Final Report

on

Power Plant / Port /

Transmission Line / Access Road /

Execution Survey of Natural Condition

Book 4

For Publishing

March 2015

Japan International Cooperation Agency (JICA)

Tokyo Electric Power Services Co., LTD

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15-007

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Table of Contents

Table of Contents

Page

Book 1

Chapter 1 Preface

Chapter 2 Basic Concept of the Project

Chapter 3 Current Situation of Bangladesh and Necessity, Justification of the Project

Chapter 4 Selection of the Suitable Site

Chapter 5 Site Conditions

Chapter 6 Fuel Supply Plan

Chapter 7 Conceptual Design

Chapter 8 Study on Civil and Construction Work

Chapter 9 Power System Analysis and Transmission Line/Substation Plan

Chapter 10 Project Construction Plan

Chapter 11 Project Implementation System

Chapter 12 Management of New Power Generation Company

Chapter 13 Operation and Maintenance Management

Chapter 14 Economic and Financial Analysis

Book 2

Chapter 15 Environmental and Social Consideration

Book 3

Chapter 16 Plan and Design of Access Road

Chapter 17 Execution Survey of Natural Condition

Book 4

Appendices

Chapter 5 Site Conditions

Appendix-C05-01 Topographic Survey

Appendix-C05-02 Geologic Survey

Appendix-C05-03 Oceanographic Survey

Chapter 10 Project Construction Plan

Appendix C-10-1 Terms of Reference (TOR) for Design and Supervision Consultant

Chapter 12 Management of New Power Generation Company

Appendix-C12-01 Draft Accounting Policy

Appendix-C12-02 Draft Accounting Manual

Appendix-C12-03 Financial Model

Appendix-C12-04-1 Draft Subsidiary Loan Agreement

Appendix-C12-04-2 Draft Subsidiary Loan Agreement

Appendix-C12-05-1 Draft Shareholder's Agreement

Appendix-C12-05-2 Draft Establishment Support Agreement

Appendix-C12-06-1 Draft Budget Financing Agreement

Appendix-C12-06-2 Draft Budget Financing Agreement

Chapter 15 Environmental and Social Consideration

Appendix C-15 Photo collection

Appendix C-15.1-1: Current Condition of Candidate Route

Appendix C-15.1-2: Inventory of Selected Route

Appendix C-15.2 Environmental regulation

Appendix C-15.5-1 Results of the survey on natural environment (Pollution control)

Appendix C-15.5-2 Results of the survey on natural environment (Marine organisms)

Appendix C-15.5-3 Results of the survey on natural environment (List of terrestrial wildlife
in power plant site)

Appendix C-15.5-4 Results of the survey on natural environment (List of terrestrial wildlife
along transmission line)

Appendix C-15.5-5: Environmental Baseline Survey Report (Access Road)

Appendix C-15.5-6 Survey Results on the "Spoon-billed Sandpiper"

(From Dec.7th 2012 to Mar.30th 2013)

Appendix C-15.5-7 Survey Results on the "Sea Turtle"

(From Dec.7th 2012 to Mar.30th 2013)+ (Inc. Addistional)+

Appendix C-15.5-8 Materials for Stakeholder meeting

Appendix C-15.5-9 Minutes of Stakeholder meeting

Appendix C-15.6 Results of the Air Pollutant Diffusion Simulation on the case of the Lower
Stack (200m)

Appendix C-15.9-1 Land Acquisition and Resettlement Action Plan (Draft)
(Power Plant, Port Facility and Transmission Line)

Appendix C-15.9-2: Land Acquisition and Resettlement Action Plan(LARAP)
(Access Road)

Appendix C-15.9-3 Materials for public consultation meeting

Appendix C-15.9-4 Minutes of public consultation meeting

Book 5

Appendices for

Chapter 16

Chapter 17

Appendix-C05-01

Topographic Survey

Topographic Survey

The topographical survey has been conducted in the survey area with the following procedure.

(1) Overview

-Survey period

- From September 28, 2012, to October 12, 2012

-Survey area

- The survey area is located at Matarbari, Cox's Bazar.

(2) Methodology

-Working grids

- To execute the field survey the survey area was divided into squares of 100m×100m by fixing northing and easting at 100m center to center.
- All the data taken is based on N, E, and Z as

N ; Northing

E ; Easting

Z ; Leveling / Elevation

-Instrumental Values

- Total Station : Leica 09 - 2 set
- RTK GPS Total Station : Trimble5700 - 1 set
- Auto Level : SokkiaB2 - 2 set
- GPS (Handheld) : Germin Tracker - 2 set
- Instruments used: Total Station (TOP CON-105)
- Level Instrument Nikon

(3) Bench Mark

All TMBs were established using RTK GPS and Total Station. The base station for thereference was **SoB GPS BM No 322**. This BM is located at SW corner of play ground of Maijpara Registered non govt primary school, east side of Chittagong- Cox's bazar highway and 22 m SW from the SW corner of school building of villaga Maijpara, upozila Chokoria and district Cox's Bazar.

-Position of SoB GPS BM No 322:

Latitude = 21° 39' 49.54171"

Longitude = 92° 04' 30.39946"

RL = 4.6182m MSL

In WGS 84 coordinate system

The Values of TMBs are as follows in UTM GRID:

-TBM-1

X= 383604.569mE、 Y= 2400623.167mN、 Z= 2.341mMSL

-TBM-5

X= 383602.853mE、 Y= 2400589.010mN、 Z= 2.725mMSL



Figure -1 Reference SoB GPS BM No 322



Figure -2 Topographic Survey at TBM-1

(4) Mapping

The total area to be mapped for the power plant site of this project is 4.0 sq km. A drawing of the Topographical Map of the survey Area is provided in Figure -3.

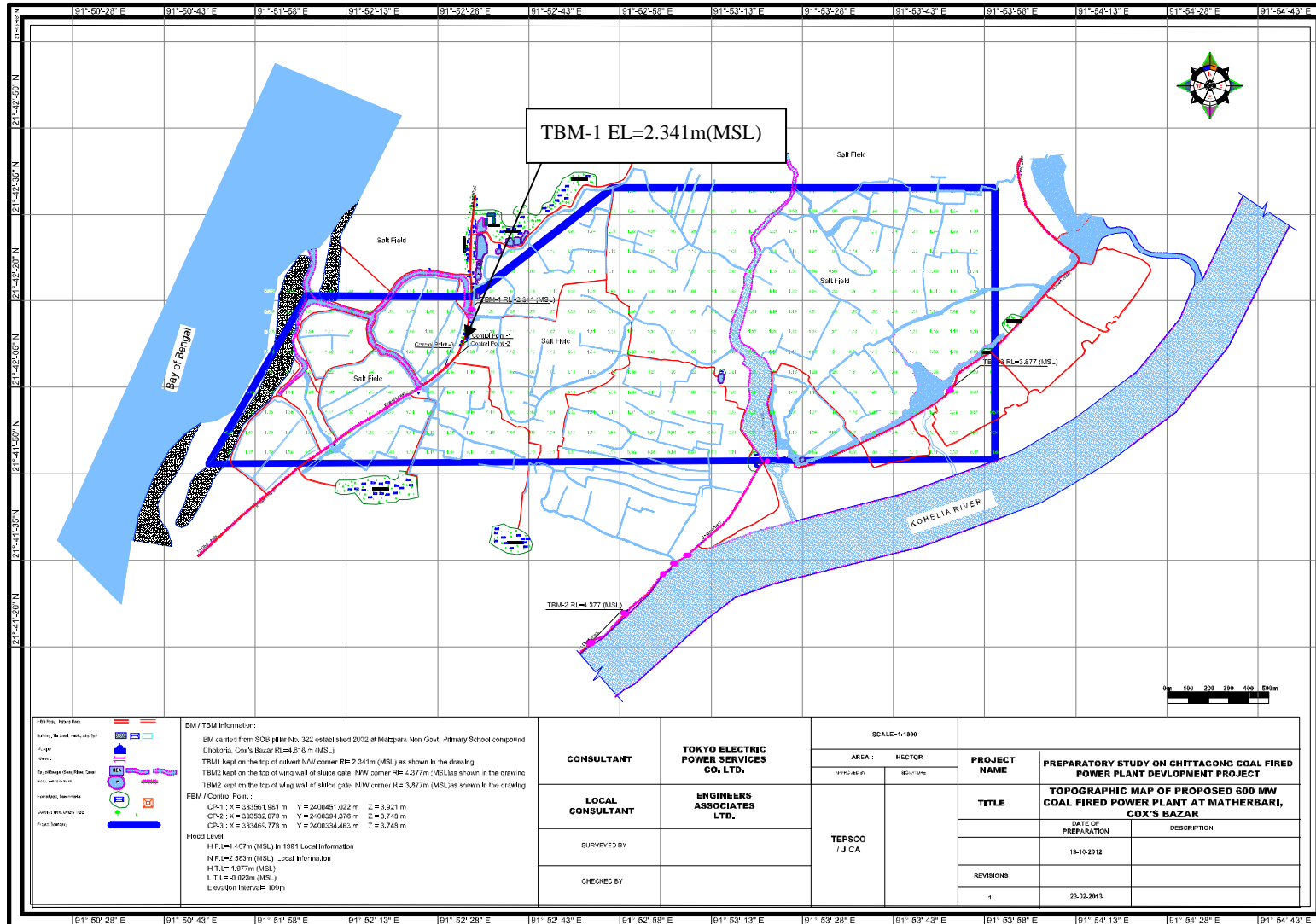


Figure -3 Drawing of a topographical map of the project site

Appendix-C05-02

Geologic Survey

Geologic Survey

The topographical survey has been conducted in the survey area with the following procedure.

(1) Overview

-Survey period

- From September 28, 2012 to October 15, 2012

-Survey area

- The project site is located at Matarbari, Cox's Bazar

(2) Methodology

(3) Methodology

-Execution of Boring

The field boring was conducted using 100mm dia casing (BH-1~BH-6) and 120mm dia casing (BH-01~BH-03). The method consists in first driving in a casing through which a hollow drill rod with a sharp chisel or chopping bit at the lower end is inserted. Water is forced under pressure through the drill rod which is alternatively raised and dropped, and also rotated. The soil cuttings are forced up and dropped and also rotated. The soil cuttings are forced up to the ground in the drilled rod and casing. Before taking a Standard Penetration Test (SPT) and collection of disturbed and undisturbed soil samples, the bore hole is cleaned with repeated circulation of mud slurry.

-SPT (Standard Penetration Test)

SPTs were performed in all the bore holes. The tests were executed by using a thick walled split sampler of 35 mm inner diameter and 50.8 mm outer diameter and 63.5 kg hammer falling freely from a constant height of 75 cm. The SPT values (N-values) were taken as the summation of blows required in the 2nd and 3rd 15 cm of penetration of the sampler. The SPT values (N-values) are shown on the bore hole logs against the respective interval of tests.

The SPT provides considerable knowledge on the density and consistency of the soil layer encountered and in addition yields disturbed /semi disturbed soil samples from within the split spoon sampler used during the tests.

-Disturbed Sample Collection

The disturbed samples were collected with the help of a split spoon sampler used during the SPTs. The collected samples were classified on site and were preserved in water tight polythene bags with proper identification marks for onward transmission to the laboratory for further analysis.

The disturbed samples were also used to reconstruct depth wise stratification of bore holes depending on their classifications.

-Undisturbed Sample Collection

The undisturbed samples were collected whenever feasible from the cohesive layers with the help of thin walled Shelby tubes 76 mm diameter. Thin walled Shelby tubes are penetrated into the undisturbed soil formation at the bottom of the borehole by applying rapid but continuous force. The samples recovered within the Shelby tubes were wax sealed at both ends and transmitted to the laboratory with proper identification marks.

-Recording of Ground Water

The ground water table was recorded in each of the boreholes by rope/rod sounding after 24 hours of completion of the drilling and sampling operation.

-Other Field Tests

Other field tests, which were conducted at the site, were done according to AASHTO/ASTM standards.

-Laboratory Tests

Different types of laboratory tests were performed in the laboratory to evaluate the physical and engineering properties of the sub-soil formation to facilitate determination of soil bearing capacities and to recommend foundation type and magnitude.

Grain size Analysis, Atterberg Limit and Sp .Gravity tests were performed to ascertain the detailed composition of the soil and to evaluate the physical parameters of the formation. These tests also help in classifying the soils properly for geological and geological interpretation.

Unconfined compression, density and shear tests were done to evaluate the shear characteristics of the soils, which directly help in bearing capacity calculation.

Consolidation tests provide data on consolidation behavior of the sub-soil formation.

The laboratory tests were performed according to AASHTO/ASTM standards.



Figure -1 Soil boring at Matarbari site



Figure -2 Soil Sample collection at Matarbari

(4) Results of the survey

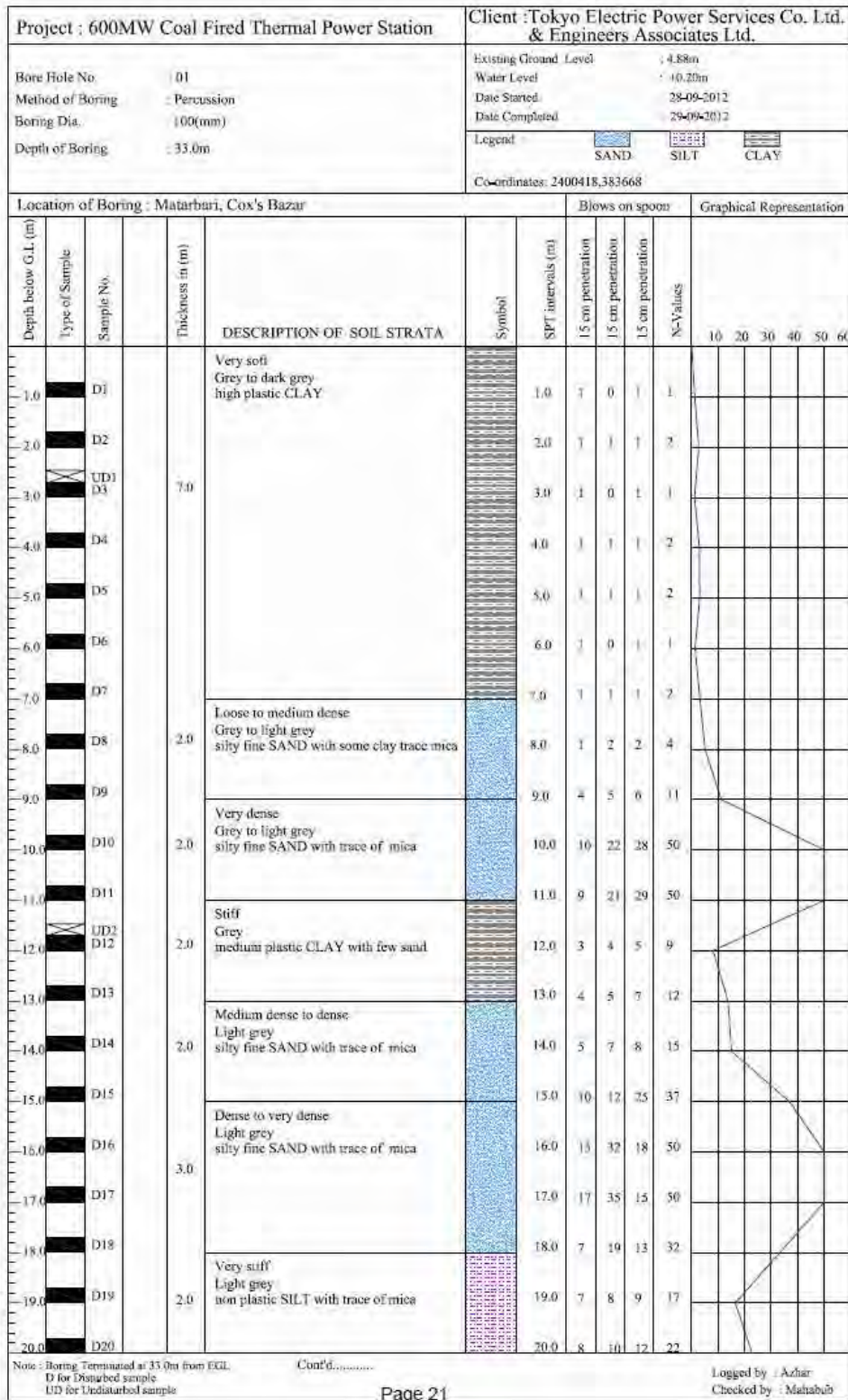


Figure -3 Bor. Logs (boring №BH-01)

Project : 600MW Coal Fired Thermal Power Station					Client :Tokyo Electric Power Services Co. Ltd. & Engineers Associates Ltd.											
Bore Hole No. : 01					Existing Ground Level : 4.88m											
Method of Boring : Percussion					Water Level : +0.28m											
Boring Dia. : 100(mm)					Date Started : 28-09-2012											
Depth of Boring : 33.0m					Date Completed : 29-09-2012											
					Legend											
					SAND		SILT		CLAY							
Co-ordinates: 2400418,383668																
Location of Boring : Matarbari, Cox's Bazar					Blows on spoon			Graphical Representation								
Depth below G.L. (m)	Type of Sample	Sample No.	Thickness in (m)	DESCRIPTION OF SOIL STRATA	Symbol	SPT intervals (m)	15 cm penetration	15 cm penetration	15 cm penetration	N-Values	10	20	30	40	50	60
21.0		D21	2.0	Medium dense to very dense Yellowish brown to brown silty fine SAND with trace of mica		21.0	9	11	12	23						
22.0		D22				22.0	10	21	29	50						
23.0		D23	2.0	Hard Grey spotted brown medium plastic CLAY with few sand		23.0	11	24	26	50						
24.0		D24				24.0	12	26	24	50						
25.0		D25				25.0	15	23	27	50						
26.0		D26		Very dense Yellowish brown to Reddish brown silty fine SAND with trace of mica		26.0	30	40	10	50						
27.0		D27	9.0			27.0	25	36	14	50						
28.0		D28				28.0	28	50	-	50						
29.0		D29				29.0	32	50	-	50						
30.0		D30				30.0	34	50	-	50						
31.0		D31				31.0	36	50	-	50						
32.0		D32				32.0	40	50	-	50						
33.0		D33				33.0	42	50	-	50						
34.0		D34		End of Boring												
35.0		D35														
36.0		D36														
37.0		D37														
38.0		D38														
39.0		D39														
40.0		D40														
Note : Boring Terminated at 33.0m from EGL. D for Disturbed sample UD for Undisturbed sample										Logged by : Azhar Checked by : Mahabub						

Figure -4 Bor. Logs (boring №BH-01)

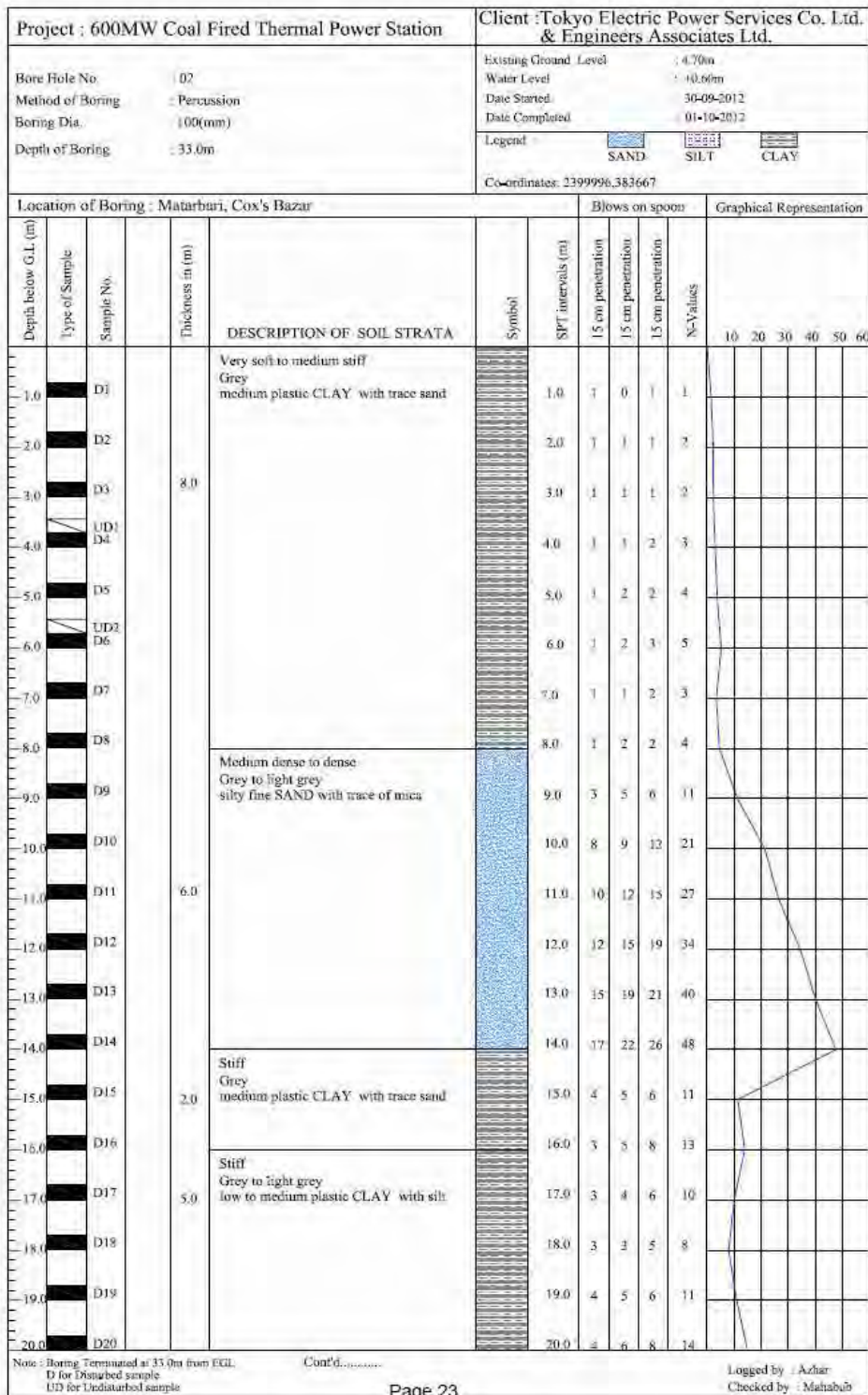


Figure -5 Bor. Logs (boring №BH-02)

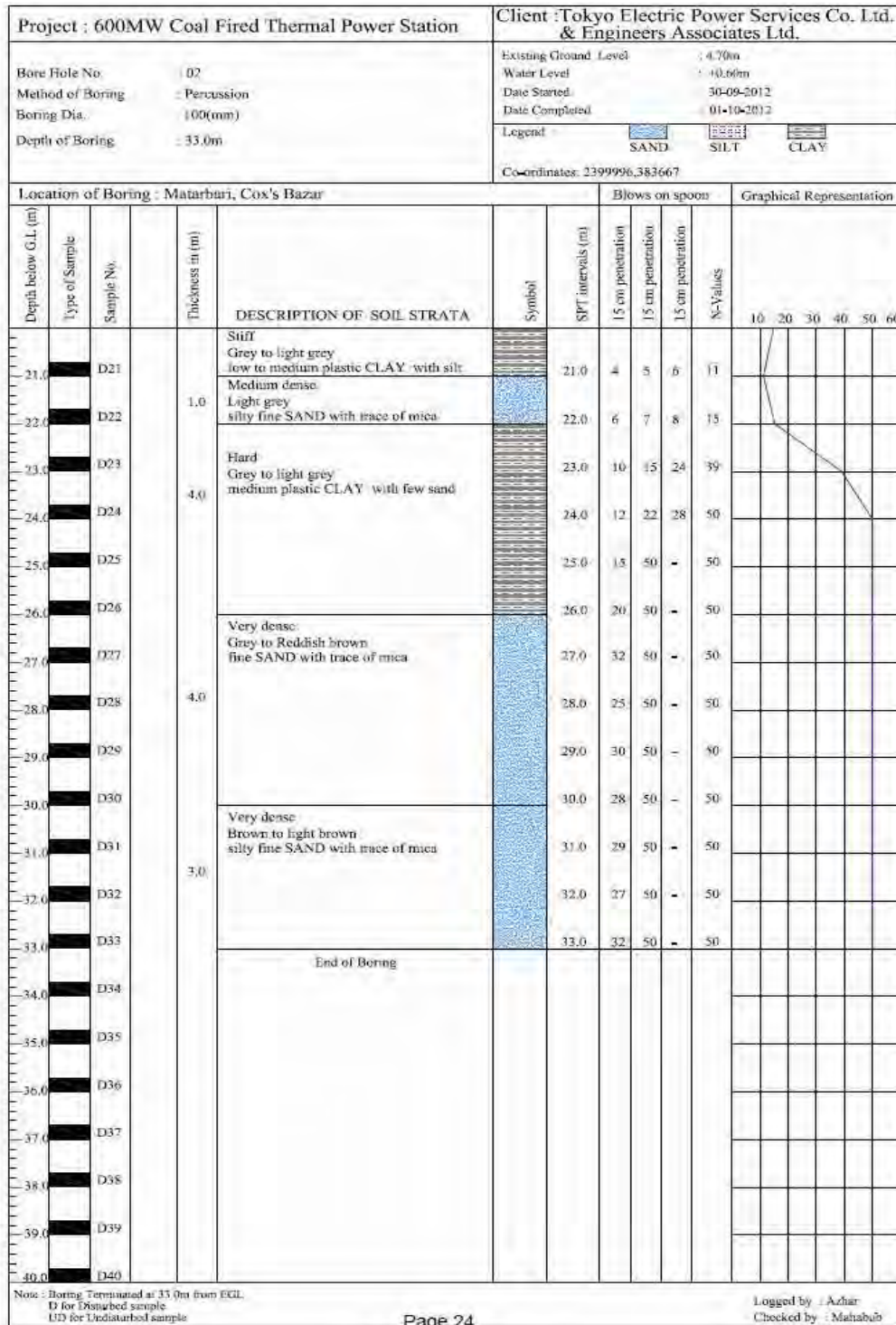


Figure-6 Bor. Logs (boring №BH-02)

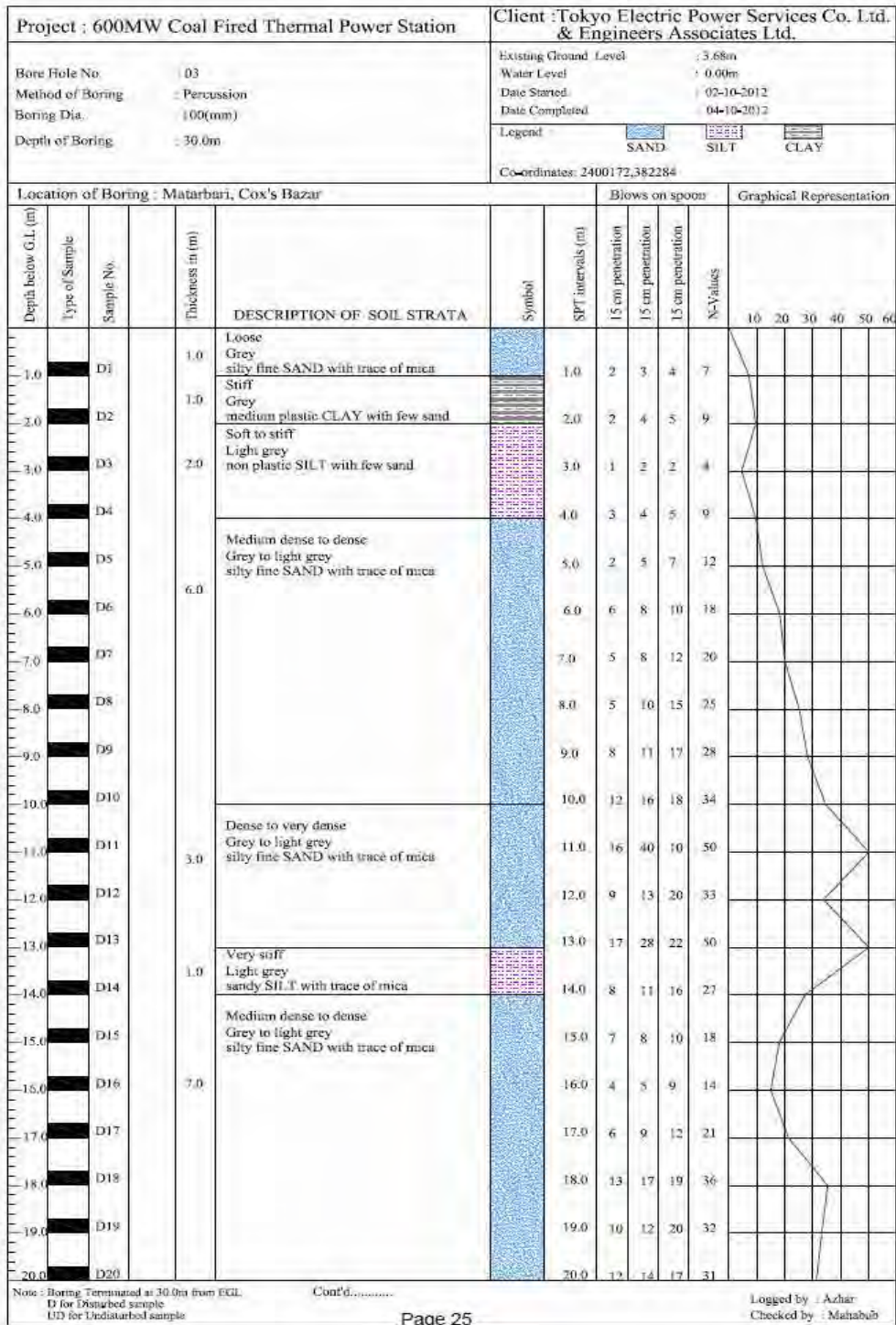


Figure -7 Bor. Logs (boring №BH-03)

Project : 600MW Coal Fired Thermal Power Station					Client :Tokyo Electric Power Services Co. Ltd. & Engineers Associates Ltd.										
Bore Hole No. : 03					Existing Ground Level : 3.68m										
Method of Boring : Percussion					Water Level : 0.00m										
Boring Dia. : 100(mm)					Date Started : 02-10-2012										
Depth of Boring : 30.0m					Date Completed : 04-10-2012										
Legend					Legend										
					SAND SILT CLAY										
Co-ordinates: 2400172,382284															
Location of Boring : Matarhari, Cox's Bazar					Blows on spoon			Graphical Representation							
Depth below G.L. (m)	Type of Sample	Sample No.	Thickness in (m)	DESCRIPTION OF SOIL STRATA	Symbol	SPT intervals (m)	15 cm penetration	15 cm penetration	15 cm penetration	N-Values	Graphical Representation				
21.0		D21	3.0	Medium dense to dense Grey to light grey silty fine SAND with trace of mica		21.0	8	16	20	36					
22.0		D22		Dense to very dense Brown to yellowish brown silty fine SAND with trace of mica		22.0	9	18	21	39					
23.0		D23				23.0	10	20	22	42					
24.0		D24			24.0	22	30	-	50						
25.0		D25	6.0	Very dense Grey fine SAND with trace of mica		25.0	21	50	-	50					
26.0		D26				26.0	25	50	-	50					
27.0		D27				27.0	30	50	-	50					
28.0		D28				28.0	32	50	-	50					
29.0		D29				29.0	34	50	-	40					
30.0		D30				30.0	32	50	-	50					
31.0		D31		End of Boring											
32.0		D32													
33.0		D33													
34.0		D34													
35.0		D35													
36.0		D36													
37.0		D37													
38.0		D38													
39.0		D39													
40.0		D40													
Note : Boring Terminated at 30.0m from EGL. D for Disturbed sample UD for Undisturbed sample										Logged by : Azhar Checked by : Mahrub					

Figure -8 Bor. Logs (boring №BH-03)

Table -1 Summary of Laboratory Test Results (boring №01-03)

SUMMARY OF LABORATORY TEST RESULTS														PROJ.: 600MW Coal Fired Thermal Power Station				
														CLIENT: Tokyo Electric Power Services Co. Ltd. & Engineers Associates Ltd.				
Bore Hole No.	01													02				
Sample No.	D1	D2	D6	D8	D9	D10	D15	D18	D20	D23	D28	D30	D33	D1	D3	D5	D8	D9
Depth in Meter	1.0	2.0	6.0	8.0	9.0	10.0	15.0	18.0	20.0	23.0	28.0	30.0	33.0	1.0	3.0	5.0	8.0	9.0
Natural Moisture Content (%)	59				25					23				52			19	
Specific Gravity																		
Atterberg Limits : Liquid Limit (LL)		50	40												54	41		
Plastic Limit (PL)		31	19												27	17		
Plasticity Index (PI)		19	21												27	24		
Grain Size Analysis : Sand (%)				82		94	88	80	82		88		90					60
Silt (%)				18		6	12	20	18		12		10					40
Clay (%)																		
D ₅₀ (mm)				0.120		0.190	0.190	0.160	0.100		0.170		0.200					0.11
Silt Factor :				0.61		0.77	0.77	0.70	0.56		0.73		0.79					0.58
Density : Wet density, gm/cc																		
Dry density, gm/cc																		
Unconfined test : Qu, kPa																		
Cohesion (C) kPa																		
Direct shear test : Cohesion C (kPa)						0						0						
Angle of Internal Friction (Degree)						31						29						

Table -2 Summary of Laboratory Test Results (boring №01-03)

SUMMARY OF LABORATORY TEST RESULTS												PROJ.: 600MW Coal Fired Thermal Power Station CLIENT: Tokyo Electric Power Services Co. Ltd. & Engineers Associates Ltd.						
Bore Hole No.	02											03						
Sample No.	D12	D14	D15	D17	D20	D22	D25	D28	D33	UD1	UD2	D1	D2	D3	D5	D8	D10	D11
Depth in Meter	12.0	14.0	15.0	17.0	20.0	22.0	25.0	28.0	33.0	3.5	5.5	1.0	2.0	3.0	5.0	8.0	10.0	11.0
Natural Moisture Content (%)		18			27		26			55	38	22				15		
Specific Gravity																		
Atterberg Limits : Liquid Limit (LL)			33	35								26						
Plastic Limit (PL)			21	19								16						
Plasticity Index (PI)			12	16								10						
Grain Size Analysis : Sand (%)	92	94				62		86	86						84		90	80
Silt (%)	8	6				38		14	14						16		10	20
Clay (%)																		
D ₅₀ (mm)	0.19	0.190				0.095		0.190	0.190						0.12		0.18	0.1
Silt Factor :	0.77	0.77				0.54		0.77	0.77						0.61		0.75	0.56
Density : Wet density, gm/cc										1.66	1.78							
Dry density, gm/cc										1.06	1.30							
Unconfined test : Q _u , kPa										28.0	33.0							
Cohesion (C) kPa										14.0	16.5							
Direct shear test : Cohesion C (kPa)								0										0
Angle of Internal Friction (Degree)								24										28

Table -3 Summary of Laboratory Test Results (boring №01-03)

SUMMARY OF LABORATORY TEST RESULTS					PROJ.: 600MW Coal Fired Thermal Power Station CLIENT: Tokyo Electric Power Services Co. Ltd. & Engineers Associates Ltd.																
Bore Hole No.	03																				
Sample No.	D16	D19	D23	D30																	
Depth in Meter	16.0	19.0	23.0	30.0																	
Natural Moisture Content (%)		18																			
Specific Gravity																					
Atterberg Limits : Liquid Limit (LL)																					
Plastic Limit (PL)																					
Plasticity Index (PI)																					
Grain Size Analysis : Sand (%)	80	98	86	100																	
Silt (%)	20	2	14	0																	
Clay (%)																					
D ₅₀ (mm)	0.1	0.190	0.190	0.200																	
Silt Factor :	0.56	0.77	0.77	0.79																	
Density : Wet density, gm/cc																					
Dry density, gm/cc																					
Unconfined test : Qu, kPa																					
Cohesion (C) kPa																					
Direct shear test : Cohesion C (kPa)																					
Angle of Internal Friction (Degree)																					

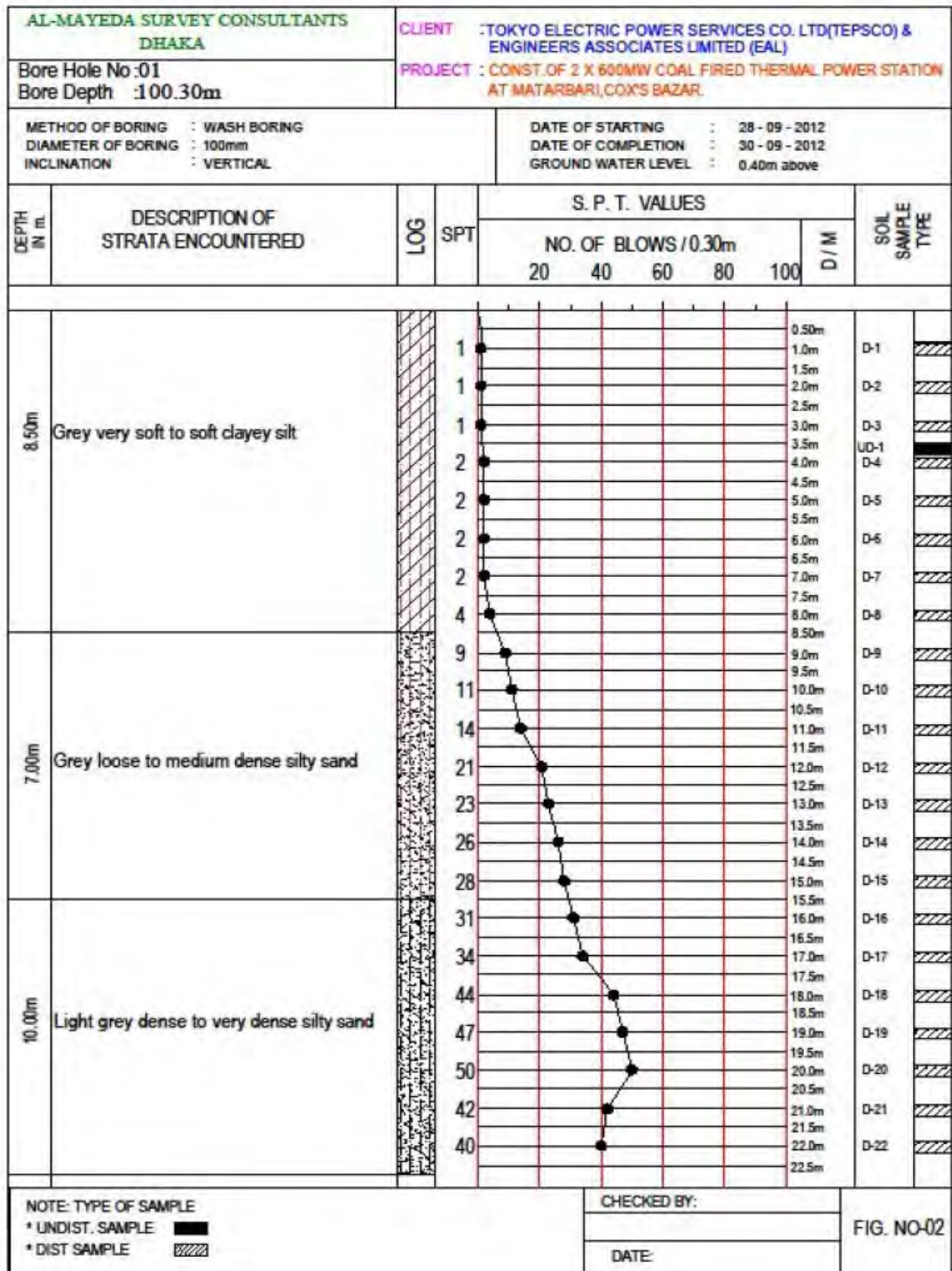


Figure -9 Bor. Logs (boring №BH-1)

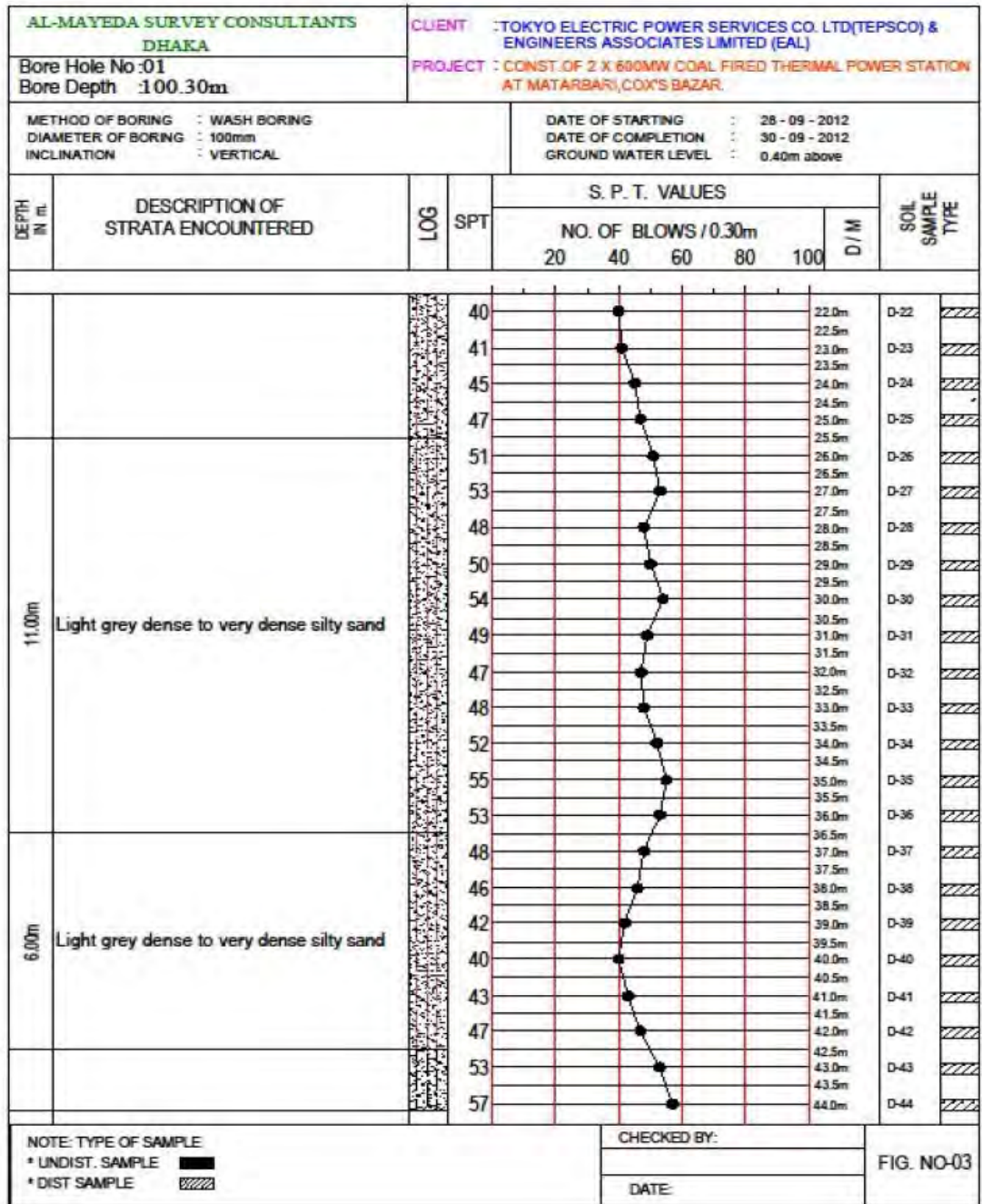


Figure -10 Bor. Logs (boring №BH-1)

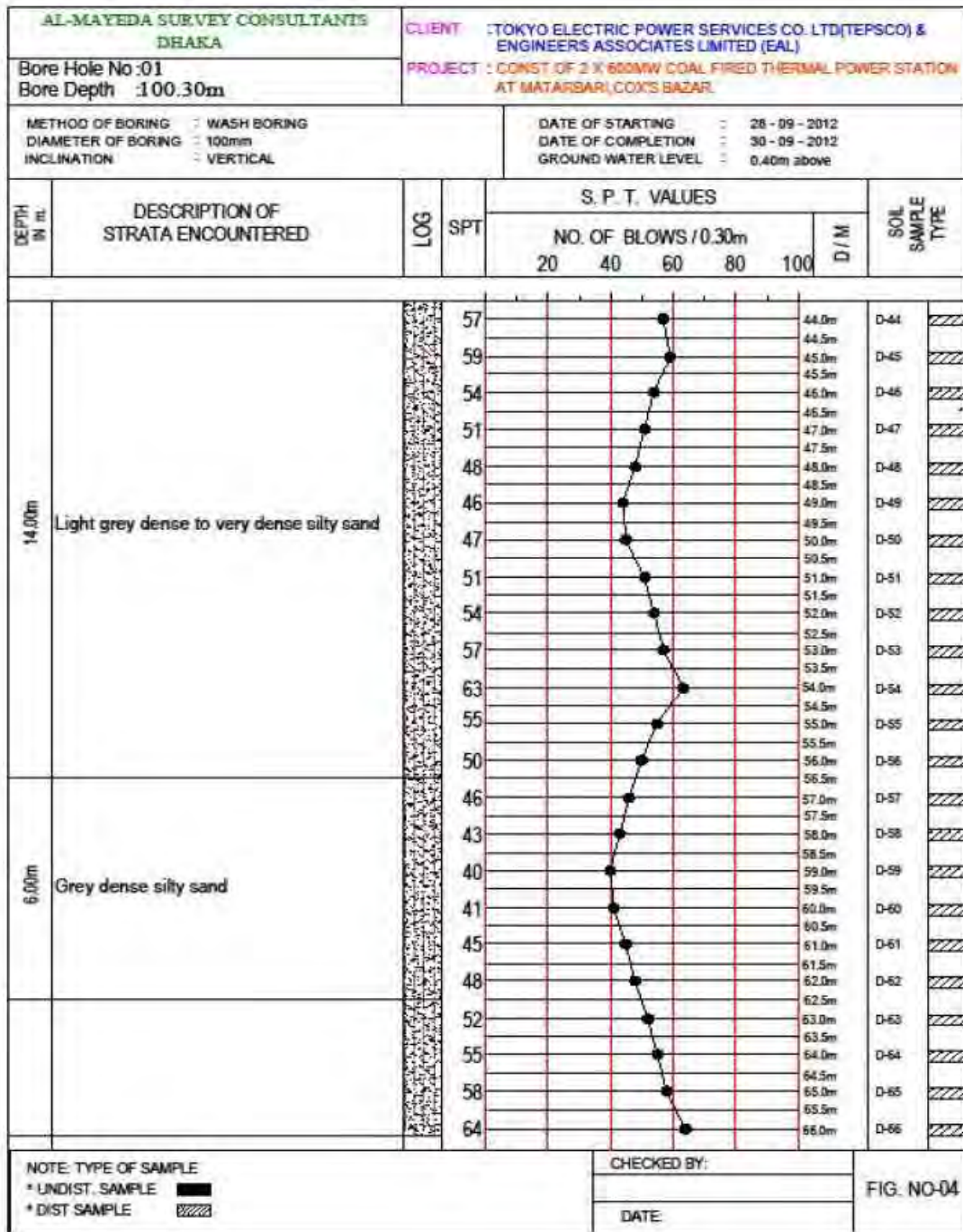


Figure -11 Bor. Logs (boring №BH-1)

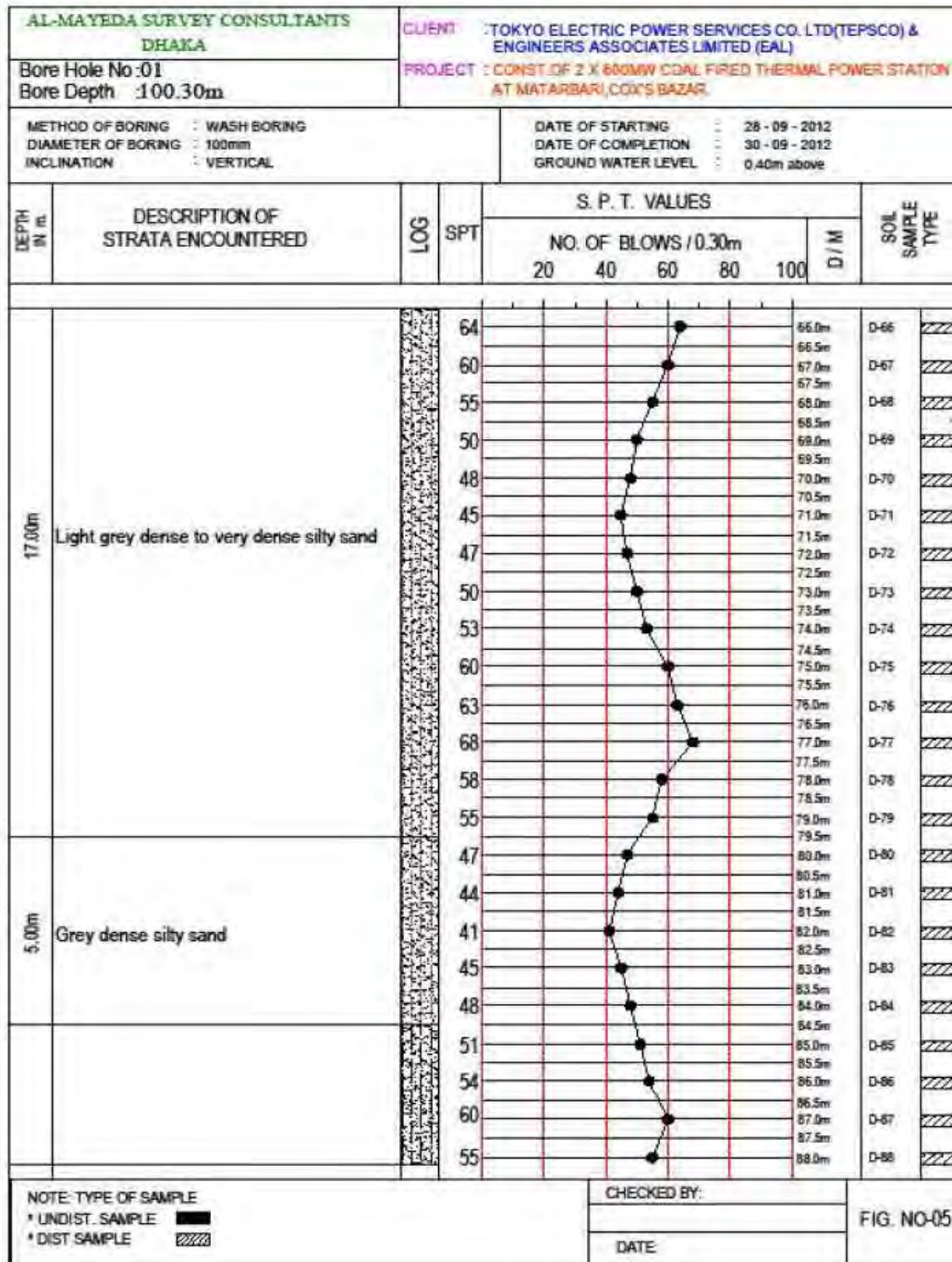


Figure -12 Bor. Logs (boring №BH-1)

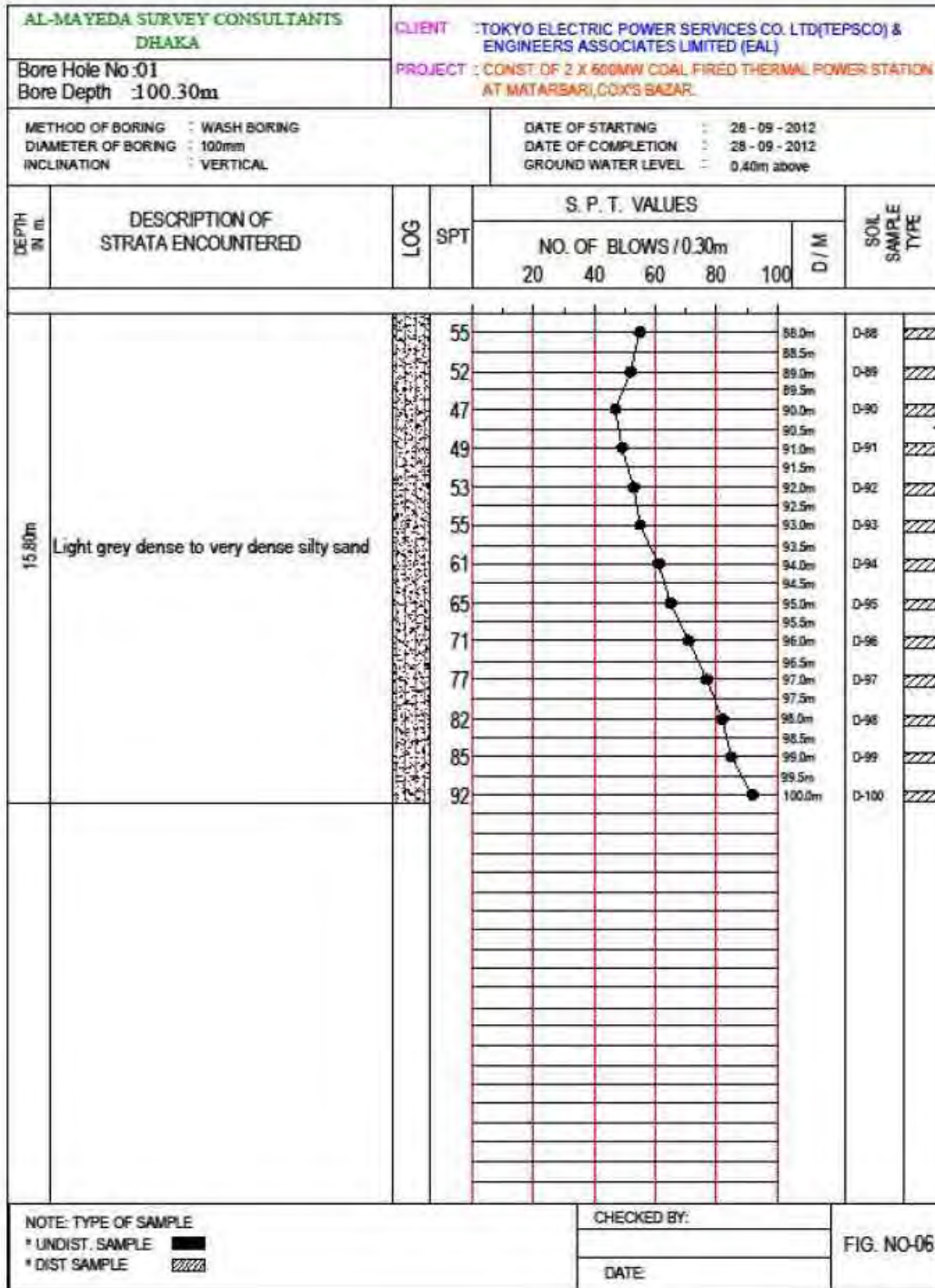


Figure -13 Bor. Logs (boring №BH-1)

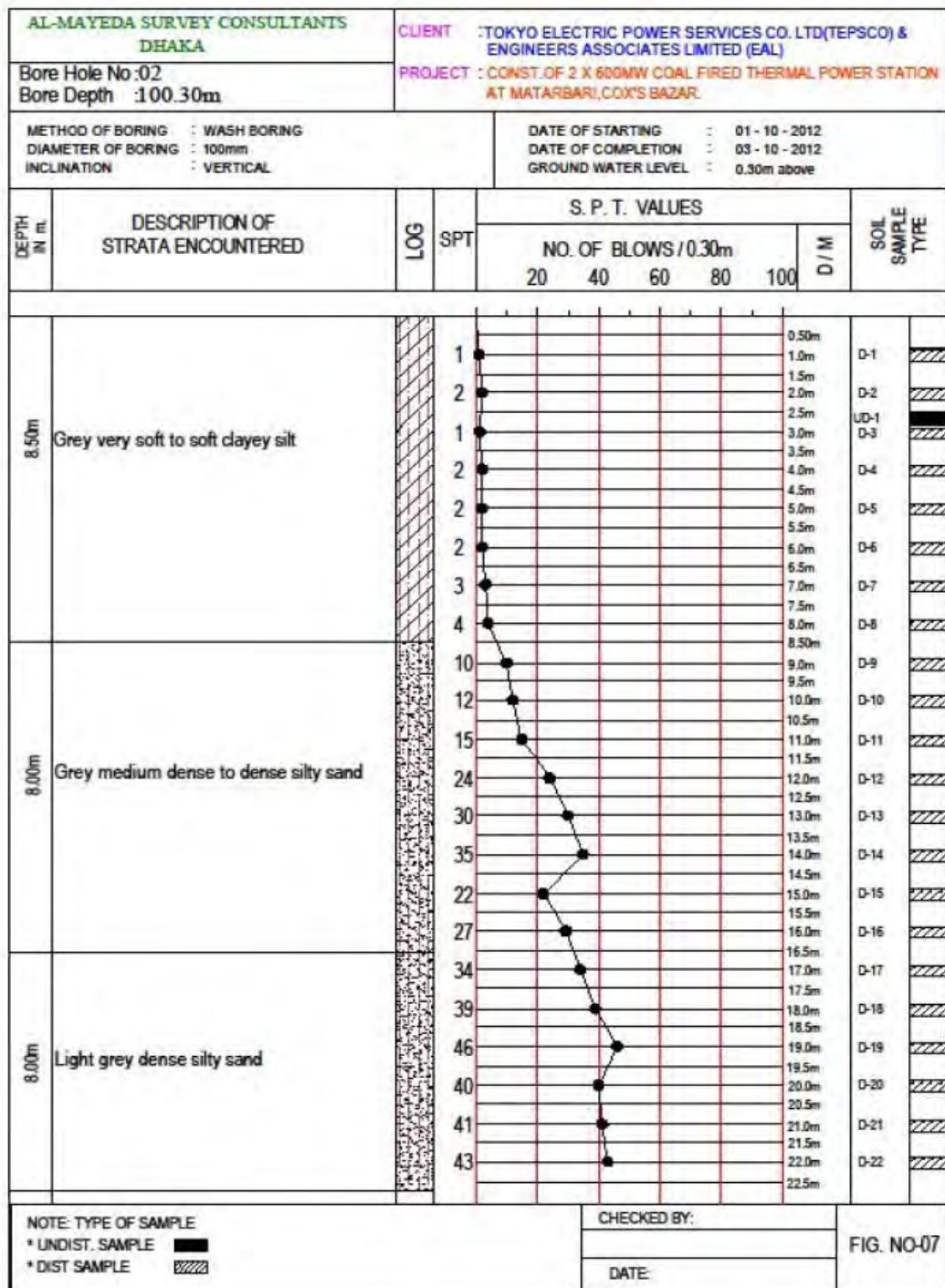


Figure -14 Bor. Logs (boring №BH-2)

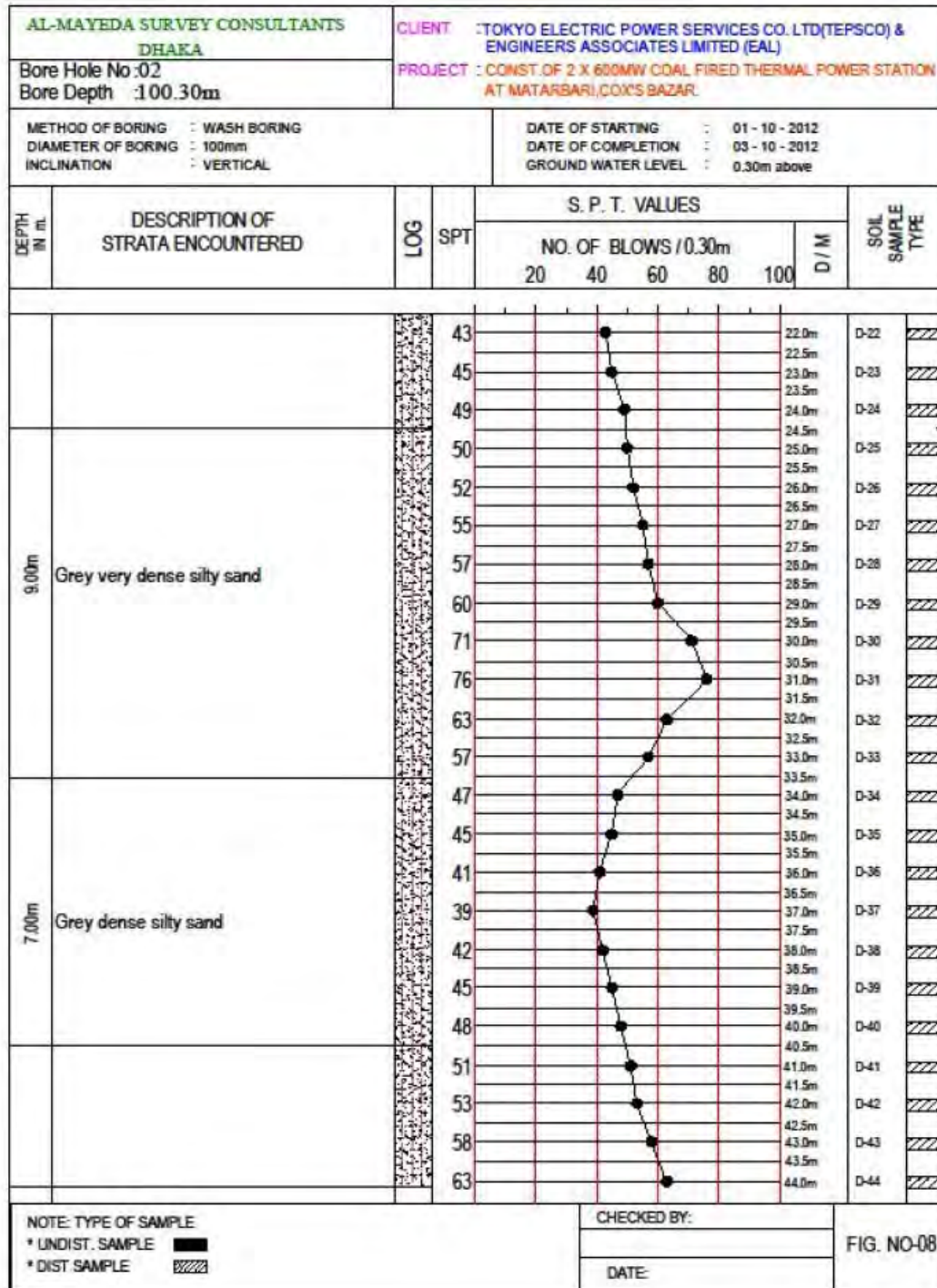


Figure -15 Bor. Logs (boring №BH-2)

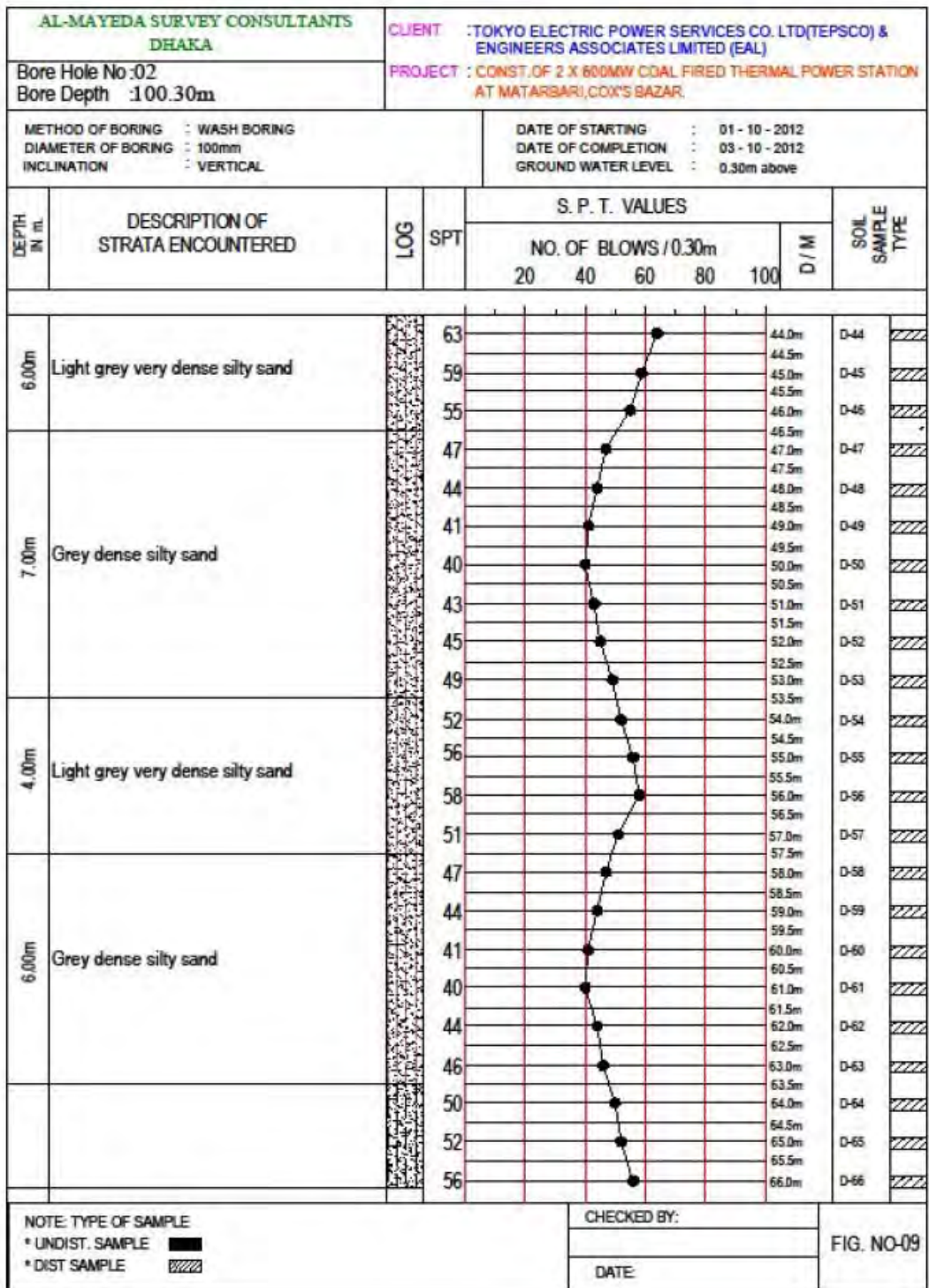


Figure -16 Bor. Logs (boring №BH-2)

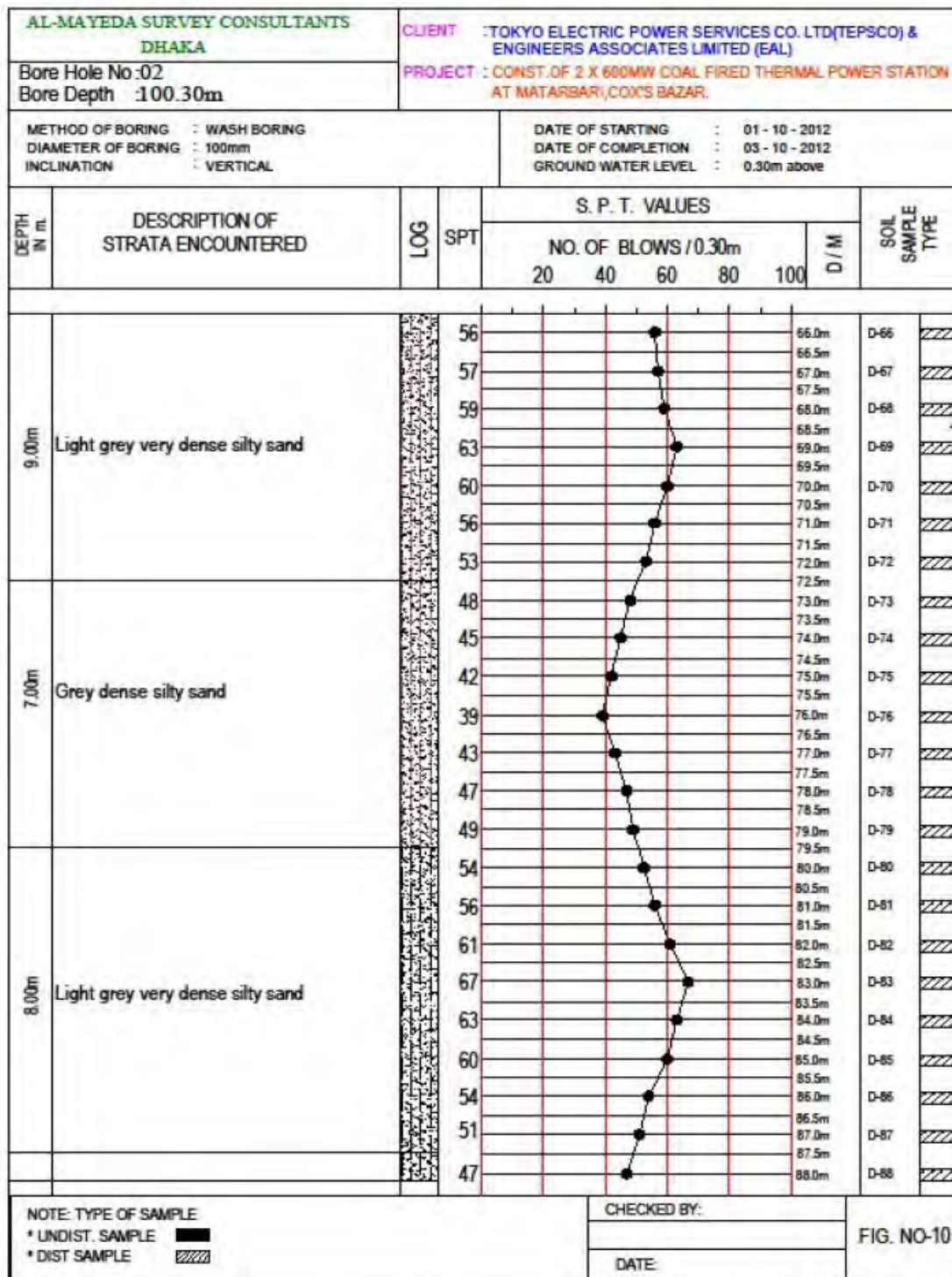


Figure-17 Bor. Logs (boring №BH-2)

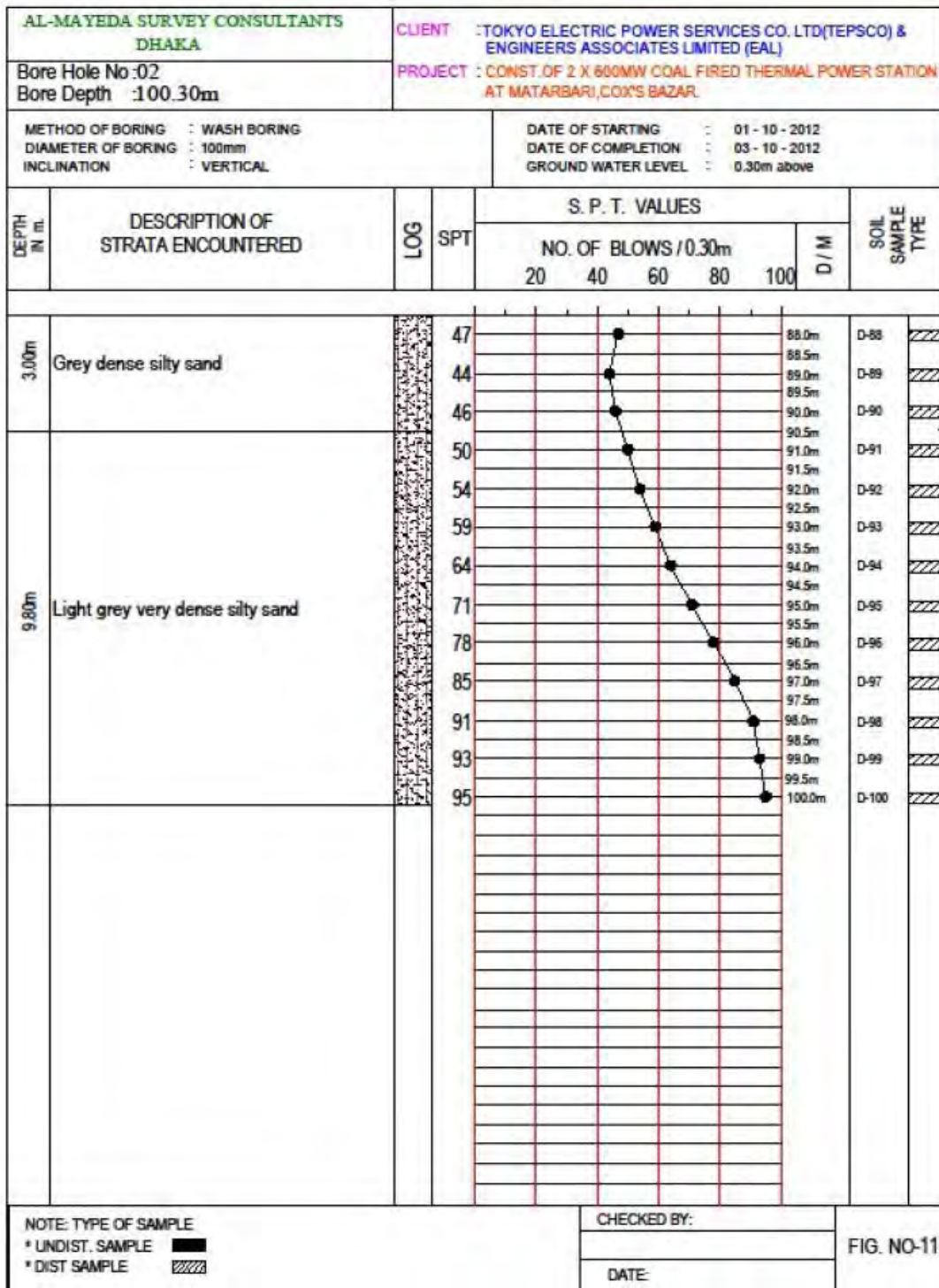


Figure -18 Bor. Logs (boring №BH-2)

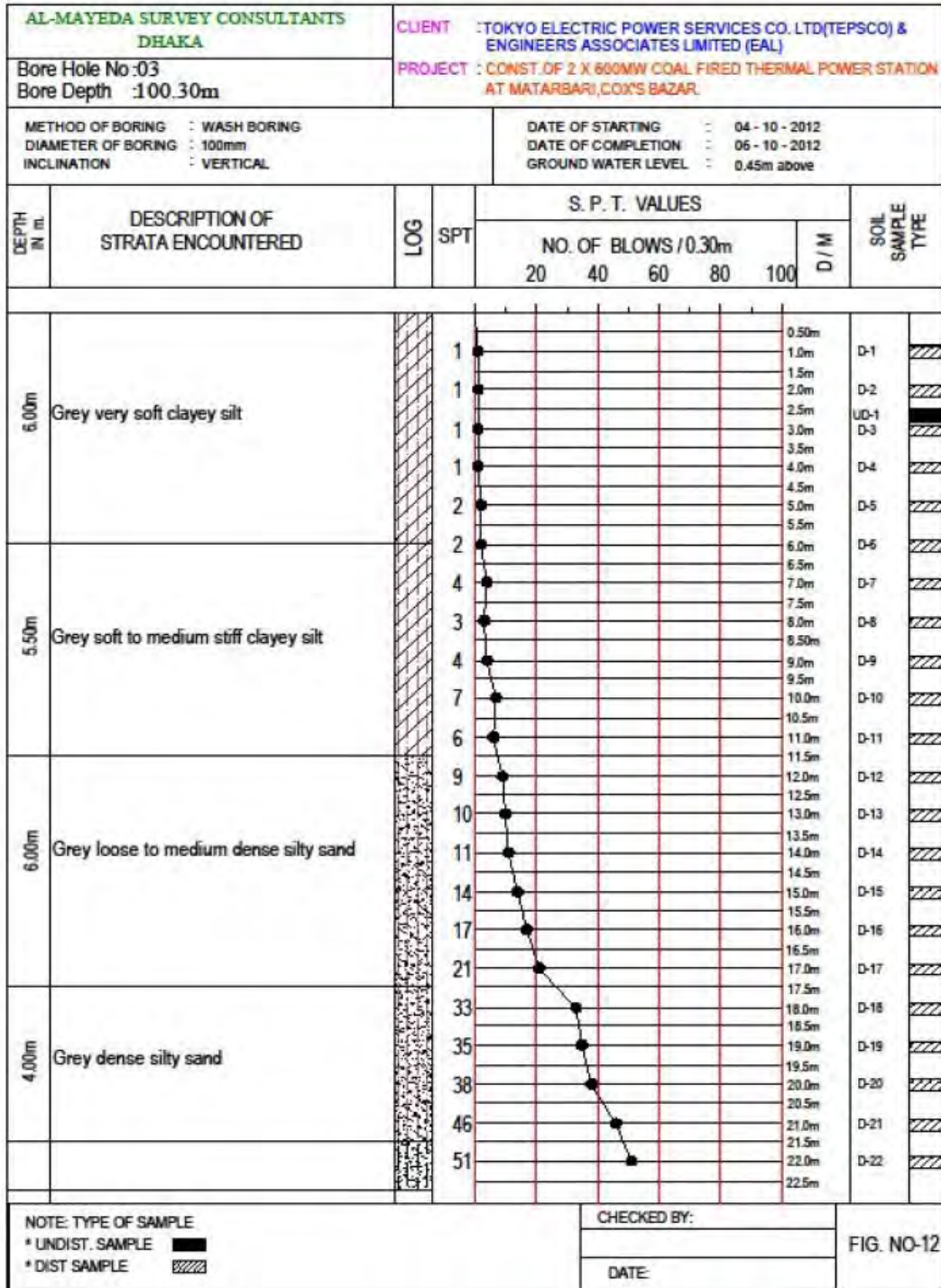


Figure -19 Bor. Logs (boring №BH-3)

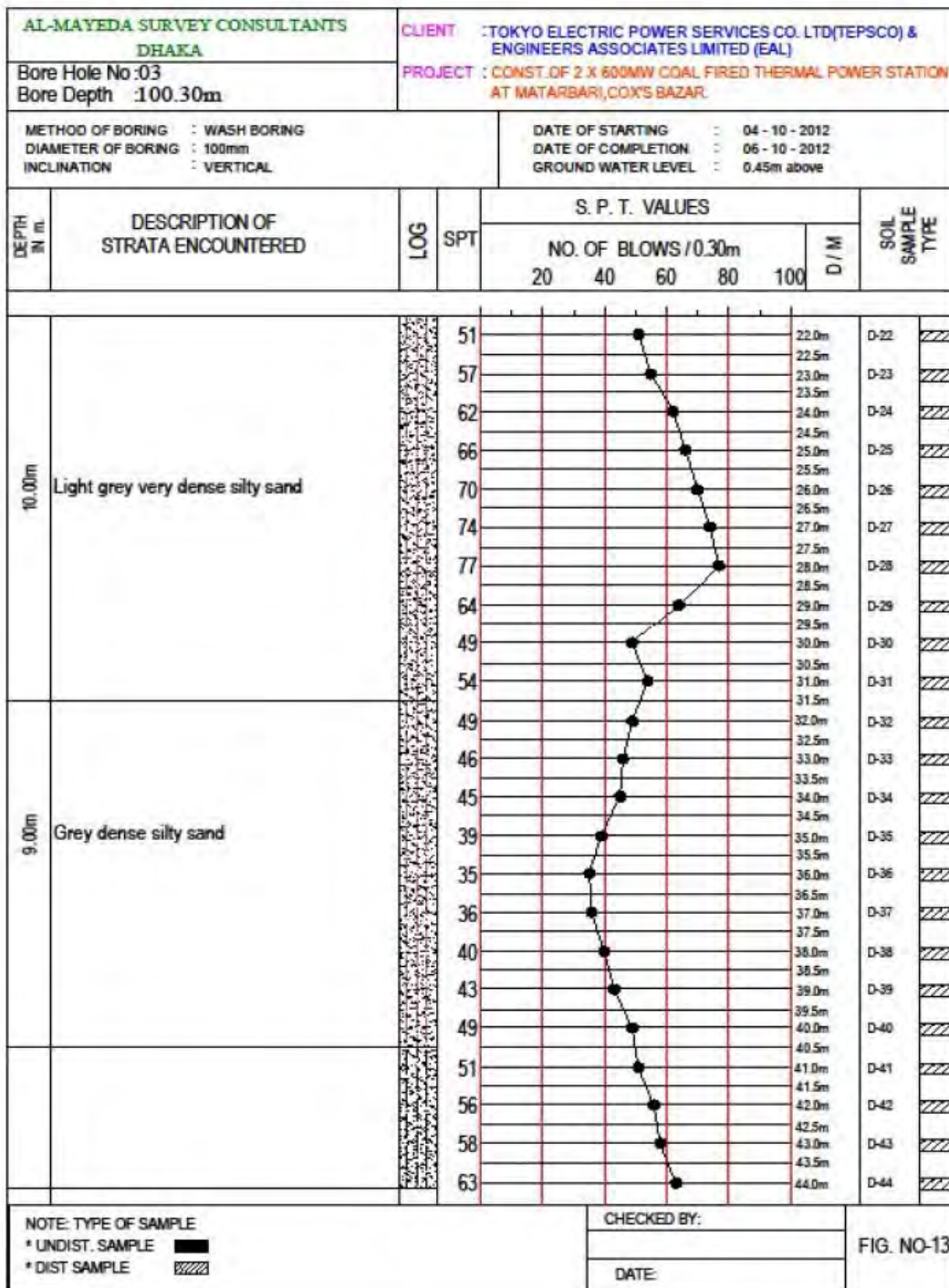


Figure -20 Bor. Logs (boring №BH-3)

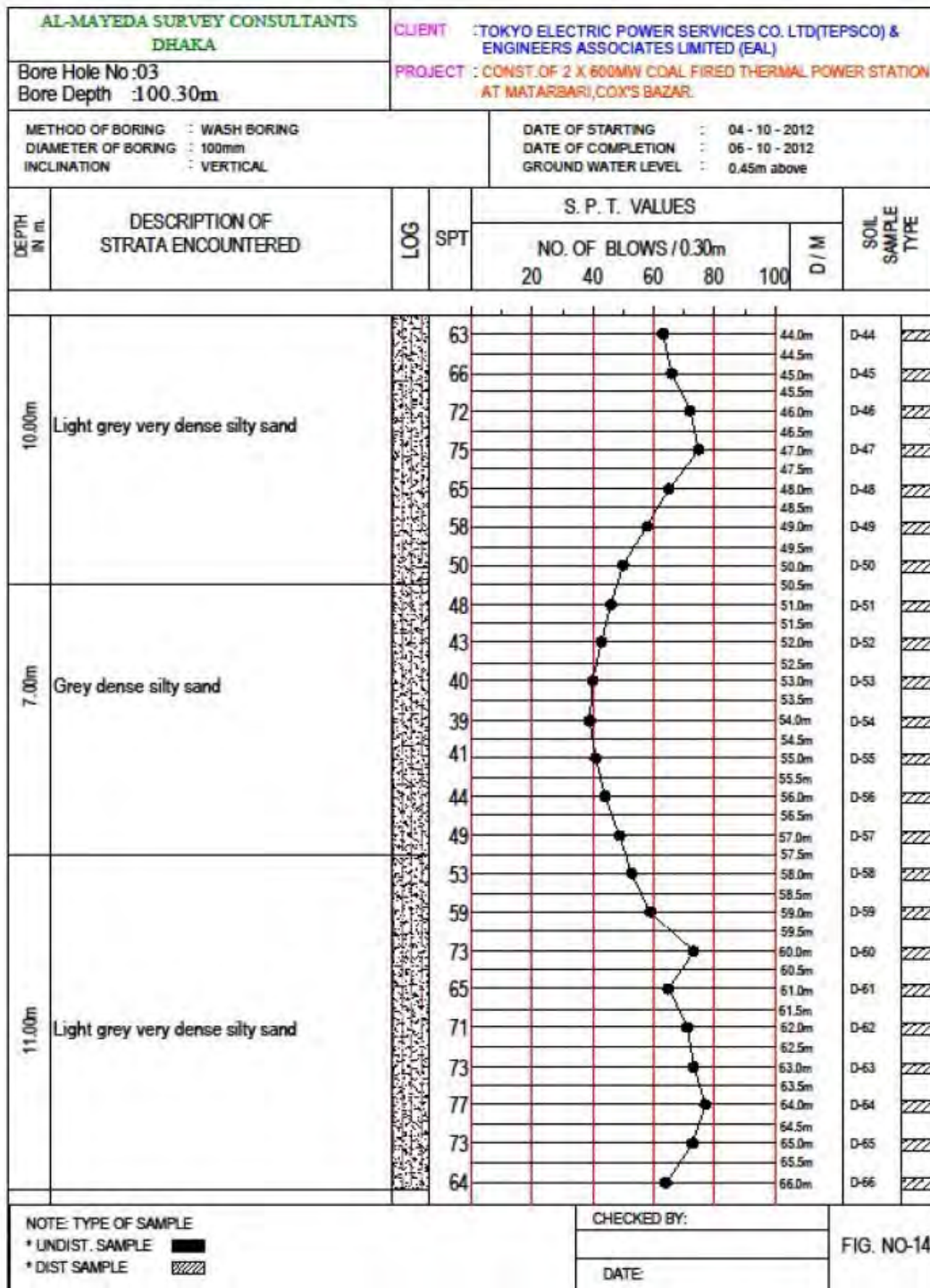


Figure -21 Bor. Logs (boring №BH-3)

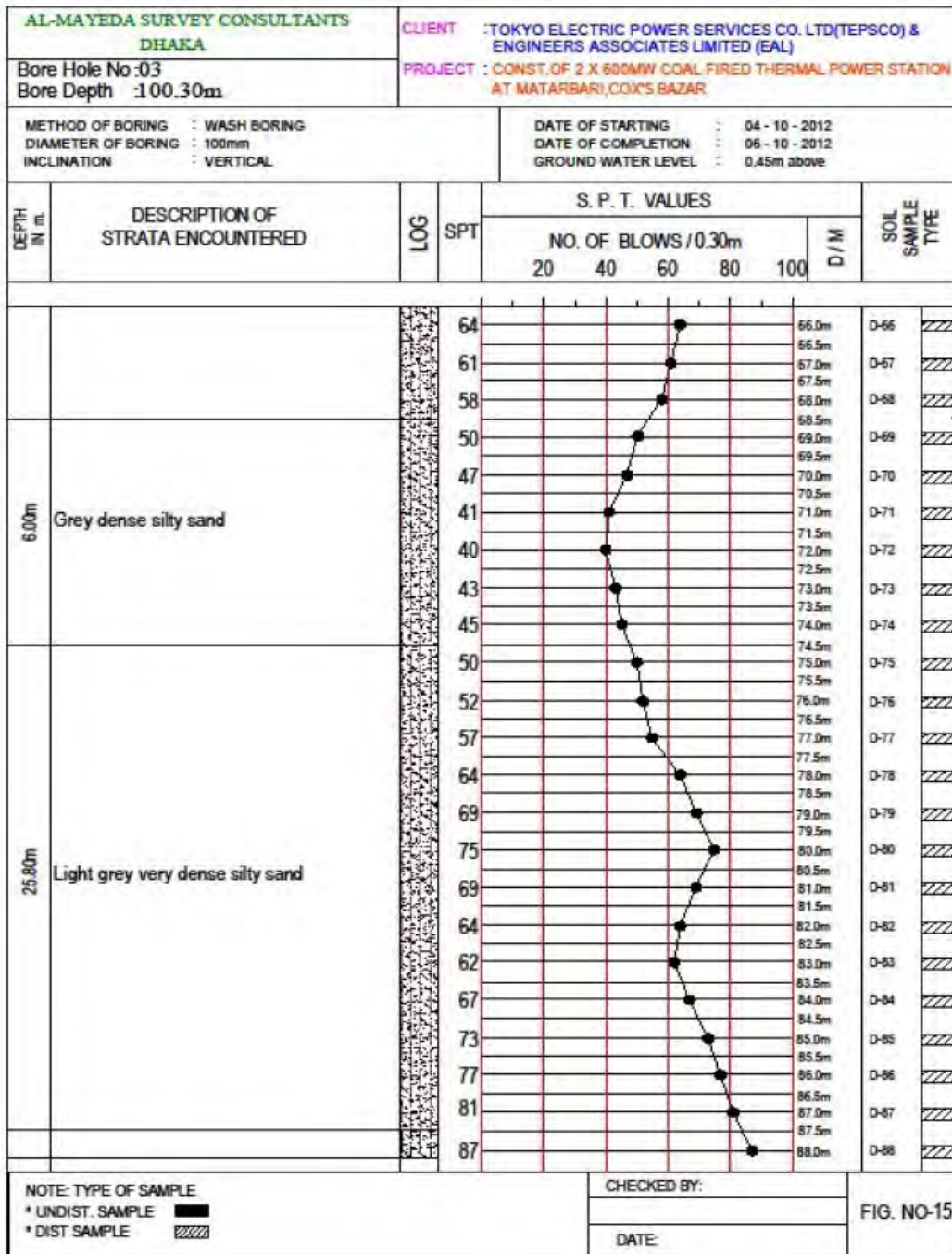


Figure -22 Bor. Logs (boring №BH-3)

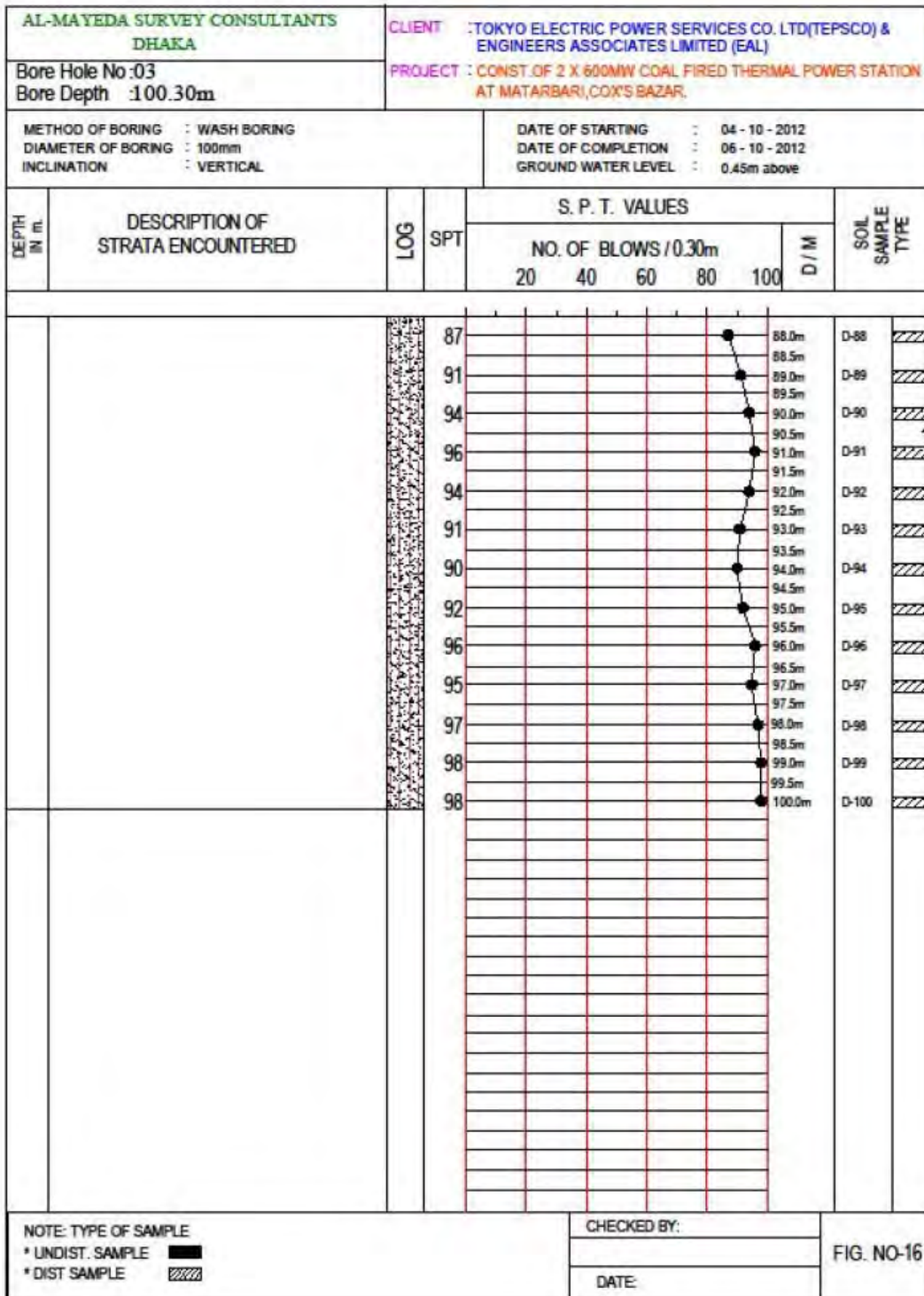


Figure -23 Bor. Logs (boring №BH-3)

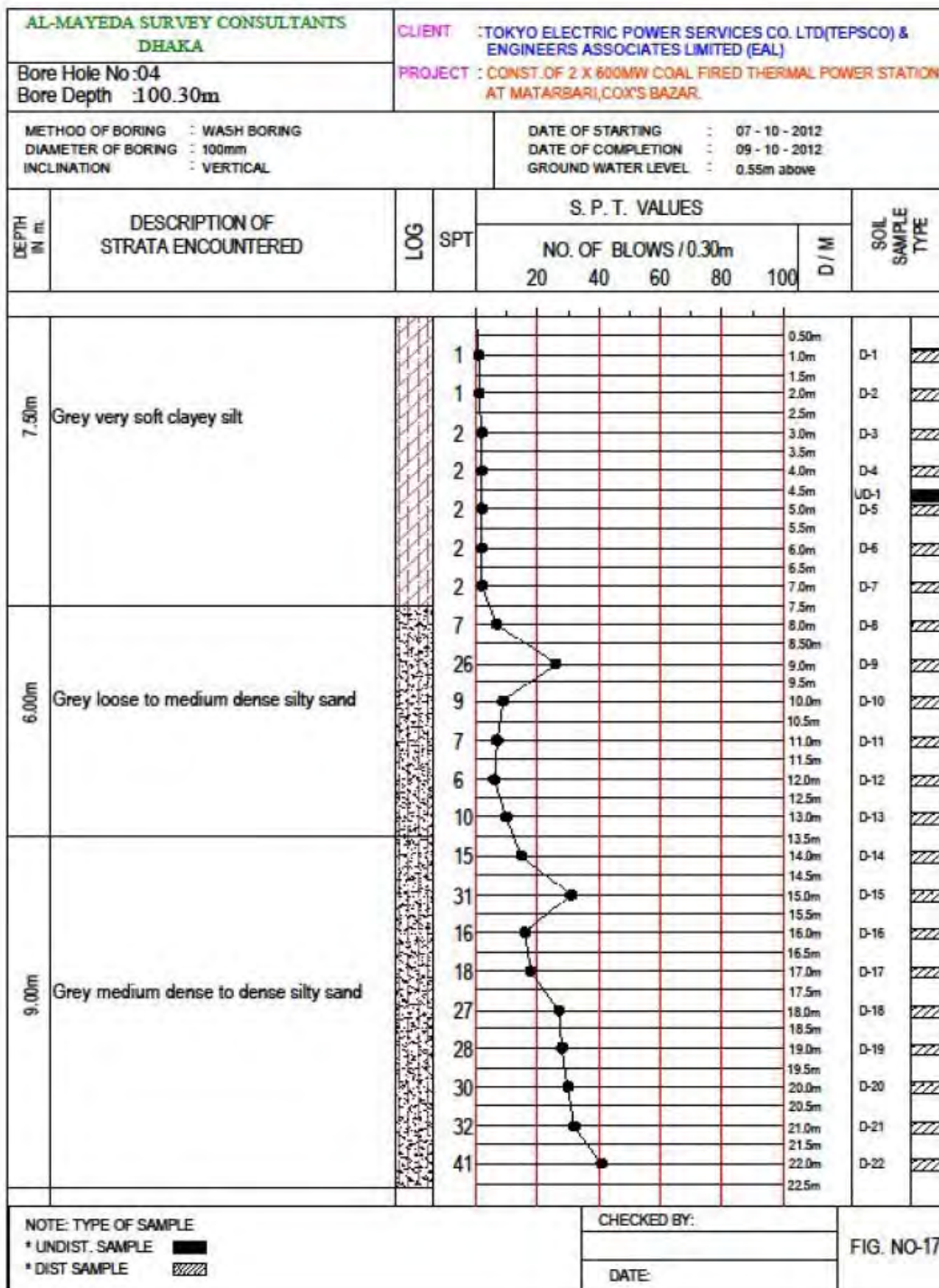


Figure -24 Bor. Logs (boring №BH-4)

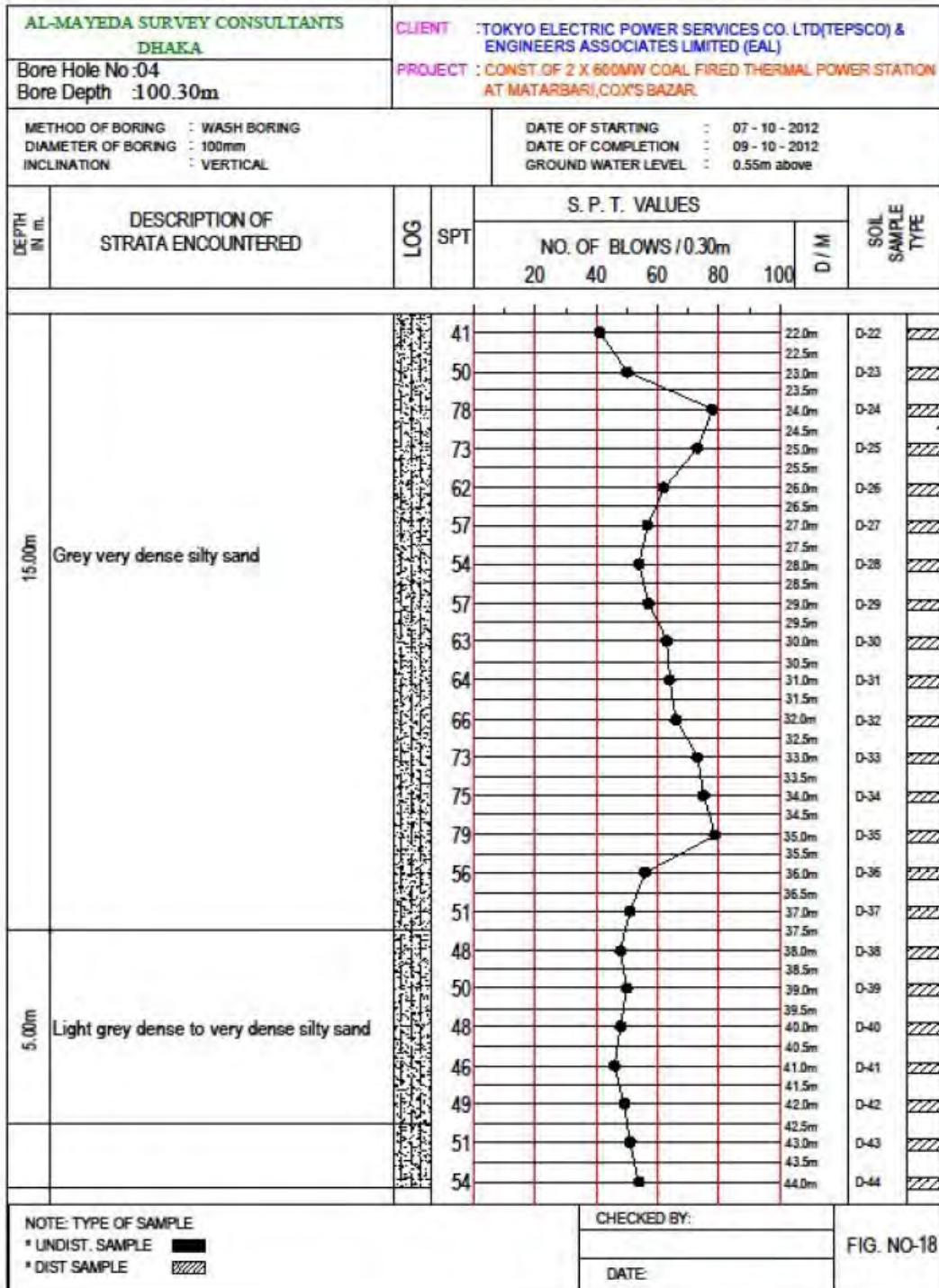


Figure -25 Bor. Logs (boring №BH-4)

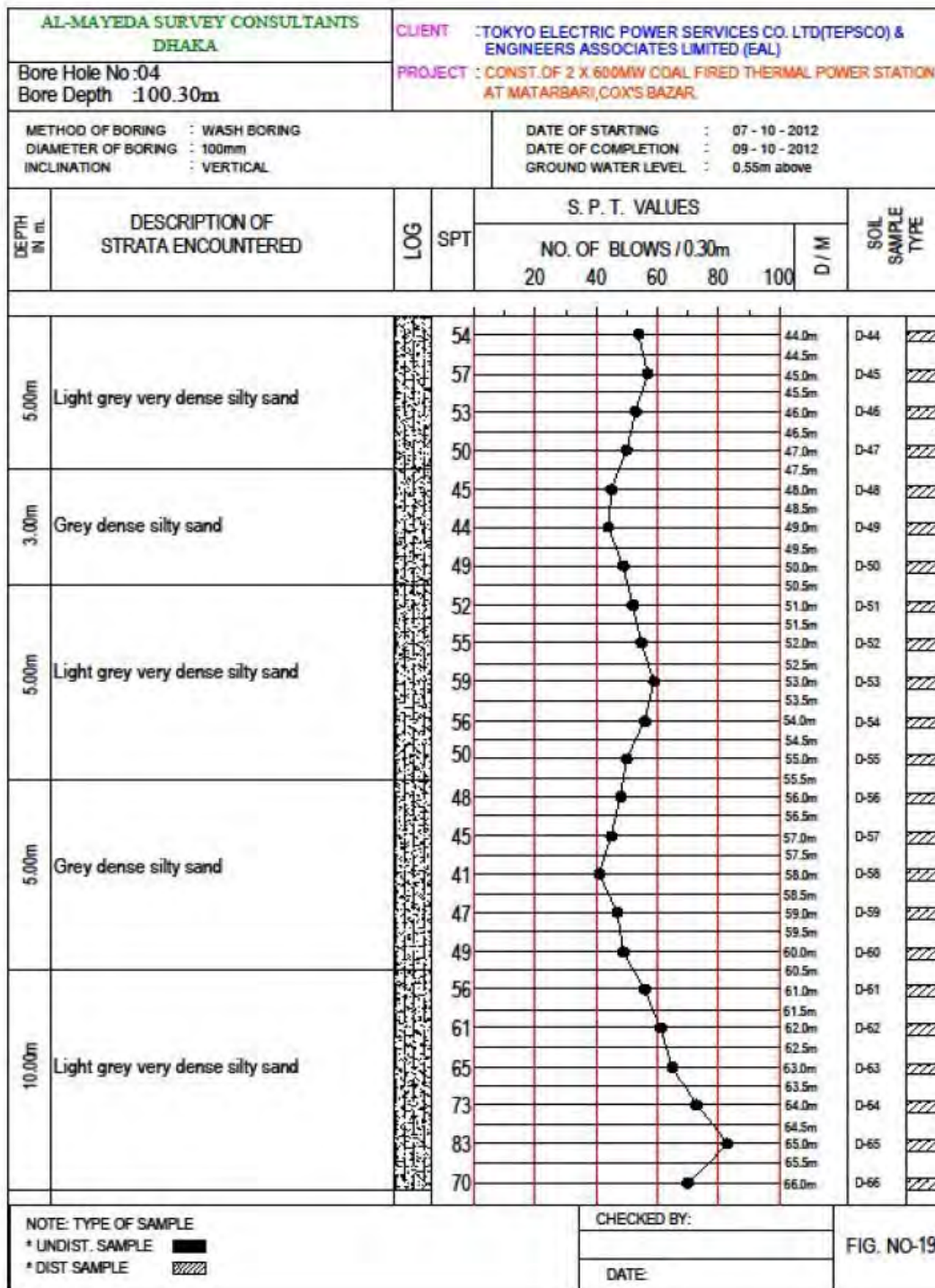


Figure -26 Bor. Logs (boring №BH-4)

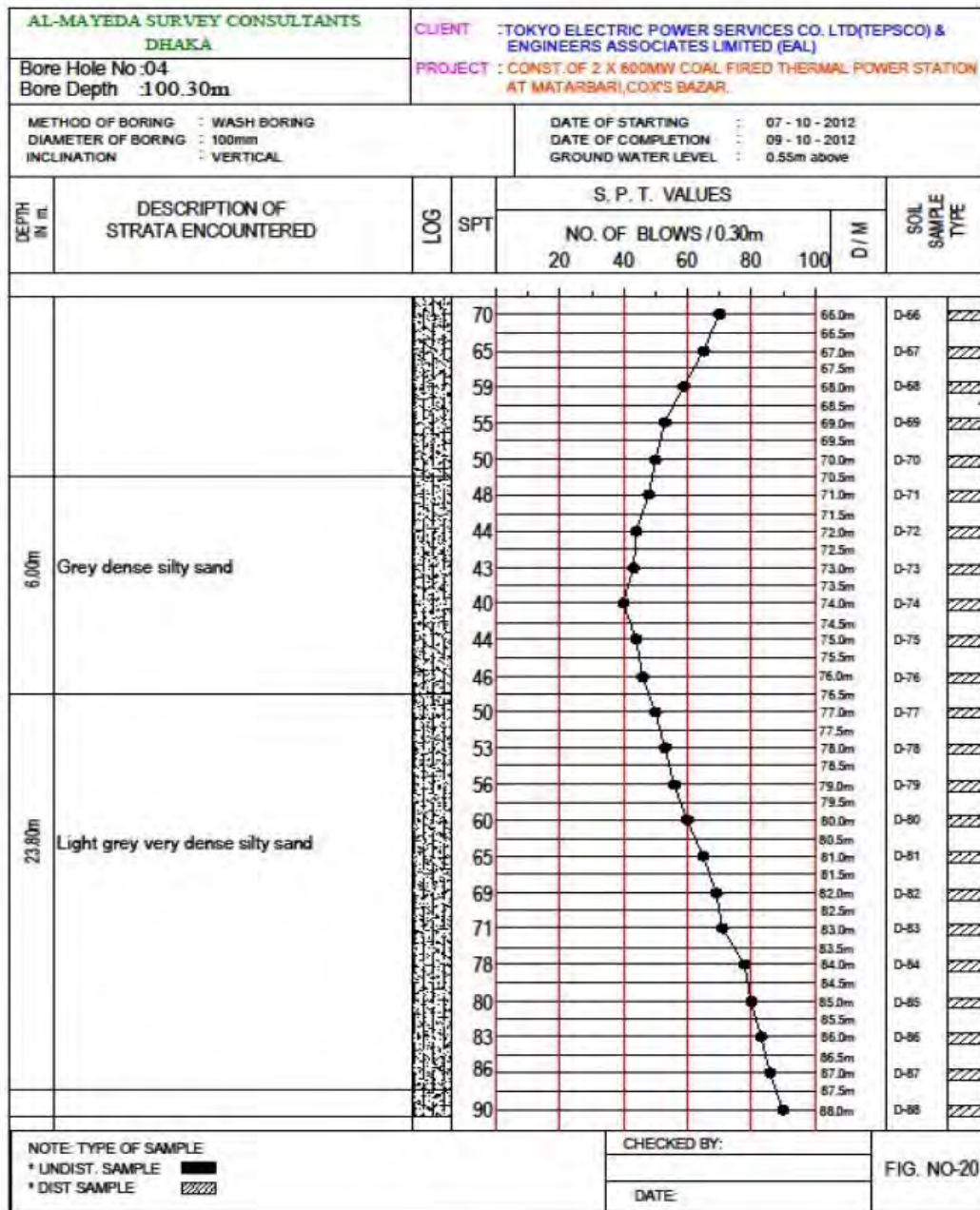


Figure -27 Bor. Logs (boring №BH-4)

AL-MAYEDA SURVEY CONSULTANTS DHAKA		CLIENT : TOKYO ELECTRIC POWER SERVICES CO. LTD(TEPSCO) & ENGINEERS ASSOCIATES LIMITED (EAL)									
Bore Hole No :04 Bore Depth :100.30m		PROJECT : CONST.OF 2 X 600MW COAL FIRED THERMAL POWER STATION AT MATARBARI, COX'S BAZAR.									
METHOD OF BORING : WASH BORING DIAMETER OF BORING : 100mm INCLINATION : VERTICAL			DATE OF STARTING : 07 - 10 - 2012 DATE OF COMPLETION : 09 - 10 - 2012 GROUND WATER LEVEL : 0.55m above								
DEPTH IN METERS	DESCRIPTION OF STRATA ENCOUNTERED	LOG	SPT	S. P. T. VALUES					SOIL SAMPLE TYPE		
				NO. OF BLOWS / 0.30m							
				20	40	60	80	100	D / M		
90		[Patterned Log Column]							88.0m	D-88	[Hatched]
									88.5m		
91									89.0m	D-89	[Hatched]
									89.5m		
93									90.0m	D-90	[Hatched]
									90.5m		
94									91.0m	D-91	[Hatched]
									91.5m		
97									92.0m	D-92	[Hatched]
									92.5m		
95									93.0m	D-93	[Hatched]
									93.5m		
90									94.0m	D-94	[Hatched]
									94.5m		
92									95.0m	D-95	[Hatched]
									95.5m		
96									96.0m	D-96	[Hatched]
									96.5m		
95									97.0m	D-97	[Hatched]
									97.5m		
97								98.0m	D-98	[Hatched]	
								98.5m			
98								99.0m	D-99	[Hatched]	
								99.5m			
98								100.0m	D-100	[Hatched]	

NOTE: TYPE OF SAMPLE * UNDIST. SAMPLE [Solid Black] * DIST SAMPLE [Hatched]	CHECKED BY:	FIG. NO-21
	DATE:	

Figure -28 Bor. Logs (boring №BH-4)

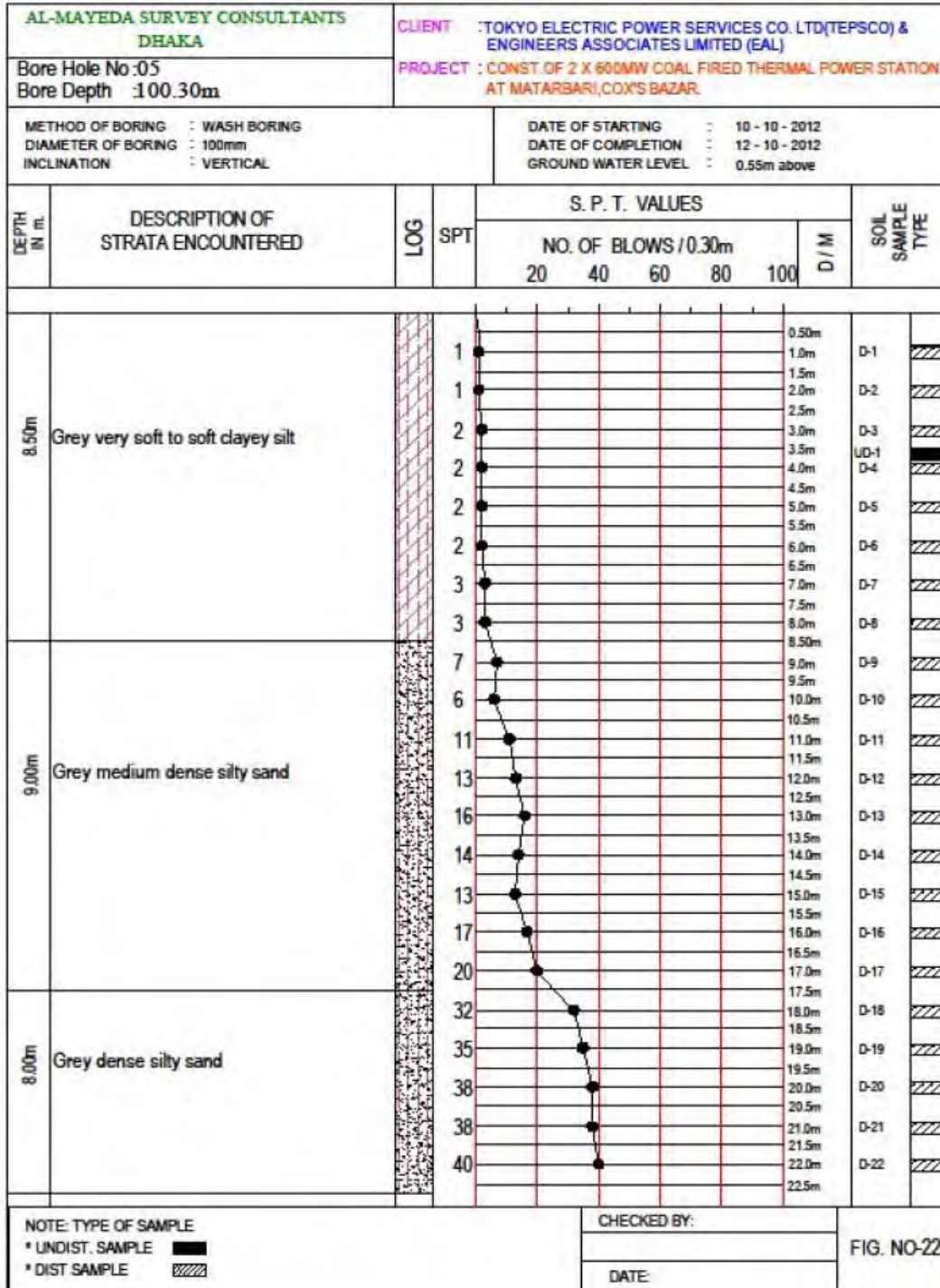


Figure -29 Bor. Logs (boring №BH-5)

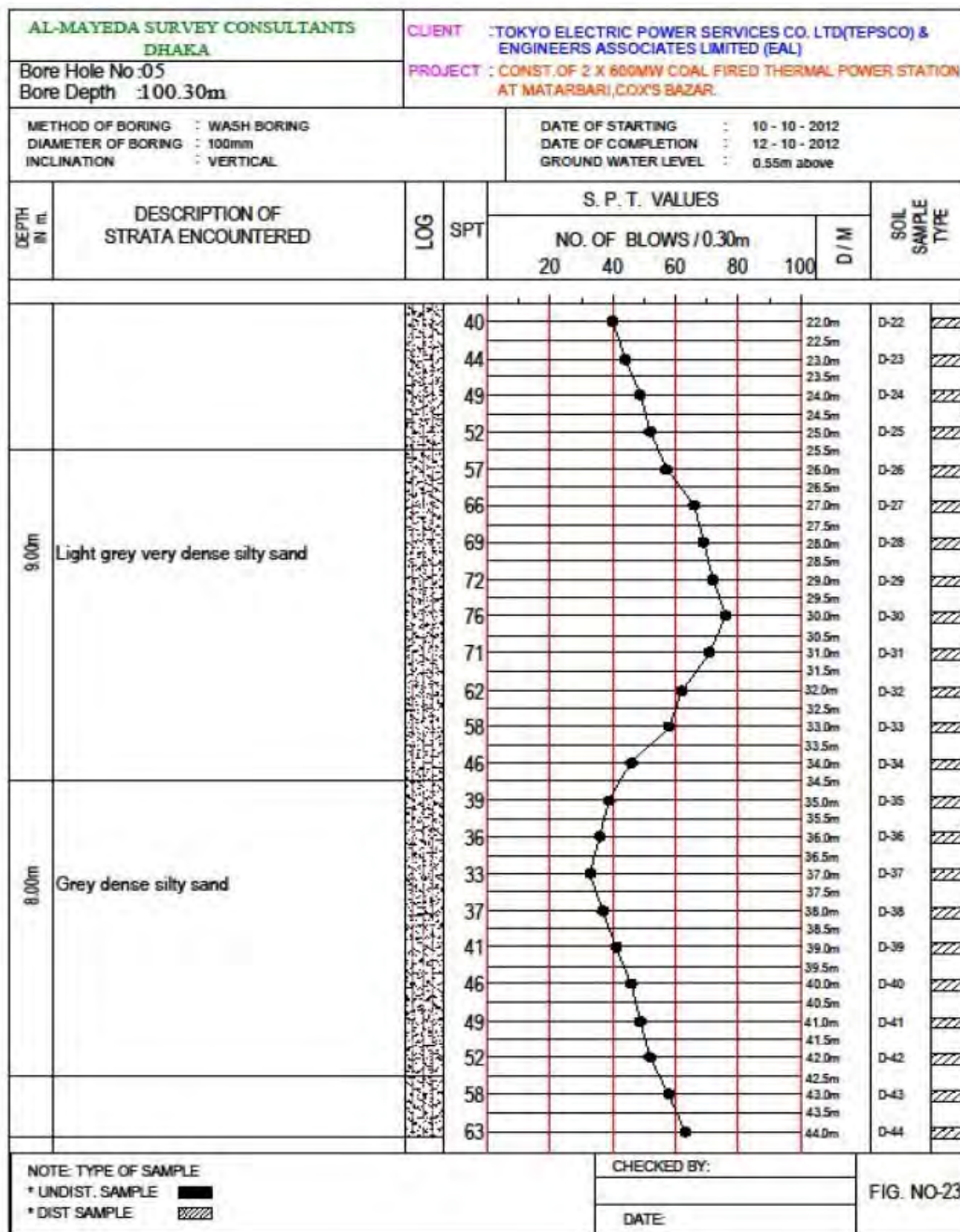


Figure -30 Bor. Logs (boring №BH-5)

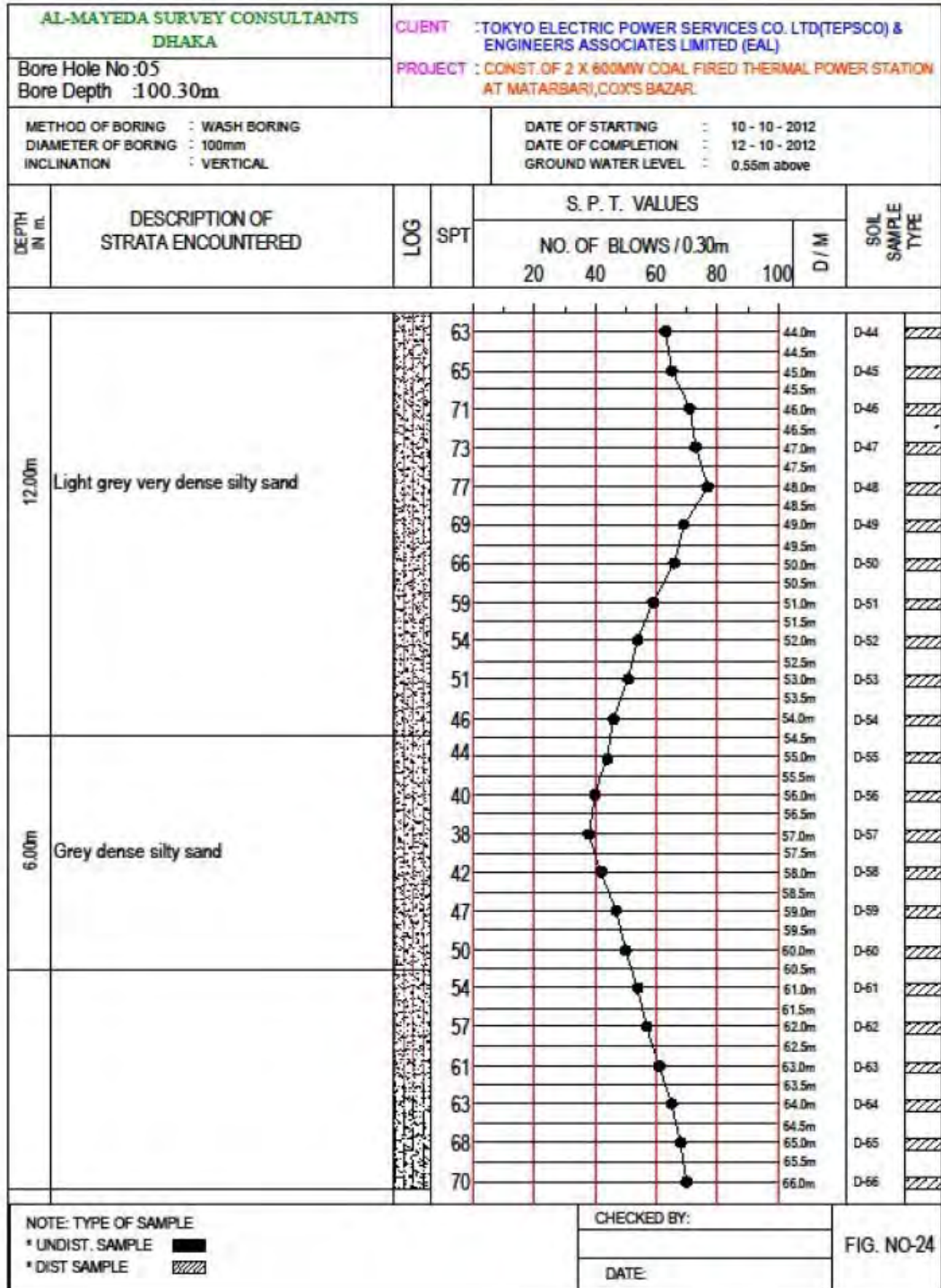


Figure -31 Bor. Logs (boring №BH-5)

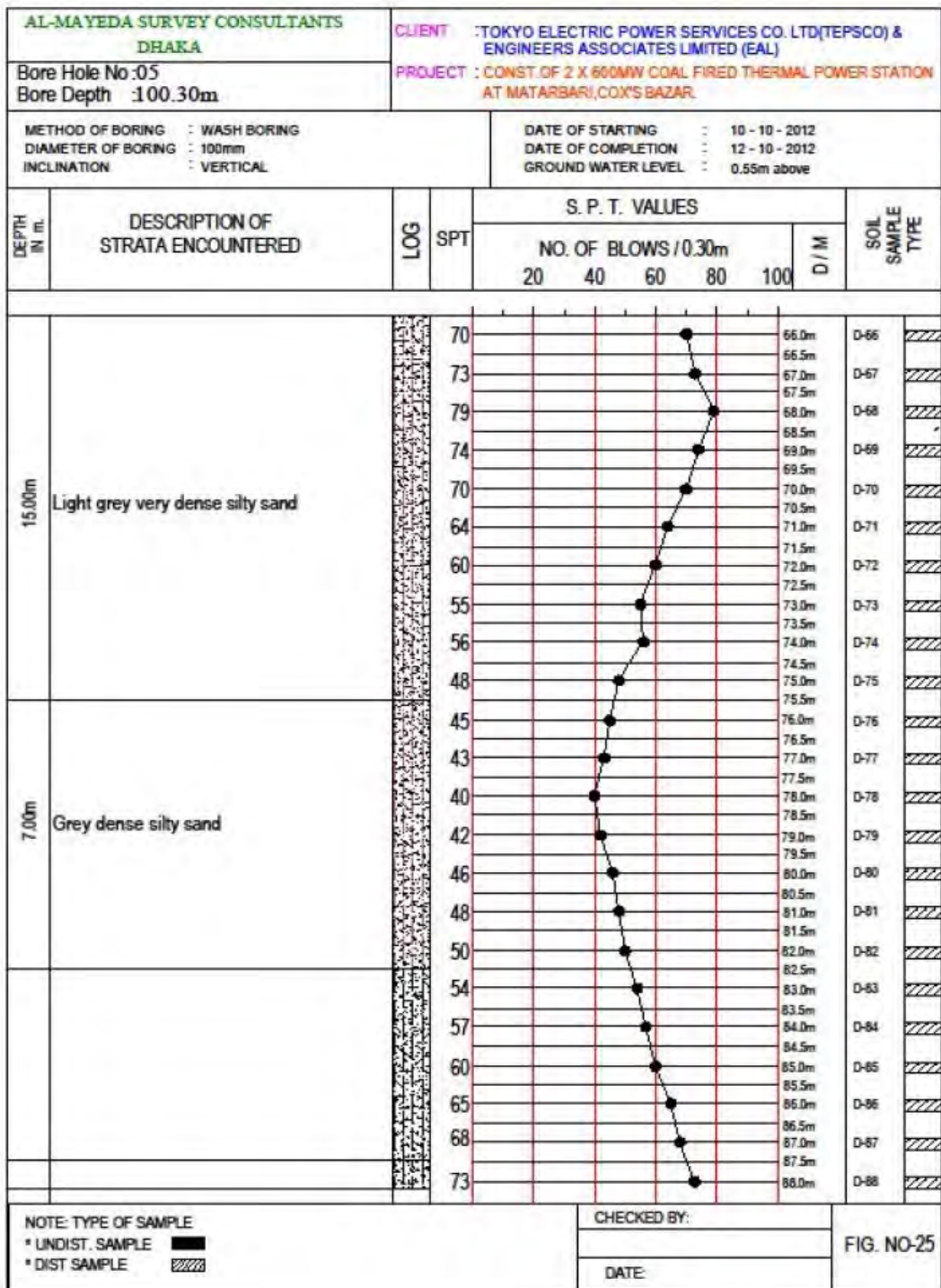


Figure -32 Bor. Logs (boring №BH-5)

AL-MAYEDA SURVEY CONSULTANTS DHAKA		CLIENT : TOKYO ELECTRIC POWER SERVICES CO. LTD(TEPCO) & ENGINEERS ASSOCIATES LIMITED (EAL)									
Bore Hole No:05 Bore Depth :100.30m		PROJECT : CONST.OF 2 X 600MW COAL FIRED THERMAL POWER STATION AT MATARBARI, COX'S BAZAR.									
METHOD OF BORING : WASH BORING DIAMETER OF BORING : 100mm INCLINATION : VERTICAL			DATE OF STARTING : 10 - 10 - 2012 DATE OF COMPLETION : 12 - 10 - 2012 GROUND WATER LEVEL : 0.55m above								
DEPTH IN m.	DESCRIPTION OF STRATA ENCOUNTERED	LOG	SPT	S. P. T. VALUES					SOIL SAMPLE TYPE		
				NO. OF BLOWS / 0.30m							
				20	40	60	80	100	D/M		
19.80m	Light grey very dense silty sand		73						88.0m	D-88	
			76						88.5m	D-89	
			80						89.0m	D-90	
			83						89.5m	D-91	
			89						90.0m	D-92	
			94						90.5m	D-93	
			97						91.0m	D-94	
			94						91.5m	D-95	
			97						92.0m	D-96	
			94						92.5m	D-97	
			97						93.0m	D-98	
			92						93.5m	D-99	
			95						94.0m	D-100	
			96						94.5m		
			98						95.0m		

NOTE: TYPE OF SAMPLE
 * UNDIST. SAMPLE
 * DIST SAMPLE

CHECKED BY: _____
 DATE: _____

FIG. NO-26

Figure -33 Bor. Logs (boring №BH-5)

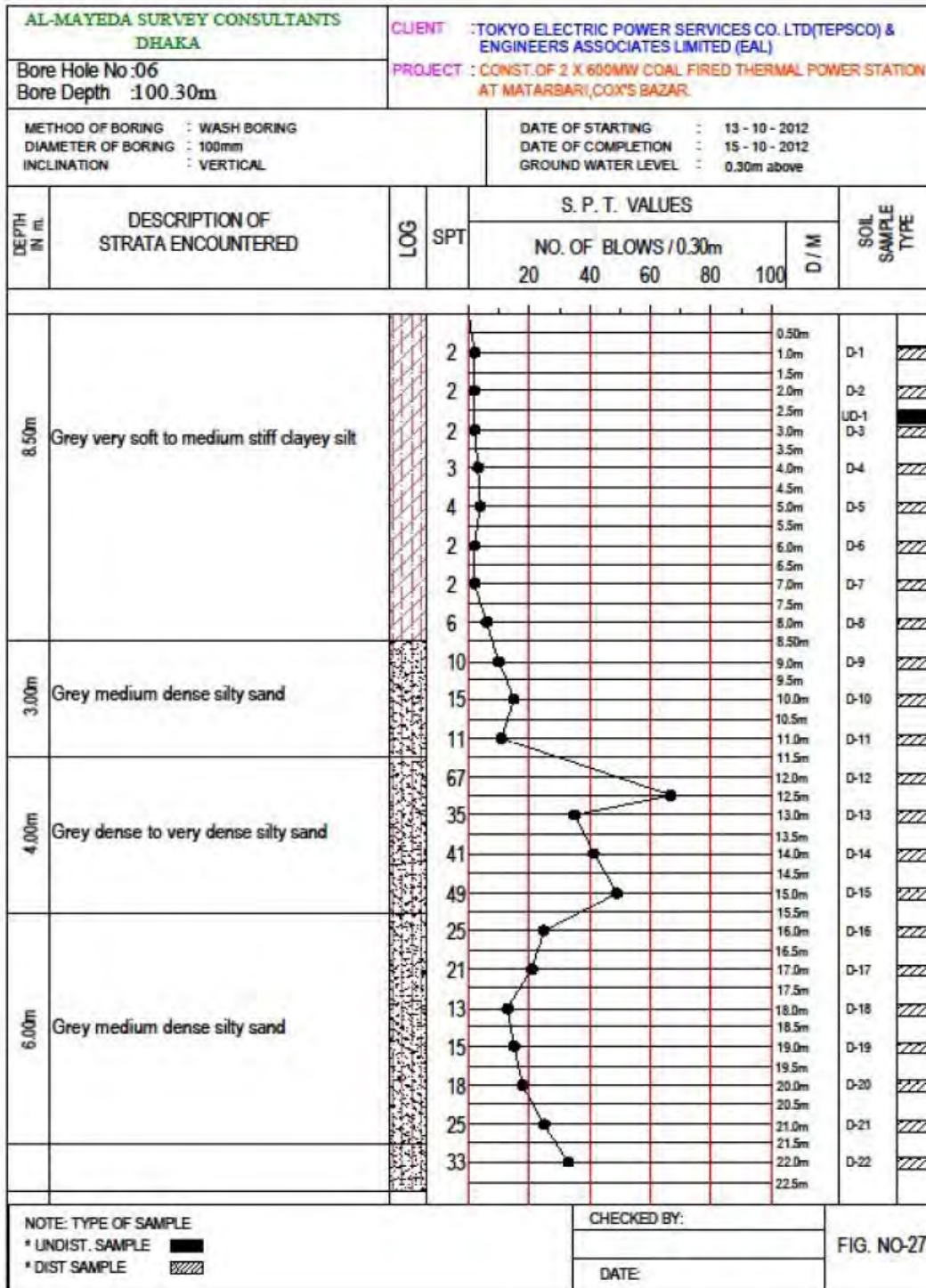


Figure -34 Bor. Logs (boring №BH-6)

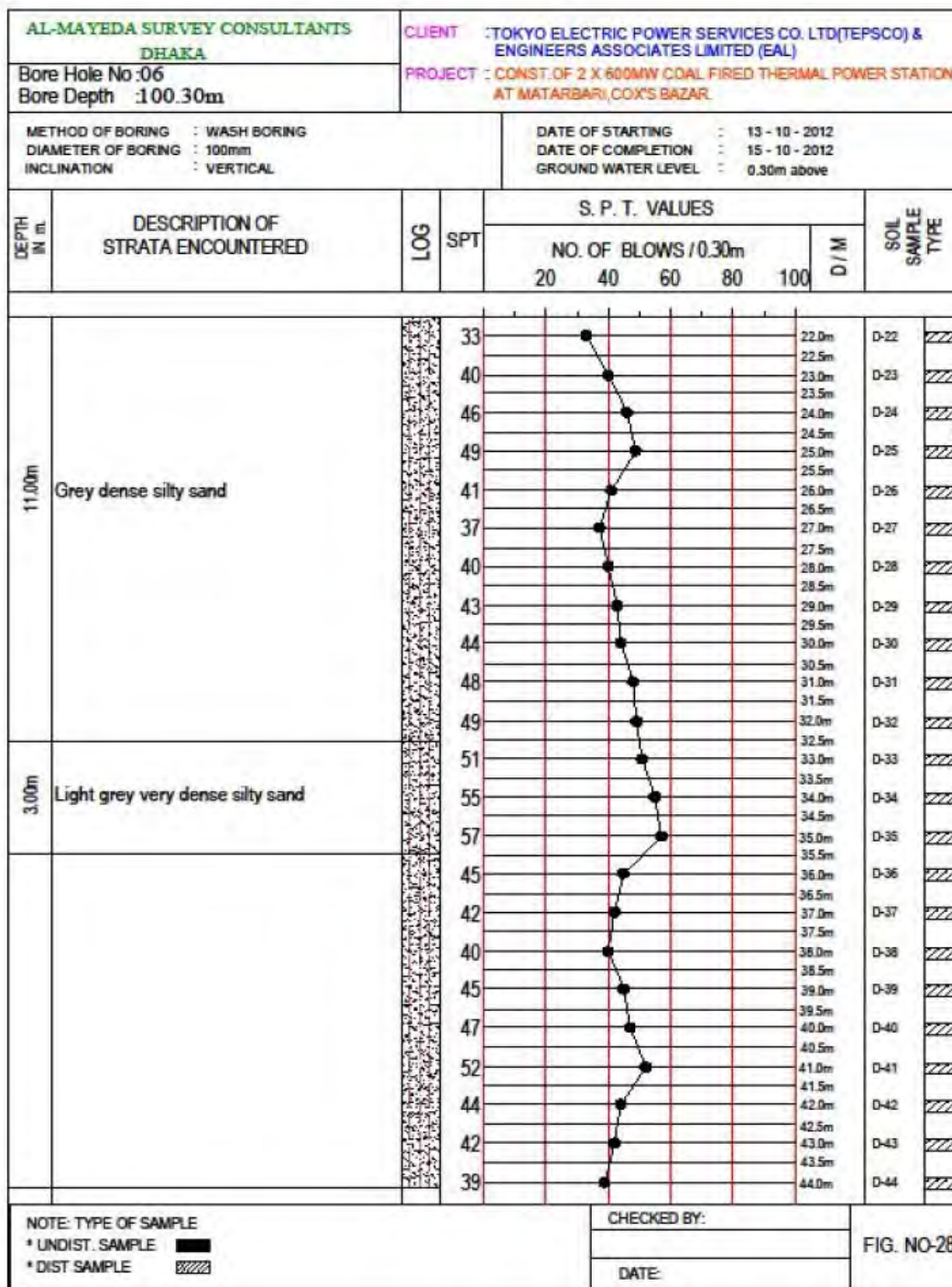


Figure -35 Bor. Logs (boring №BH-6)

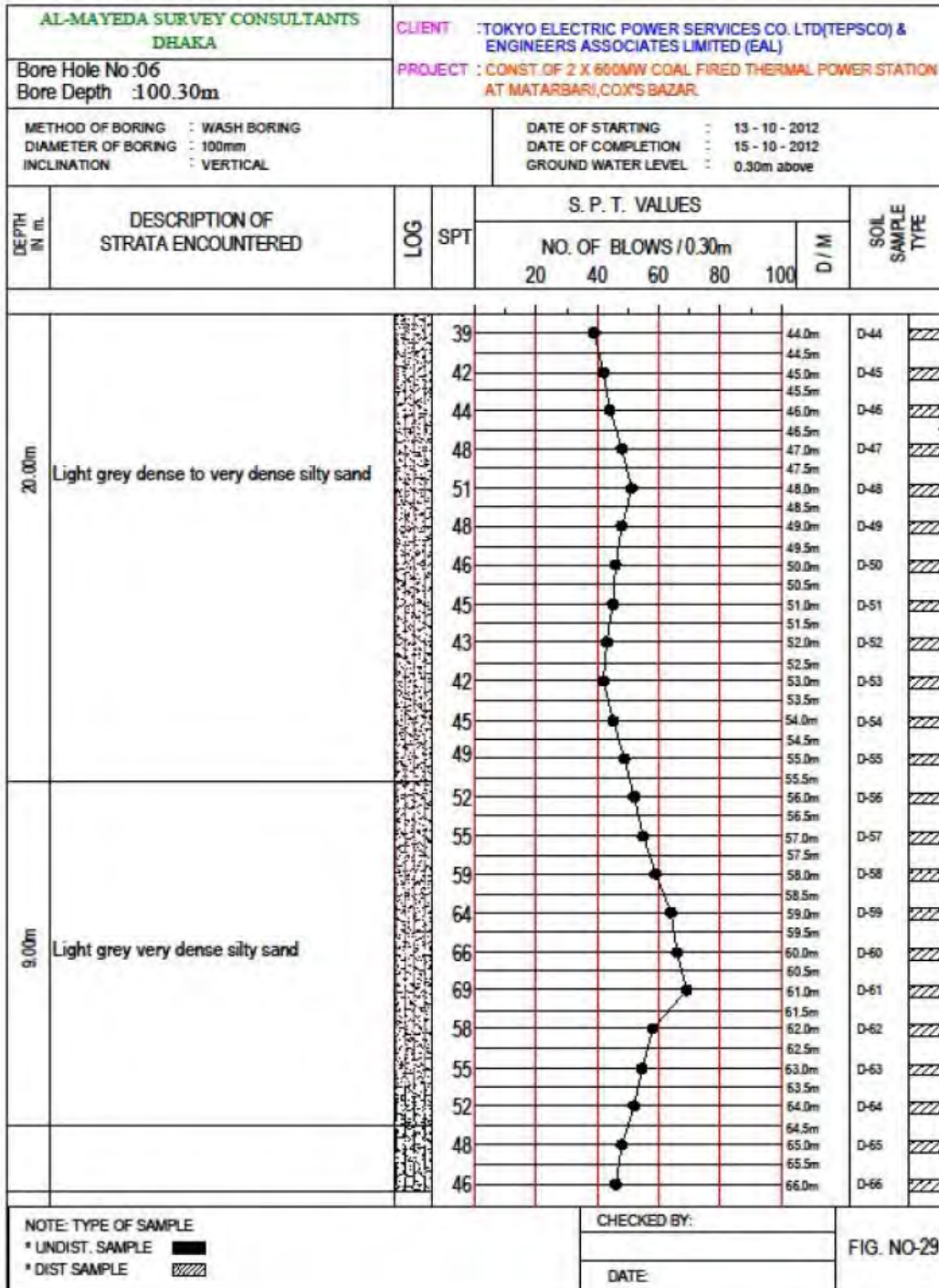


Figure -36 Bor. Logs (boring №BH-6)

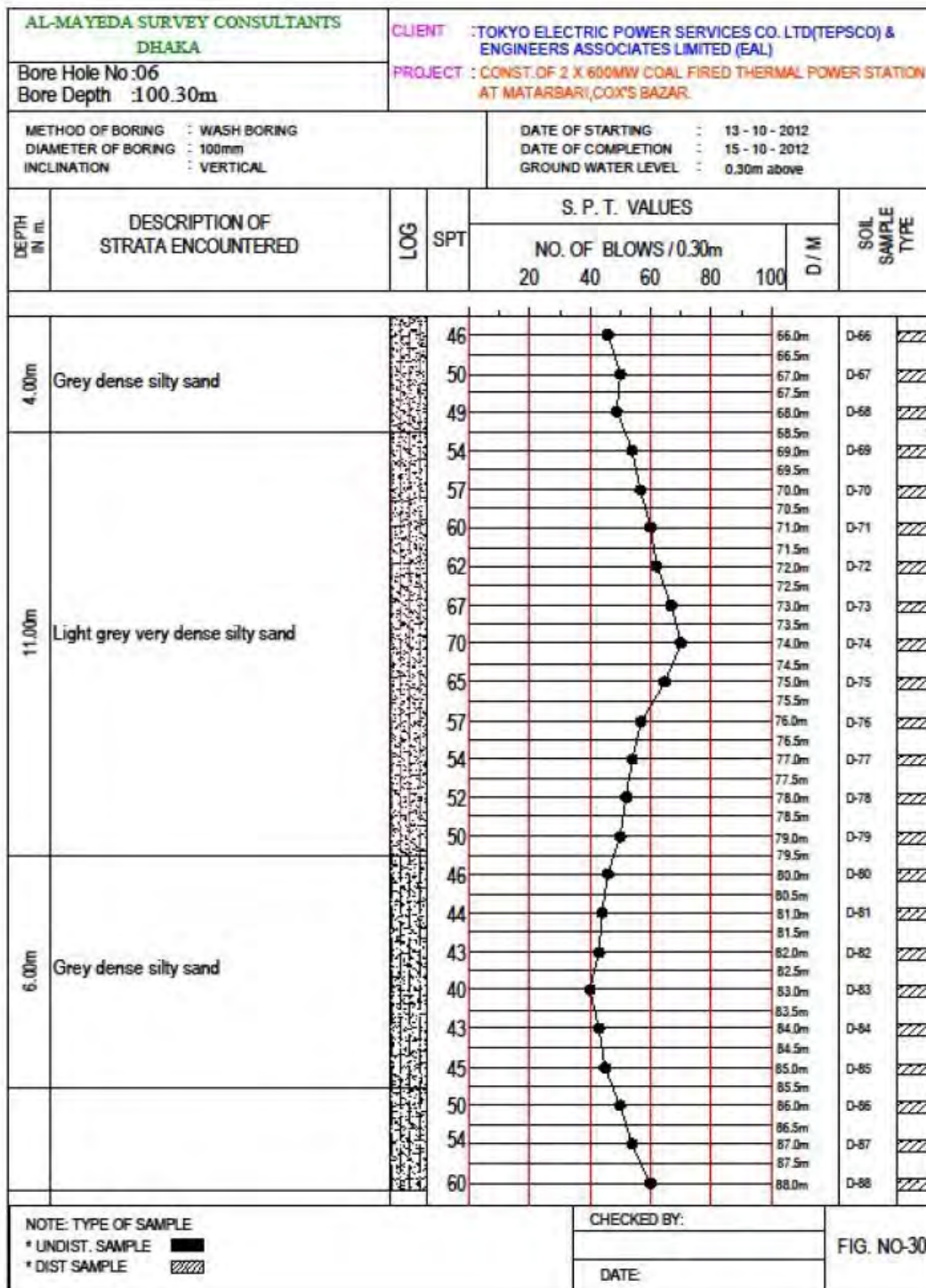


Figure -37 Bor. Logs (boring No. BH-6)

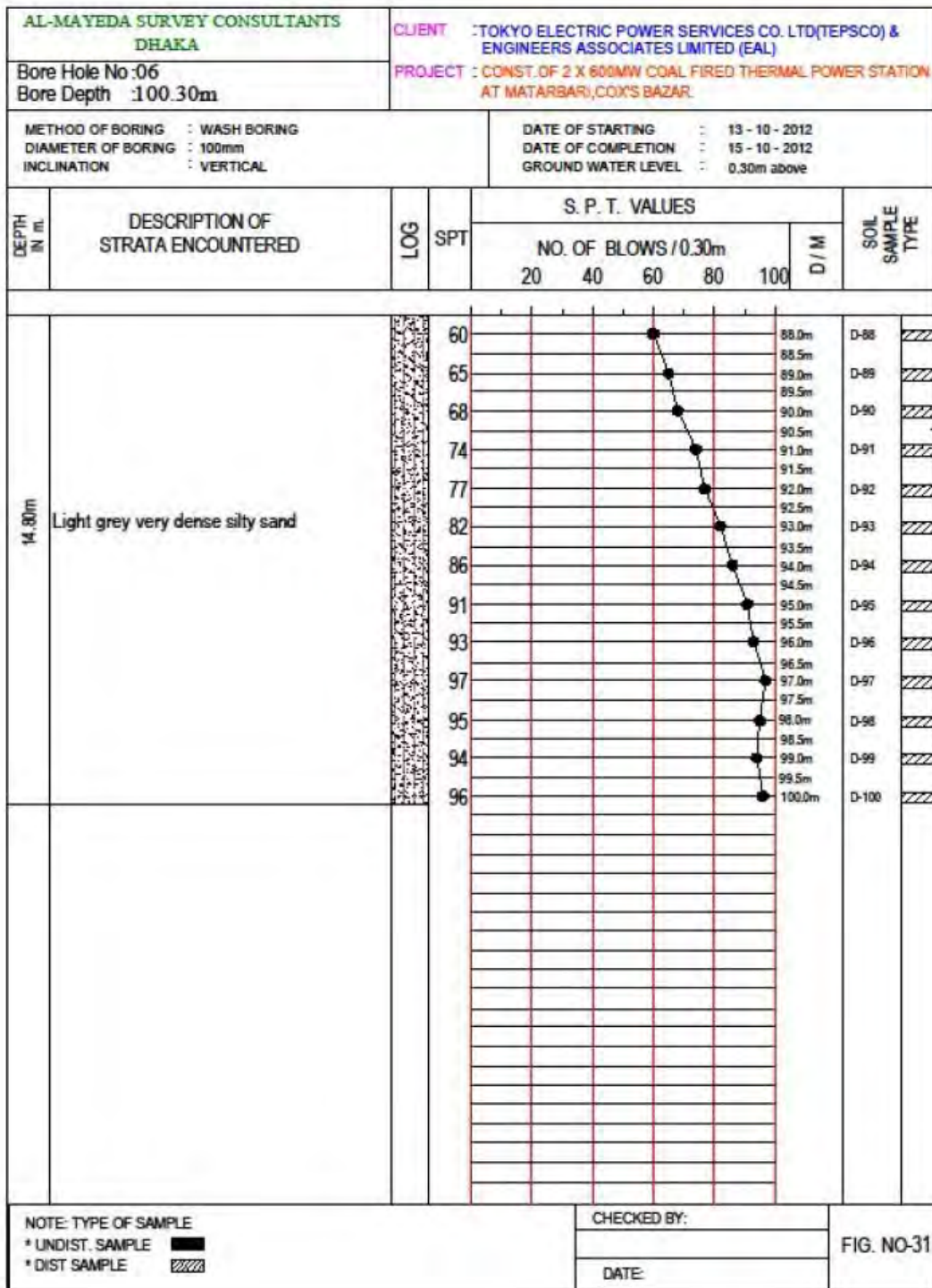


Figure -38 Bor. Logs (boring №BH-6)

Table -4 Summary of Laboratory Test Results (boring BHN₁-6)

AL-MAYEDA SURVEY CONSULTANTS DHAKA					SUMMARY OF TEST RESULTS							CLIENT: TOKYO ELECTRIC POWER SERVICES CO. LTD. (TEPSCO) & ENGINEERS ASSOCIATES LIMITED (EAL) PROJECT: CONST. OF 2X600MW COAL FIRED THERMAL POWER STATION AT MATARBARI COX'S BAZAR								
BORE HOLE NO.	SAMPLE NO	DEPTH IN METER	WET UNIT WEIGHT gm/cc	DRY UNIT WEIGHT gm/cc	NATURAL MOISTURE CONTENT %	LIQUID LIMIT %	PLASTICITY INDEX %	UNCONFINED COMPRESSION STRENGTH kg/cm ²	CONSOLIDATION TEST		TRIAxIAL SHEAR TEST (U.U.)		DIRECT SHEAR TEST		Box Shear TEST		SAND %	SILT %	CLAY %	SPECIFIC GRAVITY
									Cc	MAX LOAD TSF	0°	COHESION kg/cm ²	0°	COHESION kg/cm ²	0°	COHESION kg/cm ²				
1	UD-1	3.55 to 4.60	1.64	1.258	30.20	-	-	0.24	0.21	8.00	9.00	0.10	-	-	-	-	-	-	-	2.677
	D-2	2.00	-	-	-	43	26	-	-	-	-	-	-	-	-	-	00	72	28	-
	D-13	13.00	-	-	-	-	-	-	-	-	-	-	29	0.00	-	-	73	27	00	2.62
	D-29	29.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	82	18	00	2.62
	D-55	55.00	-	-	-	-	-	-	-	-	-	-	35	0.00	-	-	83	17	00	2.62
	D-91	91.00	-	-	-	-	-	-	-	-	-	-	36	0.00	-	-	86	14	00	2.62
2	UD-1	2.55 to 3.00	1.61	1.205	33.60	-	-	0.12	-	-	8.50	0.09	-	-	-	-	-	-	-	-
	D-5	5.00	-	-	-	41	25	-	-	-	-	-	-	-	-	-	00	74	26	-
	D-15	15.00	-	-	-	-	-	-	-	-	-	-	28	0.00	-	-	72	28	00	2.62
	D-33	33.00	-	-	-	-	-	-	-	-	-	-	36	0.00	-	-	80	20	00	2.62
	D-61	61.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	78	22	00	-
	D-95	95.00	-	-	-	-	-	-	-	-	-	-	38	0.00	-	-	87	13	00	-
3	UD-1	2.55 to 3.00	1.60	1.20	33.20	-	-	0.13	0.22	8.00	8.50	0.09	-	-	-	-	00	75	25	-
	D-3	3.00	-	-	-	40	25	-	-	-	-	-	-	-	-	-	00	75	25	-
	D-21	21.00	-	-	-	-	-	-	-	-	-	-	32	0.00	-	-	79	21	00	2.62
	D-42	42.00	-	-	-	-	-	-	-	-	-	-	34	0.00	-	-	84	16	00	2.62
	D-63	63.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	88	12	00	-
	D-98	98.00	-	-	-	-	-	-	-	-	-	-	37	0.00	-	-	90	10	00	-
4	UD-1	4.55 to 5.00	1.65	1.268	30.10	-	-	0.25	-	-	9.00	0.095	-	-	-	-	-	-	-	-
	D-4	4.00	-	-	-	41	25	-	-	-	-	-	-	-	-	-	00	74	26	-
	D-18	18.00	-	-	-	-	-	-	-	-	-	-	30	0.00	-	-	75	25	00	2.62
	D-32	32.00	-	-	-	-	-	-	-	-	-	-	35	0.00	-	-	85	15	00	2.62
	D-60	60.00	-	-	-	-	-	-	-	-	-	-	33	0.00	-	-	84	16	00	-
	D-94	94.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	91	09	00	-

FIG. NO.53

ENGINEERS ASSOCIATES LIMITED (EAL)

Table -5 Summary of Laboratory Test Results(boring BHN#1-6)

AL-MAYEDA SURVEY CONSULTANTS DHAKA						SUMMARY OF TEST RESULTS					CLIENT : TOKYO ELECTRIC POWER SERVICES CO. LTD. (TEPSCO) & ENGINEERS ASSOCIATES LIMITED (EAL) PROJECT : CONST OF 2X600MW COAL FIRED THERMAL POWER STATION AT MAARBARI COX'S BAZAR									
BORE HOLE NO.	SAMPLE NO	DEPTH IN METER	WET UNIT WEIGHT gm/cc	DRY UNIT WEIGHT gm/cc	NATURAL MOISTURE CONTENT %	LIQUID LIMIT %	PLAST- ICITY INDEX %	UNCONFINED COMPRES- SION STRENGTH kg/cm ²	CONSOLIDATION TEST		TRIAIXIAL SHEAR TEST (U.U.)		DIRECT SHEAR TEST			Box Shear TEST	SAND %	SILT %	CLAY %	SPECIFIC GRAVITY?
									Cc	MAX LOAD TSF	0 °	COHES- ION kg/cm ²	0 °	COHES- ION kg/cm ²	0 °					
5	UD-1	3.55 to 4.00	1.64	1.263	29.80	-	-	0.24	-	-	9.00	0.095	-	-	-	-	-	-	-	
	D-1	1.00	-	-	-	42	25	-	-	-	-	-	-	-	-	00	73	27	-	
	D-16	16.00	-	-	-	-	-	-	-	-	-	-	27	0.02	-	-	71	29	00	2.62
	D-48	48.00	-	-	-	-	-	-	-	-	-	-	36	0.00	-	-	86	14	00	2.62
	D-67	67.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	88	12	00	-
	D-90	90.00	-	-	-	-	-	-	-	-	-	-	38	0.00	-	-	92	08	00	-
6	UD-1	2.55 to 3.00	1.65	1.261	30.80	-	-	0.25	-	-	9.00	0.098	-	-	-	-	-	-	-	
	D-3	3.00	-	-	-	43	26	-	-	-	-	-	-	-	-	00	72	28	-	
	D-17	17.00	-	-	-	-	-	-	-	-	-	-	29	0.00	-	-	74	26	00	2.62
	D-35	35.00	-	-	-	-	-	-	-	-	-	-	35	0.00	-	-	81	19	00	-
	D-75	75.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	85	15	00	2.62
	D-96	96.00	-	-	-	-	-	-	-	-	-	-	37	0.00	-	-	90	10	00	-

FIG. NO.54

ENGINEERS ASSOCIATES LIMITED (EAL)

Appendix-C05-03

Oceanographic Survey

Deep Water Wave

An estimated global wave database has been calculated using the Wave Estimation Model “JWA3G” developed by the Japan Weather Association, based on the objectively analyzed sea surface wind values of the European Center for Medium-Range Weather Forecasts (ECMWF) as input conditions.

Model JWA3G is the most advanced model for estimating irregular waves approaching from various directions based on the spectral method

➤ Deep water Waves Data

- Period : 2006.1.1~2010.12.31
- Extraction Point : Long. 91°30' E, Long. 20°30' N
- Time Interval : 1 hour
- Data Elements : Significant wave height, period and direction

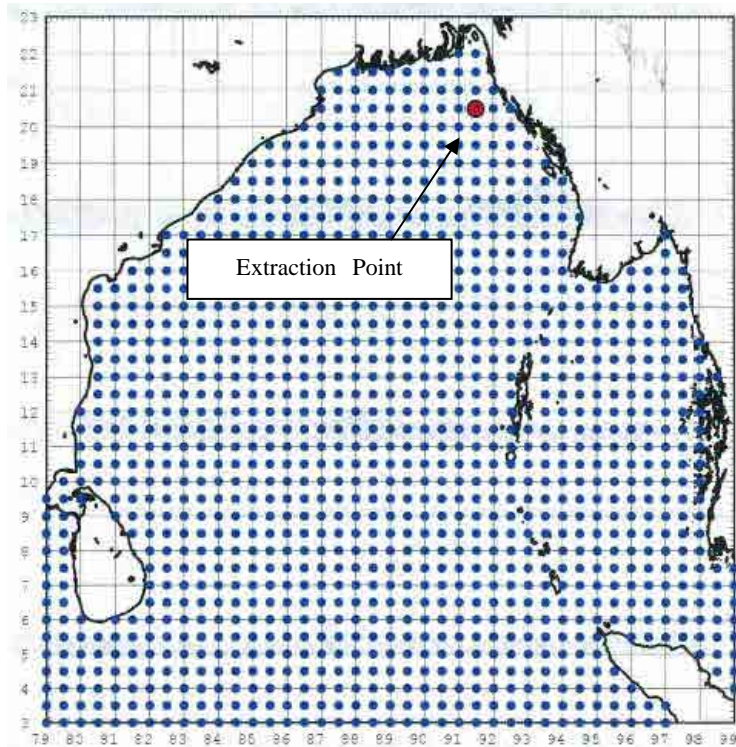


Figure -1 Area of wave forecasting data

Table -1 (1) Composite frequency of significant wave height and period (deepwater, annually)

Point : E91.5 , N20.5

Term : 2006.1.1 ~ 2010.12.31

Wave Direction : ALL

Height (m) \ Period (s)	Period (s)															Sum	Total amount
	~ 2.9	3.0 ~ 3.9	4.0 ~ 4.9	5.0 ~ 5.9	6.0 ~ 6.9	7.0 ~ 7.9	8.0 ~ 8.9	9.0 ~ 9.9	10.0 ~ 10.9	11.0 ~ 11.9	12.0 ~ 12.9	13.0 ~ 13.9	14.0 ~ 14.9	15.0 ~			
~ 0.49			18 (0.0)	75 (0.2)	187 (0.4)	323 (0.7)	378 (0.9)	346 (0.8)	131 (0.3)	17 (0.0)					1475 (3.4)	1475 (3.4)	
0.50 ~ 0.99		6 (0.0)	255 (0.6)	948 (2.2)	1729 (3.9)	2533 (5.8)	3765 (8.6)	3280 (7.5)	1734 (4.0)	484 (1.1)	189 (0.4)	19 (0.0)	13 (0.0)		14955 (34.1)	16430 (37.5)	
1.00 ~ 1.49			186 (0.4)	590 (1.3)	1089 (2.5)	2579 (5.9)	2952 (6.7)	1929 (4.4)	1389 (3.2)	917 (2.1)	350 (0.8)	110 (0.3)	18 (0.0)		12109 (27.6)	28539 (65.1)	
1.50 ~ 1.99				144 (0.3)	1295 (3.0)	2644 (6.0)	2617 (6.0)	1209 (2.8)	609 (1.4)	122 (0.3)	61 (0.1)	70 (0.2)	4 (0.0)		8775 (20.0)	37314 (85.1)	
2.00 ~ 2.49				14 (0.0)	765 (1.7)	1560 (3.6)	1158 (2.6)	462 (1.1)	129 (0.3)	67 (0.2)	42 (0.1)				4197 (9.6)	41511 (94.7)	
2.50 ~ 2.99					267 (0.6)	681 (1.6)	369 (0.8)	173 (0.4)	28 (0.1)	13 (0.0)	26 (0.1)				1557 (3.6)	43068 (98.3)	
3.00 ~ 3.49					13 (0.0)	256 (0.6)	128 (0.3)	13 (0.0)	1 (0.0)	13 (0.0)					424 (1.0)	43492 (99.2)	
3.50 ~ 3.99						131 (0.3)	36 (0.1)	9 (0.0)							176 (0.4)	43668 (99.6)	
4.00 ~ 4.49						34 (0.1)	35 (0.1)	6 (0.0)							75 (0.2)	43743 (99.8)	
4.50 ~ 4.99						2 (0.0)	17 (0.0)	10 (0.0)							29 (0.1)	43772 (99.9)	
5.00 ~ 5.49							13 (0.0)	4 (0.0)	2 (0.0)						19 (0.0)	43791 (99.9)	
5.50 ~ 5.99							6 (0.0)	7 (0.0)	4 (0.0)						17 (0.0)	43808 (100.0)	
6.00 ~ 6.49								5 (0.0)	5 (0.0)						10 (0.0)	43818 (100.0)	
6.50 ~ 6.99									6 (0.0)						6 (0.0)	43824 (100.0)	
7.00 ~															0 (0.0)	43824 (100.0)	
Sum	0 (0.0)	6 (0.0)	459 (1.0)	1771 (4.0)	5345 (12.2)	10743 (24.5)	11474 (26.2)	7453 (17.0)	4038 (9.2)	1633 (3.7)	668 (1.5)	199 (0.5)	35 (0.1)	0 (0.0)	43824 (100.0)		
Total amount	0 (0.0)	6 (0.0)	465 (1.1)	2236 (5.1)	7581 (17.3)	18324 (41.8)	29798 (68.0)	37251 (85.0)	41289 (94.2)	42922 (97.9)	43590 (99.5)	43789 (99.9)	43824 (100.0)	43824 (100.0)			

upper : frequency , (lower) : ratio

Table -1 (2) Composite frequency of significant wave height and direction (deepwater, annually)

Point : E91.5 , N20.5
 Term : 2006.1.1 ~ 2010.12.31

Direction Height (m)	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N	Sum
~ 0.49	10 (0.0)	1 (0.0)	1 (0.0)		1 (0.0)	3 (0.0)	66 (0.2)	890 (2.0)	375 (0.9)	52 (0.1)	19 (0.0)	23 (0.1)	17 (0.0)	12 (0.0)	3 (0.0)	2 (0.0)	1475 (3.4)
0.50 ~ 0.99	55 (0.1)	3 (0.0)	1 (0.0)	2 (0.0)		7 (0.0)	37 (0.1)	2921 (6.7)	8670 (19.8)	1486 (3.4)	288 (0.7)	251 (0.6)	239 (0.5)	317 (0.7)	389 (0.9)	289 (0.7)	14955 (34.1)
1.00 ~ 1.49	15 (0.0)					7 (0.0)	39 (0.1)	816 (1.9)	8201 (18.7)	1781 (4.1)	182 (0.4)	105 (0.2)	92 (0.2)	138 (0.3)	424 (1.0)	309 (0.7)	12109 (27.6)
1.50 ~ 1.99						11 (0.0)	40 (0.1)	532 (1.2)	6711 (15.3)	1396 (3.2)			2 (0.0)	3 (0.0)	28 (0.1)	52 (0.1)	8775 (20.0)
2.00 ~ 2.49						12 (0.0)	86 (0.2)	353 (0.8)	2906 (6.6)	838 (1.9)	2 (0.0)						4197 (9.6)
2.50 ~ 2.99						1 (0.0)	74 (0.2)	125 (0.3)	847 (1.9)	508 (1.2)	2 (0.0)						1557 (3.6)
3.00 ~ 3.49							17 (0.0)	73 (0.2)	258 (0.6)	76 (0.2)							424 (1.0)
3.50 ~ 3.99							33 (0.1)	22 (0.1)	80 (0.2)	41 (0.1)							176 (0.4)
4.00 ~ 4.49							22 (0.1)	5 (0.0)	35 (0.1)	13 (0.0)							75 (0.2)
4.50 ~ 4.99							5 (0.0)	9 (0.0)	15 (0.0)								29 (0.1)
5.00 ~ 5.49							7 (0.0)	6 (0.0)	6 (0.0)								19 (0.0)
5.50 ~ 5.99								7 (0.0)	10 (0.0)								17 (0.0)
6.00 ~ 6.49								6 (0.0)	4 (0.0)								10 (0.0)
6.50 ~ 6.99								1 (0.0)	5 (0.0)								6 (0.0)
7.00 ~																	0 (0.0)
Sum	80 (0.2)	4 (0.0)	2 (0.0)	2 (0.0)	1 (0.0)	41 (0.1)	426 (1.0)	5766 (13.2)	28123 (64.2)	6191 (14.1)	493 (1.1)	379 (0.9)	350 (0.8)	470 (1.1)	844 (1.9)	652 (1.5)	43824 (100.0)

upper : frequency , (lower) : ratio

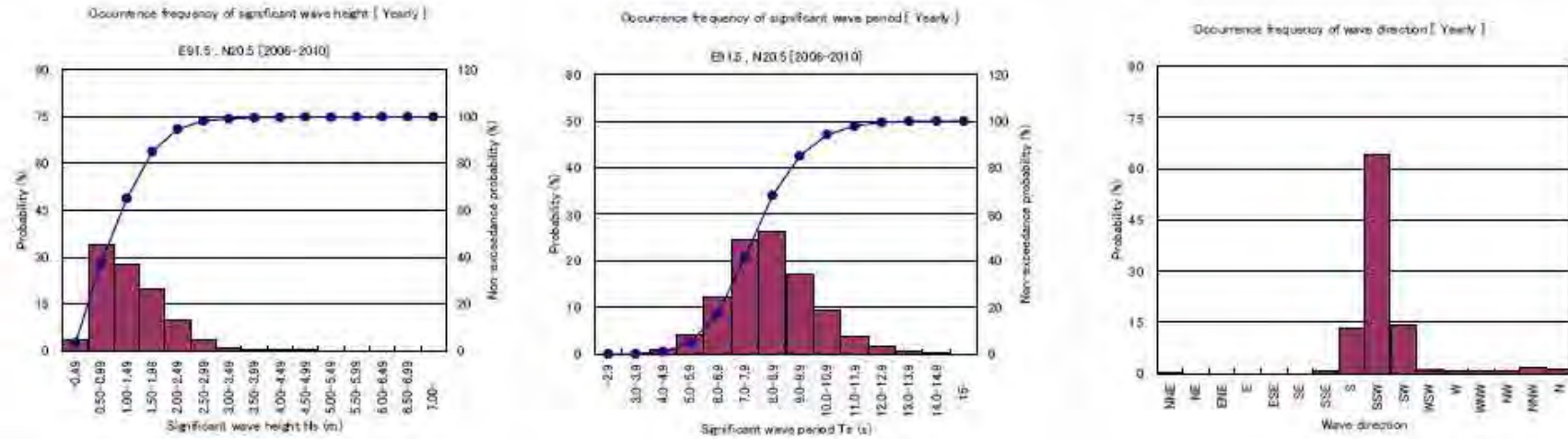


Figure -2 (1) Frequency of significant wave height and direction (deepwater, annually)

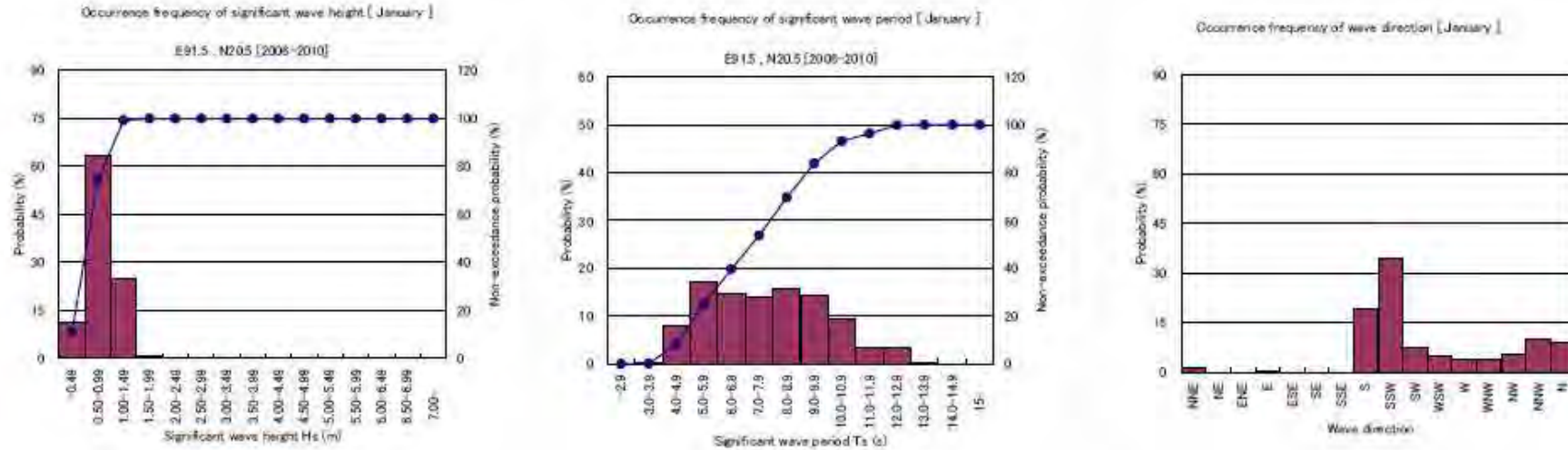


Figure -2 (2) Frequency of significant wave height and direction (deepwater, Jan.)

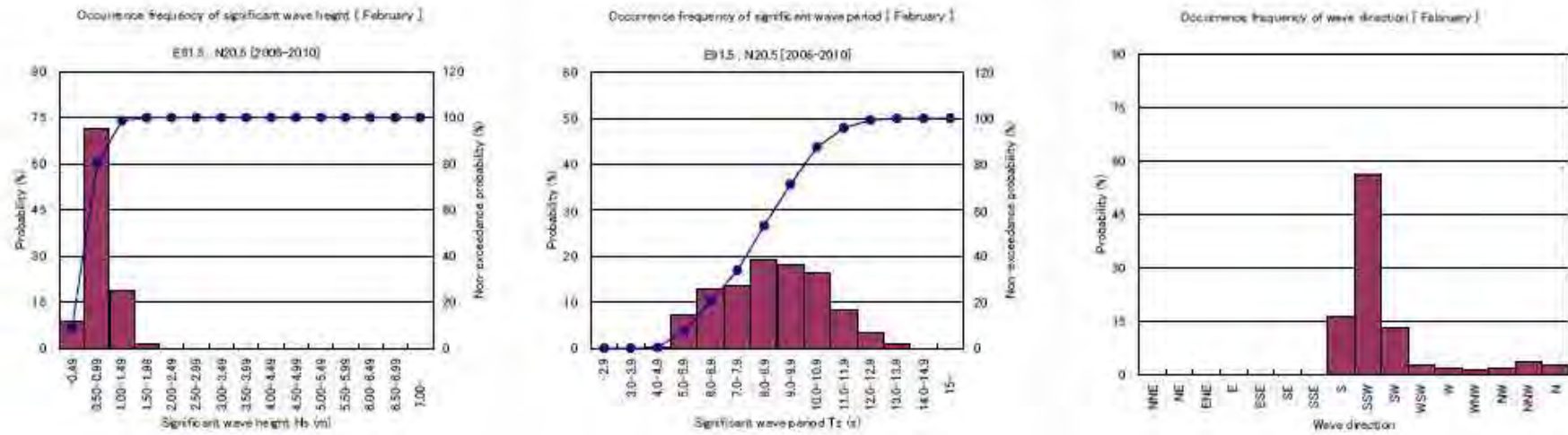


Figure -2 (3) Occurrence frequency of significant wave height and direction (deepwater, Feb.)

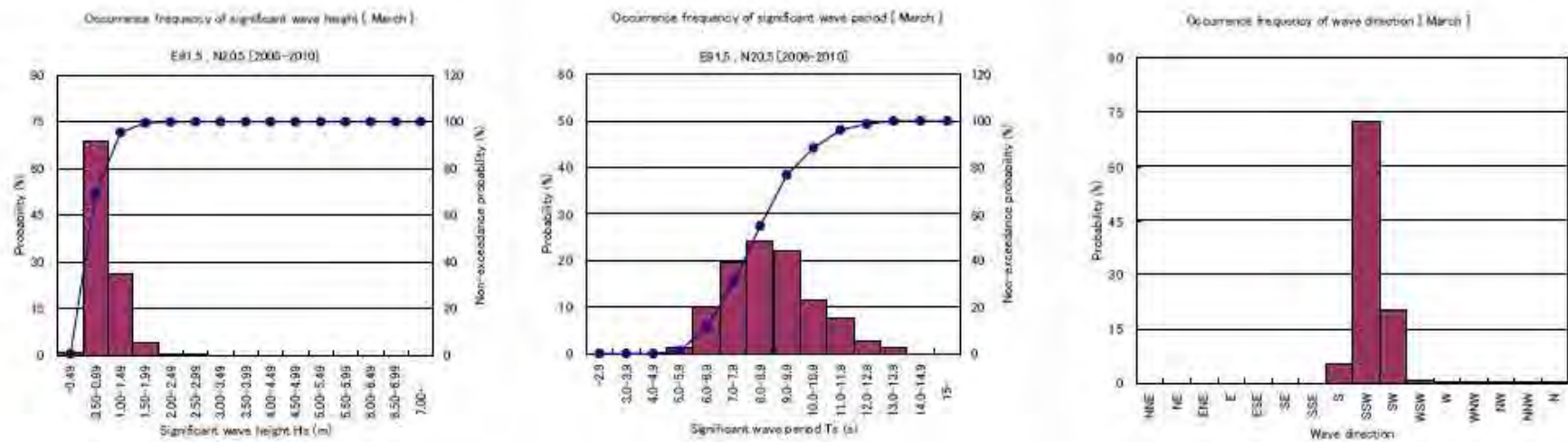


Figure -2 (4) Frequency of significant wave height and direction (deepwater, Mar.)

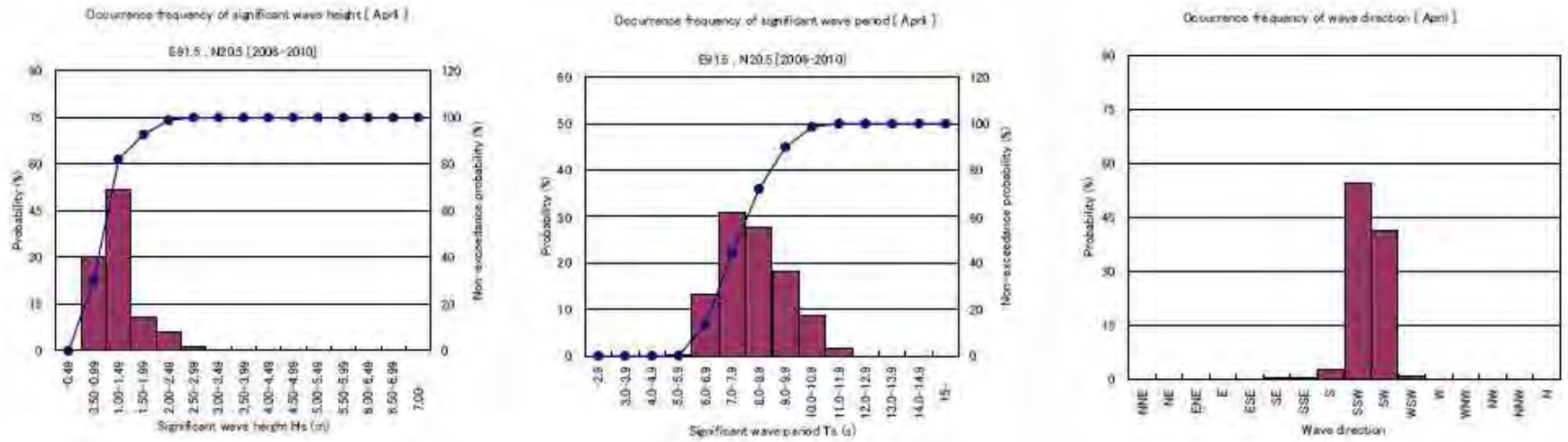


Figure -2 (5) Frequency of significant wave height and direction (deepwater, Apr.)

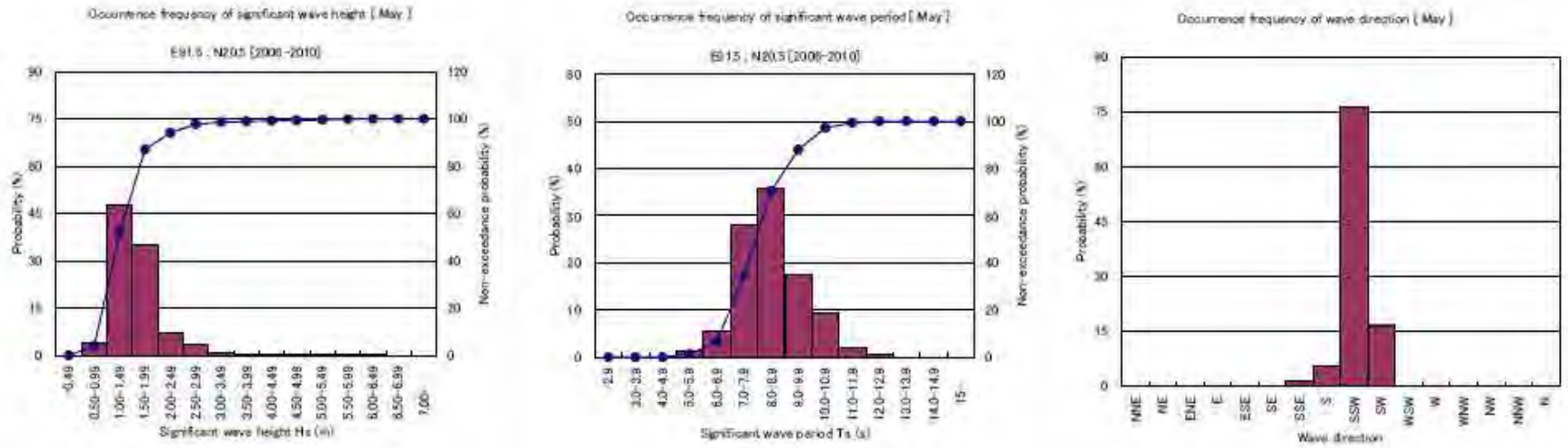


Figure -2 (6) Frequency of significant wave height and direction (deepwater, May)

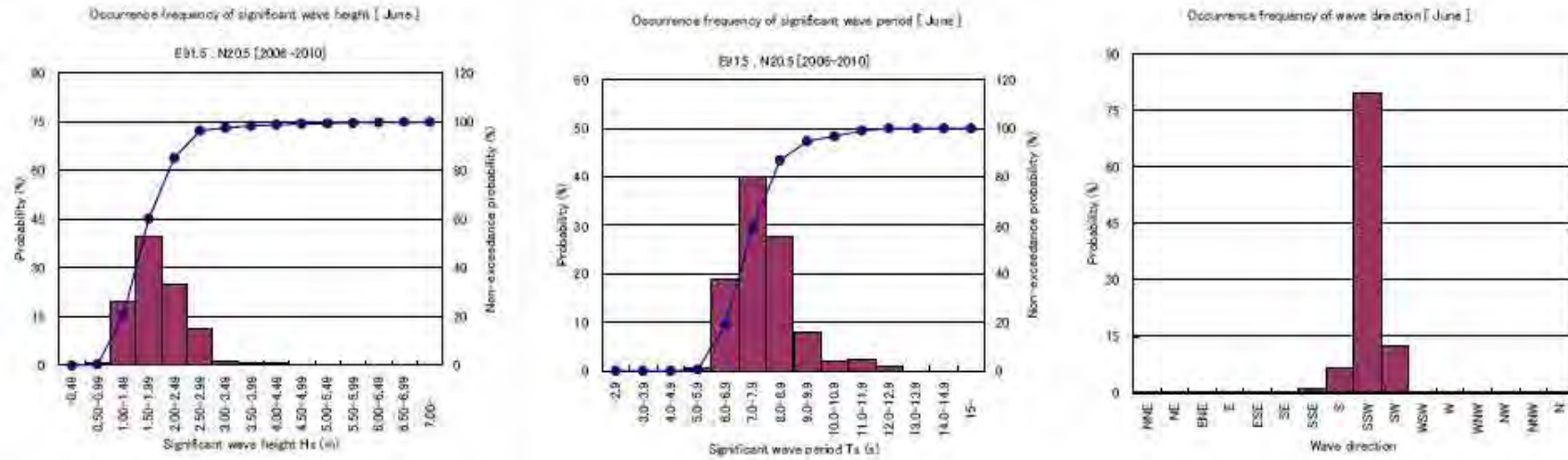


Figure -2 (7) Frequency of significant wave height and direction (deepwater, Jun.)

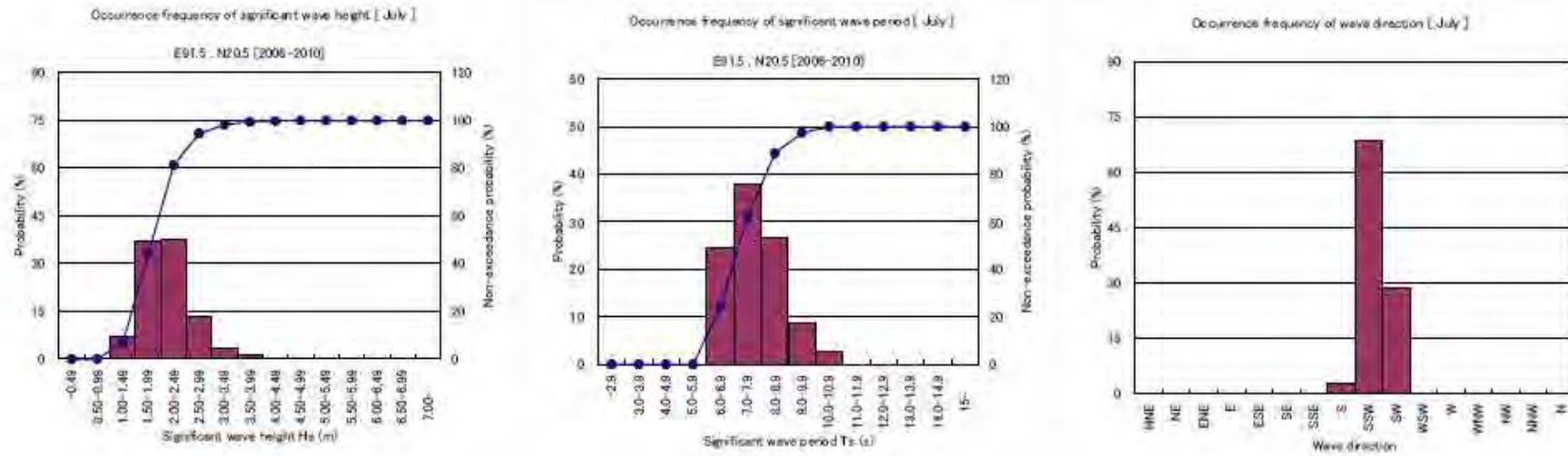


Figure 4-5 (8) Frequency of significant wave height and direction (deepwater, Jul.)

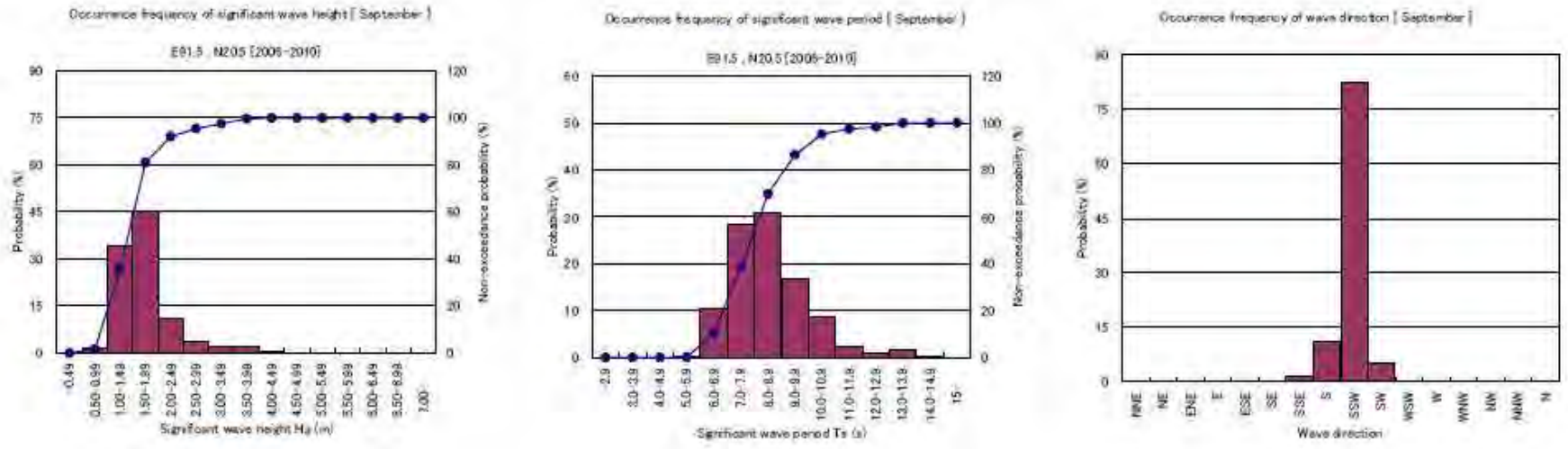


Figure -2 (9) Frequency of significant wave height and direction (deepwater, Aug.)

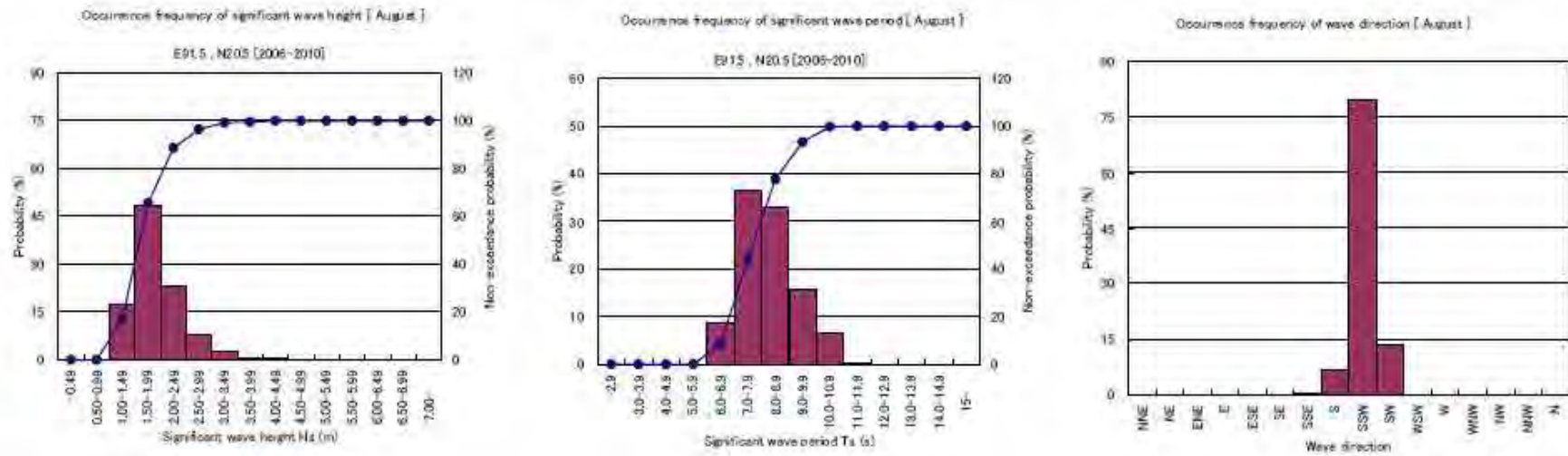


Figure 4-5 (10) Frequency of significant wave height and direction (deepwater, Sep.)

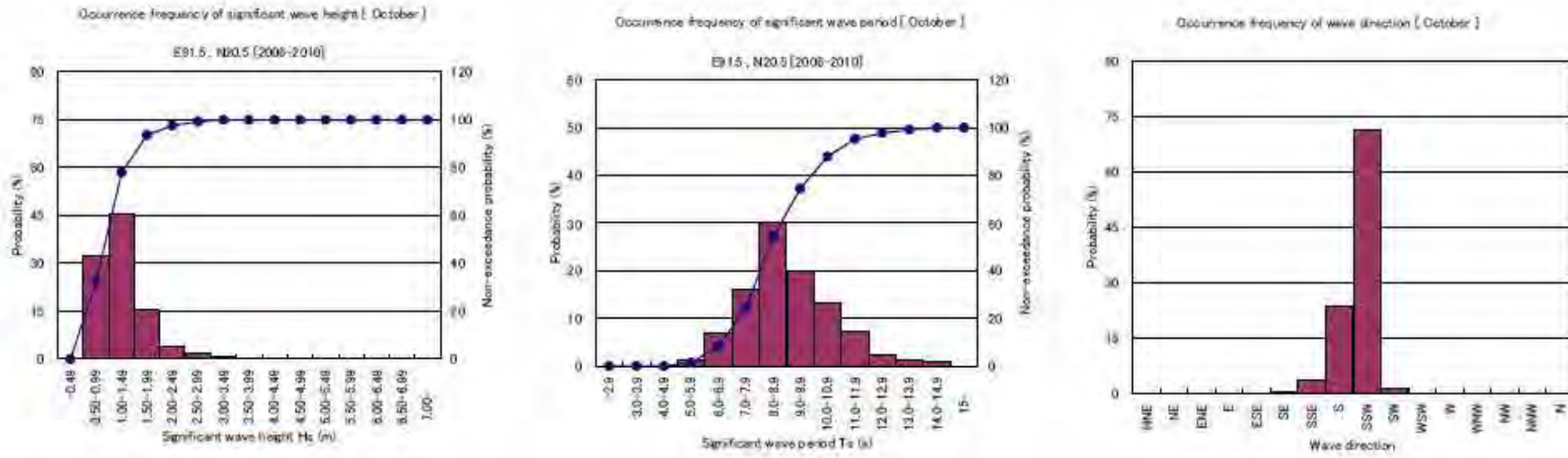


Figure 4-5 (11) Frequency of significant wave height and direction (deepwater, Oct.)

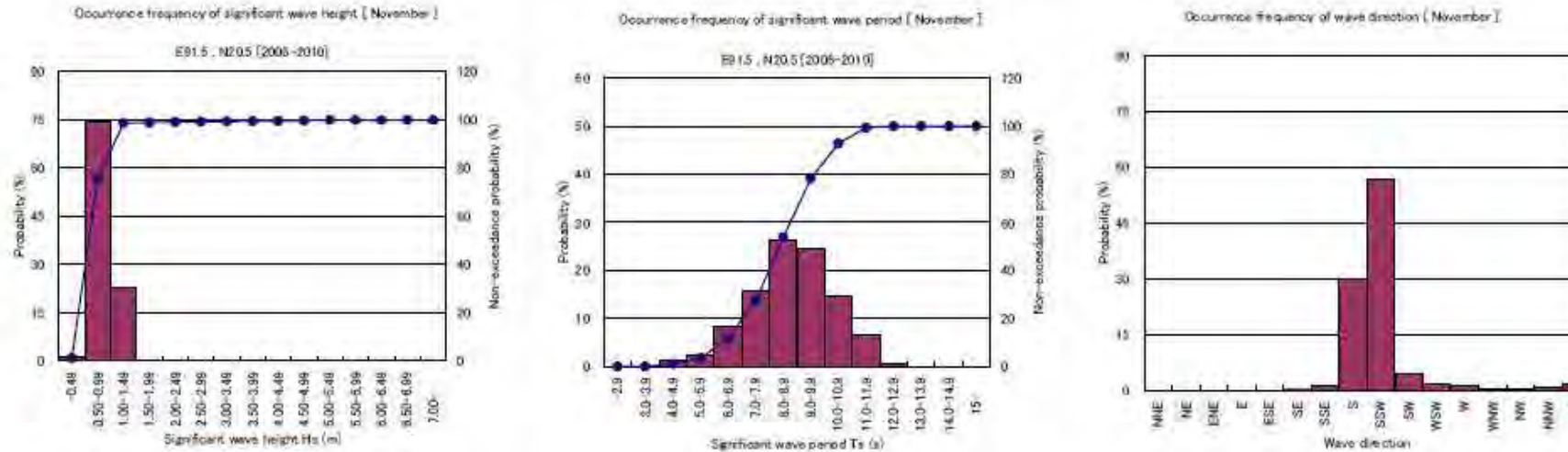


Figure 4-5 (12) Frequency of significant wave height and direction (deepwater, Nov.)

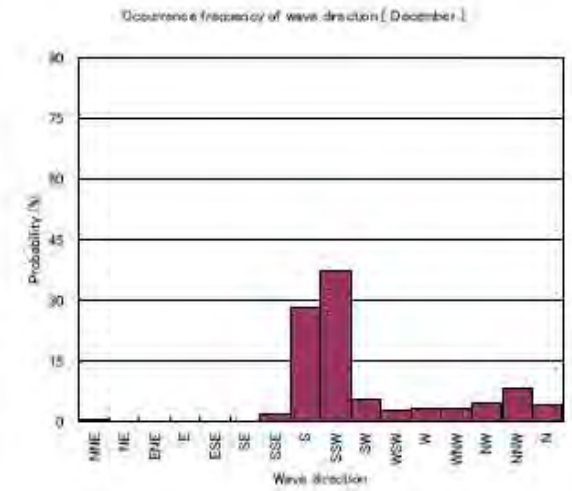
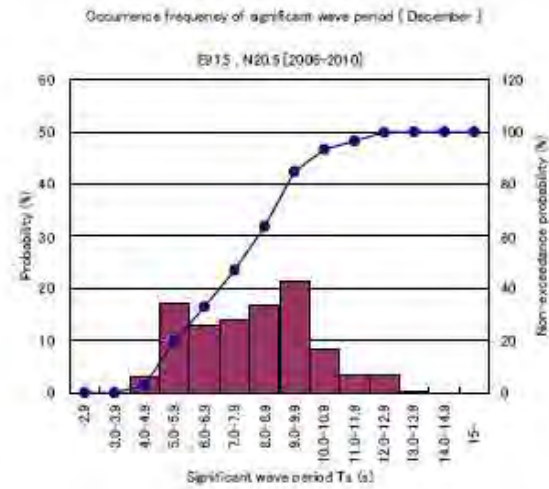
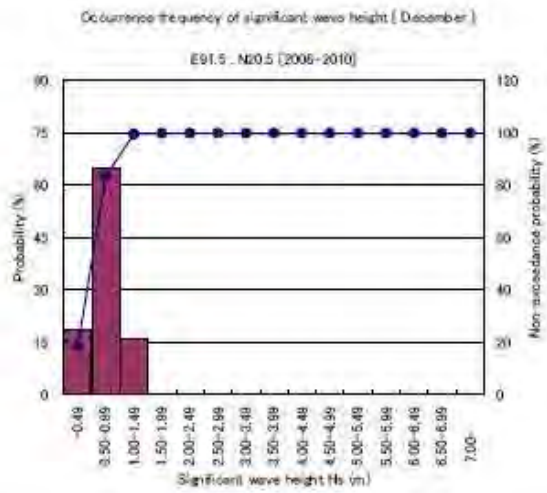


Figure 4-5 (13) Frequency of significant wave height and direction (deepwater, Dec.)

Sediment Sampling

The sediment sampling and analysis has been conducted in the survey area with the following procedure.

(1) Overview

-Survey period

- Sampling Date October 4, 2012
- Test Date October 30, 2012

-Survey area

- The survey area is located at Matarbari, Cox's Bazar.

(2) Methodology

Thin wall tube samplers (Shelby tubes) were used to collect off shore seabed materials at specified locations and preserved in specified containers. The containers were sealed properly and sent to a laboratory for necessary tests.

The seabed material at the tide land was collected manually by local divers and preserved in specified containers.

Table -2 Sediment Sample Points

SL	NAME/ID	LAT (WGS84)	LON (WGS84)	REMARKS
A. SHORELINE				
1	SS-01SL	21°42' 35"N	91°51' 58"E	Number sequence from North
2	SS-02SL	21°42' 35"N	91°51' 25"E	
3	SS-03SL	21°40' 32"N	91°51' 20"E	
4	SS-04SL	21°39' 40"N	91°51' 23"E	
5	SS-05SL	21°39' 05"N	91°50' 50"E	
B. WAVE BREAK ZONE				
1	SS-01WB	21°42' 18"N	91°51' 33"E	Number sequence from North
2	SS-02WB	21°41' 13"N	91°51' 07"E	
3	SS-03WB	21°39' 54"N	91°51' 14"E	
4	SS-04WB	21°38' 47"N	91°50' 38"E	
5	SS-05WB	21°38' 16"N	91°50' 27"E	
C. OFFSHORE				
1	SS-01OS	21°42' 00"N	91°51' 06"E	At -10m depth
2	SS-02OS	21°40' 42"N	91°50'58"E	At -10m depth
3	SS-03OS	21°38' 46"N	91°50'30"E	At -10m depth

GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Tokyo Electric Power Services Co. Ltd. & Engineers Associates Ltd.

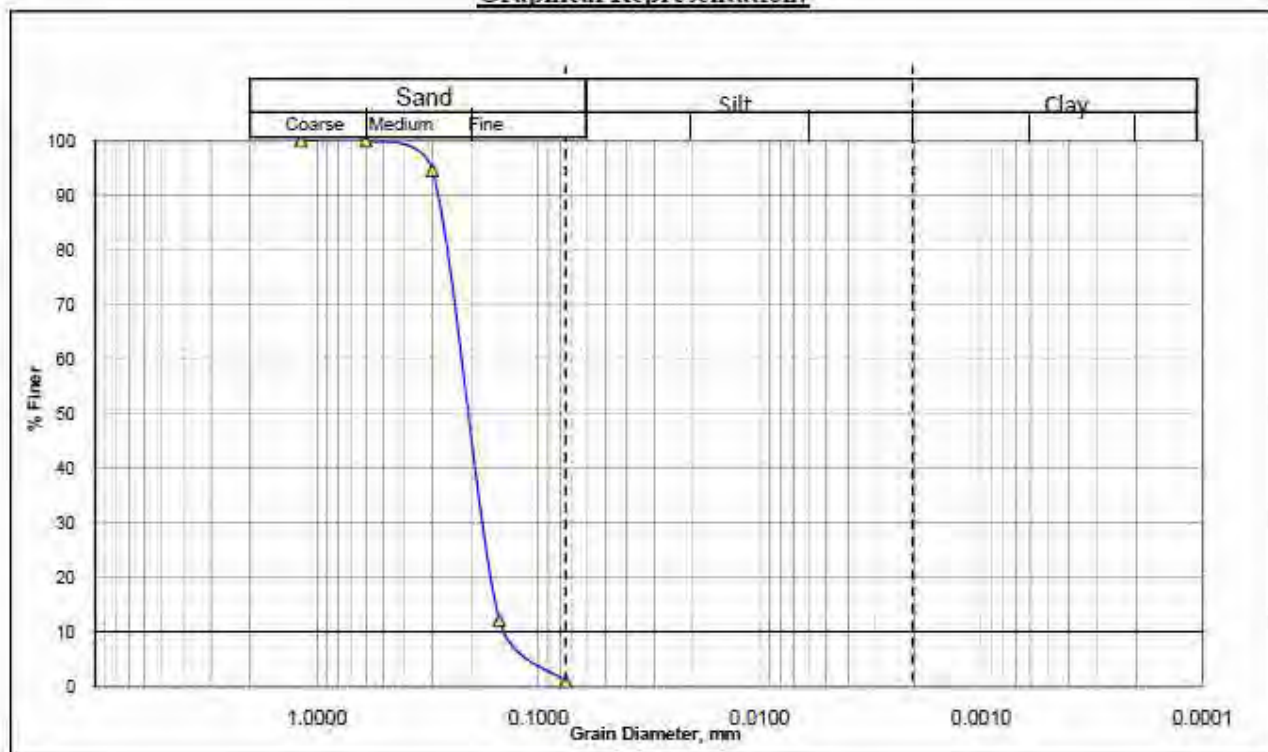
Project Location : Matarbari, Cox's Bazar

Coordinates : 382717, 2401121

Sample Date: 04/10/2012

Sample No : SS-01SL

Test Date : 30/10/2012

Graphical Representation:


Fines or % of silt and clay = 0

 Mean Diameter, D_{50} = 0.2 mm

 Silt-Factor, $f = 1.76 \times \sqrt{D_{50}}$ = 0.79

% Particles (from the grain -size analysis graph).

(0.075mm size) = 100

(0.005mm size) & (0.001mm size) = 0

Tested by : Azharul.

GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Tokyo Electric Power Services Co. Ltd. & Engineers Associates Ltd.

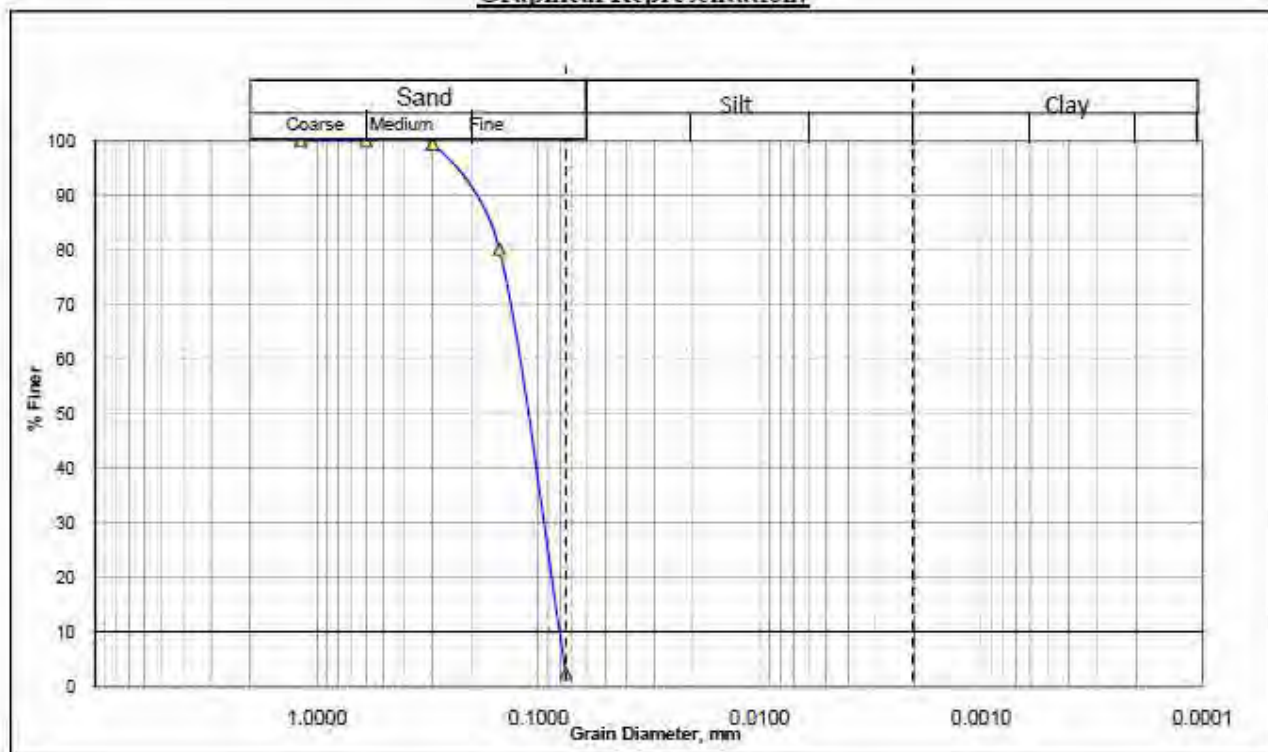
Project Location : Matarbari, Cox's Bazar

Coordinates : 381762, 2399285

Sample Date: 04/10/2012

Sample No : SS-02SL

Test Date : 30/10/2012

Graphical Representation:


Fines or % of silt and clay = 2

 Mean Diameter, D_{50} = 0.12 mm

 Silt-Factor, $f = 1.76 \times \sqrt{D_{50}} = 0.61$

% Particles (from the grain -size analysis graph).

(0.075mm size) = 98

(0.005mm size) & (0.001mm size) = 2

Tested by : Azharul.

GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Tokyo Electric Power Services Co. Ltd. & Engineers Associates Ltd.

Project Location : Matarbari, Cox's Bazar

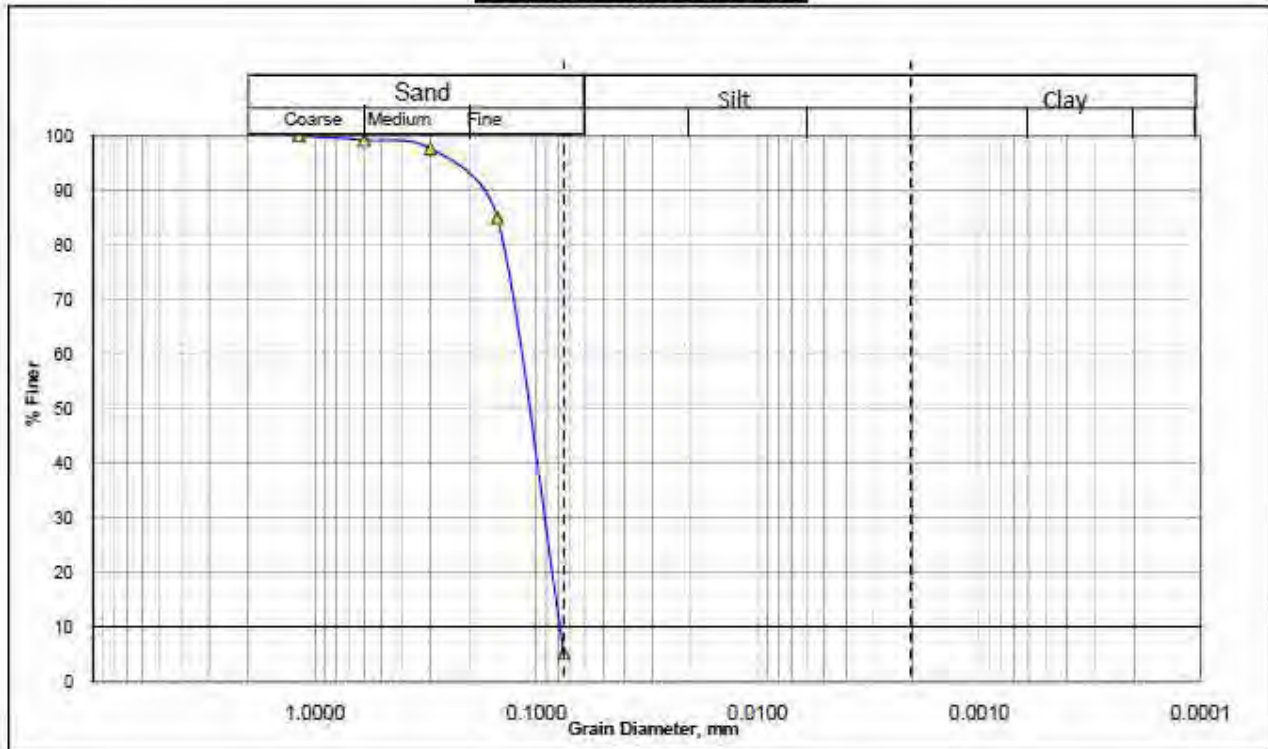
Coordinates : 381592, 2397344

Sample Date: 04/10/2012

Sample No : SS-03SL

Test Date : 30/10/2012

Graphical Representation:



Fines or % of silt and clay = 4
 Mean Diameter, D_{50} = 0.12 mm
 Silt-Factor, $f = 1.76 \times \sqrt{D_{50}} = 0.61$
 % Particles (from the grain -size analysis graph).
 (0.075mm size) = 96
 (0.005mm size) & (0.001mm size) = 4

Tested by : Azharul.

GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Tokyo Electric Power Services Co. Ltd. & Engineers Associates Ltd.

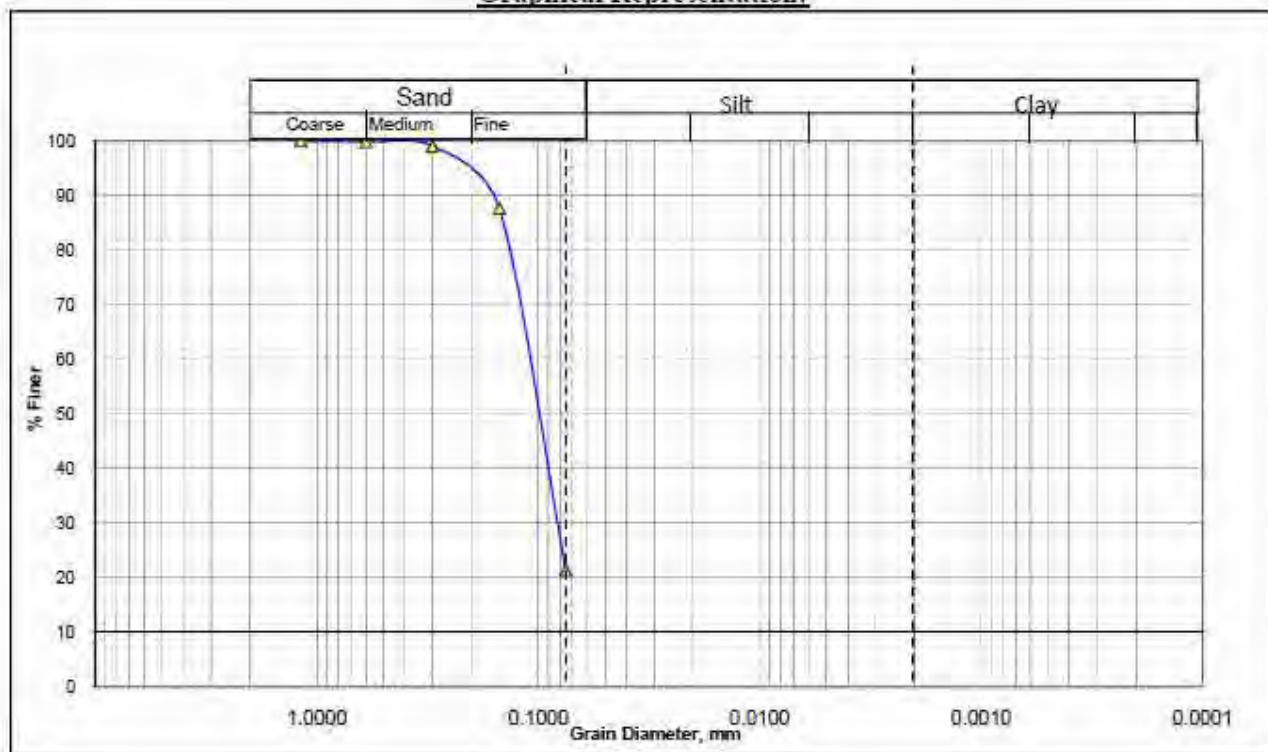
Project Location : Matarbari, Cox's Bazar

Coordinates : 382127, 2400640

Sample Date: 04/10/2012

Sample No : SS-01WB

Test Date : 30/10/2012

Graphical Representation:


Fines or % of silt and clay = 20

Mean Diameter, D_{50} = 0.1 mm

Silt-Factor, $f = 1.76 \times \sqrt{D_{50}} = 0.56$

% Particles (from the grain -size analysis graph).

(0.075mm size) = 80

(0.005mm size) & (0.001mm size) = 20

Tested by : Azharul.

GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Tokyo Electric Power Services Co. Ltd. & Engineers Associates Ltd.

Project Location : Matarbari, Cox's Bazar

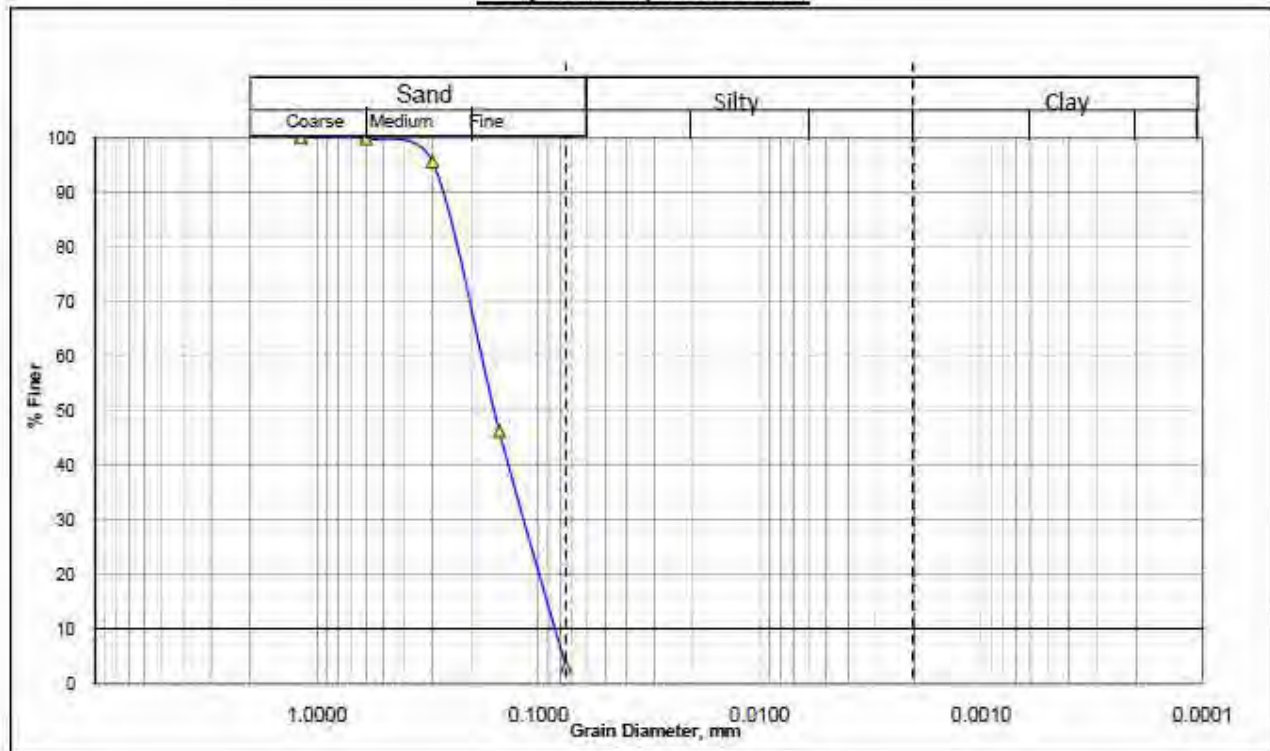
Coordinates : 381289, 2398541

Sample Date: 04/10/2012

Sample No : SS-02WB

Test Date : 30/10/2012

Graphical Representation:



Fines or % of silt and clay = 2

Mean Diameter, D_{50} = 0.16 mm

Silt-Factor, $f = 1.76 \times \sqrt{D_{50}} = 0.70$

% Particles (from the grain -size analysis graph).

(0.075mm size) = 98

(0.005mm size) & (0.001mm size) = 2

Tested by : Azharul.

GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Tokyo Electric Power Services Co. Ltd. & Engineers Associates Ltd.

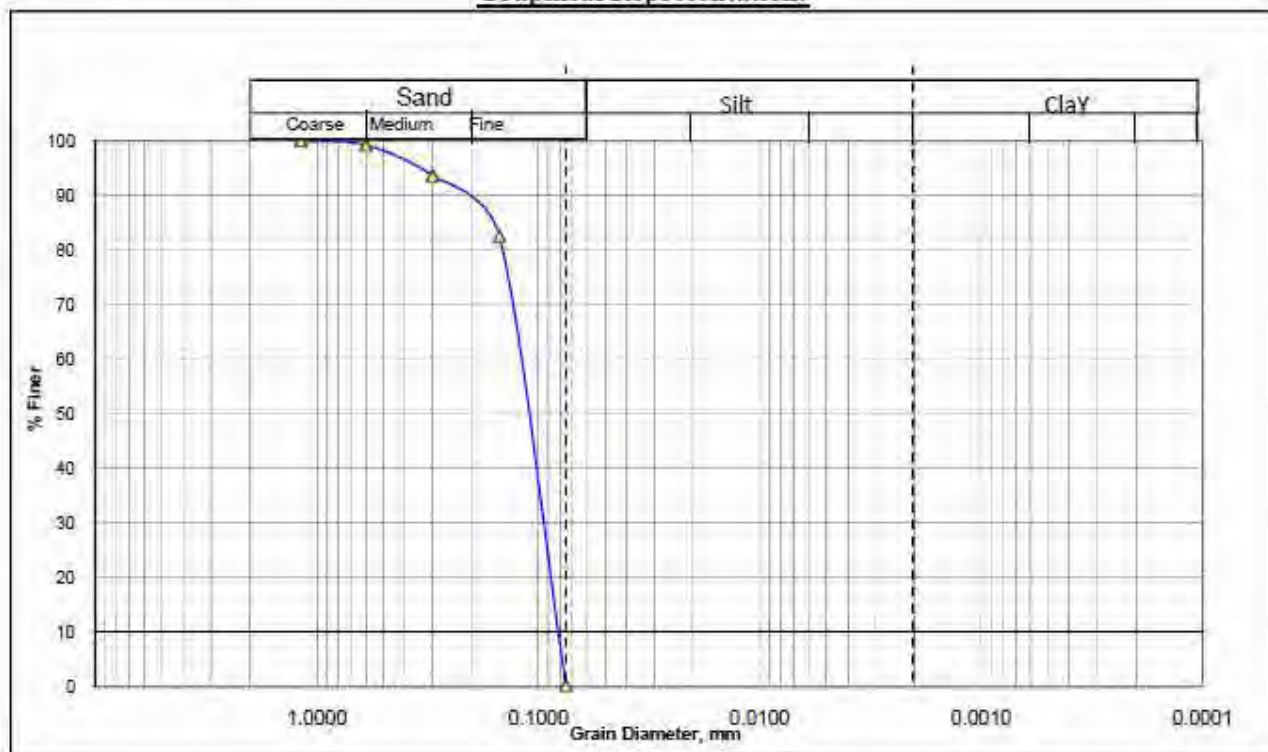
Project Location : Matarbari, Cox's Bazar

Coordinates : 381421, 2396195

Sample Date: 04/10/2012

Sample No : SS-03WB

Test Date : 30/10/2012

Graphical Representation:


Fines or % of silt and clay = 0

 Mean Diameter, $D_{50} = 0.12$ mm

 Silt-Factor, $f = 1.76 \times \sqrt{D_{50}} = 0.61$

% Particles (from the grain -size analysis graph).

(0.075mm size) = 100

(0.005mm size) & (0.001mm size) = 0

Tested by : Azharul.

GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Tokyo Electric Power Services Co. Ltd. & Engineers Associates Ltd.

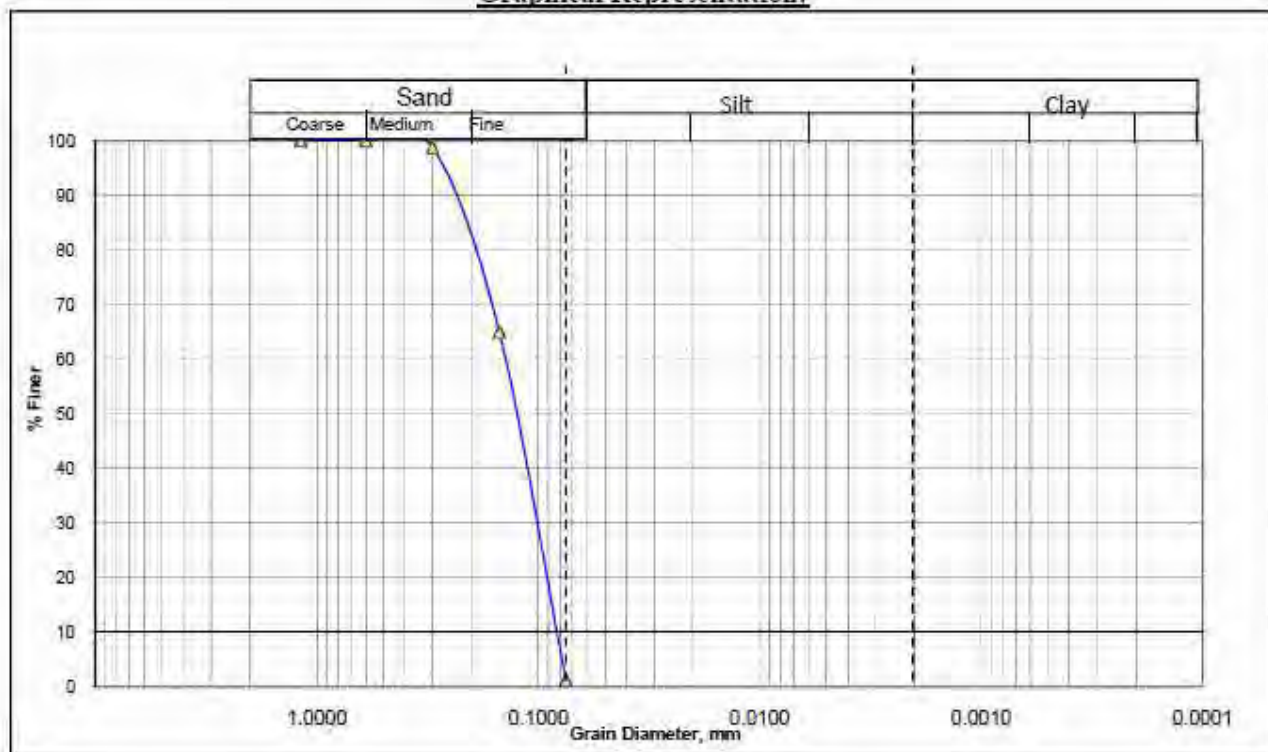
Project Location : Matarbari, Cox's Bazar

Coordinates : 381948, 2394298

Sample Date: 04/10/2012

Sample No : SS-04WB

Test Date : 30/10/2012

Graphical Representation:


Fines or % of silt and clay = 0

 Mean Diameter, $D_{50} = 0.14$ mm

 Silt-Factor, $f = 1.76 \times \sqrt{D_{50}} = 0.66$

% Particles (from the grain -size analysis graph).

(0.075mm size) = 100

(0.005mm size) & (0.001mm size) = 0

Tested by : Azharul.

GRAIN SIZE ANALYSIS BY HYDROMETER

Client : Tokyo Electric Power Services Co. Ltd. & Engineers Associates Ltd.

Project Location : Matarbari, Cox's Bazar

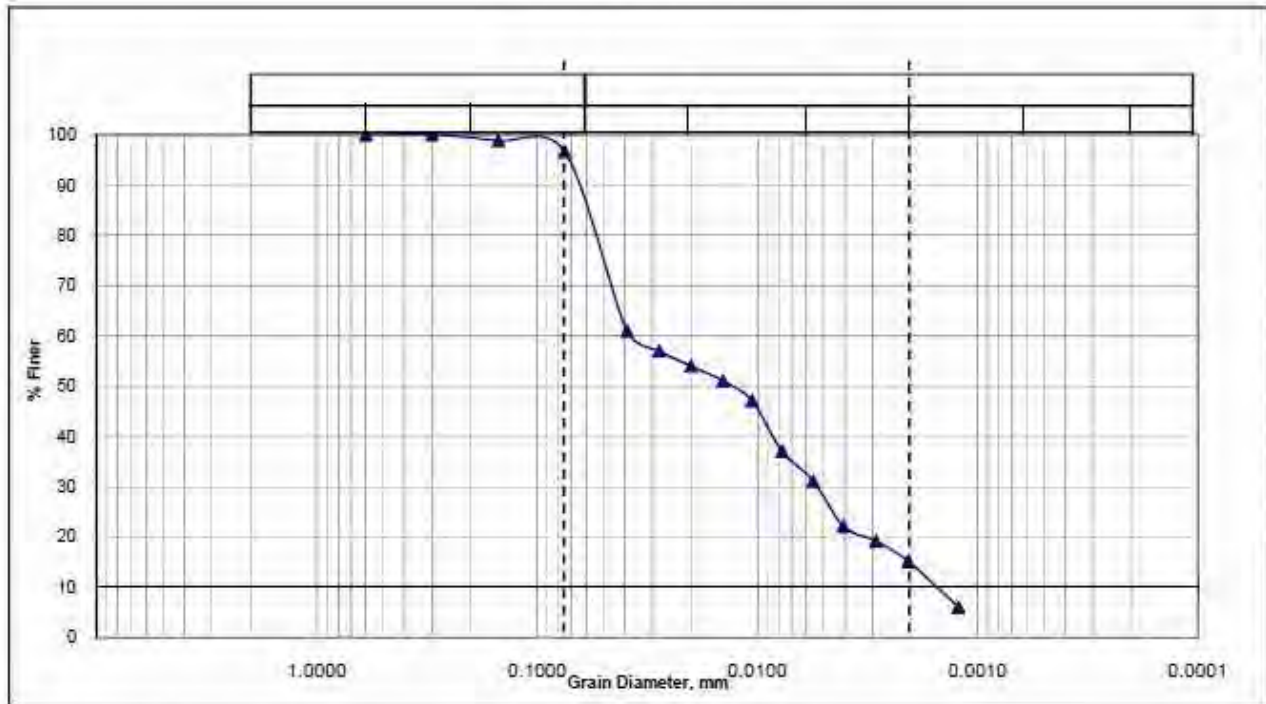
Coordinates : 381231, 2400066

Sampled Date : 4/10/2012

Sample No :SS-01OS

Test Date : 30/10/2012

Graphical Representation:



Mean Diameter, D_{50} = 0.015 mm

Silt-Factor, $f = 1.76\sqrt{D_{50}}$ = 0.22

% Particles (from the grain -size analysis graph).

Sand (0.075mm size) =2%, Silt (0.005mm size) & Clay (0.001mm size) =82% & 16%

Tested by : Azharul.



GRAIN SIZE ANALYSIS BY HYDROMETER

Client : Tokyo Electric Power Services Co. Ltd. & Engineers Associates Ltd.

Project Location : Matarbari, Cox's Bazar

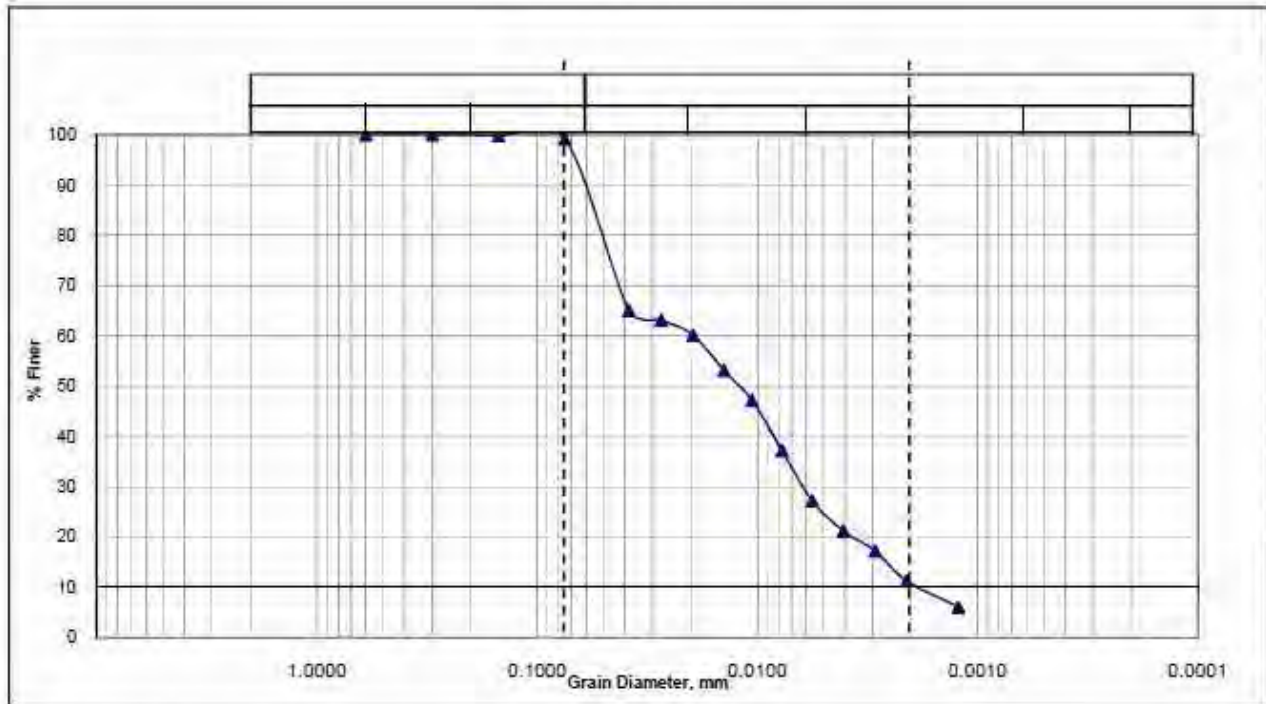
Coordinates : 380681, 2397713

Sampled Date : 4/10/2012

Sample No :SS-02OS

Test Date : 30/10/2012

Graphical Representation:



Mean Diameter, D_{50} = 0.013 mm

Silt-Factor, $f = 1.76 \times \sqrt{D_{50}}$ = 0.20

% Particles (from the grain -size analysis graph).

Sand (0.075mm size) =1%, Silt (0.005mm size) & Clay (0.001mm size) =89% & 10%

Tested by : Azharul.



GRAIN SIZE ANALYSIS BY HYDROMETER

Client : Tokyo Electric Power Services Co. Ltd. & Engineers Associates Ltd.

Project Location : Matarbari, Cox's Bazar

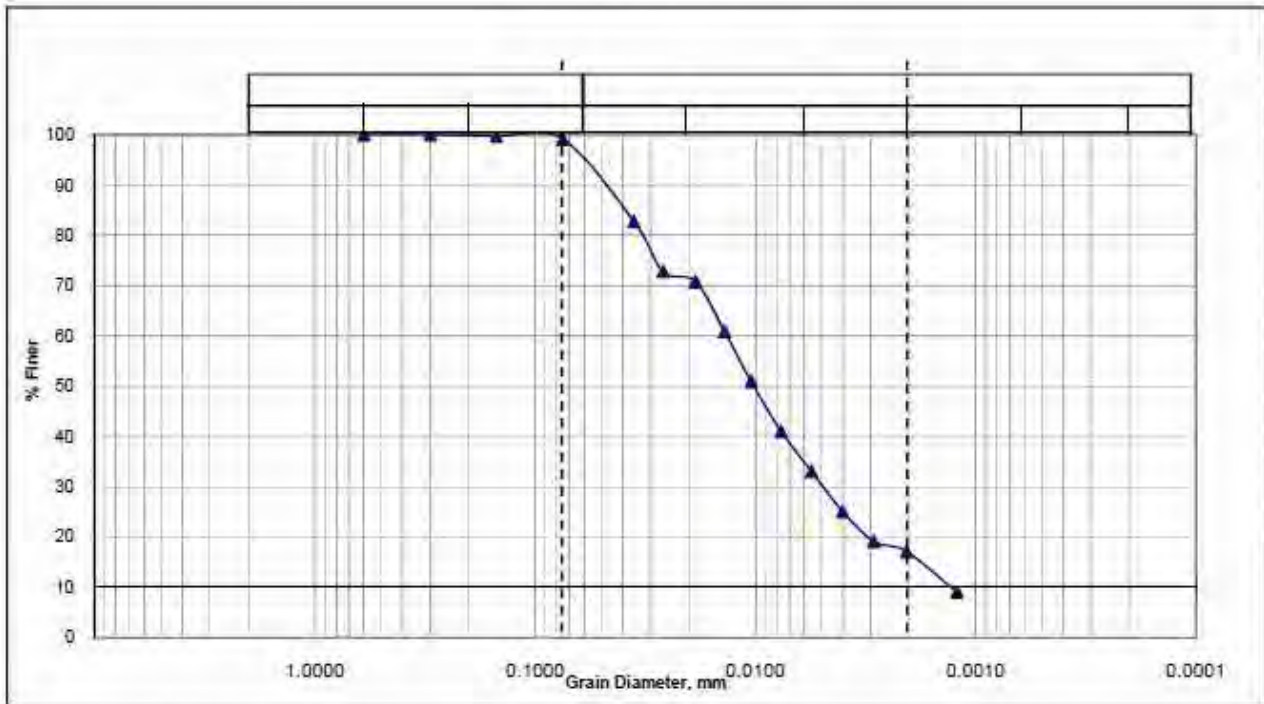
Coordinates : 379928, 2394127

Sampled Date : 4/10/2012

Sample No :SS-03OS

Test Date : 30/10/2012

Graphical Representation:



Mean Diameter, D_{50} = 0.01 mm

Silt-Factor, $f = 1.76 \times \sqrt{D_{50}}$ = 0.18

% Particles (from the grain -size analysis graph).

Sand (0.075mm size) =1%, Silt (0.005mm size) & Clay (0.001mm size) =81% & 18%

Tested by : Azharul.

SURVEY 2000

GRAIN SIZE ANALYSIS BY HYDROMETER

Client : Tokyo Electric Power Services Co. Ltd. & Engineers Associates Ltd.

Project Location : Matarbari, Cox's Bazar

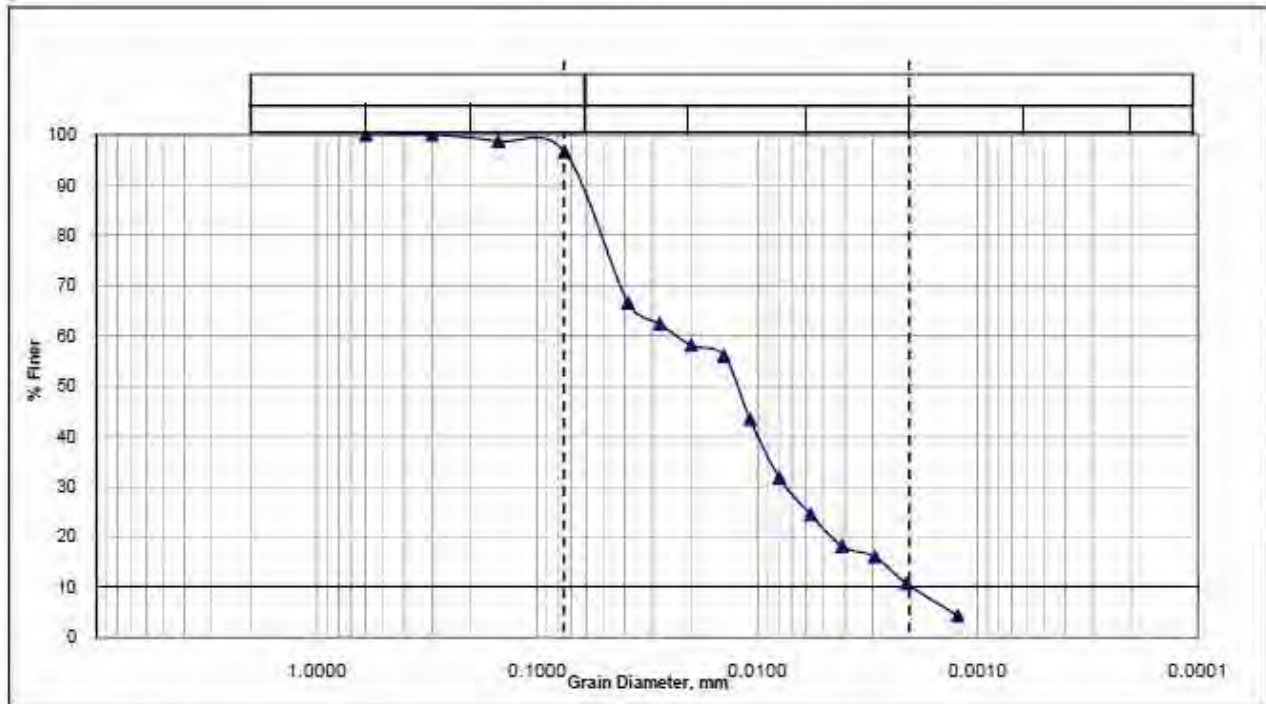
Coordinates : 382116, 2395821

Sampled Date : 4/10/2012

Sample No : SL-04SL

Test Date : 30/10/2012

Graphical Representation:



Mean Diameter, D_{50} = 0.01 mm

Silt-Factor, $f = 1.76 \times \sqrt{D_{50}}$ = 0.18

% Particles (from the grain -size analysis graph).

Sand (0.075mm size) =2%, Silt (0.005mm size) & Clay (0.001mm size) =88% & 10%

Tested by : Azharul.



GRAIN SIZE ANALYSIS BY HYDROMETER

Client : Tokyo Electric Power Services Co. Ltd. & Engineers Associates Ltd.

Project Location : Matarbari, Cox's Bazar

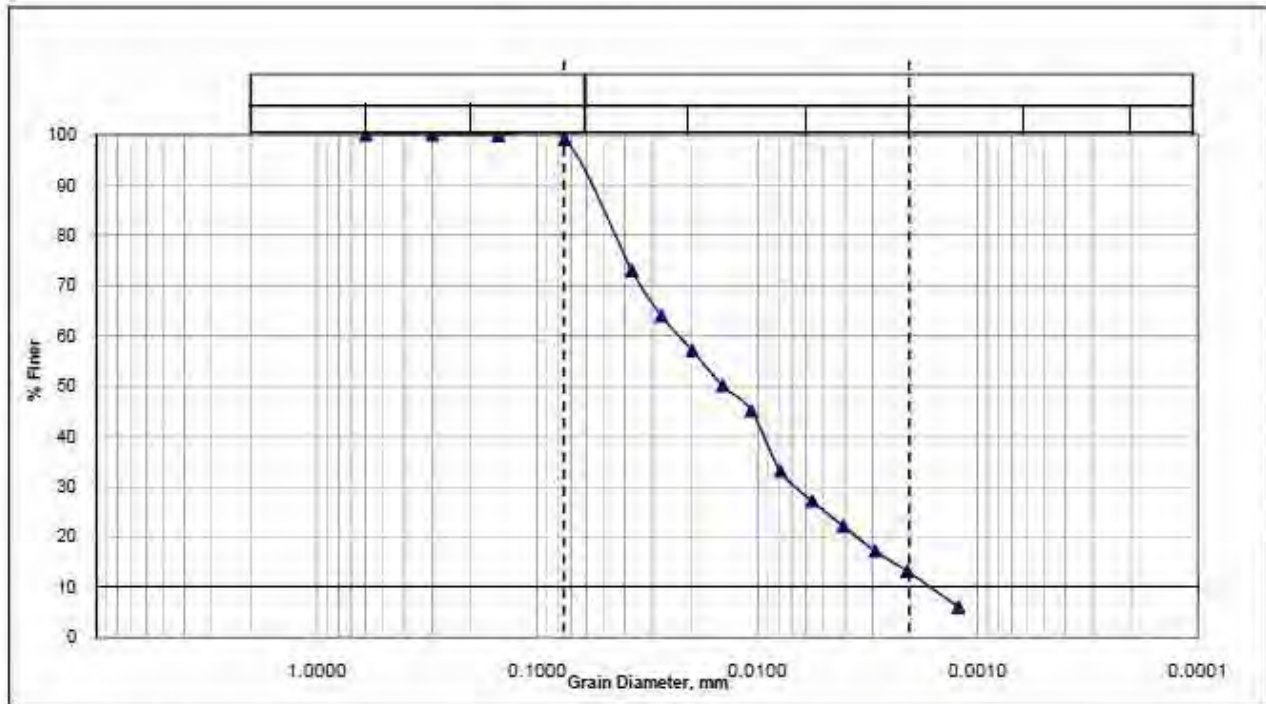
Coordinates : 383548, 2394293

Sampled Date : 4/10/2012

Sample No : SL-05SL

Test Date : 30/10/2012

Graphical Representation:



Mean Diameter, D_{50} = 0.015 mm

Silt-Factor, $f = 1.76 \times \sqrt{D_{50}}$ = 0.22

% Particles (from the grain -size analysis graph).

Sand (0.075mm size) =1%, Silt (0.005mm size) & Clay (0.001mm size) =85% & 14%

Tested by : Azharul.



GRAIN SIZE ANALYSIS BY HYDROMETER

Client : Tokyo Electric Power Services Co. Ltd. & Engineers Associates Ltd.

Project Location : Matarbari, Cox's Bazar

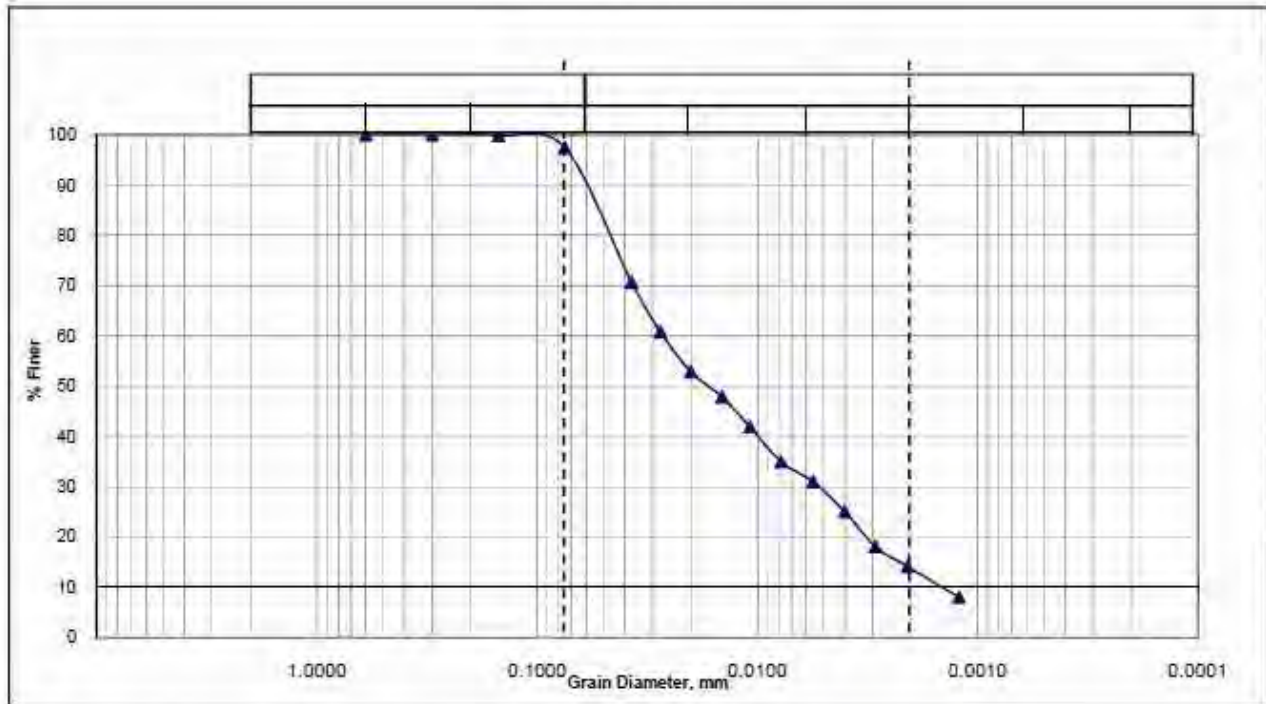
Coordinates : 382890, 2392918

Sampled Date : 4/10/2012

Sample No :SS-05wb

Test Date : 30/10/2012

Graphical Representation:



Mean Diameter, D_{50} = 0.018 mm

Silt-Factor, $f = 1.76\sqrt{D_{50}}$ = 0.24

% Particles (from the grain -size analysis graph).

Sand (0.075mm size) =2%, Silt (0.005mm size) & Clay (0.001mm size) =84% & 14%

Tested by : Azharul.

SURVEY 2000
SPECIFIC GRAVITY OF SOIL AS PER ASTM D-854

Client : Tokyo Electric Power Services Co. Ltd. & Engineers Associates Ltd.

Scheme : 600MW Coal fired power plant

Location : Matarbari, Cox's Bazar

Coordinates : 382717, 2401121

Sample No. : SS-D13L

Sampled by & Date : 4/10/2012

Laboratory Register No. :

Test Date : 30/10/2012

Pycnometer Type : Volumetric Flask/Stoppered Bottle Capacity : 50ml

Air Removal By : Boiling

Description of soil : Brown SAND with trace silt

Test Specimen :

Nature of Specimen : Oven-Dry Sample

Soaking Period : Soaked overnight (since oven-dry specimen is used)

TEST DATA :

TEST/TRIAL NO.	1		
PYCNO METER NO.	1		
Wt. of Soil (oven dry weight), W_s in gm	3.89		
Observed Temperature, T_x in deg. Centigrade	27		
Wt. of Pycnometer + water, W_a (at T_x) in gm (from Calibration Data of Pycnometer)	77.89		
Wt. of Pycnometer + water+soil, W_b (at T_x) in gm	84.07		
Specific Gravity, G (at T_x) = $W_s / (W_b - W_a)$	2.67		
Variation of Specific Gravity Values & Average (According to some specification average value shall be calculated only if (Largest value of G_s) / Smallest value of G_s) < or = 1.02)	Ratio : 2.71/2.63 > or = 1.02 Ratio : 2.73/2.71 < or = 1.02 Avg. G_s (at T_x)		0.000
Density of Water at T_x deg. Cent., in gm/cc			0.9985
Density of Water at 20 deg. Cent., in gm/cc			0.9982
Specific Gravity, G (at 20 deg. Cent.) = (Density of Water at T_x / Density of Water at 20 deg. cent.) x G (at T_x)			2.66

Tested by : S. Alam, Laboratory specialist

Comments of the Laboratory Incharge :

Signed by : M. Islam

SURVEY 2000
SPECIFIC GRAVITY OF SOIL AS PER ASTM D-854

Client : Tokyo Electric Power Services Co. Ltd. & Engineers Associates Ltd.

Scheme : 600MW Coal fired power plant

Location : Matarbari, Cox's Bazar

Coordinates : 381762, 2399285

Sample No. : SS-025L

Sampled by & Date : 4/10/2012

Laboratory Register No. :

Test Date : 30/10/2012

Pycnometer Type : Volumetric Flask/Stoppered Bottle Capacity : 50ml

Air Removal By : Boiling

Description of soil : Brown SAND with trace silt

Test Specimen :

Nature of Specimen : Oven-Dry Sample

Soaking Period : Soaked overnight (since oven-dry specimen is used)

TEST DATA :

TEST/TRIAL NO.	2		
PYCNO METER NO.	8		
Wt. of Soil (oven dry weight), W_s in gm	8.83		
Observed Temperature, T_x in deg. Centigrade	27		
Wt. of Pycnometer + water, W_a (at T_x) in gm (from Calibration Data of Pycnometer)	48.09		
Wt. of Pycnometer + water+soil, W_b (at T_x) in gm	51.8		
Specific Gravity, G (at T_x) = $W_s / (W_a + W_b - W_s)$	2.66		
Variation of Specific Gravity Values & Average (According to some specification average value shall be calculated only if (Largest value of G_s) / Smallest value of G_s) < or = 1.02)	Ratio : 2.71/2.63 > or = 1.02 Ratio : 2.73/2.71 < or = 1.02 Avg. G_s (at T_x)		0.000
Density of Water at T_x deg. Cent., in gm/cc			0.9985
Density of Water at 20 deg. Cent., in gm/cc			0.9982
Specific Gravity, G (at 20 deg. Cent.) = (Density of Water at T_x / Density of Water at 20 deg. cent.) x G (at T_x)			2.66

Tested by : S. Alam, Laboratory specialist

Comments of the Laboratory Incharge :

Signed by : M. Islam

SURVEY 2000
SPECIFIC GRAVITY OF SOIL AS PER ASTM D-854

Client : Tokyo Electric Power Services Co. Ltd. & Engineers Associates Ltd.

Scheme : 600MW Coal fired power plant

Location : Matarbari, Cox's Bazar

Coordinates : 381592, 2397344

Sample No. : SS-035L

Sampled by & Date : 4/10/2012

Laboratory Register No. :

Test Date : 30/10/2012

Pycnometer Type : Volumetric Flask/Stoppered Bottle Capacity : 50ml

Air Removal By : Boiling

Description of soil : Grey SAND with trace silt

Test Specimen :

Nature of Specimen : Oven-Dry Sample

Soaking Period : Soaked overnight (since oven-dry specimen is used)

TEST DATA :

TEST/TRIAL NO.	3		
PYCNO METER NO.	7		
Wt. of Soil (oven dry weight), W_s in gm	11.98		
Observed Temperature, T_x in deg. Centigrade	24		
Wt. of Pycnometer + water, W_a (at T_x) in gm (from Calibration Data of Pycnometer)	78.29		
Wt. of Pycnometer + water+soil, W_b (at T_x) in gm	86.82		
Specific Gravity, G (at T_x) = $W_s / (W_b - W_a)$	2.70		
Variation of Specific Gravity Values & Average (According to some specification average value shall be calculated only if (Largest value of G_s) / Smallest value of G_s) < or = 1.02)	Ratio : 2.71/2.63 > or = 1.02 Ratio : 2.73/2.71 < or = 1.02 Avg. G_s (at T_x)		0.000
Density of Water at T_x deg. Cent., in gm/cc			0.9973
Density of Water at 20 deg. Cent., in gm/cc			0.9982
Specific Gravity, G (at 20 deg. Cent.) = (Density of Water at T_x / Density of Water at 20 deg. cent.) x G (at T_x)			2.70

Tested by : S. Alam, Laboratory specialist

Comments of the Laboratory Incharge :

Signed by : M. Islam

SURVEY 2000
SPECIFIC GRAVITY OF SOIL AS PER ASTM D-854

Client : Tokyo Electric Power Services Co. Ltd. & Engineers Associates Ltd.

Scheme : 600MW Coal fired power plant

Location : Matarbari, Cox's Bazar

Coordinates : 382116, 2395821

Sample No. : SS-043L

Sampled by & Date : 4/10/2012

Laboratory Register No. :

Test Date : 30/10/2012

Pycnometer Type : Volumetric Flask/Stoppered Bottle Capacity : 50ml

Air Removal By : Boiling

Description of soil : Reddish low plastic SILT with trace clay

Test Specimen :

Nature of Specimen : Oven-Dry Sample

Soaking Period : Soaked overnight (since oven-dry specimen is used)

TEST DATA :

TEST/TRIAL NO.	4		
PYCNO METER NO.	6		
Wt. of Soil (oven dry weight), W_s in gm	2.59		
Observed Temperature, T_x in deg. Centigrade	24		
Wt. of Pycnometer + water, W_a (at T_x) in gm (from Calibration Data of Pycnometer)	76.73		
Wt. of Pycnometer + water+soil, W_b (at T_x) in gm	82.42		
Specific Gravity, G (at T_x) = $W_s / (W_b - W_a)$	2.48		
Variation of Specific Gravity Values & Average (According to some specification average value shall be calculated only if (Largest value of G_s) / Smallest value of G_s) < or = 1.02)	Ratio : 2.71/2.63 > or = 1.02 Ratio : 2.73/2.71 < or = 1.02 Avg. G_s (at T_x)		0.000
Density of Water at T_x deg. Cent., in gm/cc			0.9973
Density of Water at 20 deg. Cent., in gm/cc			0.9982
Specific Gravity, G (at 20 deg. Cent.) = (Density of Water at T_x / Density of Water at 20 deg. cent.) x G (at T_x)			2.48

Tested by : S. Alam, Laboratory specialist

Comments of the Laboratory Incharge :

Signed by : M. Islam

SURVEY 2000
SPECIFIC GRAVITY OF SOIL AS PER ASTM D-854

Client : Tokyo Electric Power Services Co. Ltd. & Engineers Associates Ltd.

Scheme : 600MW Coal fired power plant

Location : Matarbari, Cox's Bazar

Coordinates : 383548, 2394283

Sample No. : SS-055L

Sampled by & Date : 4/10/2012

Laboratory Register No. :

Test Date : 30/10/2012

Pycnometer Type : Volumetric Flask/Stoppered Bottle Capacity : 50ml

Air Removal By : Boiling

Description of soil : Grey medium plastic clayey SILT

Test Specimen :

Nature of Specimen : Oven-Dry Sample

Soaking Period : Soaked overnight (since oven-dry specimen is used)

TEST DATA :

TEST/TRIAL NO.	5		
PYCNO METER NO.	3		
Wt. of Soil (oven dry weight), W_s in gm	9.78		
Observed Temperature, T_x in deg. Centigrade	24		
Wt. of Pycnometer + water, W_a (at T_x) in gm (from Calibration Data of Pycnometer)	76.00		
Wt. of Pycnometer + water+soil, W_b (at T_x) in gm	86.12		
Specific Gravity, G (at T_x) = $W_s / (W_b - W_a)$	2.67		
Variation of Specific Gravity Values & Average (According to some specification average value shall be calculated only if (Largest value of G_s) / Smallest value of G_s) < or = 1.02)	Ratio : 2.71/2.63 > or = 1.02 Ratio : 2.73/2.71 < or = 1.02 Avg. G_s (at T_x)		0.000
Density of Water at T_x deg. Cent., in gm/cc			0.9973
Density of Water at 20 deg. Cent., in gm/cc			0.9982
Specific Gravity, G (at 20 deg. Cent.) = (Density of Water at T_x / Density of Water at 20 deg. cent.) x G (at T_x)			2.67

Tested by : S. Alam, Laboratory specialist

Comments of the Laboratory Incharge :

Signed by : M. Islam

SURVEY 2000
SPECIFIC GRAVITY OF SOIL AS PER ASTM D-854

Client : Tokyo Electric Power Services Co. Ltd. & Engineers Associates Ltd.

Scheme : 600MW Coal fired power plant

Location : Matarbari, Cox's Bazar

Coordinates : 382127, 2400640

Sample No. : SS-D1WB

Sampled by & Date : 4/10/2012

Laboratory Register No. :

Test Date : 31/10/2012

Pycnometer Type : Volumetric Flask/Stoppered Bottle Capacity : 50ml

Air Removal By : Boiling

Description of soil : Grey SAND with silt

Test Specimen :

Nature of Specimen : Oven-Dry Sample

Soaking Period : Soaked overnight (since oven-dry specimen is used)

TEST DATA :

TEST/TRIAL NO.	8		
PYCNO METER NO.	8		
Wt. of Soil (oven dry weight), W_s in gm	10.86		
Observed Temperature, T_x in deg. Centigrade	27		
Wt. of Pycnometer + water, W_a (at T_x) in gm (from Calibration Data of Pycnometer)	76.80		
Wt. of Pycnometer + water+soil, W_b (at T_x) in gm	85.57		
Specific Gravity, G (at T_x) = $W_s / (W_b - W_a)$	2.66		
Variation of Specific Gravity Values & Average (According to some specification average value shall be calculated only if (Largest value of G_s) / Smallest value of G_s) < or = 1.02)	Ratio : 2.71/2.63 > or = 1.02 Ratio : 2.73/2.71 < or = 1.02 Avg. G_s (at T_x)		0.000 2.66
Density of Water at T_x deg. Cent., in gm/cc			0.9985
Density of Water at 20 deg. Cent., in gm/cc			0.9982
Specific Gravity, G (at 20 deg. Cent.) = (Density of Water at T_x / Density of Water at 20 deg. cent.) x G (at T_x)			2.65

Tested by : S. Alam, Laboratory specialist

Comments of the Laboratory Incharge :

Signed by : M. Islam

SURVEY 2000
SPECIFIC GRAVITY OF SOIL AS PER ASTM D-854

Client : Tokyo Electric Power Services Co. Ltd. & Engineers Associates Ltd.

Scheme : 600MW Coal fired power plant

Location : Matarbari, Cox's Bazar

Coordinates : 381289, 2398541

Sample No. : SS-02WB

Sampled by & Date : 4/10/2012

Laboratory Register No. :

Test Date : 31/10/2012

Pycnometer Type : Volumetric Flask/Stoppered Bottle Capacity : 50ml

Air Removal By : Boiling

Description of soil : Brown SAND with trace silt

Test Specimen :

Nature of Specimen : Oven-Dry Sample

Soaking Period : Soaked overnight (since oven-dry specimen is used)

TEST DATA :

TEST/TRIAL NO.	7		
PYCNO METER NO.	2		
Wt. of Soil (oven dry weight), W_s in gm	8.28		
Observed Temperature, T_x in deg. Centigrade	27		
Wt. of Pycnometer + water, W_a (at T_x) in gm (from Calibration Data of Pycnometer)	76.18		
Wt. of Pycnometer + water+soil, W_b (at T_x) in gm	84.4		
Specific Gravity, G (at T_x) = $W_s / (W_b - W_a)$	2.71		
Variation of Specific Gravity Values & Average (According to some specification average value shall be calculated only if (Largest value of G_s) / Smallest value of G_s) < or = 1.02)	Ratio : 2.71/2.63 > or = 1.02 Ratio : 2.73/2.71 < or = 1.02 Avg. G_s (at T_x)		0.000
Density of Water at T_x deg. Cent., in gm/cc			0.9985
Density of Water at 20 deg. Cent., in gm/cc			0.9982
Specific Gravity, G (at 20 deg. Cent.) = (Density of Water at T_x / Density of Water at 20 deg. cent.) x G (at T_x)			2.70

Tested by : S. Alam, Laboratory specialist

Comments of the Laboratory Incharge :

Signed by : M. Islam

SURVEY 2000
SPECIFIC GRAVITY OF SOIL AS PER ASTM D-854

Client : Tokyo Electric Power Services Co. Ltd. & Engineers Associates Ltd.

Scheme : 600MW Coal fired power plant

Location : Matarbari, Cox's Bazar

Coordinates : 381421, 2398195

Sample No. : SS-03WB

Sampled by & Date : 4/10/2012

Laboratory Register No. :

Test Date : 31/10/2012

Pycnometer Type : Volumetric Flask/Stoppered Bottle Capacity : 50ml

Air Removal By : Boiling

Description of soil : Grey SAND with trace silt

Test Specimen :

Nature of Specimen : Oven-Dry Sample

Soaking Period : Soaked overnight (since oven-dry specimen is used)

TEST DATA :

TEST/TRIAL NO.	5		
PYCNO METER NO.	3		
Wt. of Soil (oven dry weight), W_s in gm	12.26		
Observed Temperature, T_x in deg. Centigrade	27		
Wt. of Pycnometer + water, W_a (at T_x) in gm (from Calibration Data of Pycnometer)	79.07		
Wt. of Pycnometer + water+soil, W_b (at T_x) in gm	88.72		
Specific Gravity, G (at T_x) = $W_s / (W_b - W_a)$	2.68		
Variation of Specific Gravity Values & Average (According to some specification average value shall be calculated only if (Largest value of G_s) / Smallest value of G_s) < or = 1.02)	Ratio : 2.71/2.63 > or = 1.02 Ratio : 2.73/2.71 < or = 1.02 Avg. G_s (at T_x)		0.000
Density of Water at T_x deg. Cent., in gm/cc			0.9985
Density of Water at 20 deg. Cent., in gm/cc			0.9982
Specific Gravity, G (at 20 deg. Cent.) = (Density of Water at T_x / Density of Water at 20 deg. cent.) x G (at T_x)			2.68

Tested by : S. Alam, Laboratory specialist

Comments of the Laboratory Incharge :

Signed by : M. Islam

SURVEY 2000
SPECIFIC GRAVITY OF SOIL AS PER ASTM D-854

Client : Tokyo Electric Power Services Co. Ltd. & Engineers Associates Ltd.

Scheme : 600MW Coal fired power plant

Location : Matarbari, Cox's Bazar

Coordinates : 381848, 2394288

Sample No. : SS-04WB

Sampled by & Date : 4/10/2012

Laboratory Register No. :

Test Date : 31/10/2012

Pycnometer Type : Volumetric Flask/Stoppered Bottle Capacity : 50ml

Air Removal By : Boiling

Description of soil : Grey SAND with silt

Test Specimen :

Nature of Specimen : Oven-Dry Sample

Soaking Period : Soaked overnight (since oven-dry specimen is used)

TEST DATA :

TEST/TRIAL NO.	8		
PYCNO METER NO.	7		
Wt. of Soil (oven dry weight), W_s in gm	8.63		
Observed Temperature, T_x in deg. Centigrade	27		
Wt. of Pycnometer + water, W_a (at T_x) in gm (from Calibration Data of Pycnometer)	77.69		
Wt. of Pycnometer + water+soil, W_b (at T_x) in gm	83.09		
Specific Gravity, G (at T_x) = $W_s / (W_b - W_a)$	2.67		
Variation of Specific Gravity Values & Average (According to some specification average value shall be calculated only if (Largest value of G_s) / Smallest value of G_s) < or = 1.02)	Ratio : 2.71/2.63 > or = 1.02 Ratio : 2.73/2.71 < or = 1.02 Avg. G_s (at T_x)		0.000
Density of Water at T_x deg. Cent., in gm/cc			0.9985
Density of Water at 20 deg. Cent., in gm/cc			0.9982
Specific Gravity, G (at 20 deg. Cent.) = (Density of Water at T_x / Density of Water at 20 deg. cent.) x G (at T_x)			2.67

Tested by : S. Alam, Laboratory specialist

Comments of the Laboratory Incharge :

Signed by : M. Islam

SURVEY 2000
SPECIFIC GRAVITY OF SOIL AS PER ASTM D-854

Client : Tokyo Electric Power Services Co. Ltd. & Engineers Associates Ltd.

Scheme : 600MW Coal fired power plant

Location : Matarbari, Cox's Bazar

Coordinates : 382890, 2392918

Sample No. : SS-05WB

Sampled by & Date : 4/10/2012

Laboratory Register No. :

Test Date : 31/10/2012

Pycnometer Type : Volumetric Flask/Stoppered Bottle Capacity : 50ml

Air Removal By : Boiling

Description of soil : Brownish grey medium plastic clayey SILT with trace sand

Test Specimen :

Nature of Specimen : Oven-Dry Sample

Soaking Period : Soaked overnight (since oven-dry specimen is used)

TEST DATA :

TEST/TRIAL NO.	10		
PYCNO METER NO.	8		
Wt. of Soil (oven dry weight), W_s in gm	2.65		
Observed Temperature, T_x in deg. Centigrade	27		
Wt. of Pycnometer + water, W_a (at T_x) in gm (from Calibration Data of Pycnometer)	46.06		
Wt. of Pycnometer + water+soil, W_b (at T_x) in gm	52.13		
Specific Gravity, G (at T_x) = $W_s / (W_a + W_b - W_s)$	2.70		
Variation of Specific Gravity Values & Average (According to some specification average value shall be calculated only if (Largest value of G_s) / Smallest value of G_s) < or = 1.02)	Ratio : 2.71/2.63 > or = 1.02 Ratio : 2.73/2.71 < or = 1.02 Avg. G_s (at T_x)		0.000
Density of Water at T_x deg. Cent., in gm/cc			0.9985
Density of Water at 20 deg. Cent., in gm/cc			0.9982
Specific Gravity, G (at 20 deg. Cent.) = (Density of Water at T_x / Density of Water at 20 deg. cent.) x G (at T_x)			2.66

Tested by : S. Alam, Laboratory specialist

Comments of the Laboratory Incharge :

Signed by : M. Islam

SURVEY 2000
SPECIFIC GRAVITY OF SOIL AS PER ASTM D-854

Client : Tokyo Electric Power Services Co. Ltd. & Engineers Associates Ltd.

Scheme : 600MW Coal fired power plant

Location : Matarbari, Cox's Bazar

Coordinates : 381231, 2400088

Sample No. : SS-0105

Sampled by & Date : 4/10/2012

Laboratory Register No. :

Test Date : 30/10/2012

Pycnometer Type : Volumetric Flask/Stoppered Bottle Capacity : 50ml

Air Removal By : Boiling

Description of soil : Brownish grey medium plastic clayey SILT with trace sand

Test Specimen :

Nature of Specimen : Oven-Dry Sample

Soaking Period : Soaked overnight (since oven-dry specimen is used)

TEST DATA :

TEST/TRIAL NO.	11		
PYCNO METER NO.	2		
Wt. of Soil (oven dry weight), W_s in gm	10.88		
Observed Temperature, T_x in deg. Centigrade	24		
Wt. of Pycnometer + water, W_a (at T_x) in gm (from Calibration Data of Pycnometer)	79.16		
Wt. of Pycnometer + water+soil, W_b (at T_x) in gm	86.93		
Specific Gravity, G (at T_x) = $W_s / (W_b - W_a)$	2.68		
Variation of Specific Gravity Values & Average (According to some specification average value shall be calculated only if (Largest value of G_s) / Smallest value of G_s) < or = 1.02)	Ratio : 2.71/2.63 > or = 1.02 Ratio : 2.73/2.71 < or = 1.02 Avg. G_s (at T_x)		0.000
Density of Water at T_x deg. Cent., in gm/cc			0.9973
Density of Water at 20 deg. Cent., in gm/cc			0.9982
Specific Gravity, G (at 20 deg. Cent.) = (Density of Water at T_x / Density of Water at 20 deg. cent.) x G (at T_x)			2.68

Tested by : S. Alam, Laboratory specialist

Comments of the Laboratory Incharge :

Signed by : M. Islam

SURVEY 2000
SPECIFIC GRAVITY OF SOIL AS PER ASTM D-854

Client : Tokyo Electric Power Services Co. Ltd. & Engineers Associates Ltd.

Scheme : 600MW Coal fired power plant

Location : Matarbari, Cox's Bazar

Coordinates : 380881, 2397713

Sample No. : SS-0203

Sampled by & Date : 4/10/2012

Laboratory Register No. :

Test Date : 30/10/2012

Pycnometer Type : Volumetric Flask/Stoppered Bottle Capacity : 50ml

Air Removal By : Boiling

Description of soil : Reddish clayey SILT

Test Specimen :

Nature of Specimen : Oven-Dry Sample

Soaking Period : Soaked overnight (since oven-dry specimen is used)

TEST DATA :

TEST/TRIAL NO.	12		
PYCNO METER NO.	1		
Wt. of Soil (oven dry weight), W_s in gm	12.88		
Observed Temperature, T_x in deg. Centigrade	24		
Wt. of Pycnometer + water, W_a (at T_x) in gm (from Calibration Data of Pycnometer)	77.82		
Wt. of Pycnometer + water+soil, W_b (at T_x) in gm	86.94		
Specific Gravity, G (at T_x) = $W_s / (W_b - W_a)$	2.67		
Variation of Specific Gravity Values & Average (According to some specification average value shall be calculated only if (Largest value of G_s) / Smallest value of G_s) < or = 1.02)	Ratio : 2.71/2.63 > or = 1.02 Ratio : 2.73/2.71 < or = 1.02 Avg. G_s (at T_x)		0.000
Density of Water at T_x deg. Cent., in gm/cc			0.9973
Density of Water at 20 deg. Cent., in gm/cc			0.9982
Specific Gravity, G (at 20 deg. Cent.) = (Density of Water at T_x / Density of Water at 20 deg. cent.) x G (at T_x)			2.67

Tested by : S. Alam, Laboratory specialist

Comments of the Laboratory Incharge :

Signed by : M. Islam

SURVEY 2000
SPECIFIC GRAVITY OF SOIL AS PER ASTM D-854

Client : Tokyo Electric Power Services Co. Ltd. & Engineers Associates Ltd.

Scheme : 800MW Coal fired power plant

Location : Matarbari, Cox's Bazar

Coordinates : 379928, 2394127

Sample No. : SS-0305

Sampled by & Date : 4/10/2012

Laboratory Register No. :

Test Date : 30/10/2012

Pycnometer Type : Volumetric Flask/Stoppered Bottle Capacity : 50ml

Air Removal By : Boiling

Description of soil : Brown SAND with trace silt

Test Specimen :

Nature of Specimen : Oven-Dry Sample

Soaking Period : Soaked overnight (since oven-dry specimen is used)

TEST DATA :

TEST/TRIAL NO.	13		
PYCNO METER NO.	C		
Wt. of Soil (oven dry weight), W_s in gm	6.29		
Observed Temperature, T_x in deg. Centigrade	24		
Wt. of Pycnometer + water, W_a (at T_x) in gm (from Calibration Data of Pycnometer)	46.29		
Wt. of Pycnometer + water+soil, W_b (at T_x) in gm	50.24		
Specific Gravity, G (at T_x) = $W_s / (W_b - W_a)$	2.68		
Variation of Specific Gravity Values & Average (According to some specification average value shall be calculated only if (Largest value of G_s) / Smallest value of G_s) < or = 1.02)	Ratio : 2.71/2.63 > or = 1.02 Ratio : 2.73/2.71 < or = 1.02 Avg. G_s (at T_x)		0.000
Density of Water at T_x deg. Cent., in gm/cc			0.9973
Density of Water at 20 deg. Cent., in gm/cc			0.9982
Specific Gravity, G (at 20 deg. Cent.) = (Density of Water at T_x / Density of Water at 20 deg. cent.) x G (at T_x)			2.68

Tested by : S. Alam, Laboratory specialist

Comments of the Laboratory Incharge :

Signed by : M. Islam

The sediment sampling and analysis has been conducted in the survey area with the following procedure.

(1) Overview

-Survey period

- Sampling Date April 6, 2013
- Test Date April 13, 2013

-Survey area

- The survey area is located at Matarbari, Cox’s Bazar.

(2) Methodology

Thin wall tube samplers (Shelby tubes) were used to collect off shore seabed materials at specified locations and preserved in specified containers. The containers were sealed properly and sent to a laboratory for necessary tests.

The seabed material at the tide land was collected manually by local divers and preserved in specified containers.

Table -3 Sediment Sample Points

SL	NAME/ID	LAT (WGS84)	LON (WGS84)	REMARKS
A. SHORELINE				
1	SS-01SL	21°42' 35"N	91°51' 58"E	Number sequence from North
2	SS-02SL	21°42' 35"N	91°51' 25"E	
3	SS-03SL	21°40' 32"N	91°51' 20"E	
4	SS-04SL	21°39' 40"N	91°51' 23"E	
5	SS-05SL	21°39' 05"N	91°50' 50"E	
B. WAVE BREAK ZONE				
1	SS-01WB	21°42' 18"N	91°51' 33"E	Number sequence from North
2	SS-02WB	21°41' 13"N	91°51' 07"E	
3	SS-03WB	21°39' 54"N	91°51' 14"E	
4	SS-04WB	21°38' 47"N	91°50' 38"E	
5	SS-05WB	21°38' 16"N	91°50' 27"E	
C. OFFSHORE				
1	SS-01OS	21°42' 00"N	91°51' 06"E	At -10m depth
2	SS-02OS	21°40' 42"N	91°50'58"E	At -10m depth
3	SS-03OS	21°38' 46"N	91°50'30"E	At -10m depth

GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Tokyo Electric Power Services Co. Ltd. & Engineers Associates Ltd.

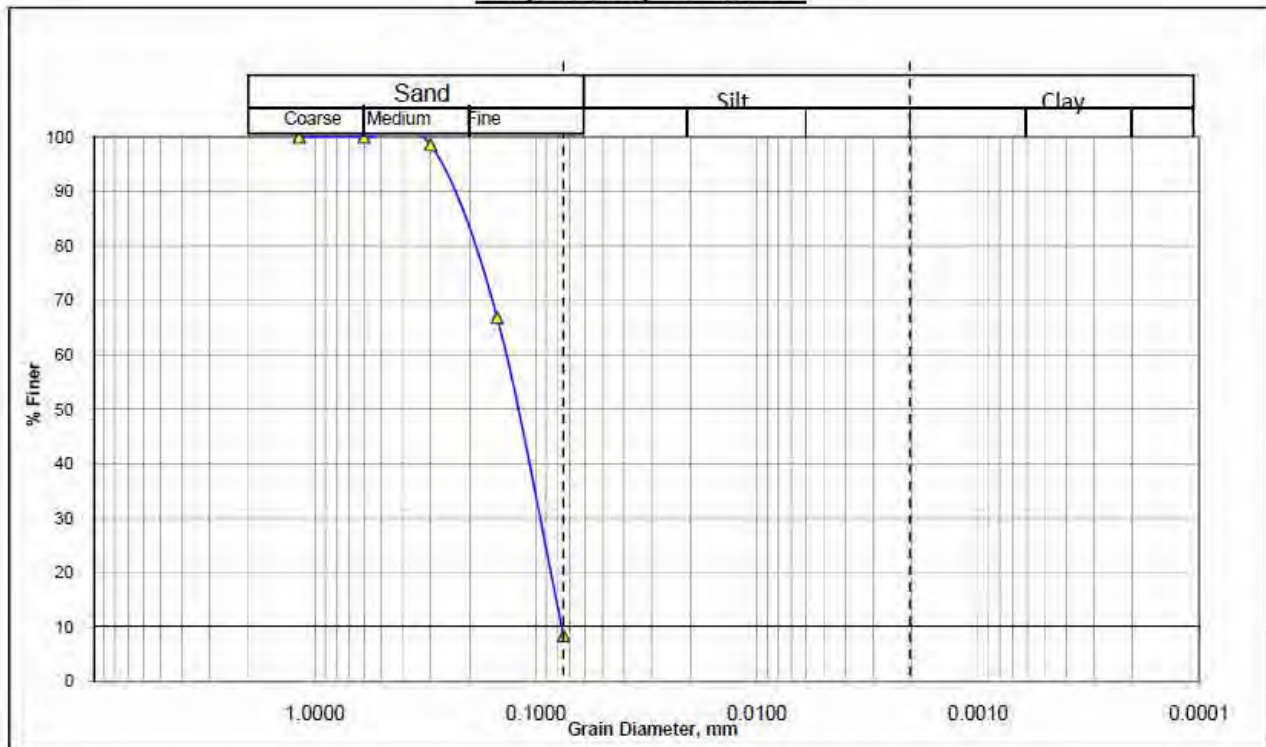
Project Location : Matarbari, Cox's Bazar

Coordinates : 382717, 2401121

Sample Date: 06/04/2013

Sample No : SS-01SL

Test Date : 13/04/2013

Graphical Representation:


Fines or % of silt and clay = 8

 Mean Diameter, $D_{50} = 0.12$ mm

 Silt-Factor, $f = 1.76 \times \sqrt{D_{50}} = 0.61$

% Particles (from the grain -size analysis graph).

(0.075mm size) = 92

(0.005mm size) & (0.001mm size) = 8

Tested by : Azharul.

GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Tokyo Electric Power Services Co. Ltd. & Engineers Associates Ltd.

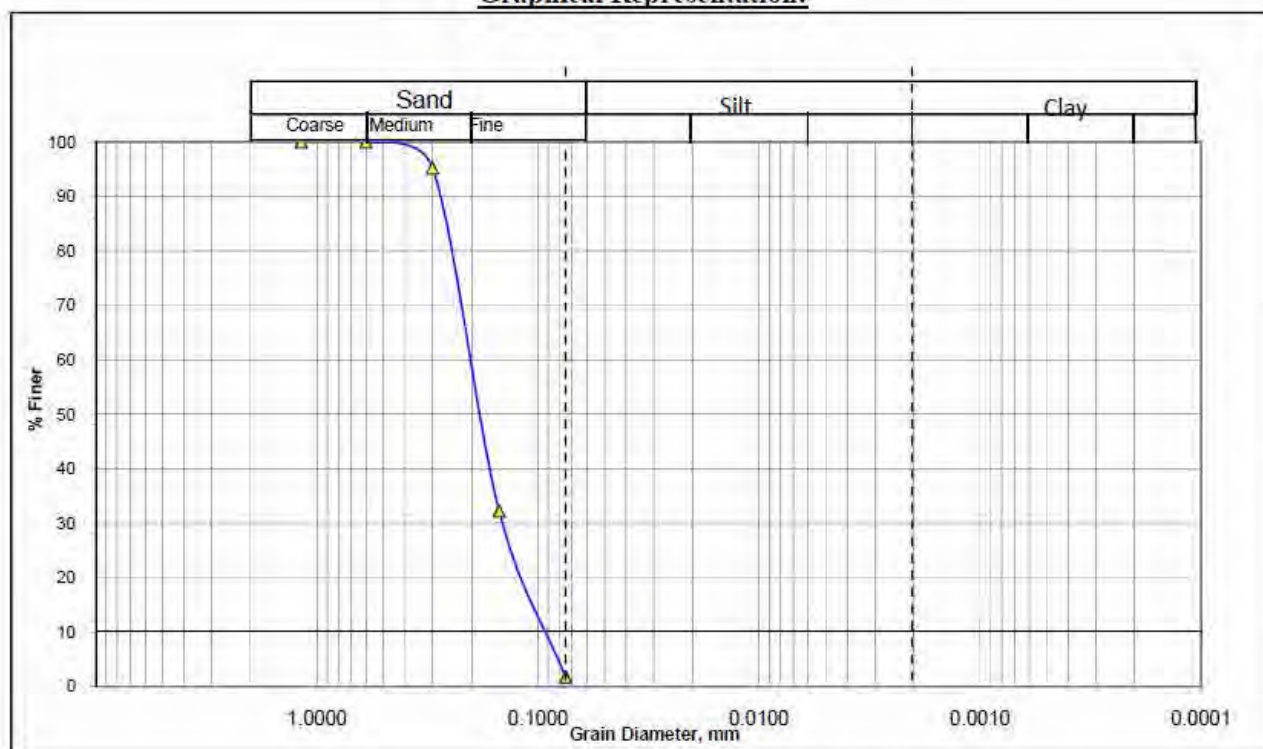
Project Location : Matarbari, Cox's Bazar

Coordinates : 381762, 2399285

Sample Date: 06/04/2013

Sample No : SS-02SL

Test Date : 13/04/2013

Graphical Representation:


Fines or % of silt and clay = 2

 Mean Diameter, D_{50} = 0.18 mm

 Silt-Factor, $f = 1.76 \times \sqrt{D_{50}} = 0.75$

% Particles (from the grain -size analysis graph).

(0.075mm size) = 98

(0.005mm size) & (0.001mm size) = 2

Tested by : Azharul.

GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Tokyo Electric Power Services Co. Ltd. & Engineers Associates Ltd.

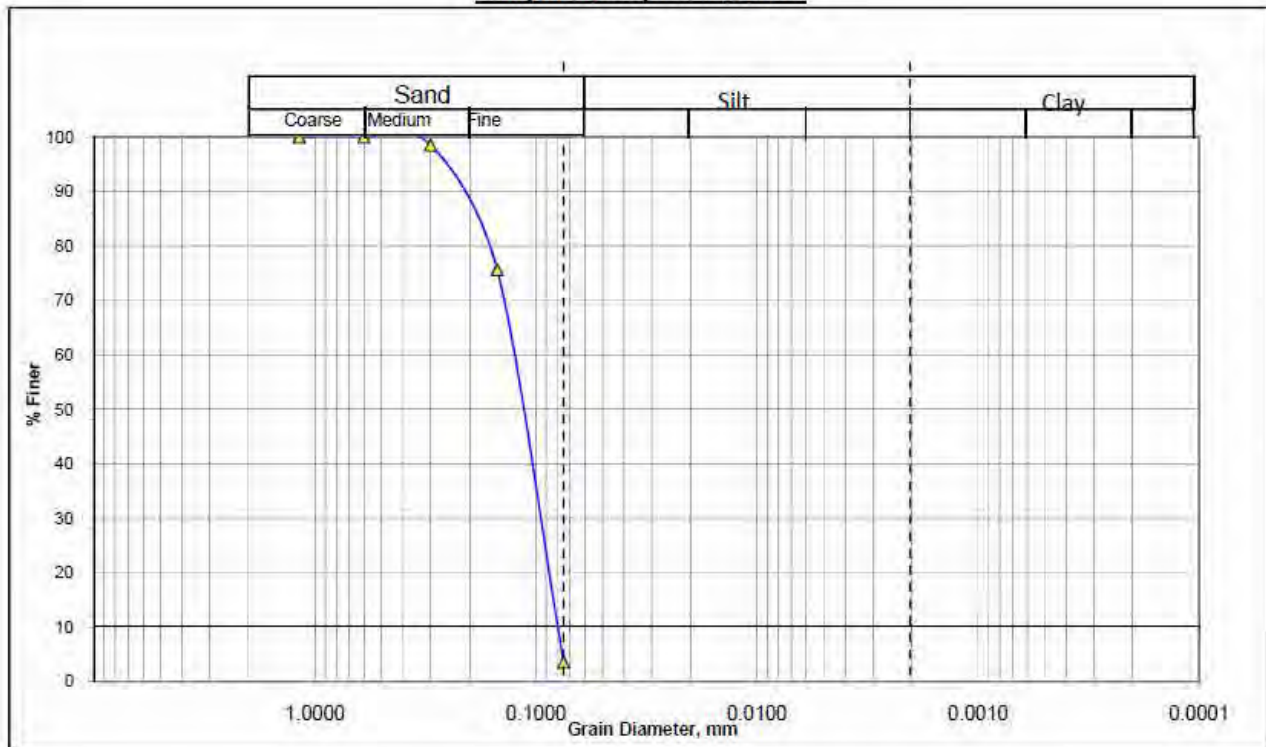
Project Location : Matarbari, Cox's Bazar

Coordinates : 381592, 2397344

Sample Date: 06/04/2013

Sample No : SS-03SL

Test Date : 13/04/2013

Graphical Representation:


Fines or % of silt and clay = 4

 Mean Diameter, $D_{50} = 0.12$ mm

 Silt-Factor, $f = 1.76 \times \sqrt{D_{50}} = 0.61$

% Particles (from the grain -size analysis graph).

(0.075mm size) = 96

(0.005mm size) & (0.001mm size) = 4

Tested by : Azharul.

GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Tokyo Electric Power Services Co. Ltd. & Engineers Associates Ltd.

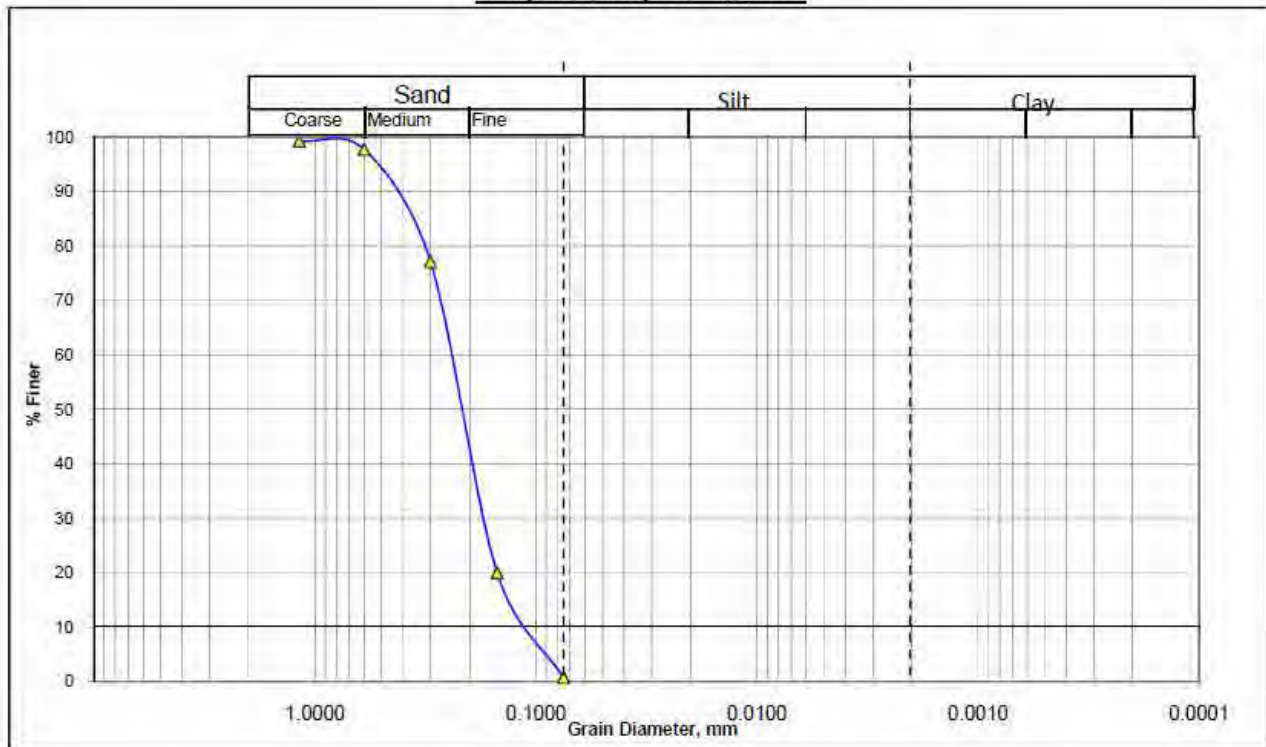
Project Location : Matarbari, Cox's Bazar

Coordinates : 382116, 2395821

Sample Date: 06/04/2013

Sample No : SS-04SL

Test Date : 13/04/2013

Graphical Representation:


Fines or % of silt and clay = 0

 Mean Diameter, $D_{50} = 0.22$ mm

 Silt-Factor, $f = 1.76 \times \sqrt{D_{50}} = 0.83$

% Particles (from the grain -size analysis graph).

(0.075mm size) = 100

(0.005mm size) & (0.001mm size) = 0

Tested by : Azharul.

GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Tokyo Electric Power Services Co. Ltd. & Engineers Associates Ltd.

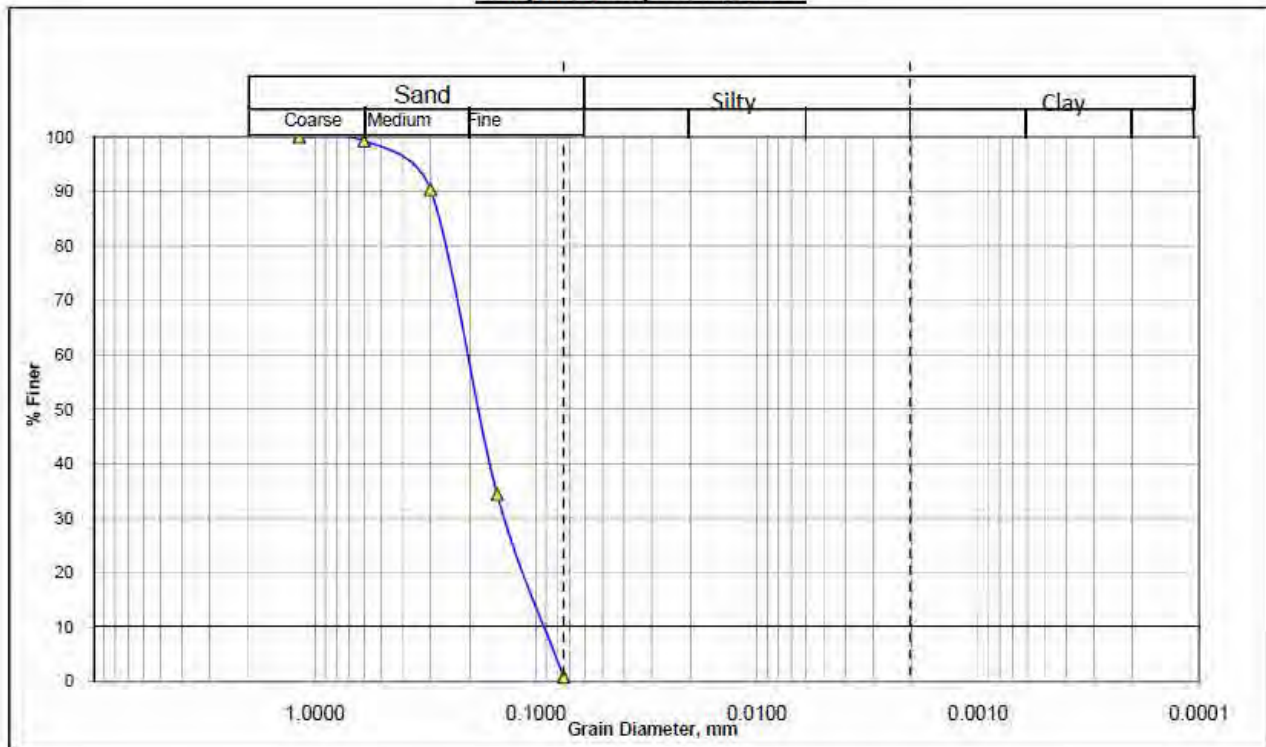
Project Location : Matarbari, Cox's Bazar

Coordinates : 383548, 2394293

Sample Date: 06/04/2013

Sample No : SS-05SL

Test Date : 13/04/2013

Graphical Representation:


Fines or % of silt and clay = 0

 Mean Diameter, $D_{50} = 0.18$ mm

 Silt-Factor, $f = 1.76 \times \sqrt{D_{50}} = 0.75$

% Particles (from the grain -size analysis graph).

(0.075mm size) = 100

(0.005mm size) & (0.001mm size) = 0

Tested by : Azharul.

GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Tokyo Electric Power Services Co. Ltd. & Engineers Associates Ltd.

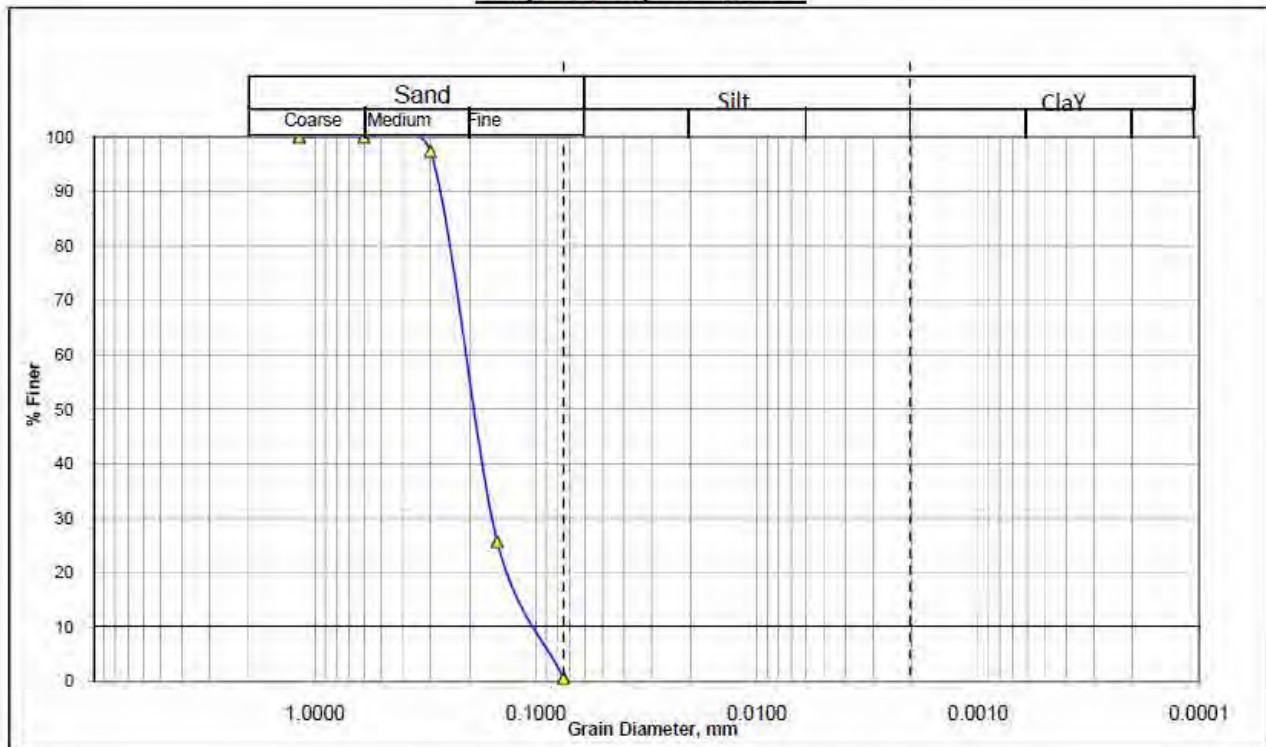
Project Location : Matarbari, Cox's Bazar

Coordinates : 382127, 2400640

Sample Date: 06/04/2013

Sample No : SS-01WB

Test Date : 13/04/2013

Graphical Representation:


Fines or % of silt and clay = 0

 Mean Diameter, $D_{50} = 0.19$ mm

 Silt-Factor, $f = 1.76 \times \sqrt{D_{50}} = 0.77$

% Particles (from the grain -size analysis graph).

(0.075mm size) = 100

(0.005mm size) & (0.001mm size) = 0

Tested by : Azharul.

GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Tokyo Electric Power Services Co. Ltd. & Engineers Associates Ltd.

Project Location : Matarbari, Cox's Bazar

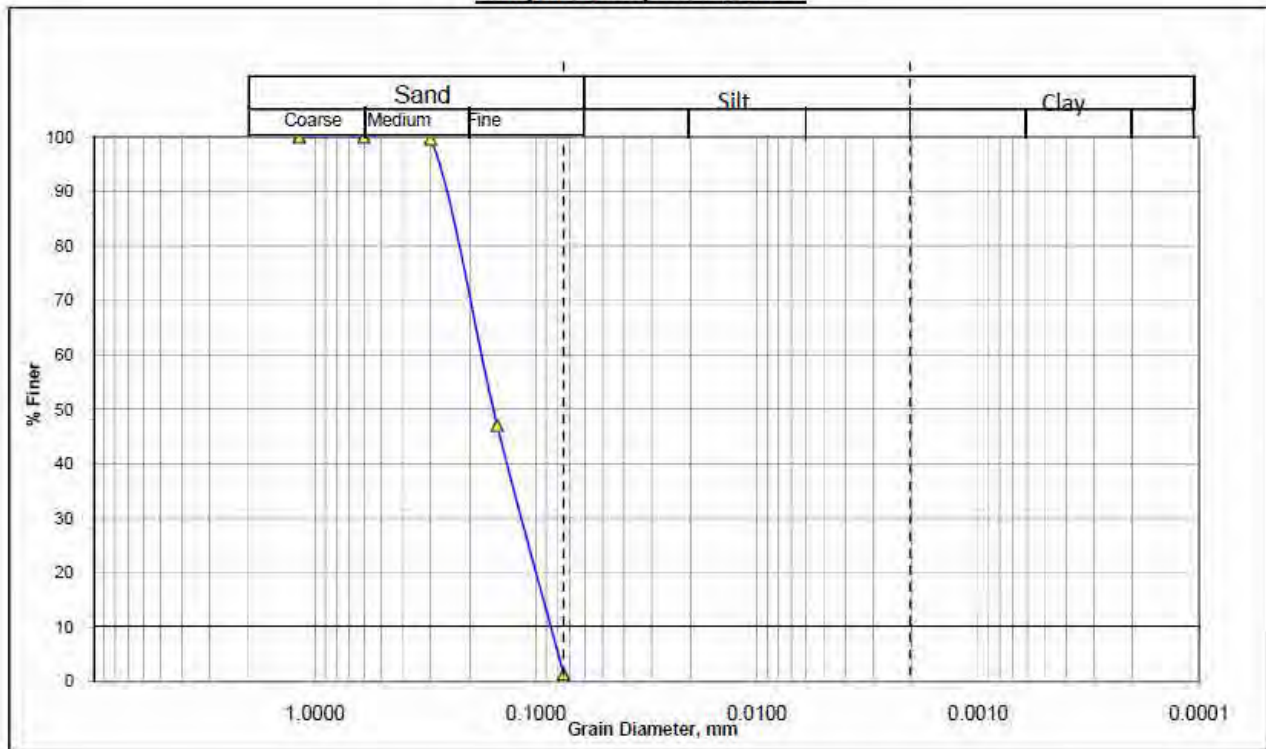
Coordinates : 381289, 2398541

Sample Date: 06/04/2013

Sample No : SS-02WB

Test Date : 13/04/2013

Graphical Representation:



Fines or % of silt and clay = 2

Mean Diameter, $D_{50} = 0.16$ mm

Silt-Factor, $f = 1.76 \times \sqrt{D_{50}} = 0.70$

% Particles (from the grain -size analysis graph).

(0.075mm size) = 98

(0.005mm size) & (0.001mm size) = 2

Tested by : Azharul.

GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Tokyo Electric Power Services Co. Ltd. & Engineers Associates Ltd.

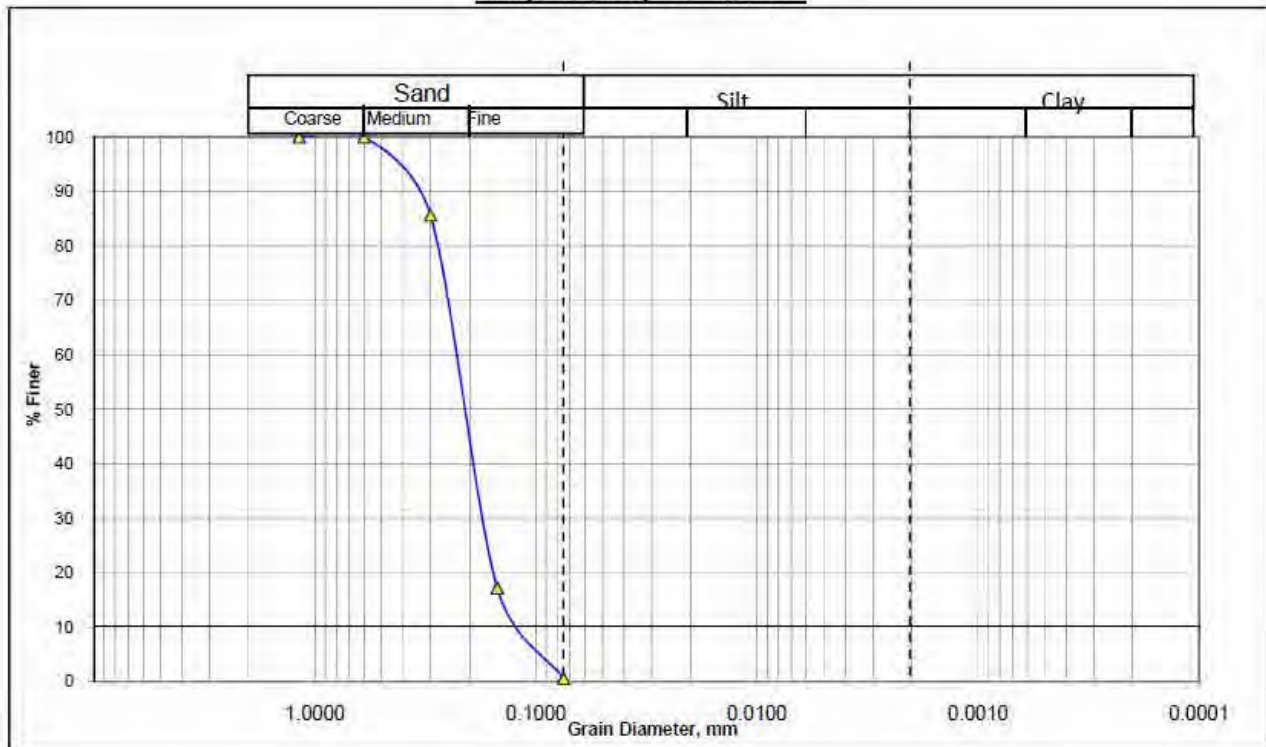
Project Location : Matarbari, Cox's Bazar

Coordinates : 381421, 2396195

Sample Date: 06/04/2013

Sample No : SS-03WB

Test Date : 13/04/2013

Graphical Representation:


Fines or % of silt and clay = 0

 Mean Diameter, $D_{50} = 0.21$ mm

 Silt-Factor, $f = 1.76 \times \sqrt{D_{50}} = 0.81$

% Particles (from the grain -size analysis graph).

(0.075mm size) = 100

(0.005mm size) & (0.001mm size) = 0

Tested by : Azharul.

GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Tokyo Electric Power Services Co. Ltd. & Engineers Associates Ltd.

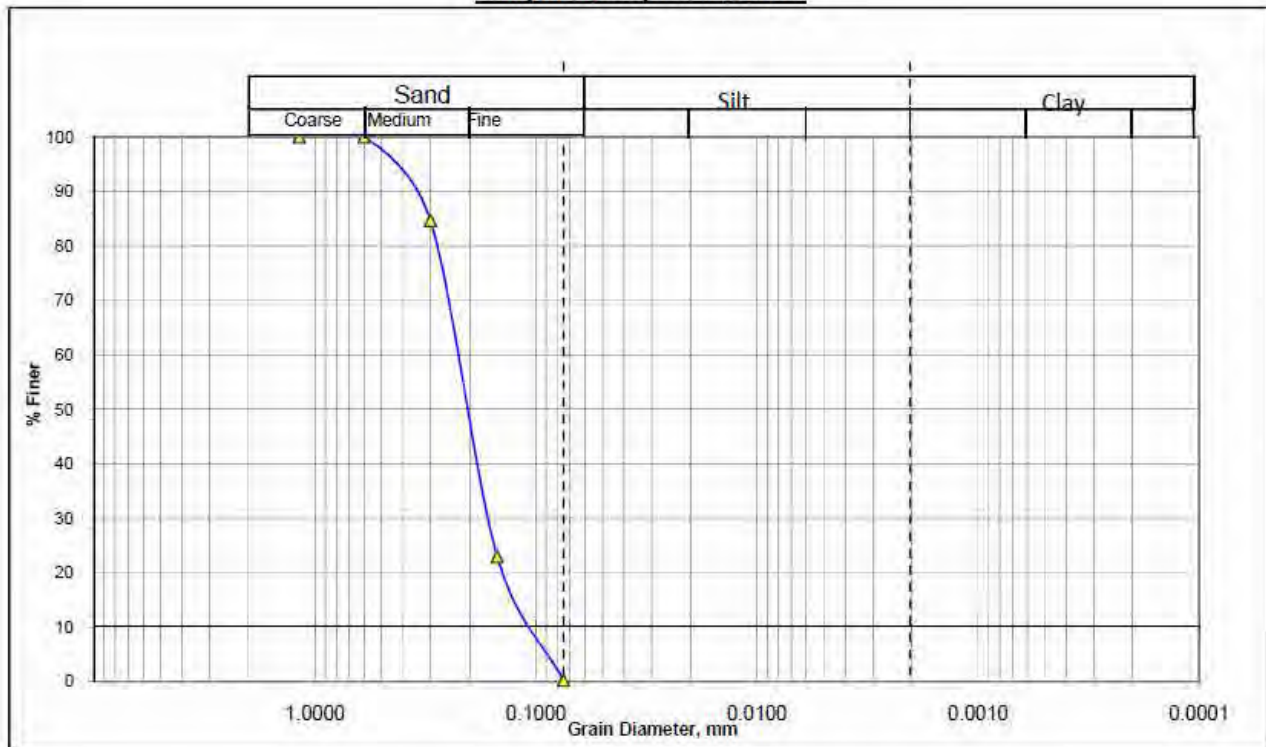
Project Location : Matarbari, Cox's Bazar

Coordinates : 381948, 2394298

Sample Date: 06/04/2013

Sample No : SS-04WB

Test Date : 13/04/2013

Graphical Representation:


Fines or % of silt and clay = 0

 Mean Diameter, D_{50} = 0.2 mm

 Silt-Factor, $f = 1.76 \times \sqrt{D_{50}}$ = 0.79

% Particles (from the grain -size analysis graph).

(0.075mm size) = 100

(0.005mm size) & (0.001mm size) = 0

Tested by : Azharul.

GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Tokyo Electric Power Services Co. Ltd. & Engineers Associates Ltd.

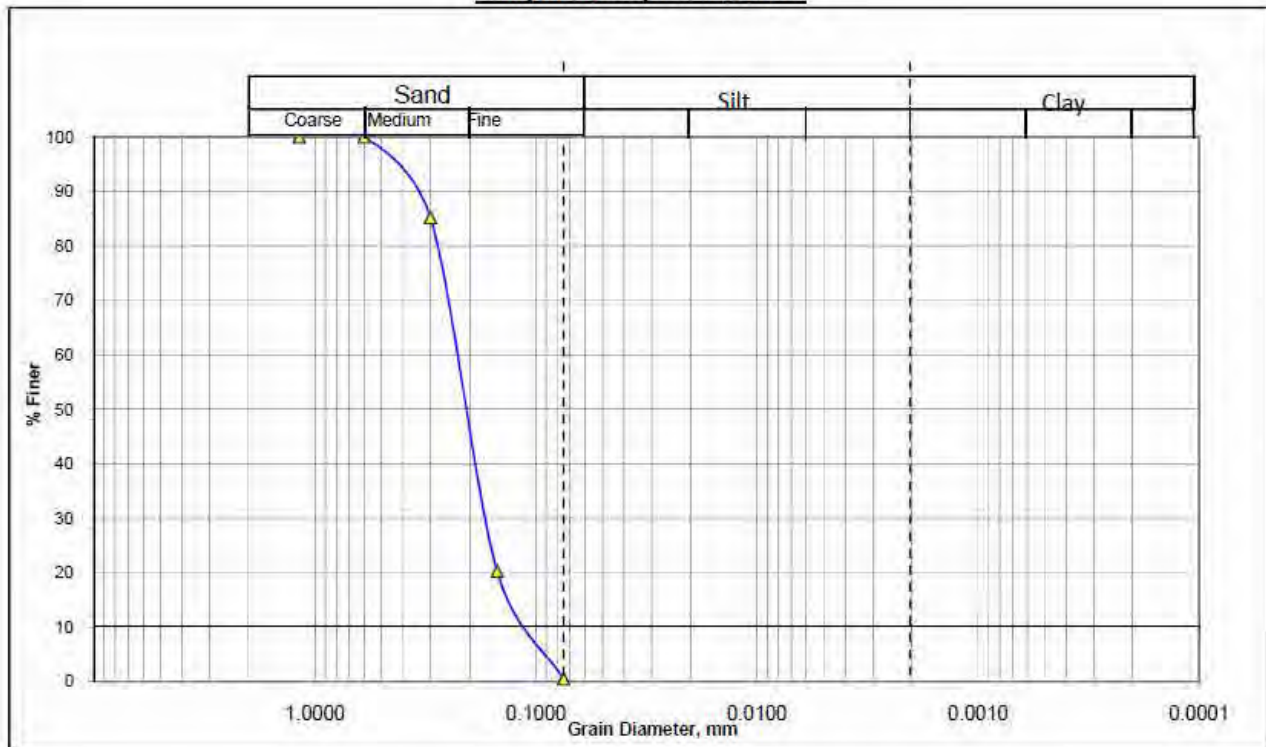
Project Location : Matarbari, Cox's Bazar

Coordinates : 382890, 2392918

Sample Date: 06/04/2013

Sample No : SS-05WB

Test Date : 13/04/2013

Graphical Representation:


Fines or % of silt and clay = 0

 Mean Diameter, D_{50} = 0.2 mm

 Silt-Factor, $f = 1.76 \times \sqrt{D_{50}}$ = 0.79

% Particles (from the grain -size analysis graph).

(0.075mm size) = 100

(0.005mm size) & (0.001mm size) = 0

Tested by : Azharul.

GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Tokyo Electric Power Services Co. Ltd. & Engineers Associates Ltd.

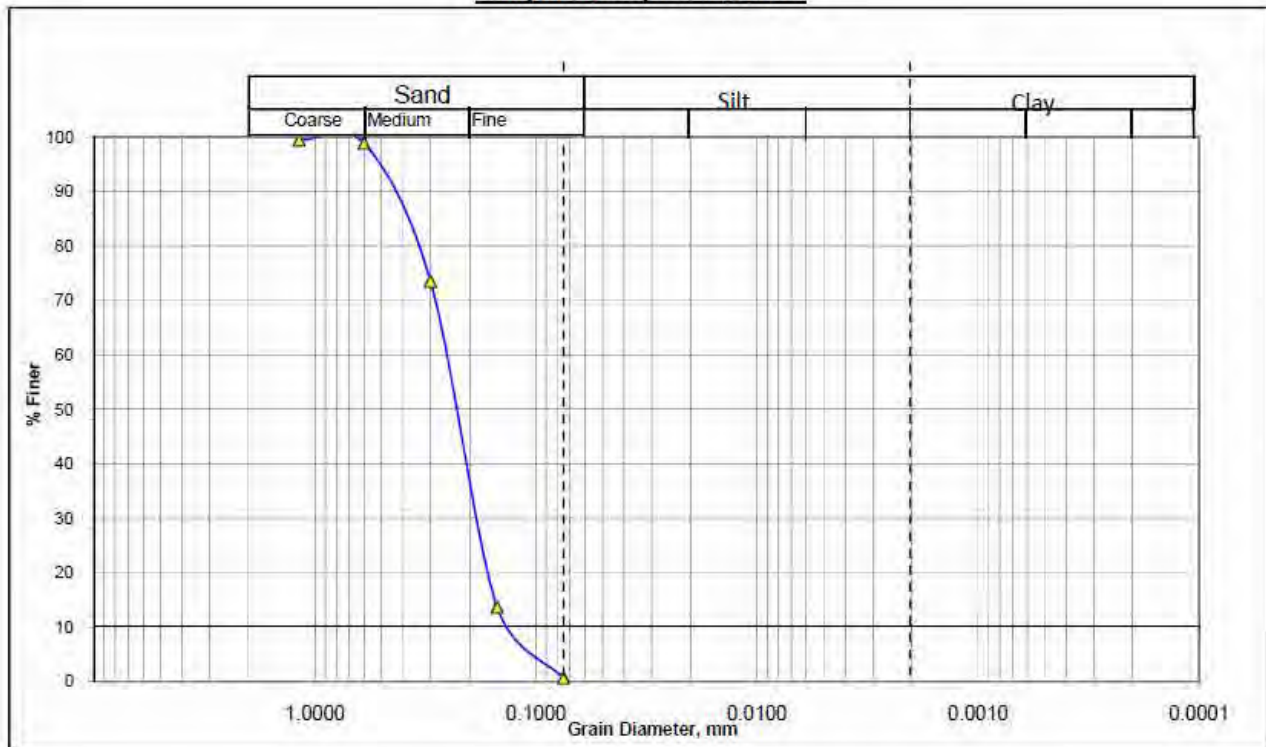
Project Location : Matarbari, Cox's Bazar

Coordinates : 381231, 2400066

Sample Date: 06/04/2013

Sample No : SS-01OS

Test Date : 13/04/2013

Graphical Representation:


Fines or % of silt and clay = 0

 Mean Diameter, $D_{50} = 0.23$ mm

 Silt-Factor, $f = 1.76 \times \sqrt{D_{50}} = 0.84$

% Particles (from the grain -size analysis graph).

(0.075mm size) = 100

(0.005mm size) & (0.001mm size) = 0

Tested by : Azharul.

GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Tokyo Electric Power Services Co. Ltd. & Engineers Associates Ltd.

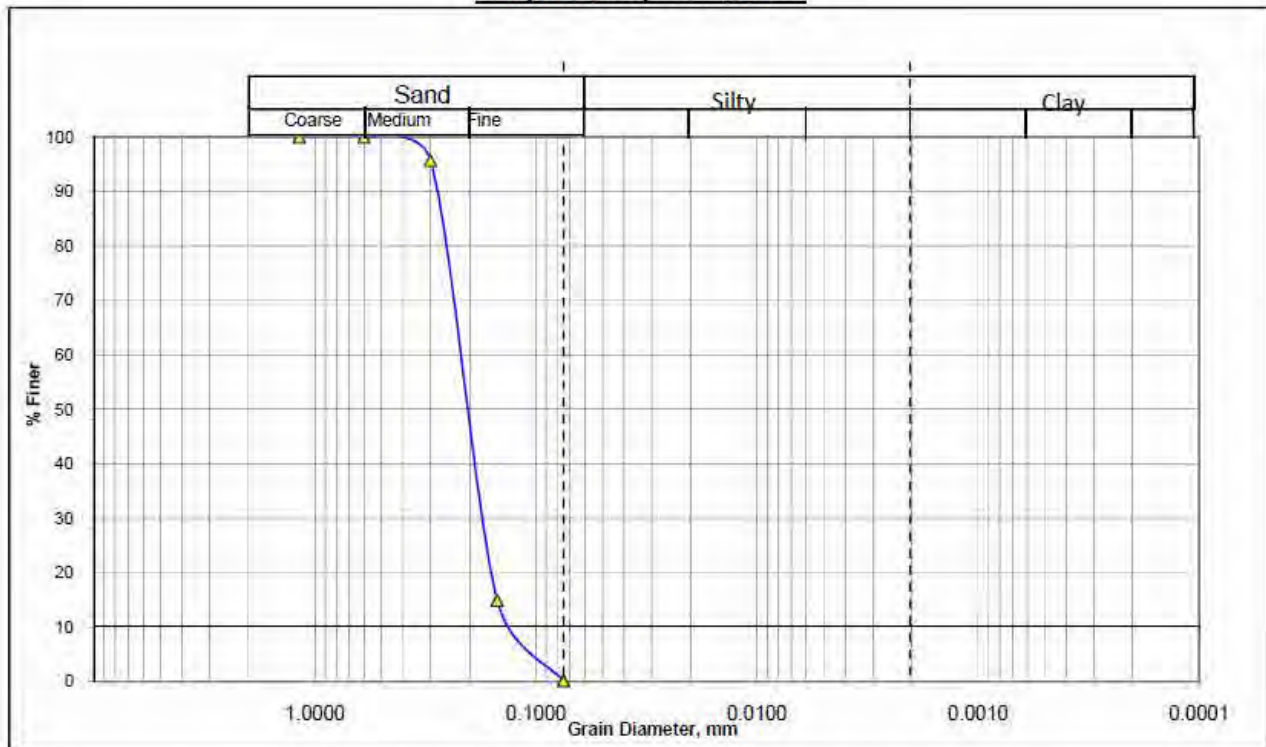
Project Location : Matarbari, Cox's Bazar

Coordinates : 380681, 2397713

Sample Date: 06/04/2013

Sample No : SS-02OS

Test Date : 13/04/2013

Graphical Representation:


Fines or % of silt and clay = 0

 Mean Diameter, D_{50} = 0.2 mm

 Silt-Factor, $f = 1.76 \times \sqrt{D_{50}}$ = 0.79

% Particles (from the grain -size analysis graph).

(0.075mm size) = 100

(0.005mm size) & (0.001mm size) = 0

Tested by : Azharul.

GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Tokyo Electric Power Services Co. Ltd. & Engineers Associates Ltd.

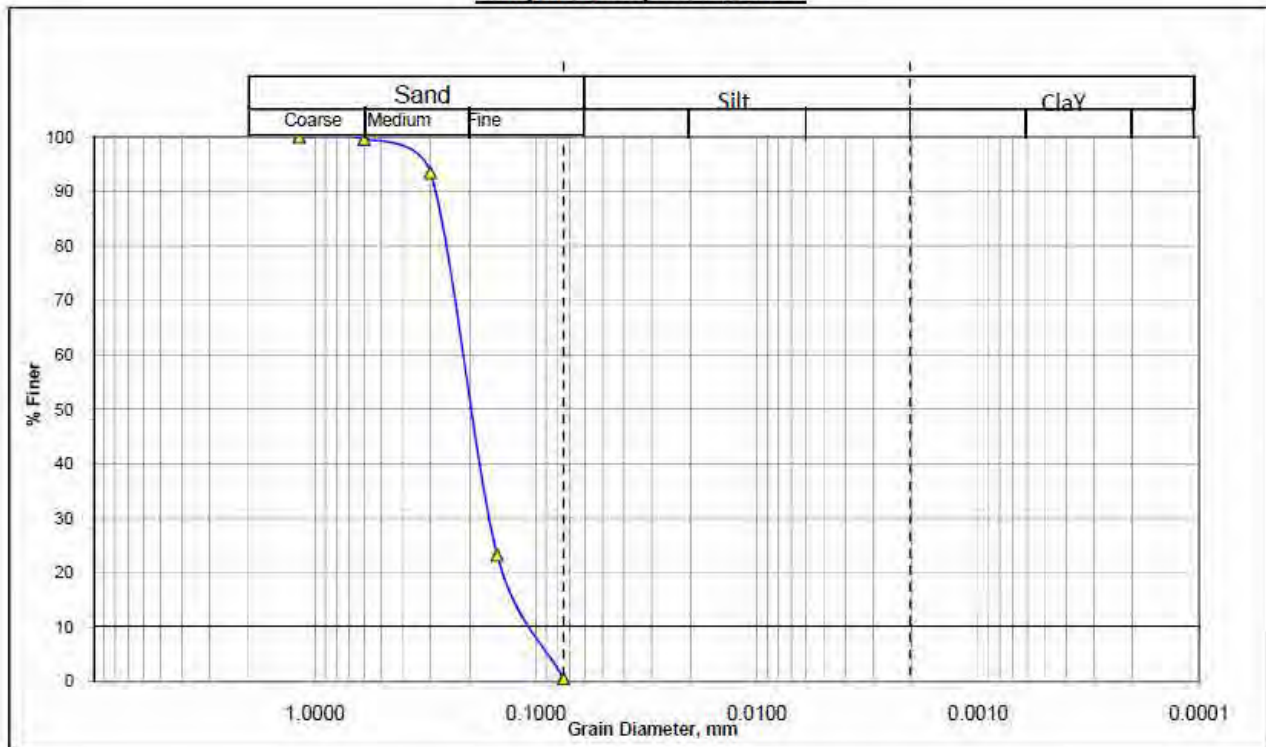
Project Location : Matarbari, Cox's Bazar

Coordinates : 379928, 2394127

Sample Date: 06/04/2013

Sample No : SS-03OS

Test Date : 13/04/2013

Graphical Representation:


Fines or % of silt and clay = 0

 Mean Diameter, D_{50} = 0.2 mm

 Silt-Factor, $f = 1.76 \times \sqrt{D_{50}}$ = 0.79

% Particles (from the grain -size analysis graph).

(0.075mm size) = 100

(0.005mm size) & (0.001mm size) = 0

Tested by : Azharul.

SURVEY 2000
SPECIFIC GRAVITY OF SOIL AS PER ASTM D-854

Client : Tokyo Electric Power Services Co. Ltd. & Engineers Associates Ltd.

Scheme :2x 600MW Coal fired power plant

Location : Matarbari, Cox's Bazar

Coordinates : 382717, 2401121

Sample No. : SS-01SL

Sampled by & Date :

6/4/2013

Laboratory Register No. :

Test Date : 15/4/2013

Pycnometer Type :Volumetric Flask/Stoppered Bottle Capacity : 50mL

Air Removal By : Boiling

Description of soil : Grey fine SAND with trace of mica

Test Specimen :

Nature of Specimen : Oven-Dry Sample

Soaking Period : Soaked overnight (since oven-dry specimen is used)

TEST DATA :

TEST/TRIAL NO.	1		
PYCNOMETER NO.	4		
Wt. of Soil (oven dry weight), W_g in gm	15.00		
Observed Temperature, T_x in deg.Centigrade	29		
Wt.of Pycnometer + water, W_a (at T_x) in gm (from Calibration Data of Pycnometer)	80.40		
Wt.of Pycnometer + water+soil, W_b (at T_x) in gm	99.79		
Specific Gravity, G (at T_x) = $W_g/(W_a+W_b-W_g)$	2.67		
Variation of Specific Gravity Values & Average (According to some specification average value shall be calculated only if (Largest value of G_s) Smallest value of G_s) < or = 1.02)	Ratio : 2.71/2.63 >or = 1.02 Ratio : 2.73/2.71 < or = 1.02 Avg. G_s (at T_x)		0.000 2.67
Density of Water at T_x deg.Cent., in gm/cc			0.996
Density of Water at 20 deg.Cent., in gm/cc			0.9982
Specific Gravity, G (at 20 deg.Cent.) = (Density of Water at T_x /Density of Water at 20 deg.cent.) x G (at T_x)			2.67

Tested by : S. Alam, Laboratory specialist

Comments of the Laboratory Incharge :

Signed by : M. Islam

SURVEY 2000
SPECIFIC GRAVITY OF SOIL AS PER ASTM D-854

Client : Tokyo Electric Power Services Co. Ltd. & Engineers Associates Ltd.

Scheme :2x 600MW Coal fired power plant

Location : Matarbari, Cox's Bazar

Coordinates : 381762, 2399285

Sample No. : SS-02SL

Sampled by & Date :

6/4/2013

Laboratory Register No. :

Test Date :

15/4/2013

Pycnometer Type :Volumetric Flask/Stoppered Bottle Capacity : 50mL

Air Removal By : Boiling

Description of soil : Grey fine SAND with trace of mica

Test Specimen :

Nature of Specimen : Oven-Dry Sample

Soaking Period : Soaked overnight (since oven-dry specimen is used)

TEST DATA :

TEST/TRIAL NO.	2		
PYCNOMETER NO.	2		
Wt. of Soil (oven dry weight), W_s in gm	15.00		
Observed Temperature, T_x in deg.Centigrade	32		
Wt.of Pycnometer + water, W_a (at T_x) in gm (from Calibration Data of Pycnometer)	79.16		
Wt.of Pycnometer + water+soil, W_b (at T_x) in gm	88.54		
Specific Gravity, G (at T_x) = $W_s/(W_a+W_b-W_s)$	2.67		
Variation of Specific Gravity Values & Average (According to some specification average value shall be calculated only if (Largest value of G_s) Smallest value of G_s < or = 1.02)	Ratio : 2.71/2.63 >or = 1.02 Ratio : 2.73/2.71 < or = 1.02 Avg. G_s (at T_x)		0.000 2.67
Density of Water at T_x deg.Cent., in gm/cc	0.9951		
Density of Water at 20 deg.Cent., in gm/cc	0.9982		
Specific Gravity, G (at 20 deg.Cent.) = (Density of Water at T_x /Density of Water at 20 deg.cent.) x G (at T_x)	2.66		

Tested by : S. Alam, Laboratory specialist

Comments of the Laboratory Incharge :

Signed by : M. Islam

SURVEY 2000
SPECIFIC GRAVITY OF SOIL AS PER ASTM D-854

Client : Tokyo Electric Power Services Co. Ltd. & Engineers Associates Ltd.

Scheme :2x 600MW Coal fired power plant

Location : Matarbari, Cox's Bazar

Coordinates : 381592, 2397344

Sample No. : SS-03SL

Sampled by & Date :

6/4/2013

Laboratory Register No. :

Test Date :

15/4/2013

Pycnometer Type :Volumetric Flask/Stoppered Bottle Capacity : 50mL

Air Removal By : Boiling

Description of soil : Grey fine SAND with trace of mica

Test Specimen :

Nature of Specimen : Oven-Dry Sample

Soaking Period : Soaked overnight (since oven-dry specimen is used)

TEST DATA :

TEST/TRIAL NO.	3		
PYCNOMETER NO.	p-9		
Wt. of Soil (oven dry weight), W_s in gm	15.00		
Observed Temperature, T_x in deg.Centigrade	32		
Wt.of Pycnometer + water, W_a (at T_x) in gm (from Calibration Data of Pycnometer)	79.65		
Wt.of Pycnometer + water+soil, W_b (at T_x) in gm	89.04		
Specific Gravity, G (at T_x) = $W_s/(W_a+W_s-W_b)$	2.67		
Variation of Specific Gravity Values & Average (According to some specification average value shall be calculated only if (Largest value of G_s) Smallest value of G_s < or = 1.02)	Ratio : 2.71/2.63 >or = 1.02 Ratio : 2.73/2.71 < or = 1.02 Avg. G_s (at T_x)		0.000 2.67
Density of Water at T_x deg.Cent., in gm/cc			0.9951
Density of Water at 20 deg.Cent., in gm/cc			0.9982
Specific Gravity, G (at 20 deg.Cent.) = (Density of Water at T_x /Density of Water at 20 deg.cent.) x G (at T_x)			2.67

Tested by : S. Alam, Laboratory specialist

Comments of the Laboratory Incharge :

Signed by : M. Islam

SURVEY 2000
SPECIFIC GRAVITY OF SOIL AS PER ASTM D-854

Client : Tokyo Electric Power Services Co. Ltd. & Engineers Associates Ltd.

Scheme :2x 600MW Coal fired power plant

Location : Matarbari, Cox's Bazar

Coordinates : 382116, 2395821

Sample No. : SS-04SL

Sampled by & Date :

6/4/2013

Laboratory Register No. :

Test Date :

15/4/2013

Pycnometer Type :Volumetric Flask/Stoppered Bottle Capacity : 50mL

Air Removal By : Boiling

Description of soil : Grey fine SAND with trace of mica

Test Specimen :

Nature of Specimen : Oven-Dry Sample

Soaking Period : Soaked overnight (since oven-dry specimen is used)

TEST DATA :

TEST/TRIAL NO.	4		
PYCNOMETER NO.	8		
Wt. of Soil (oven dry weight), W_g in gm	15.00		
Observed Temperature, T_x in deg.Centigrade	32		
Wt.of Pycnometer + water, W_a (at T_x) in gm (from Calibration Data of Pycnometer)	80.85		
Wt.of Pycnometer + water+soil, W_b (at T_x) in gm	90.22		
Specific Gravity, G (at T_x) = $W_g/(W_a+W_b-W_g)$	2.66		
Variation of Specific Gravity Values & Average (According to some specification average value shall be calculated only if (Largest value of G_s) Smallest value of G_s < or = 1.02)	Ratio : 2.71/2.63 >or = 1.02 Ratio : 2.73/2.71 < or = 1.02 Avg. G_s (at T_x)		0.000 2.66
Density of Water at T_x deg.Cent., in gm/cc			0.9951
Density of Water at 20 deg.Cent., in gm/cc			0.9982
Specific Gravity, G (at 20 deg.Cent.) = (Density of Water at T_x /Density of Water at 20 deg.cent.) x G (at T_x)			2.66

Tested by : S. Alam, Laboratory specialist

Comments of the Laboratory Incharge :

Signed by : M. Islam

SURVEY 2000
SPECIFIC GRAVITY OF SOIL AS PER ASTM D-854

Client : Tokyo Electric Power Services Co. Ltd. & Engineers Associates Ltd.

Scheme :2x 600MW Coal fired power plant

Location : Matarbari, Cox's Bazar

Coordinates : 383548, 2394293

Sample No. : SS-05SL

Sampled by & Date :

6/4/2013

Laboratory Register No. :

Test Date :

15/4/2013

Pycnometer Type :Volumetric Flask/Stoppered Bottle Capacity : 50mL

Air Removal By : Boiling

Description of soil : Grey fine SAND with trace of mica

Test Specimen :

Nature of Specimen : Oven-Dry Sample

Soaking Period : Soaked overnight (since oven-dry specimen is used)

TEST DATA :

TEST/TRIAL NO.	5		
PYCNOMETER NO.	5		
Wt. of Soil (oven dry weight), W_g in gm	15.00		
Observed Temperature, T_x in deg.Centigrade	32		
Wt.of Pycnometer + water, W_a (at T_x) in gm (from Calibration Data of Pycnometer)	81.30		
Wt.of Pycnometer + water+soil, W_b (at T_x) in gm	90.65		
Specific Gravity, G (at T_x) = $W_g/(W_a+W_b-W_g)$	2.65		
Variation of Specific Gravity Values & Average (According to some specification average value shall be calculated only if (Largest value of G_s) Smallest value of G_s < or = 1.02)	Ratio : 2.71/2.63 >or = 1.02 Ratio : 2.73/2.71 < or = 1.02 Avg. G_s (at T_x)		0.000 2.65
Density of Water at T_x deg.Cent., in gm/cc			0.9951
Density of Water at 20 deg.Cent., in gm/cc			0.9982
Specific Gravity, G (at 20 deg.Cent.) = (Density of Water at T_x /Density of Water at 20 deg.cent.) x G (at T_x)			2.65

Tested by : S. Alam, Laboratory specialist

Comments of the Laboratory Incharge :

Signed by : M. Islam

SURVEY 2000
SPECIFIC GRAVITY OF SOIL AS PER ASTM D-854

Client : Tokyo Electric Power Services Co. Ltd. & Engineers Associates Ltd.

Scheme :2x 600MW Coal fired power plant

Location : Matarbari, Cox's Bazar

Coordinates : 382127, 2400640

Sample No. : SS-01WB

Sampled by & Date :

6/4/2013

Laboratory Register No. :

Test Date :

15/4/2013

Pycnometer Type :Volumetric Flask/Stoppered Bottle Capacity : 50mL

Air Removal By : Boiling

Description of soil : Grey fine SAND with trace of mica

Test Specimen :

Nature of Specimen : Oven-Dry Sample

Soaking Period : Soaked overnight (since oven-dry specimen is used)

TEST DATA :

TEST/TRIAL NO.	6		
PYCNOMETER NO.	9		
Wt. of Soil (oven dry weight), W_s in gm	15.00		
Observed Temperature, T_x in deg.Centigrade	29		
Wt.of Pycnometer + water, W_a (at T_x) in gm (from Calibration Data of Pycnometer)	79.84		
Wt.of Pycnometer + water+soil, W_b (at T_x) in gm	89.19		
Specific Gravity, G (at T_x) = $W_s/(W_a+W_b-W_s)$	2.65		
Variation of Specific Gravity Values & Average (According to some specification average value shall be calculated only if (Largest value of G_s) Smallest value of G_s < or = 1.02)	Ratio : 2.71/2.63 >or = 1.02 Ratio : 2.73/2.71 < or = 1.02 Avg. G_s (at T_x)		0.000 2.65
Density of Water at T_x deg.Cent., in gm/cc			0.996
Density of Water at 20 deg.Cent., in gm/cc			0.9982
Specific Gravity, G (at 20 deg.Cent.) = (Density of Water at T_x /Density of Water at 20 deg.cent.) x G (at T_x)			2.65

Tested by : S. Alam, Laboratory specialist

Comments of the Laboratory Incharge :

Signed by : M. Islam

SURVEY 2000
SPECIFIC GRAVITY OF SOIL AS PER ASTM D-854

Client : Tokyo Electric Power Services Co. Ltd. & Engineers Associates Ltd.

Scheme :2x 600MW Coal fired power plant

Location : Matarbari, Cox's Bazar

Coordinates : 381289, 2398541

Sample No. : SS-02WB

Sampled by & Date : 6/4/2013

Laboratory Register No. :

Test Date : 15/4/2013

Pycnometer Type :Volumetric Flask/Stoppered Bottle Capacity : 50mL

Air Removal By : Boiling

Description of soil : Grey fine to very fine SAND with trace of mica

Test Specimen :

Nature of Specimen : Oven-Dry Sample

Soaking Period : Soaked overnight (since oven-dry specimen is used)

TEST DATA :

TEST/TRIAL NO.	7		
PYCNOMETER NO.	4		
Wt. of Soil (oven dry weight), W_s in gm	15.00		
Observed Temperature, T_x in deg.Centigrade	32		
Wt.of Pycnometer + water, W_a (at T_x) in gm (from Calibration Data of Pycnometer)	80.38		
Wt.of Pycnometer + water+soil, W_b (at T_x) in gm	89.76		
Specific Gravity, G (at T_x) = $W_s/(W_a+W_b-W_s)$	2.67		
Variation of Specific Gravity Values & Average (According to some specification average value shall be calculated only if (Largest value of G_s) Smallest value of G_s < or = 1.02)	Ratio : 2.71/2.63 >or = 1.02 Ratio : 2.73/2.71 < or = 1.02 Avg. G_s (at T_x)		0.000 2.67
Density of Water at T_x deg.Cent., in gm/cc			0.9951
Density of Water at 20 deg.Cent., in gm/cc			0.9982
Specific Gravity, G (at 20 deg.Cent.) = (Density of Water at T_x /Density of Water at 20 deg.cent.) x G (at T_x)			2.66

Tested by : S. Alam, Laboratory specialist

Comments of the Laboratory Incharge :

Signed by : M. Islam

SURVEY 2000
SPECIFIC GRAVITY OF SOIL AS PER ASTM D-854

Client : Tokyo Electric Power Services Co. Ltd. & Engineers Associates Ltd.

Scheme :2x 600MW Coal fired power plant

Location : Matarbari, Cox's Bazar

Coordinates : 381421, 2396195

Sample No. : SS-03WB

Sampled by & Date :

6/4/2013

Laboratory Register No. :

Test Date :

15/4/2013

Pycnometer Type :Volumetric Flask/Stoppered Bottle Capacity : 50mL

Air Removal By : Boiling

Description of soil : Grey fine SAND with trace of mica

Test Specimen :

Nature of Specimen : Oven-Dry Sample

Soaking Period : Soaked overnight (since oven-dry specimen is used)

TEST DATA :

TEST/TRIAL NO.	8		
PYCNOMETER NO.	6		
Wt. of Soil (oven dry weight), W_s in gm	15.00		
Observed Temperature, T_x in deg.Centigrade	32		
Wt.of Pycnometer + water, W_a (at T_x) in gm (from Calibration Data of Pycnometer)	76.83		
Wt.of Pycnometer + water+soil, W_b (at T_x) in gm	86.2		
Specific Gravity, G (at T_x) = $W_s/(W_a+W_s-W_b)$	2.66		
Variation of Specific Gravity Values & Average (According to some specification average value shall be calculated only if (Largest value of G_s) Smallest value of G_s < or = 1.02)	Ratio : 2.71/2.63 >or = 1.02 Ratio : 2.73/2.71 < or = 1.02 Avg. G_s (at T_x)		0.000 2.66
Density of Water at T_x deg.Cent., in gm/cc			0.9951
Density of Water at 20 deg.Cent., in gm/cc			0.9982
Specific Gravity, G (at 20 deg.Cent.) = (Density of Water at T_x /Density of Water at 20 deg.cent.) x G (at T_x)			2.66

Tested by : S. Alam, Laboratory specialist

Comments of the Laboratory Incharge :

Signed by : M. Islam

SURVEY 2000
SPECIFIC GRAVITY OF SOIL AS PER ASTM D-854

Client : Tokyo Electric Power Services Co. Ltd. & Engineers Associates Ltd.

Scheme :2x 600MW Coal fired power plant

Location : Matarbari, Cox's Bazar

Coordinates : 381948, 2394298

Sample No. : SS-04WB

Sampled by & Date : 6/4/2013

Laboratory Register No. :

Test Date : 15/4/2013

Pycnometer Type :Volumetric Flask/Stoppered Bottle Capacity : 50mL

Air Removal By : Boiling

Description of soil : Brown fine to medium SAND with trace of mica

Test Specimen :

Nature of Specimen : Oven-Dry Sample

Soaking Period : Soaked overnight (since oven-dry specimen is used)

TEST DATA :

TEST/TRIAL NO.	9		
PYCNOMETER NO.	7		
Wt. of Soil (oven dry weight), W_s in gm	15.00		
Observed Temperature, T_x in deg.Centigrade	32		
Wt.of Pycnometer + water, W_a (at T_x) in gm (from Calibration Data of Pycnometer)	78.23		
Wt.of Pycnometer + water+soil, W_b (at T_x) in gm	87.58		
Specific Gravity, G (at T_x) = $W_s/(W_a+W_s-W_b)$	2.65		
Variation of Specific Gravity Values & Average (According to some specification average value shall be calculated only if (Largest value of G_s) Smallest value of G_s < or = 1.02)	Ratio : 2.71/2.63 >or = 1.02 Ratio : 2.73/2.71 < or = 1.02 Avg. G_s (at T_x)		0.000 2.65
Density of Water at T_x deg.Cent., in gm/cc			0.9951
Density of Water at 20 deg.Cent., in gm/cc			0.9982
Specific Gravity, G (at 20 deg.Cent.) = (Density of Water at T_x /Density of Water at 20 deg.cent.) x G (at T_x)			2.65

Tested by : S. Alam, Laboratory specialist

Comments of the Laboratory Incharge :

Signed by : M. Islam

SURVEY 2000
SPECIFIC GRAVITY OF SOIL AS PER ASTM D-854

Client : Tokyo Electric Power Services Co. Ltd. & Engineers Associates Ltd.

Scheme :2x 600MW Coal fired power plant

Location : Matarbari, Cox's Bazar

Coordinates : 382890, 2392918

Sample No. : SS-05WB

Sampled by & Date :

6/4/2013

Laboratory Register No. :

Test Date :

15/4/2013

Pycnometer Type :Volumetric Flask/Stoppered Bottle Capacity : 50mL

Air Removal By : Boiling

Description of soil : Light grey fine to very fine SAND with trace of mica

Test Specimen :

Nature of Specimen : Oven-Dry Sample

Soaking Period : Soaked overnight (since oven-dry specimen is used)

TEST DATA :

TEST/TRIAL NO.	10		
PYCNOMETER NO.	3		
Wt. of Soil (oven dry weight), W_s in gm	15.00		
Observed Temperature, T_x in deg.Centigrade	32		
Wt.of Pycnometer + water, W_a (at T_x) in gm (from Calibration Data of Pycnometer)	79.06		
Wt.of Pycnometer + water+soil, W_b (at T_x) in gm	88.43		
Specific Gravity, G (at T_x) = $W_s/(W_a+W_s-W_b)$	2.66		
Variation of Specific Gravity Values & Average (According to some specification average value shall be calculated only if (Largest value of G_s) Smallest value of G_s < or = 1.02)	Ratio : 2.71/2.63 >or = 1.02 Ratio : 2.73/2.71 < or = 1.02 Avg. G_s (at T_x)		0.000 2.66
Density of Water at T_x deg.Cent., in gm/cc			0.9951
Density of Water at 20 deg.Cent., in gm/cc			0.9982
Specific Gravity, G (at 20 deg.Cent.) = (Density of Water at T_x /Density of Water at 20 deg.cent.) x G (at T_x)			2.66

Tested by : S. Alam, Laboratory specialist

Comments of the Laboratory Incharge :

Signed by : M. Islam

SURVEY 2000
SPECIFIC GRAVITY OF SOIL AS PER ASTM D-854

Client : Tokyo Electric Power Services Co. Ltd. & Engineers Associates Ltd.

Scheme :2x 600MW Coal fired power plant

Location : Matarbari, Cox's Bazar

Coordinates : 381231, 2400066

Sample No. : SS-01OS

Sampled by & Date :

6/4/2013

Laboratory Register No. :

Test Date :

15/4/2013

Pycnometer Type :Volumetric Flask/Stoppered Bottle Capacity : 50mL

Air Removal By : Boiling

Description of soil : Grey fine SAND with trace of mica

Test Specimen :

Nature of Specimen : Oven-Dry Sample

Soaking Period : Soaked overnight (since oven-dry specimen is used)

TEST DATA :

TEST/TRIAL NO.	11		
PYCNOMETER NO.	3		
Wt. of Soil (oven dry weight), W_g in gm	15.00		
Observed Temperature, T_x in deg.Centigrade	29		
Wt.of Pycnometer + water, W_a (at T_x) in gm (from Calibration Data of Pycnometer)	79.10		
Wt.of Pycnometer + water+soil, W_b (at T_x) in gm	88.5		
Specific Gravity, G (at T_x) = $W_g/(W_a+W_b-W_g)$	2.68		
Variation of Specific Gravity Values & Average (According to some specification average value shall be calculated only if (Largest value of G_s) Smallest value of G_s < or = 1.02)	Ratio : 2.71/2.63 >or = 1.02 Ratio : 2.73/2.71 < or = 1.02 Avg. G_s (at T_x)		0.000 2.68
Density of Water at T_x deg.Cent., in gm/cc			0.996
Density of Water at 20 deg.Cent., in gm/cc			0.9982
Specific Gravity, G (at 20 deg.Cent.) = (Density of Water at T_x /Density of Water at 20 deg.cent.) x G (at T_x)			2.67

Tested by : S. Alam, Laboratory specialist

Comments of the Laboratory Incharge :

Signed by : M. Islam

SURVEY 2000
SPECIFIC GRAVITY OF SOIL AS PER ASTM D-854

Client : Tokyo Electric Power Services Co. Ltd. & Engineers Associates Ltd.

Scheme :2x 600MW Coal fired power plant

Location : Matarbari, Cox's Bazar

Coordinates : 380681, 2397713

Sample No. : SS-02OS

Sampled by & Date :

6/4/2013

Laboratory Register No. :

Test Date : 15/4/2013

Pycnometer Type :Volumetric Flask/Stoppered Bottle Capacity : 50mL

Air Removal By : Boiling

Description of soil : Grey fine SAND with trace of mica

Test Specimen :

Nature of Specimen : Oven-Dry Sample

Soaking Period : Soaked overnight (since oven-dry specimen is used)

TEST DATA :

TEST/TRIAL NO.	12		
PYCNOMETER NO.	1		
Wt. of Soil (oven dry weight), W_s in gm	15.00		
Observed Temperature, T_x in deg.Centigrade	32		
Wt.of Pycnometer + water, W_a (at T_x) in gm (from Calibration Data of Pycnometer)	77.83		
Wt.of Pycnometer + water+soil, W_b (at T_x) in gm	87.21		
Specific Gravity, G (at T_x) = $W_s/(W_a+W_b-W_s)$	2.67		
Variation of Specific Gravity Values & Average (According to some specification average value shall be calculated only if (Largest value of G_s) Smallest value of G_s) < or = 1.02)	Ratio : 2.71/2.63 > or = 1.02 Ratio : 2.73/2.71 < or = 1.02 Avg. G_s (at T_x)		0.000 2.67
Density of Water at T_x deg.Cent., in gm/cc			0.9951
Density of Water at 20 deg.Cent., in gm/cc			0.9982
Specific Gravity, G (at 20 deg.Cent.) = (Density of Water at T_x /Density of Water at 20 deg.cent.) x G (at T_x)			2.66

Tested by : S. Alam, Laboratory specialist

Comments of the Laboratory Incharge :

Signed by : M. Islam

SURVEY 2000
SPECIFIC GRAVITY OF SOIL AS PER ASTM D-854

Client : Tokyo Electric Power Services Co. Ltd. & Engineers Associates Ltd.

Scheme :2x 600MW Coal fired power plant

Location : Matarbari, Cox's Bazar

Coordinates : 379928, 2394127

Sample No. : SS-03OS

Sampled by & Date :

6/4/2013

Laboratory Register No. :

Test Date :

15/4/2013

Pycnometer Type :Volumetric Flask/Stoppered Bottle Capacity : 50mL

Air Removal By : Boiling

Description of soil : Grey fine SAND with trace of mica

Test Specimen :

Nature of Specimen : Oven-Dry Sample

Soaking Period : Soaked overnight (since oven-dry specimen is used)

TEST DATA :

TEST/TRIAL NO.	13		
PYCNOMETER NO.	8		
Wt. of Soil (oven dry weight), W_s in gm	15.00		
Observed Temperature, T_x in deg.Centigrade	29		
Wt.of Pycnometer + water, W_a (at T_x) in gm (from Calibration Data of Pycnometer)	80.83		
Wt.of Pycnometer + water+soil, W_b (at T_x) in gm	90.2		
Specific Gravity, G (at T_x) = $W_s/(W_a+W_s-W_b)$	2.66		
Variation of Specific Gravity Values & Average (According to some specification average value shall be calculated only if (Largest value of G_s) Smallest value of G_s < or = 1.02)	Ratio : 2.71/2.63 >or = 1.02 Ratio : 2.73/2.71 < or = 1.02 Avg. G_s (at T_x)		0.000 2.66
Density of Water at T_x deg.Cent., in gm/cc			0.996
Density of Water at 20 deg.Cent., in gm/cc			0.9982
Specific Gravity, G (at 20 deg.Cent.) = (Density of Water at T_x /Density of Water at 20 deg.cent.) x G (at T_x)			2.66

Tested by : S. Alam, Laboratory specialist

Comments of the Laboratory Incharge :

Signed by : M. Islam

Photograph





Water Quality

The Water pollution survey has been conducted in the survey area with the following procedure.

(1) Overview

-Survey period

Sampling Date October 12, 2012

Test Date November 3-17, 2012

-Survey area

- The project site is located at Matarbari, Cox's Bazar.

(2) Methodology

The locations of water sampling were pre-defined by the consultant for both offshore and tidal land. GPS was used to locate the sampling position.

The total depth of water was measured first at each sampling location to calculate the actual depth (layer) of sampling. Graduated sounding rope/lead line was used to measure the total depth. Water samples were collected in three different layers by a water sample collecting tube from boat deck with the required length of rope. To ensure the specific depth and verticality, sufficient weight was tied at the end of the rope. The depth was measured from the sea-surface, and water samples collected in specific containers after leaving a sufficient amount of water. The plastic containers and glass bottles were cleaned and washed perfectly (without any chemicals). Soon after collecting samples the containers were sealed carefully. Related information (date, time, depth, location, etc.) and unique identification marks were provided on each container. All samples were preserved carefully and kept away from strong sunlight and movement, and were send to laboratory without delay.

Table -4 Water Sample Points

SL	NAME/ID	LAT (WGS84)	LON (WGS84)	REMARKS
1	WS-01	21°43' 08"N	91°52' 06"E	At -2m depth
2	WS-02	21°43' 08"N	91°51' 34"E	At -10m depth
3	WS-03	21°42' 05"N	91°51' 12"E	At -10m depth
4	WS-04	21°40' 42"N	91°51' 08"E	At -2m depth
5	WS-05	21°40' 42"N	91°50' 54"E	At -10m depth



LABORATORY AND IN-SITU ANALYSIS OF SAMPLES
(Sediment Concentration)

Client :Tokyo Electric Power Services Co. Ltd. & Engineers Associates Ltd.

Project : 600MW Coal Fired Power Station

Project Location : Matarbari, Cox's Bazar

Sample No : WS-01

Sample Date : 12/10/2012

Depth (m) : 0.5

Test Date : 17/11/2012

Coordinates : 382040, 2402143

TEST DATA

Weight of Water + Sediment (mL)	200.00
Total Suspended Solids or Wt. of dry sediment (50µm Sieve) A gm	0.05
Total Dissolved Solids or Wt. of dry sediment (0.5µm Filter) B gm	0.09
Total Solids or Wt. of dry sediment (A+B) gm	0.135
Total Solids in (mg/L)	675.00

pH of Water	8.6
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Tested by : Azharul.



LABORATORY AND IN-SITU ANALYSIS OF SAMPLES
(Sediment Concentration)

Client :Tokyo Electric Power Services Co. Ltd. & Engineers Associates Ltd.

Project : 600MW Coal Fired Power Station

Project Location : Matarbari, Cox's Bazar

Sample No : WS-01

Sample Date : 12/10/2012

Depth (m) : 1.0

Test Date : 17/11/2012

Coordinates : 382040, 2402143

TEST DATA

Weight of Water + Sediment (mL)	200.00
Total Suspended Solids or Wt. of dry sediment (50µm Sieve) A gm	0.06
Total Dissolved Solids or Wt. of dry sediment (0.5µm Filter) B gm	0.08
Total Solids or Wt. of dry sediment (A+B) gm	0.14
Total Solids in (mg/L)	700.00

pH of Water	8.7
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Tested by : Azharul.



LABORATORY AND IN-SITU ANALYSIS OF SAMPLES
(Sediment Concentration)

Client :Tokyo Electric Power Services Co. Ltd. & Engineers Associates Ltd.

Project : 600MW Coal Fired Power Station

Project Location : Matarbari, Cox's Bazar

Sample No : WS-01

Sample Date : 12/10/2012

Depth (m) : 1.5

Test Date : 17/11/2012

Coordinates : 382040, 2402143

TEST DATA

Weight of Water + Sediment (mL)	200.00
Total Suspended Solids or Wt. of dry sediment (50µm Sieve) A gm	0.06
Total Dissolved Solids or Wt. of dry sediment (0.5µm Filter) B gm	0.09
Total Solids or Wt. of dry sediment (A+B) gm	0.15
Total Solids in (mg/L)	750.00

pH of Water	8.9
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Tested by : Azharul.



LABORATORY AND IN-SITU ANALYSIS OF SAMPLES
(Sediment Concentration)

Client :Tokyo Electric Power Services Co. Ltd. & Engineers Associates Ltd.

Project : 600MW Coal Fired Power Station

Project Location : Matarbari, Cox's Bazar

Sample No : WS-02

Sample Date : 12/10/2012

Depth (m) : 0.5

Test Date : 13/11/2012

Coordinates : 382040, 2402143

TEST DATA

Weight of Water + Sediment (mL)	750.00
Total Suspended Solids or Wt. of dry sediment (50µm Sieve) A gm	0.05
Total Dissolved Solids or Wt. of dry sediment (0.5µm Filter) B gm	0.56
Total Solids or Wt. of dry sediment (A+B) gm	0.605
Total Solids in (mg/L)	806.67

pH of Water	8.4
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Tested by : Azharul.



LABORATORY AND IN-SITU ANALYSIS OF SAMPLES
(Sediment Concentration)

Client :Tokyo Electric Power Services Co. Ltd. & Engineers Associates Ltd.

Project : 600MW Coal Fired Power Station

Project Location : Matarbari, Cox's Bazar

Sample No : WS-02

Sample Date : 12/10/2012

Depth (m) : 5.0

Test Date : 13/11/2012

Coordinates : 382040, 2402143

TEST DATA

Weight of Water + Sediment (mL)	750.00
Total Suspended Solids or Wt. of dry sediment (50µm Sieve) A gm	0.04
Total Dissolved Solids or Wt. of dry sediment (0.5µm Filter) B gm	0.55
Total Solids or Wt. of dry sediment (A+B) gm	0.585
Total Solids in (mg/L)	780.00

pH of Water	8.5
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Tested by : Azharul.



LABORATORY AND IN-SITU ANALYSIS OF SAMPLES
(Sediment Concentration)

Client :Tokyo Electric Power Services Co. Ltd. & Engineers Associates Ltd.

Project : 600MW Coal Fired Power Station

Project Location : Matarbari, Cox's Bazar

Sample No : WS-02

Sample Date : 12/10/2012

Depth (m) : 9.5

Test Date : 13/11/2012

Coordinates : 382040, 2402143

TEST DATA

Weight of Water + Sediment (mL)	750.00
Total Suspended Solids or Wt. of dry sediment (50µm Sieve) A gm	0.05
Total Dissolved Solids or Wt. of dry sediment (0.5µm Filter) B gm	0.65
Total Solids or Wt. of dry sediment (A+B) gm	0.7
Total Solids in (mg/L)	933.33

pH of Water	8.7
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Tested by : Azharul.



LABORATORY AND IN-SITU ANALYSIS OF SAMPLES
(Sediment Concentration)

Client :Tokyo Electric Power Services Co. Ltd. & Engineers Associates Ltd.

Project : 600MW Coal Fired Power Station

Project Location : Matarbari, Cox's Bazar

Sample No : WS-03

Sample Date : 12/10/2012

Depth (m) : 0.5

Test Date : 03/11/2012

Coordinates : 382025, 2400175

TEST DATA

Weight of Water + Sediment (mL)	500.00
Total Suspended Solids or Wt. of dry sediment (50µm Sieve) A gm	0.04
Total Dissolved Solids or Wt. of dry sediment (0.5µm Filter) B gm	0.16
Total Solids or Wt. of dry sediment (A+B) gm	0.2
Total Solids in (mg/L)	400.00

pH of Water	8.3
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Tested by : Azharul.



LABORATORY AND IN-SITU ANALYSIS OF SAMPLES
(Sediment Concentration)

Client :Tokyo Electric Power Services Co. Ltd. & Engineers Associates Ltd.

Project : 600MW Coal Fired Power Station

Project Location : Matarbari, Cox's Bazar

Sample No : WS-03

Sample Date : 12/10/2012

Depth (m) : 5.0

Test Date : 03/11/2012

Coordinates : 382025, 2400175

TEST DATA

Weight of Water + Sediment (mL)	500.00
Total Suspended Solids or Wt. of dry sediment (50µm Sieve) A gm	0.03
Total Dissolved Solids or Wt. of dry sediment (0.5µm Filter) B gm	0.16
Total Solids or Wt. of dry sediment (A+B) gm	0.19
Total Solids in (mg/L)	380.00

pH of Water	8.5
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Tested by : Azharul.



LABORATORY AND IN-SITU ANALYSIS OF SAMPLES
(Sediment Concentration)

Client :Tokyo Electric Power Services Co. Ltd. & Engineers Associates Ltd.

Project : 600MW Coal Fired Power Station

Project Location : Matarbari, Cox's Bazar

Sample No : WS-03

Sample Date : 12/10/2012

Depth (m) : 9.5

Test Date : 03/11/2012

Coordinates : 382025, 2400175

TEST DATA

Weight of Water + Sediment (mL)	500.00
Total Suspended Solids or Wt. of dry sediment (50µm Sieve) A gm	0.04
Total Dissolved Solids or Wt. of dry sediment (0.5µm Filter) B gm	0.17
Total Solids or Wt. of dry sediment (A+B) gm	0.21
Total Solids in (mg/L)	420.00

pH of Water	8.6
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Tested by : Azharul.



LABORATORY AND IN-SITU ANALYSIS OF SAMPLES
(Sediment Concentration)

Client :Tokyo Electric Power Services Co. Ltd. & Engineers Associates Ltd.

Project : 600MW Coal Fired Power Station

Project Location : Matarbari, Cox's Bazar

Sample No : WS-04

Sample Date : 12/10/2012

Depth (m) : 0.5

Test Date : 17/11/2012

Coordinates : 382011,2398207

TEST DATA

Weight of Water + Sediment (mL)	200.00
Total Suspended Solids or Wt. of dry sediment (50µm Sieve) A gm	0.04
Total Dissolved Solids or Wt. of dry sediment (0.5µm Filter) B gm	0.09
Total Solids or Wt. of dry sediment (A+B) gm	0.13
Total Solids in (mg/L)	650.00

pH of Water	9
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Tested by : Azharul.



LABORATORY AND IN-SITU ANALYSIS OF SAMPLES
(Sediment Concentration)

Client :Tokyo Electric Power Services Co. Ltd. & Engineers Associates Ltd.

Project : 600MW Coal Fired Power Station

Project Location : Matarbari, Cox's Bazar

Sample No : WS-04

Sample Date : 12/10/2012

Depth (m) : 1.0

Test Date : 17/11/2012

Coordinates : 382011,2398207

TEST DATA

Weight of Water + Sediment (mL)	200.00
Total Suspended Solids or Wt. of dry sediment (50µm Sieve) A gm	0.06
Total Dissolved Solids or Wt. of dry sediment (0.5µm Filter) B gm	0.08
Total Solids or Wt. of dry sediment (A+B) gm	0.135
Total Solids in (mg/L)	675.00

pH of Water	8.8
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Tested by : Azharul.



LABORATORY AND IN-SITU ANALYSIS OF SAMPLES
(Sediment Concentration)

Client :Tokyo Electric Power Services Co. Ltd. & Engineers Associates Ltd.

Project : 600MW Coal Fired Power Station

Project Location : Matarbari, Cox's Bazar

Sample No : WS-04

Sample Date : 12/10/2012

Depth (m) : 1.5

Test Date : 17/11/2012

Coordinates : 382011,2398207

TEST DATA

Weight of Water + Sediment (mL)	200.00
Total Suspended Solids or Wt. of dry sediment (50µm Sieve) A gm	0.05
Total Dissolved Solids or Wt. of dry sediment (0.5µm Filter) B gm	0.10
Total Solids or Wt. of dry sediment (A+B) gm	0.15
Total Solids in (mg/L)	750.00

pH of Water	9.1
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Tested by : Azharul.



LABORATORY AND IN-SITU ANALYSIS OF SAMPLES
(Sediment Concentration)

Client :Tokyo Electric Power Services Co. Ltd. & Engineers Associates Ltd.

Project : 600MW Coal Fired Power Station

Project Location : Matarbari, Cox's Bazar

Sample No : WS-05

Sample Date : 12/10/2012

Depth (m) : 0.5

Test Date : 12/11/2012

Coordinates : 382011, 2398207

TEST DATA

Weight of Water + Sediment (mL)	500.00
Total Suspended Solids or Wt. of dry sediment (50 μ m Sieve) A gm	0.14
Total Dissolved Solids or Wt. of dry sediment (0.5 μ m Filter) B gm	0.26
Total Solids or Wt. of dry sediment (A+B) gm	0.4
Total Solids in (mg/L)	800.00

P ^H of Water	9.3
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Tested by : Azharul.



LABORATORY AND IN-SITU ANALYSIS OF SAMPLES
(Sediment Concentration)

Client :Tokyo Electric Power Services Co. Ltd. & Engineers Associates Ltd.

Project : 600MW Coal Fired Power Station

Project Location : Matarbari, Cox's Bazar

Sample No : WS-05

Sample Date : 12/10/2012

Depth (m) : 5.0

Test Date : 12/11/2012

Coordinates : 382011, 2398207

TEST DATA

Weight of Water + Sediment (mL)	500.00
Total Suspended Solids or Wt. of dry sediment (50µm Sieve) A gm	0.13
Total Dissolved Solids or Wt. of dry sediment (0.5µm Filter) B gm	0.28
Total Solids or Wt. of dry sediment (A+B) gm	0.41
Total Solids in (mg/L)	820.00

P ^H of Water	9.7
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Tested by : Azharul.



LABORATORY AND IN-SITU ANALYSIS OF SAMPLES
(Sediment Concentration)

Client :Tokyo Electric Power Services Co. Ltd. & Engineers Associates Ltd.

Project : 600MW Coal Fired Power Station

Project Location : Matarbari, Cox's Bazar

Sample No : WS-05

Sample Date : 12/10/2012

Depth (m) : 9.5

Test Date : 12/11/2012

Coordinates : 382011, 2398207

TEST DATA

Weight of Water + Sediment (mL)	500.00
Total Suspended Solids or Wt. of dry sediment (50µm Sieve) A gm	0.15
Total Dissolved Solids or Wt. of dry sediment (0.5µm Filter) B gm	0.29
Total Solids or Wt. of dry sediment (A+B) gm	0.44
Total Solids in (mg/L)	880.00

P ^H of Water	9.6
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Tested by : Azharul.

The Water pollution survey has been conducted in the survey area with the following procedure.

(1) Overview

-Survey period

Sampling Date April 6, 2013
 Test Date April 11, 2013

-Survey area

- The project site is located at Matarbari, Cox’s Bazar.

(2) Methodology

The locations of water sampling were pre-defined by the consultant for both offshore and tidal land. GPS was used to locate the sampling position.

The total depth of water was measured first at each sampling location to calculate the actual depth (layer) of sampling. Graduated sounding rope/lead line was used to measure the total depth. Water samples were collected in three different layers by a water sample collecting tube from boat deck with the required length of rope. To ensure the specific depth and verticality, sufficient weight was tied at the end of the rope. The depth was measured from the sea–surface, and water samples collected in specific containers after leaving a sufficient amount of water. The plastic containers and glass bottles were cleaned and washed perfectly (without any chemicals). Soon after collecting samples the containers were sealed carefully. Related information (date, time, depth, location, etc.) and unique identification marks were provided on each container. All samples were preserved carefully and kept away from strong sunlight and movement, and were send to laboratory without delay.

Table -5 Water Sample Points

SL	NAME/ID	LAT (WGS84)	LON (WGS84)	REMARKS
1	WS-01	21°43' 08"N	91°52' 06"E	At -2m depth
2	WS-02	21°43' 08"N	91°51' 34"E	At -10m depth
3	WS-03	21°42' 05"N	91°51' 12"E	At -10m depth
4	WS-04	21°40' 42"N	91°51' 08"E	At -2m depth
5	WS-05	21°40' 42"N	91°50' 54"E	At -10m depth



LABORATORY AND IN-SITU ANALYSIS OF SAMPLES
(Sediment Concentration)

Client :Tokyo Electric Power Services Co. Ltd. & Engineers Associates Ltd.

Project : 2x600MW Coal Fired Power Station

Project Location : Matarbari, Cox's Bazar

Sample No : WS-01

Sample Date : 06/04/2013

Depth (m) : 0.5

Test Date : 11/04/2013

Coordinates : 382040, 2402143

TEST DATA

Weight of Water + Sediment (mL)	500.00
Total Suspended Solids or Wt. of dry sediment (50 μ m Sieve) A gm	0.03
Total Dissolved Solids or Wt. of dry sediment (0.5 μ m Filter) B gm	0.06
Total Solids or Wt. of dry sediment (A+B) gm	0.09
Total Solids in (mg/L)	180.00

P ^H of Water	7.8
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Tested by : Azharul.

Signed by : Mahabub



LABORATORY AND IN-SITU ANALYSIS OF SAMPLES
(Sediment Concentration)

Client :Tokyo Electric Power Services Co. Ltd. & Engineers Associates Ltd.

Project : 2x600MW Coal Fired Power Station

Project Location : Matarbari, Cox's Bazar

Sample No : WS-01

Sample Date : 06/04/2013

Depth (m) : 1.0

Test Date : 16/04/2013

Coordinates : 382040, 2402143

TEST DATA

Weight of Water + Sediment (mL)	500.00
Total Suspended Solids or Wt. of dry sediment (50 μ m Sieve) A gm	0.17
Total Dissolved Solids or Wt. of dry sediment (0.5 μ m Filter) B gm	0.19
Total Solids or Wt. of dry sediment (A+B) gm	0.36
Total Solids in (mg/L)	720.00

P ^H of Water	8.3
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Tested by : Azharul.

Signed by : Mahabub



SURVEY 2000

LABORATORY AND IN-SITU ANALYSIS OF SAMPLES (Sediment Concentration)

Client :Tokyo Electric Power Services Co. Ltd. & Engineers Associates Ltd.

Project : 2x600MW Coal Fired Power Station

Project Location : Matarbari, Cox's Bazar

Sample No : WS-01

Sample Date : 06/04/2013

Depth (m) : 1.5

Test Date : 17/04/2013

Coordinates : 382040, 2402143

TEST DATA

Weight of Water + Sediment (mL)	250.00
Total Suspended Solids or Wt. of dry sediment (50 μ m Sieve) A gm	0.06
Total Dissolved Solids or Wt. of dry sediment (0.5 μ m Filter) B gm	0.23
Total Solids or Wt. of dry sediment (A+B) gm	0.29
Total Solids in (mg/L)	1160.00

P ^H of Water	7.8
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Tested by : Azharul.

Signed by : Mahabub



LABORATORY AND IN-SITU ANALYSIS OF SAMPLES
(Sediment Concentration)

Client :Tokyo Electric Power Services Co. Ltd. & Engineers Associates Ltd.

Project : 2x600MW Coal Fired Power Station

Project Location : Matarbari, Cox's Bazar

Sample No : WS-02

Sample Date : 06/04/2013

Depth (m) : 0.5

Test Date : 15/04/2013

Coordinates : 382040, 2402143

TEST DATA

Weight of Water + Sediment (mL)	500.00
Total Suspended Solids or Wt. of dry sediment (50 μ m Sieve) A gm	0.05
Total Dissolved Solids or Wt. of dry sediment (0.5 μ m Filter) B gm	0.02
Total Solids or Wt. of dry sediment (A+B) gm	0.065
Total Solids in (mg/L)	130.00

P ^H of Water	7.9
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Tested by : Azharul.

Signed by : Mahabub



LABORATORY AND IN-SITU ANALYSIS OF SAMPLES
(Sediment Concentration)

Client :Tokyo Electric Power Services Co. Ltd. & Engineers Associates Ltd.

Project : 2x600MW Coal Fired Power Station

Project Location : Matarbari, Cox's Bazar

Sample No : WS-02

Sample Date : 06/04/2013

Depth (m) : 5.0

Test Date : 16/04/2013

Coordinates : 382040, 2402143

TEST DATA

Weight of Water + Sediment (mL)	500.00
Total Suspended Solids or Wt. of dry sediment (50 μ m Sieve) A gm	0.095
Total Dissolved Solids or Wt. of dry sediment (0.5 μ m Filter) B gm	0.06
Total Solids or Wt. of dry sediment (A+B) gm	0.155
Total Solids in (mg/L)	310.00

P ^H of Water	7.8
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Tested by : Azharul.

Signed by : Mahabub



LABORATORY AND IN-SITU ANALYSIS OF SAMPLES
(Sediment Concentration)

Client :Tokyo Electric Power Services Co. Ltd. & Engineers Associates Ltd.

Project : 2x600MW Coal Fired Power Station

Project Location : Matarbari, Cox's Bazar

Sample No : WS-02

Sample Date : 06/04/2013

Depth (m) : 9.5

Test Date : 16/04/2013

Coordinates : 382040, 2402143

TEST DATA

Weight of Water + Sediment (mL)	500.00
Total Suspended Solids or Wt. of dry sediment (50 μ m Sieve) A gm	0.10
Total Dissolved Solids or Wt. of dry sediment (0.5 μ m Filter) B gm	0.59
Total Solids or Wt. of dry sediment (A+B) gm	0.69
Total Solids in (mg/L)	1380.00

P ^H of Water	7.8
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Tested by : Azharul.

Signed by : Mahabub



LABORATORY AND IN-SITU ANALYSIS OF SAMPLES
(Sediment Concentration)

Client :Tokyo Electric Power Services Co. Ltd. & Engineers Associates Ltd.

Project : 2x600MW Coal Fired Power Station

Project Location : Matarbari, Cox's Bazar

Sample No : WS-03

Sample Date : 06/04/2013

Depth (m) : 0.5

Test Date : 10/04/2013

Coordinates : 382025, 2400175

TEST DATA

Weight of Water + Sediment (mL)	500.00
Total Suspended Solids or Wt. of dry sediment (50µm Sieve) A gm	0.04
Total Dissolved Solids or Wt. of dry sediment (0.5µm Filter) B gm	0.08
Total Solids or Wt. of dry sediment (A+B) gm	0.12
Total Solids in (mg/L)	240.00

P ^H of Water	7.8
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Tested by : Azharul.

Signed by : Mahabub



LABORATORY AND IN-SITU ANALYSIS OF SAMPLES
(Sediment Concentration)

Client :Tokyo Electric Power Services Co. Ltd. & Engineers Associates Ltd.

Project : 2x600MW Coal Fired Power Station

Project Location : Matarbari, Cox's Bazar

Sample No : WS-03

Sample Date : 06/04/2013

Depth (m) : 5.0

Test Date : 11/04/2013

Coordinates : 382025, 2400175

TEST DATA

Weight of Water + Sediment (mL)	500.00
Total Suspended Solids or Wt. of dry sediment (50µm Sieve) A gm	0.01
Total Dissolved Solids or Wt. of dry sediment (0.5µm Filter) B gm	0.22
Total Solids or Wt. of dry sediment (A+B) gm	0.23
Total Solids in (mg/L)	460.00

P ^H of Water	7.2
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Tested by : Azharul.

Signed by : Mahabub



LABORATORY AND IN-SITU ANALYSIS OF SAMPLES
(Sediment Concentration)

Client : Tokyo Electric Power Services Co. Ltd. & Engineers Associates Ltd.

Project : 2x600MW Coal Fired Power Station

Project Location : Matarbari, Cox's Bazar

Sample No : WS-03

Sample Date : 06/04/2013

Depth (m) : 9.5

Test Date : 09/04/2013

Coordinates : 382025, 2400175

TEST DATA

Weight of Water + Sediment (mL)	500.00
Total Suspended Solids or Wt. of dry sediment (50µm Sieve) A gm	0.03
Total Dissolved Solids or Wt. of dry sediment (0.5µm Filter) B gm	0.16
Total Solids or Wt. of dry sediment (A+B) gm	0.19
Total Solids in (mg/L)	380.00

P ^H of Water	7.7
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Tested by : Azharul.

Signed by : Mahabub



LABORATORY AND IN-SITU ANALYSIS OF SAMPLES
(Sediment Concentration)

Client : Tokyo Electric Power Services Co. Ltd. & Engineers Associates Ltd.

Project : 2x600MW Coal Fired Power Station

Project Location : Matarbari, Cox's Bazar

Sample No : WS-04

Sample Date : 06/04/2013

Depth (m) : 0.5

Test Date : 10/04/2013

Coordinates : 382011,2398207

TEST DATA

Weight of Water + Sediment (mL)	500.00
Total Suspended Solids or Wt. of dry sediment (50 μ m Sieve) A gm	0.04
Total Dissolved Solids or Wt. of dry sediment (0.5 μ m Filter) B gm	0.09
Total Solids or Wt. of dry sediment (A+B) gm	0.13
Total Solids in (mg/L)	260.00

P ^H of Water	8
-------------------------	---

Tested by : Azharul.

Signed by : Mahabub



LABORATORY AND IN-SITU ANALYSIS OF SAMPLES
(Sediment Concentration)

Client :Tokyo Electric Power Services Co. Ltd. & Engineers Associates Ltd.

Project : 2x600MW Coal Fired Power Station

Project Location : Matarbari, Cox's Bazar

Sample No : WS-04

Sample Date : 06/04/2013

Depth (m) : 1.0

Test Date : 17/04/2013

Coordinates : 382011,2398207

TEST DATA

Weight of Water + Sediment (mL)	250.00
Total Suspended Solids or Wt. of dry sediment (50 μ m Sieve) A gm	0.01
Total Dissolved Solids or Wt. of dry sediment (0.5 μ m Filter) B gm	0.02
Total Solids or Wt. of dry sediment (A+B) gm	0.03
Total Solids in (mg/L)	120.00

P ^H of Water	8.3
-------------------------	-----

Tested by : Azharul.

Signed by : Mahabub



LABORATORY AND IN-SITU ANALYSIS OF SAMPLES
(Sediment Concentration)

Client : Tokyo Electric Power Services Co. Ltd. & Engineers Associates Ltd.

Project : 2x600MW Coal Fired Power Station

Project Location : Matarbari, Cox's Bazar

Sample No : WS-04

Sample Date : 06/04/2013

Depth (m) : 1.5

Test Date : 17/04/2013

Coordinates : 382011,2398207

TEST DATA

Weight of Water + Sediment (mL)	250.00
Total Suspended Solids or Wt. of dry sediment (50 μ m Sieve) A gm	0.13
Total Dissolved Solids or Wt. of dry sediment (0.5 μ m Filter) B gm	0.09
Total Solids or Wt. of dry sediment (A+B) gm	0.22
Total Solids in (mg/L)	880.00

P ^H of Water	8.4
-------------------------	-----

Tested by : Azharul.

Signed by : Mahabub



LABORATORY AND IN-SITU ANALYSIS OF SAMPLES
(Sediment Concentration)

Client :Tokyo Electric Power Services Co. Ltd. & Engineers Associates Ltd.

Project : 2x600MW Coal Fired Power Station

Project Location : Matarbari, Cox's Bazar

Sample No : WS-05

Sample Date : 06/04/2013

Depth (m) : 0.5

Test Date : 18/04/2013

Coordinates : 382011, 2398207

TEST DATA

Weight of Water + Sediment (mL)	250.00
Total Suspended Solids or Wt. of dry sediment (50µm Sieve) A gm	0.19
Total Dissolved Solids or Wt. of dry sediment (0.5µm Filter) B gm	0.01
Total Solids or Wt. of dry sediment (A+B) gm	0.2
Total Solids in (mg/L)	800.00

P ^H of Water	6.9
-------------------------	-----

Tested by : Azharul.

Signed by : Mahabub



LABORATORY AND IN-SITU ANALYSIS OF SAMPLES
(Sediment Concentration)

Client :Tokyo Electric Power Services Co. Ltd. & Engineers Associates Ltd.

Project : 2x600MW Coal Fired Power Station

Project Location : Matarbari, Cox's Bazar

Sample No : WS-05

Sample Date : 06/04/2013

Depth (m) : 5.0

Test Date : 18/04/2013

Coordinates : 382011, 2398207

TEST DATA

Weight of Water + Sediment (mL)	250.00
Total Suspended Solids or Wt. of dry sediment (50 μ m Sieve) A gm	0.17
Total Dissolved Solids or Wt. of dry sediment (0.5 μ m Filter) B gm	0.10
Total Solids or Wt. of dry sediment (A+B) gm	0.27
Total Solids in (mg/L)	1080.00

P ^H of Water	8.5
-------------------------	-----

Tested by : Azharul.

Signed by : Mahabub



LABORATORY AND IN-SITU ANALYSIS OF SAMPLES
(Sediment Concentration)

Client :Tokyo Electric Power Services Co. Ltd. & Engineers Associates Ltd.

Project : 2x600MW Coal Fired Power Station

Project Location : Matarbari, Cox's Bazar

Sample No : WS-05

Sample Date : 06/04/2013

Depth (m) : 9.5

Test Date : 11/04/2013

Coordinates : 382011, 2398207

TEST DATA

Weight of Water + Sediment (mL)	500.00
Total Suspended Solids or Wt. of dry sediment (50µm Sieve) A gm	0.03
Total Dissolved Solids or Wt. of dry sediment (0.5µm Filter) B gm	0.07
Total Solids or Wt. of dry sediment (A+B) gm	0.1
Total Solids in (mg/L)	200.00

P ^H of Water	6.6
-------------------------	-----

Tested by : Azharul.

Signed by : Mahabub

Photograph





Water Depth

The bathymetric survey has been conducted in the survey area with the following procedure.

(1) Overview

-Survey period

From October 8, 2012, to October 24, 2012.

-Survey area

The project site is located at Matarbari, Cox's Bazar.

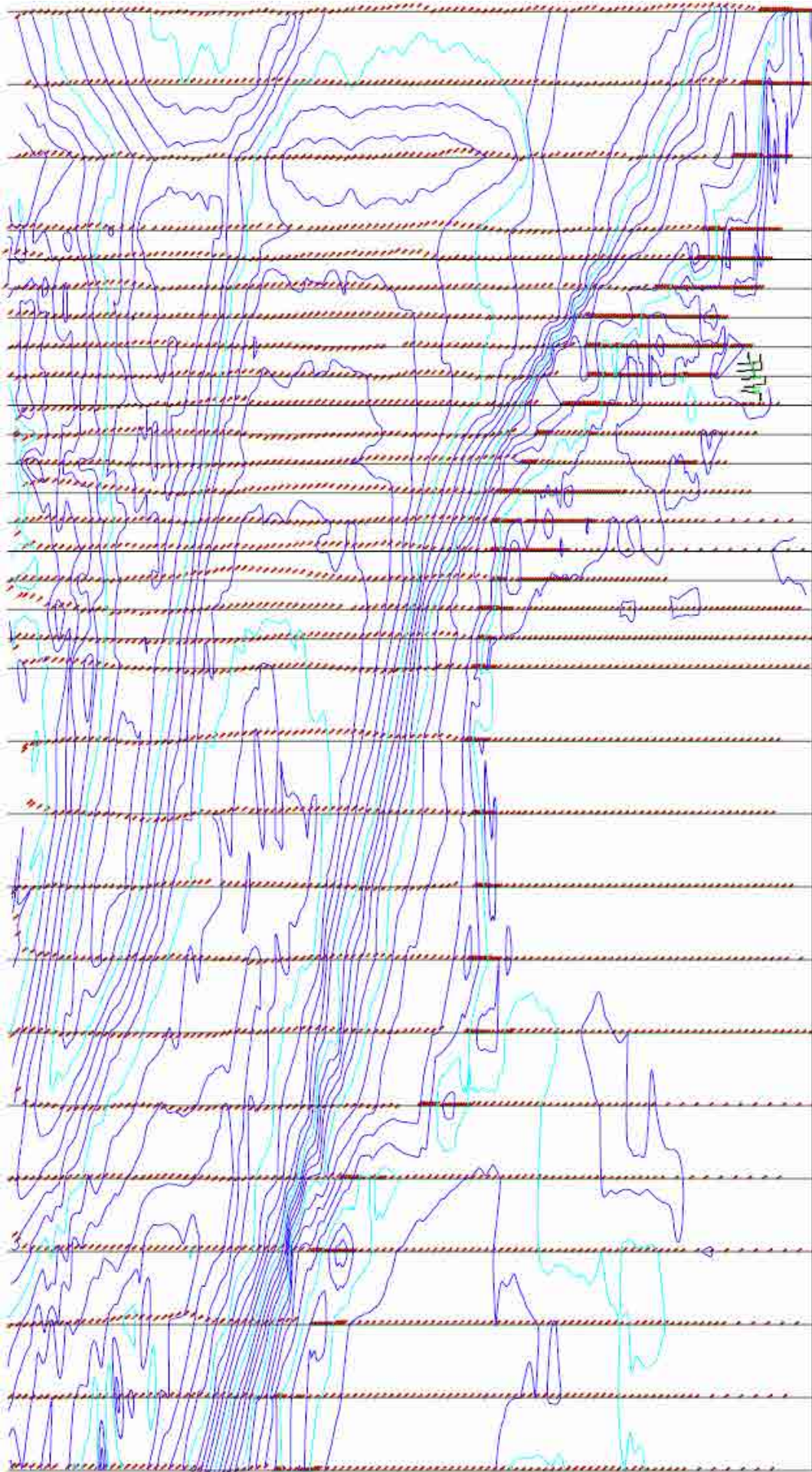
(2) Methodology

The survey was conducted using fourteen hydrographic survey lines at 200m intervals with 50m interval sounding, and 16 hydrographic survey lines at 500m intervals with 50m interval sounding. The length of the survey line was 5km and the reference coordinates were as follows:

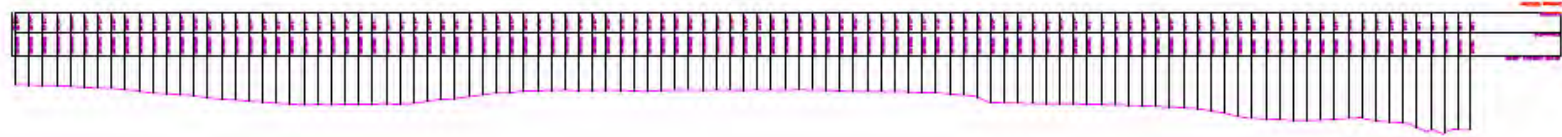
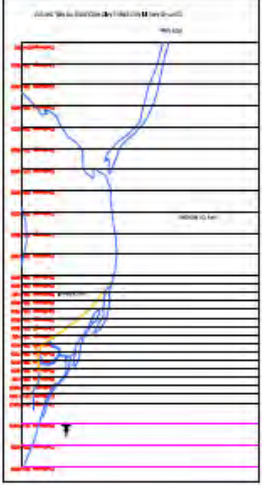
Latitude N21°42'12"N Longitude E91°52'31"E RTK GPS.

An echo sounder was used connected with the navigation and data acquisition PC via interface cable and synchronized with the hydrographic software HYPAC. Before conducting the survey, a line of survey was created as per the directions. A navigation module guided the surveyor for the run line of the survey vessel and data acquisition. Using a computer screen the hydrographic surveyor could know his position, speed and direction of the survey vessel, and the depth profile, etc. The survey vessel was run at a maximum of 6 knots per hour for data acquisition. Calibration for the echo sounder was done prior to the survey run everyday using a bar check plate.

Tide levels were recorded at half hourly intervals for tidal correction of bathymetric height.



PROJECT NO. 1000000000		SHEET NO. 1000000000	
			
DATE	SCALE	PROJECT	NO.
10/10/00	1" = 100'	1000000000	1000000000
CROSS SECTION			
ROADWAY TYPE: Two Lane Highway			
ROADWAY WIDTH: 20.00			
ROADWAY CENTERLINE: 0.00			
ROADWAY EDGE OF PAVEMENT: ±0.00			
ROADWAY SURFACE: Asphalt			
ROADWAY DRAINAGE: None			



COT

	
Ministry of Forests, Energy & Natural Resources 1000 Main Street West, Regina, Saskatchewan S4N 0A3 Tel: (306) 779-3800 Fax: (306) 779-3801 Email: info@forestry.gov.sk.ca	
PROJECT NO.	1000
DATE	2010
SCALE	1:100
PROJECT NAME	COAL AND TURBINE POWER PLANT ELECTRICAL CONNECTION
DESIGNER	SKIDMORE OWINGS & MERRILL LLP
CLIENT	COAL AND TURBINE POWER PLANT ELECTRICAL CONNECTION
PROJECT LOCATION	COAL AND TURBINE POWER PLANT ELECTRICAL CONNECTION

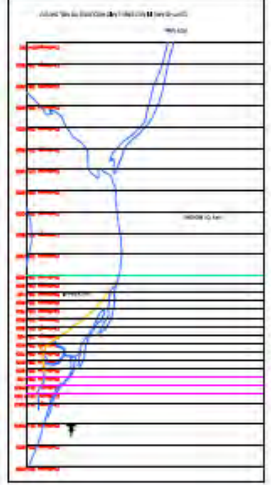
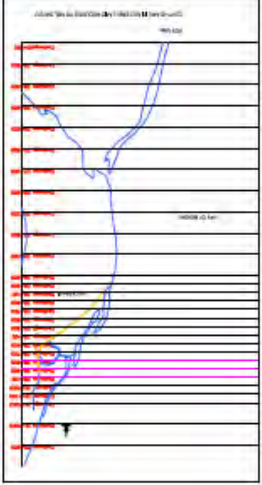
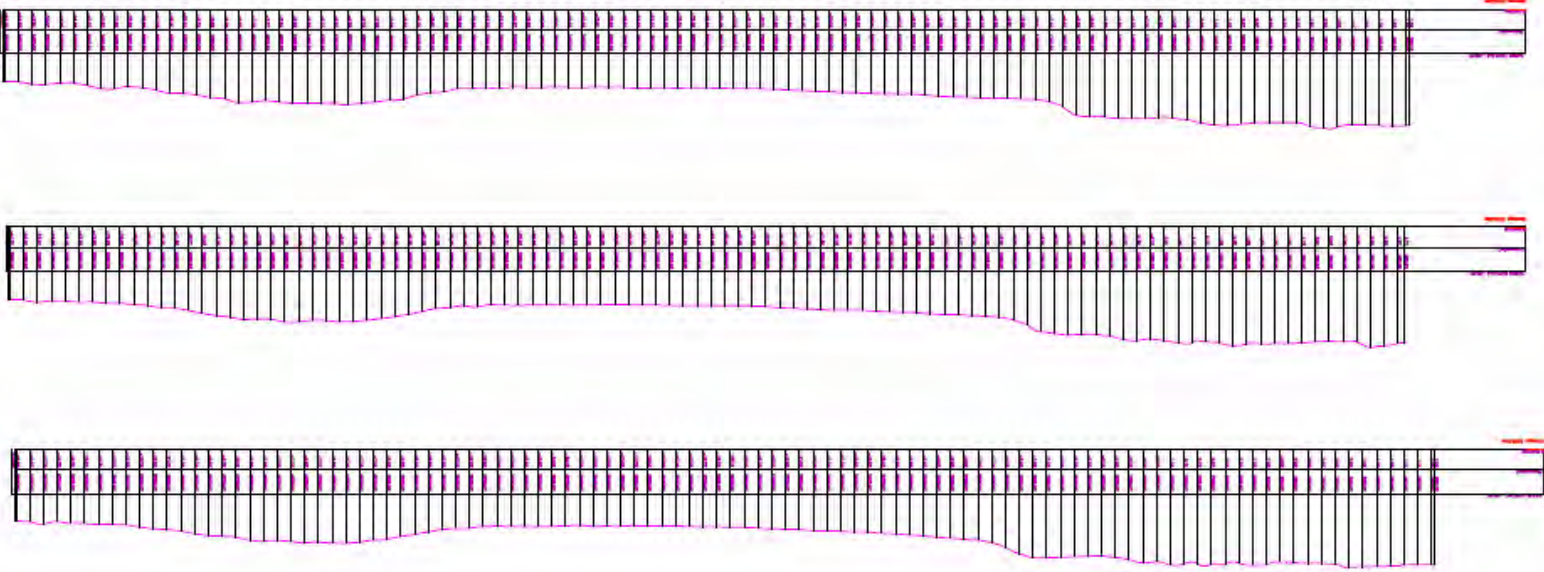


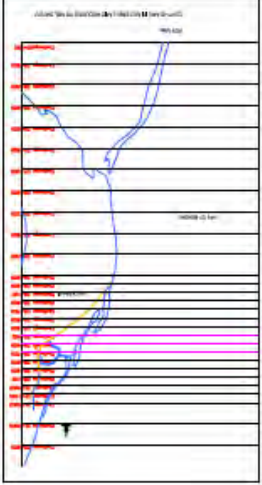
FIG. 1

	
Ministry of Forests, Energy & Natural Resources Direction des forêts Direction des ressources naturelles	
PROJET	NOUVEAU
DATE	2014
PROJET	NOUVEAU
PROJET	NOUVEAU
CROSS SECTION	
Cross Section of the River (Municipal Council)	
Cross Section of the River (Municipal Council)	
Cross Section of the River (Municipal Council)	



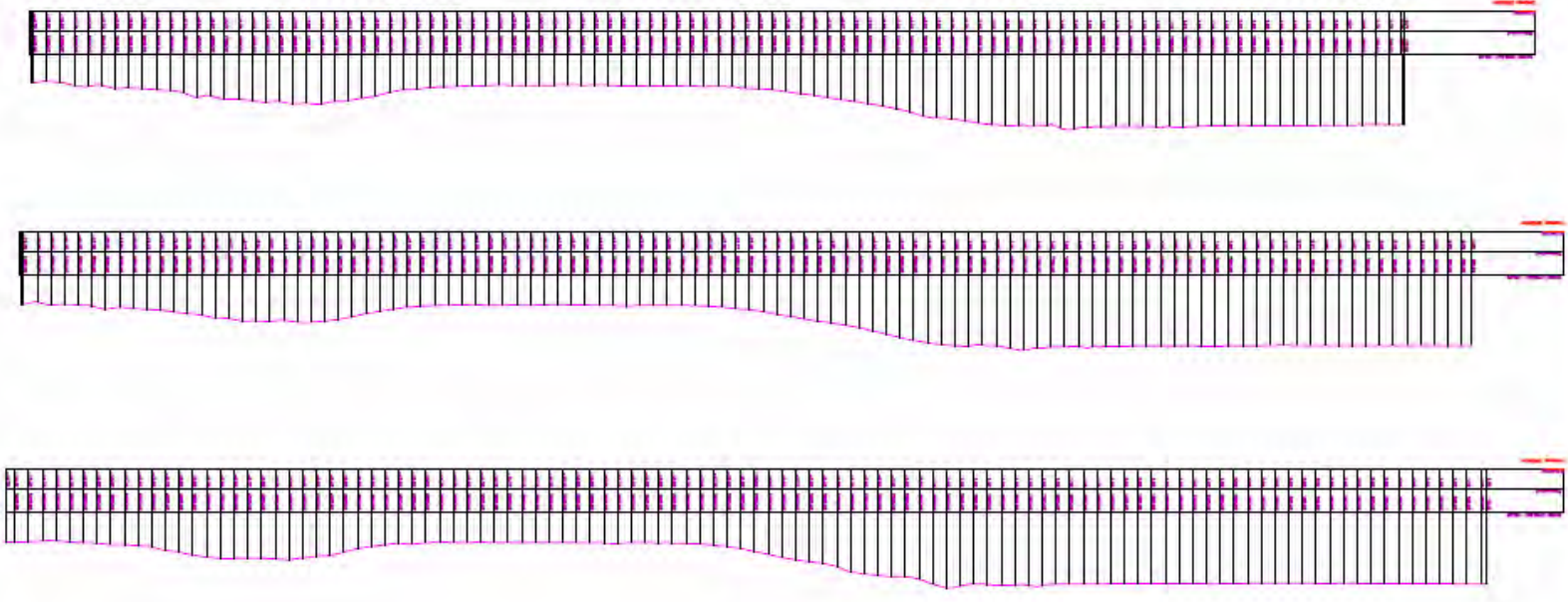
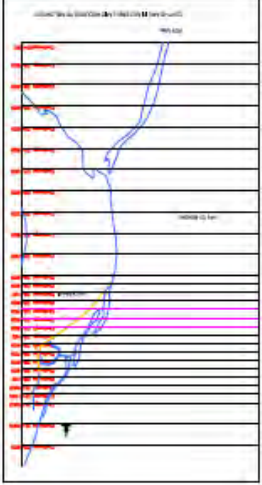
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Ministry of Forests, Energy & Natural Resources Direction des forêts Direction des ressources naturelles	
PROJET	NO. 100
DATE	2010
PROJET	NO. 100
PROJET	NO. 100
PROJET	NO. 100
CROSS SECTION	
Cross Section of the River (Municipal Council)	
Cross Section of the River (Municipal Council)	
Cross Section of the River (Municipal Council)	

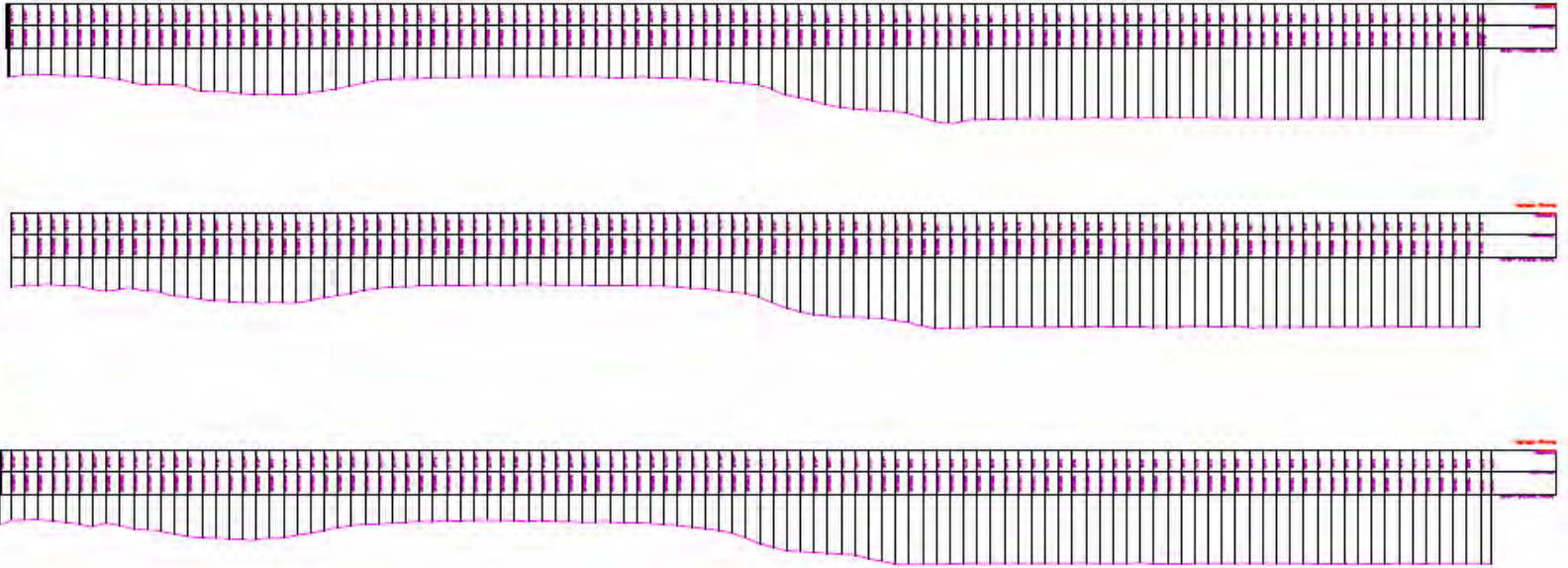
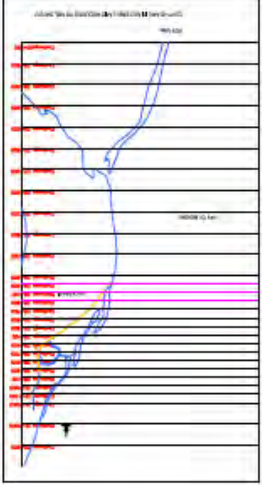


0.01

PROJECT NO. 107		SHEET NO. 107	
			
Ministry of Transport, Planning & Economic Development State of Palestine			
DATE	SCALE	PROJECT NO.	SHEET NO.
10/2014	1:100	107	107
CROSS SECTION			
Coastal Road from The National Council to The National Council			
Section No. 107 Stationing: 107+00 to 107+100			

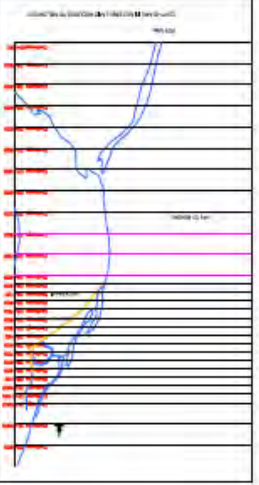
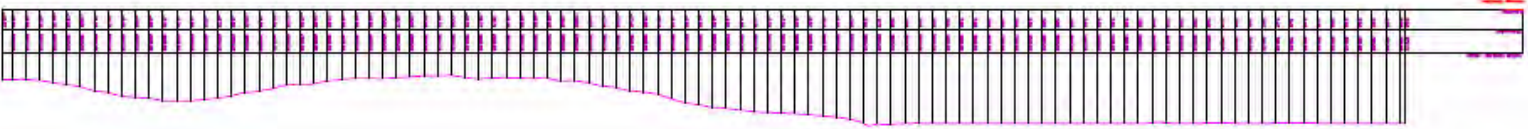
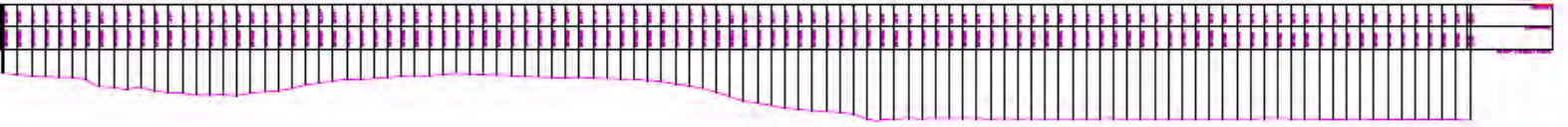


	
Ministry of Forests, Energy & Natural Resources Direction des forêts Direction des ressources naturelles	
PROJET	NOUVEAU
DATE	2014
PROJET	NOUVEAU
PROJET	NOUVEAU
CROSS SECTION	
Cross Section of the River (Municipal Council)	
Cross Section of the River (Municipal Council)	
Cross Section of the River (Municipal Council)	



100

	
Ministry of Forests, Energy & Natural Resources Forestry Centre, 1030 Main Street West, Peterborough, Ontario K9J 8H9	
PROJECT NO.	1039
DATE	2010
SCALE	1:100
PROJECT NAME	COLEBY TOWNSHIP POWER TRANSMISSION CORRIDOR
CROSS SECTION	
COLEBY TOWNSHIP POWER TRANSMISSION CORRIDOR	
1039 - COLEBY TOWNSHIP POWER TRANSMISSION CORRIDOR	
1039 - COLEBY TOWNSHIP POWER TRANSMISSION CORRIDOR	



1039

DATE	NO. 10	NO. 11	NO. 12	NO. 13	NO. 14	NO. 15	NO. 16	NO. 17	NO. 18	NO. 19	NO. 20	NO. 21	NO. 22	NO. 23	NO. 24	NO. 25	NO. 26	NO. 27	NO. 28	NO. 29	NO. 30	NO. 31	NO. 32	NO. 33	NO. 34	NO. 35	NO. 36	NO. 37	NO. 38	NO. 39	NO. 40	NO. 41	NO. 42	NO. 43	NO. 44	NO. 45	NO. 46	NO. 47	NO. 48	NO. 49	NO. 50	NO. 51	NO. 52	NO. 53	NO. 54	NO. 55	NO. 56	NO. 57	NO. 58	NO. 59	NO. 60	NO. 61	NO. 62	NO. 63	NO. 64	NO. 65	NO. 66	NO. 67	NO. 68	NO. 69	NO. 70	NO. 71	NO. 72	NO. 73	NO. 74	NO. 75	NO. 76	NO. 77	NO. 78	NO. 79	NO. 80	NO. 81	NO. 82	NO. 83	NO. 84	NO. 85	NO. 86	NO. 87	NO. 88	NO. 89	NO. 90	NO. 91	NO. 92	NO. 93	NO. 94	NO. 95	NO. 96	NO. 97	NO. 98	NO. 99	NO. 100
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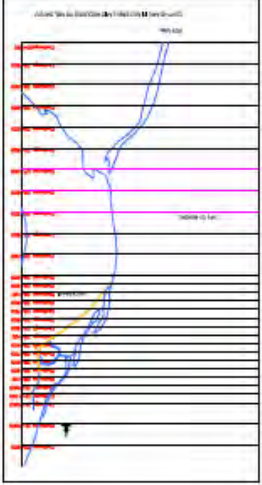
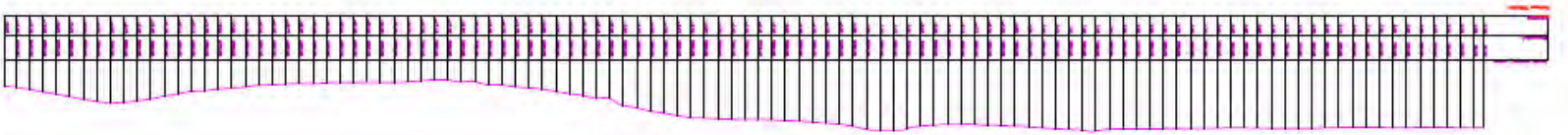
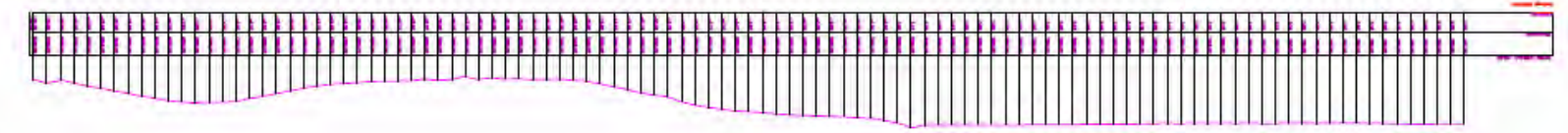
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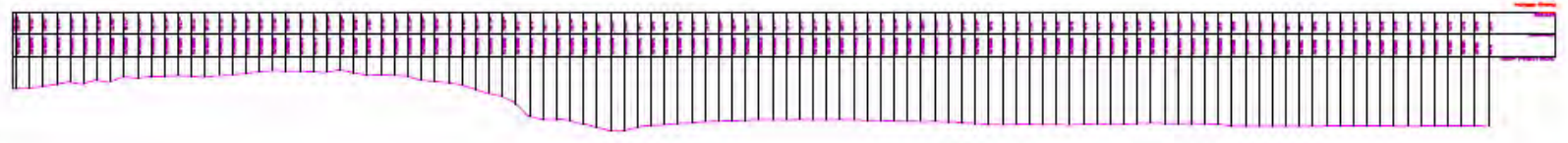
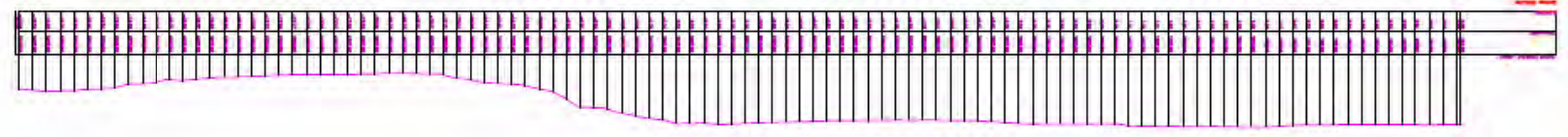
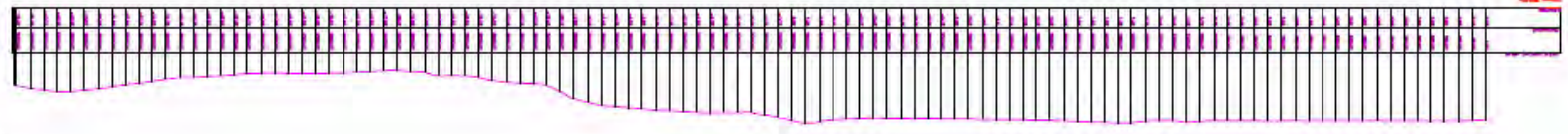
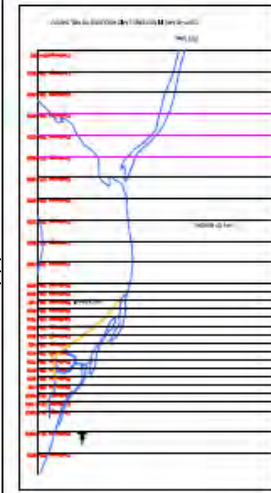
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SECTION



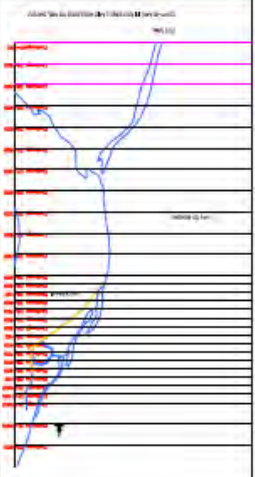
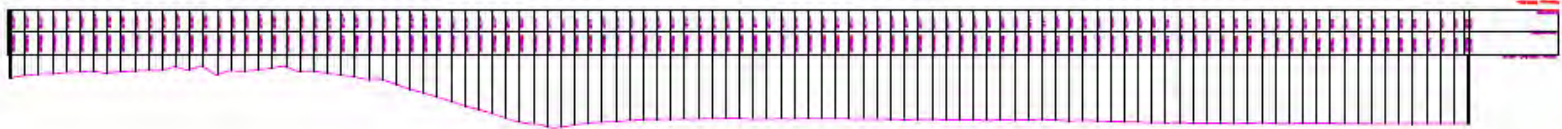
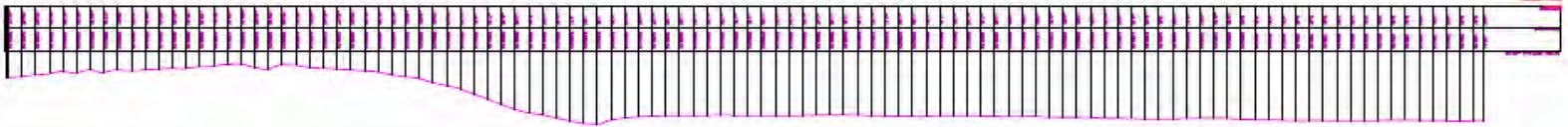
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11

BRITISH COLUMBIA MINISTRY OF FORESTS, FIRE AND RURAL DEVELOPMENT	PROJECT NO. 12-10-0000 PROJECT NAME: COASTAL TOWNSHIP TRAIL RECONSTRUCTION DRAWING NO. TR-10-0000-01 DRAWING TITLE: CROSS SECTION
DESIGNER: TRAIL RECONSTRUCTION CHECKED: TRAIL RECONSTRUCTION DATE: 2012	SCALE: 1:10 SHEET NO. 1 OF 1
CROSS SECTION COASTAL TOWNSHIP TRAIL RECONSTRUCTION	
DRAWING MADE BY: TRAIL RECONSTRUCTION DRAWING CHECKED BY: TRAIL RECONSTRUCTION	



The bathymetric survey has been conducted in the survey area with the following procedure.

(1) Overview

-Survey period

From March 28, 2013, to April 11, 2013.

-Survey area

The project site is located at Matarbari, Cox's Bazar.

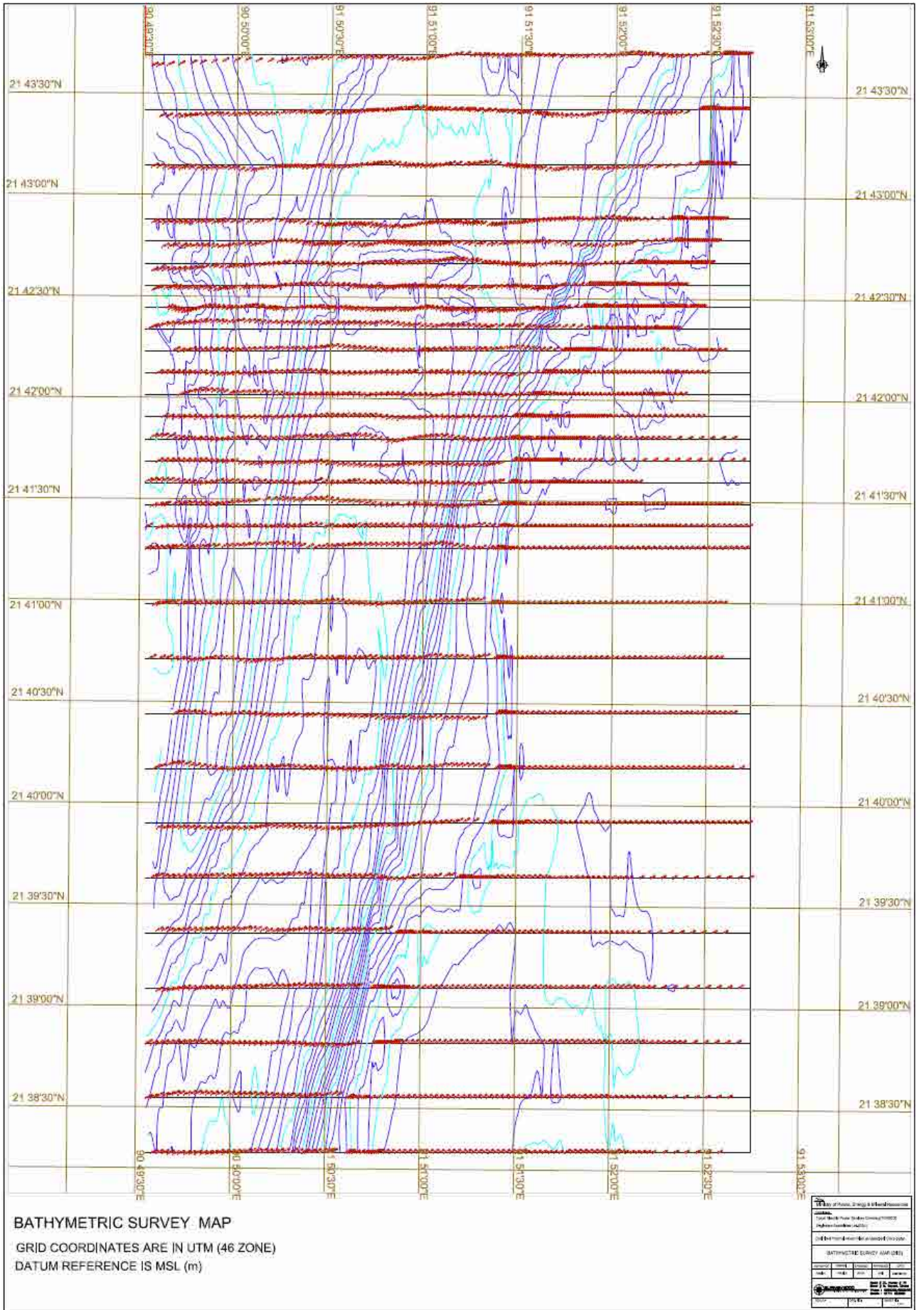
(2) Methodology

The survey was conducted using fourteen hydrographic survey lines at 200m intervals with 50m interval sounding, and 16 hydrographic survey lines at 500m intervals with 50m interval sounding. The length of the survey line was 5km and the reference coordinates were as follows:

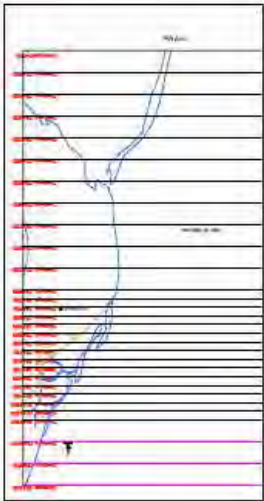
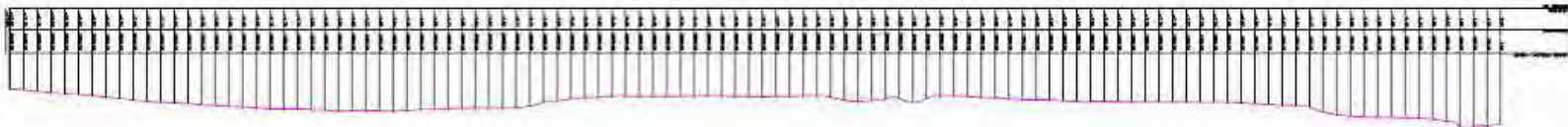
Latitude N21°42'12"N Longitude E91°52'31"E RTK GPS.

An echo sounder was used connected with the navigation and data acquisition PC via interface cable and synchronized with the hydrographic software HYPAC. Before conducting the survey, a line of survey was created as per the directions. A navigation module guided the surveyor for the run line of the survey vessel and data acquisition. Using a computer screen the hydrographic surveyor could know his position, speed and direction of the survey vessel, and the depth profile, etc. The survey vessel was run at a maximum of 6 knots per hour for data acquisition. Calibration for the echo sounder was done prior to the survey run everyday using a bar check plate.

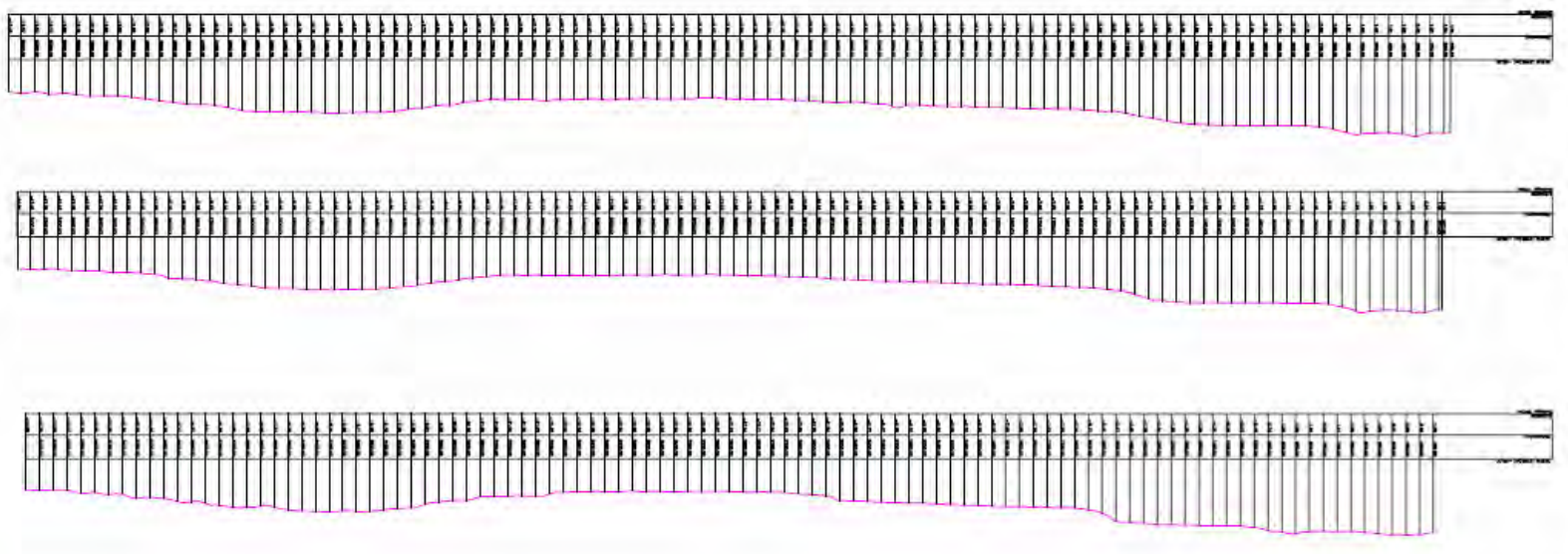
Tide levels were recorded at half hourly intervals for tidal correction of bathymetric height.



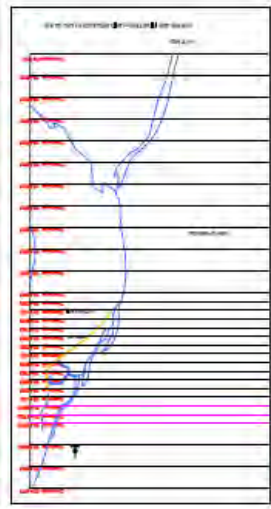
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SHEET NO. 10		OF 10	
PROJECT NAME: [Project Name]			
DRAWN BY: [Name]			
CHECKED BY: [Name]			
DATE: 15/05/2018			
SCALE: 1:100			
SECTION: CROSS SECTION			
LOCATION: [Location]			
ELEVATION: [Elevation]			
REVISION: [Revision]			
APPROVED BY: [Signature]			



OTHERS ARE MATCHING AND SHOULD BE ASY. DATA

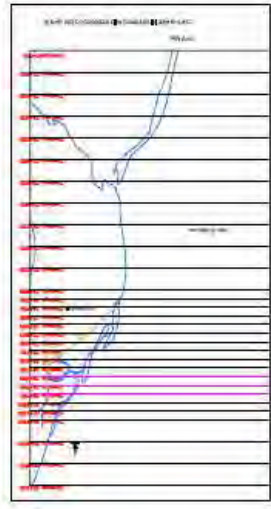


DATE	NO. OF SHEETS	SHEET NO.
1/1/2024	10	10
PROJECT NAME: [REDACTED]		
DRAWN BY: [REDACTED]		
CHECKED BY: [REDACTED]		
SCALE: 1:100		
CROSS SECTIONS		
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[REDACTED]		
[REDACTED]		
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DATE: 15/01/2024 BY: [Signature]

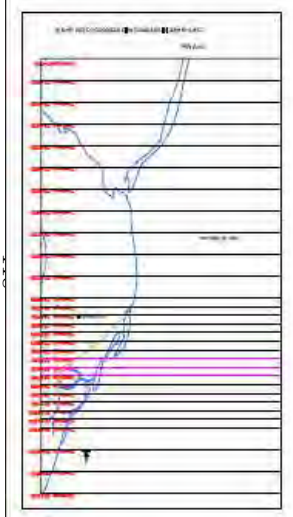
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DRAWING NO.: [Drawing No.]			
SCALE: 1:100			
SHEET NO.: [Sheet No.]			
TITEL: CROSS SECTIONS			
[Description of the drawing content]			



DATE: 15/01/2024 BY: [Signature]

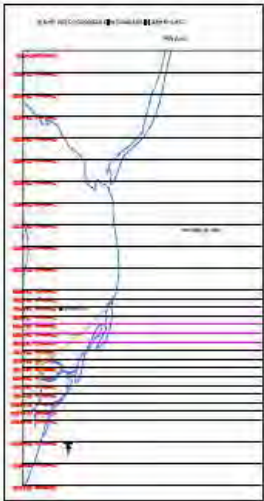
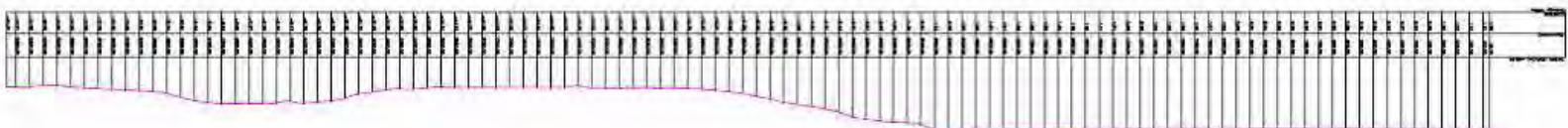
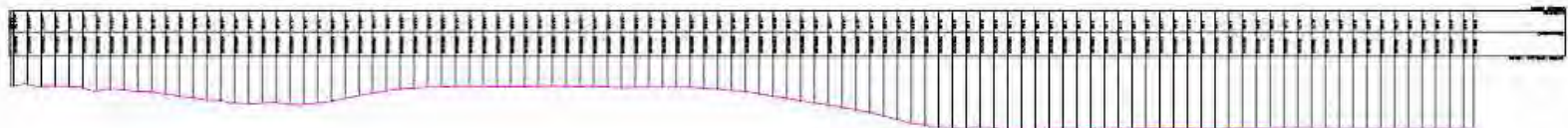
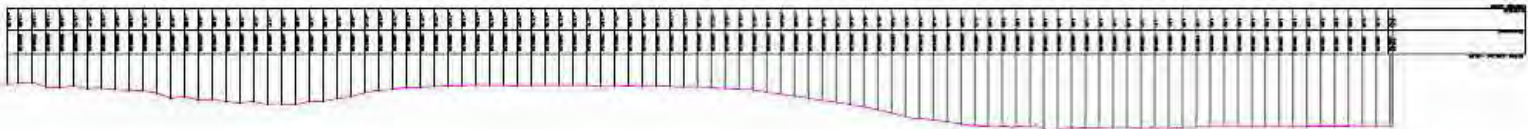


NO.	DATE	BY	CHKD.	APPD.
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DRAWING: [Drawing Name]				
SCALE: [Scale]				
SHEET: [Sheet Number]				
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GROSS SECTION				
[Detailed Description]				
[Additional Information]				



Project Name: [Illegible]

NO.	DATE	REVISION
01	10/10/2024	ISSUED FOR TENDER
02	15/10/2024	REVISION OF CONTRACT
03	20/10/2024	FINAL CONTRACT
CROSS SECTIONS		
Contract Name: [Illegible]		
Contract Number: [Illegible]		
Project Location: [Illegible]		
Scale: [Illegible]		



DATE: 15/01/2024 BY: [Signature]

NO.	REV.	DATE	BY
01	01	15/01/2024	[Signature]

PROJECT INFORMATION

PROJECT NAME: [Project Name]

CLIENT: [Client Name]

LOCATION: [Location]

SCALE: 1:100

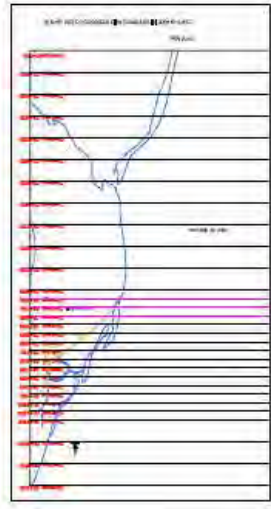
DATE: 15/01/2024

CROSS SECTIONS

SECTION NO. 1

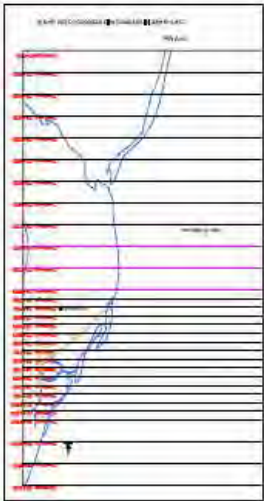
SECTION NO. 2

SECTION NO. 3



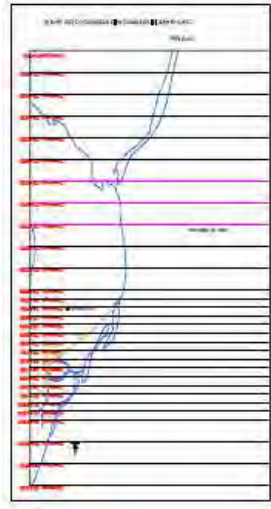
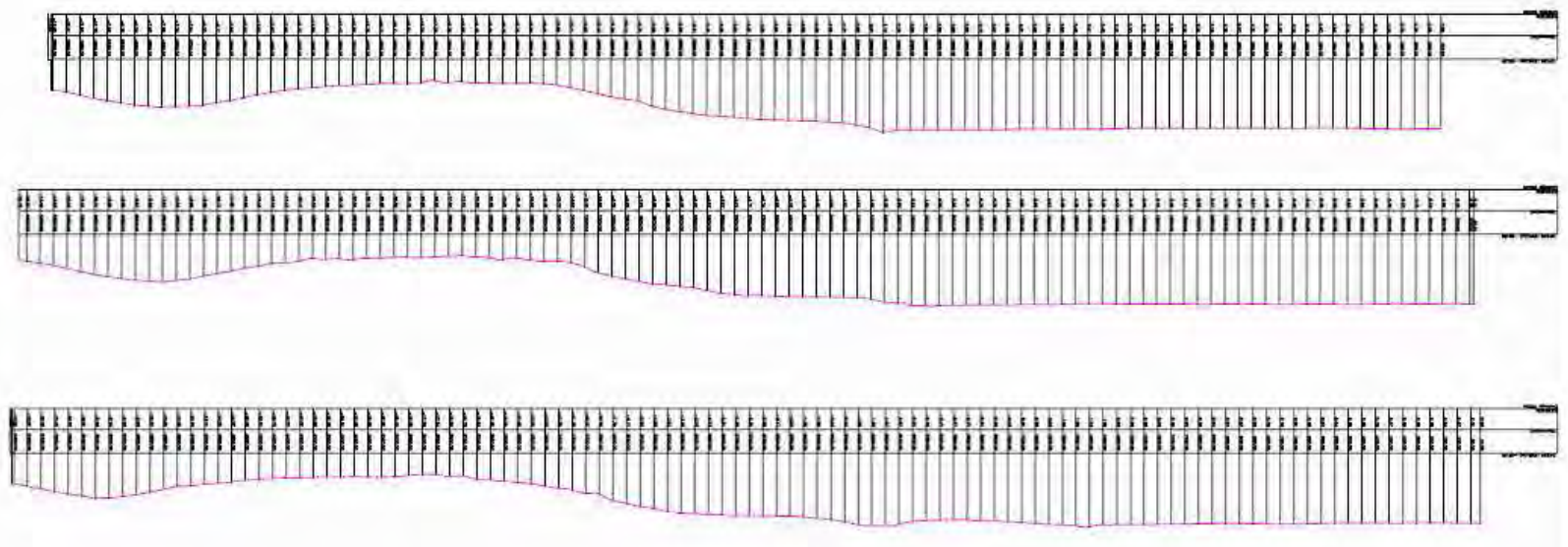
DATE	SCALE	PROJECT
1/1/2024	1:1	ROADWAY IMPROVEMENT PROJECT
PROJECT INFORMATION PROJECT NO: 2023-001 SHEET NO: 10 OF 15 DRAWN BY: J. SMITH CHECKED BY: M. JONES APPROVED BY: D. BROWN		
CROSS SECTIONS THIS SHEET CONTAINS THE FOLLOWING CROSS SECTIONS: STATION 1+00 TO 1+50 STATION 1+50 TO 2+00 STATION 2+00 TO 2+50		

Vertical scale: 1" = 10' (Vertical axis only)

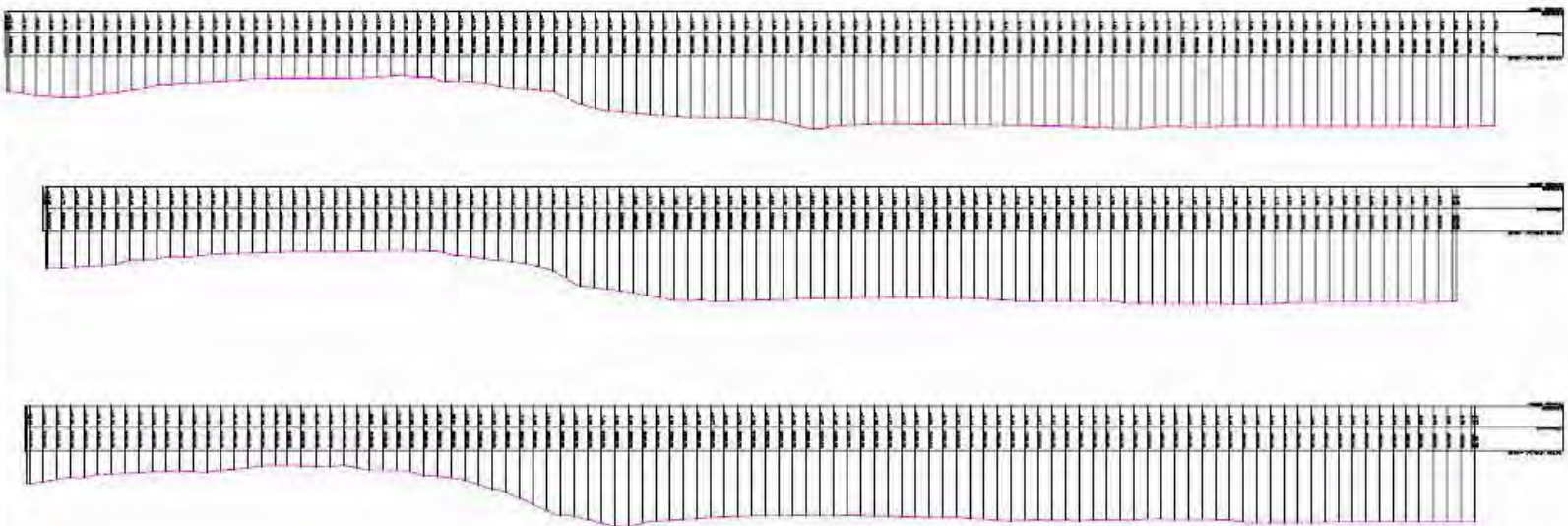


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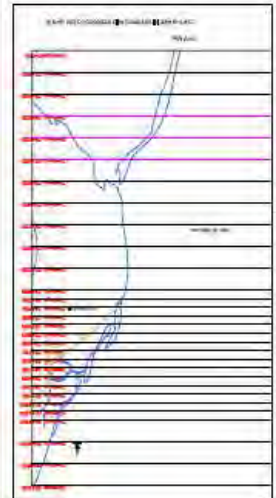
DATE	NO.	REV.	BY	CHKD.
10/10/10	1	0
PROJECT INFORMATION				
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LOCATION	...			
CROSS SECTIONS				
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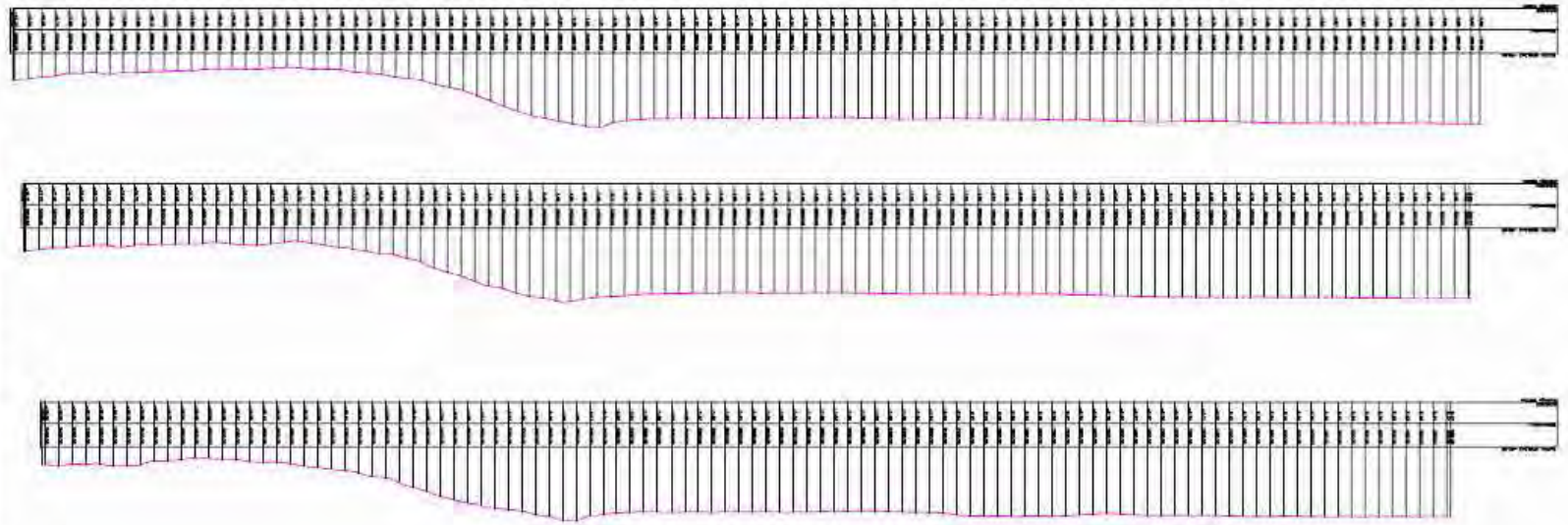
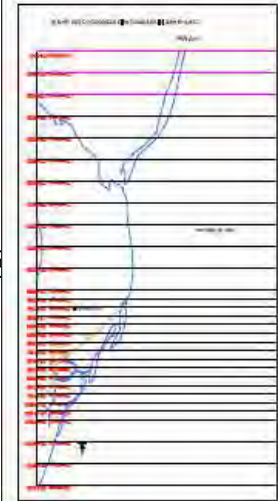
NO.	NAME	DATE	TIME	WATER LEVEL (m)	WIND SPEED (km/h)	WIND DIRECTION	WAVE HEIGHT (m)	WAVE PERIOD (s)	WAVE DIRECTION	WAVE STATE
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3										
4										
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Tidal Observation

NO. 1	NO. 2	NO. 3	NO. 4	NO. 5	NO. 6	NO. 7	NO. 8	NO. 9	NO. 10	NO. 11	NO. 12	NO. 13	NO. 14	NO. 15	NO. 16	NO. 17	NO. 18	NO. 19	NO. 20	NO. 21	NO. 22	NO. 23	NO. 24	NO. 25	NO. 26	NO. 27	NO. 28	NO. 29	NO. 30	NO. 31	NO. 32	NO. 33	NO. 34	NO. 35	NO. 36	NO. 37	NO. 38	NO. 39	NO. 40	NO. 41	NO. 42	NO. 43	NO. 44	NO. 45	NO. 46	NO. 47	NO. 48	NO. 49	NO. 50	NO. 51	NO. 52	NO. 53	NO. 54	NO. 55	NO. 56	NO. 57	NO. 58	NO. 59	NO. 60	NO. 61	NO. 62	NO. 63	NO. 64	NO. 65	NO. 66	NO. 67	NO. 68	NO. 69	NO. 70	NO. 71	NO. 72	NO. 73	NO. 74	NO. 75	NO. 76	NO. 77	NO. 78	NO. 79	NO. 80	NO. 81	NO. 82	NO. 83	NO. 84	NO. 85	NO. 86	NO. 87	NO. 88	NO. 89	NO. 90	NO. 91	NO. 92	NO. 93	NO. 94	NO. 95	NO. 96	NO. 97	NO. 98	NO. 99	NO. 100
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Vertical scale of cross-sections (m) shall be as shown.





Water Level

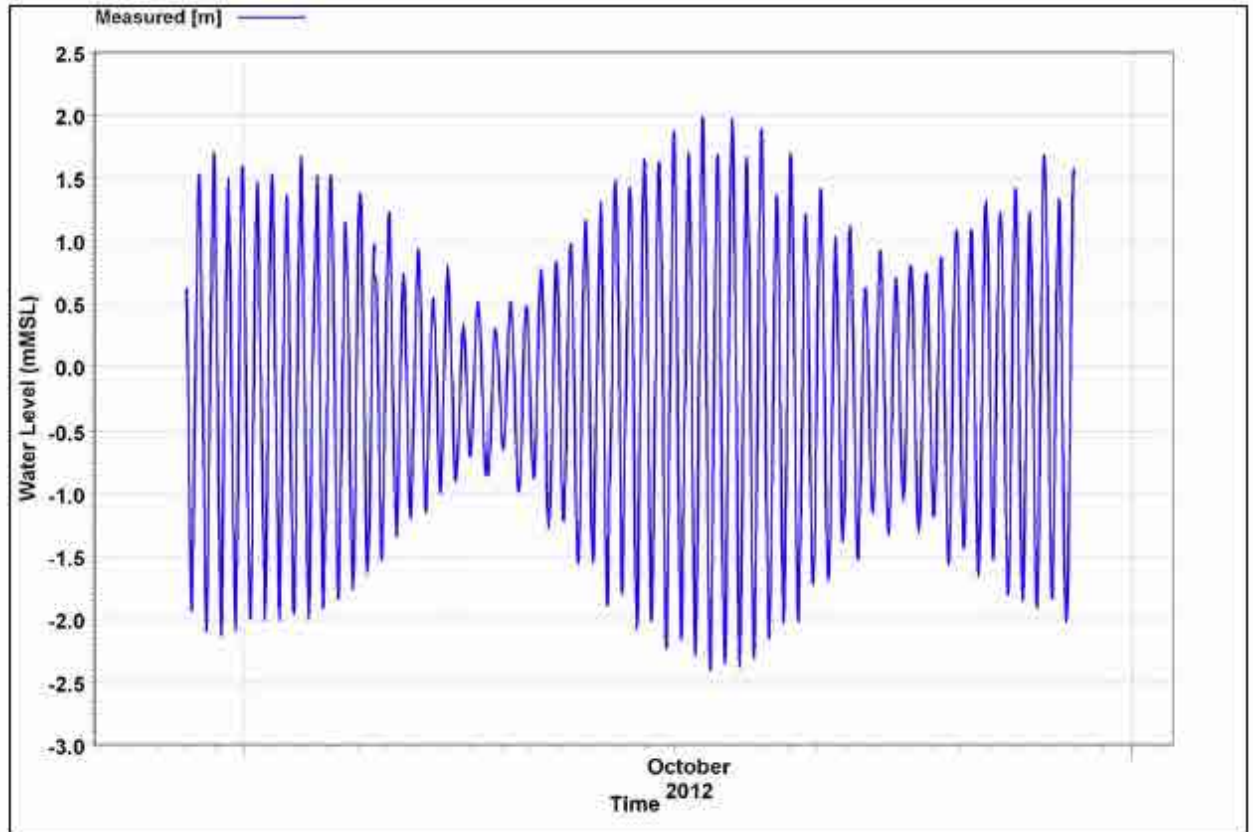


Figure- 1 Variation of water level near Matarbari site

Water level was collected for one month from 29 September Harmonic analysis was carried out to predict the water level for the specified location for full year through calculation of harmonic constituents.

Harmonic Analysis:

Harmonic Analysis is the transformation of tidal observations from the time domain to frequency domain. The tidal variations can then be given by the sum of the harmonic constituents, which period is associated with the period of the tide generating forces. The periods fall into three tidal species (long-period, diurnal and semidiurnal). Each tidal species contains groups of harmonics, which can be separated by analysis of a month of observations. In term each group contains constituents, which can be separated by analysis of a year of observations. Third diurnal, fourth diurnal and higher species of harmonics are generated by shallow water effects. Normally long tidal records are needed to determine amplitude and phase for a larger number of constituents with high accuracy. Here we analyzed 30 days data and the calculated harmonic constituents are furnished in the Table 3-1. Water level of 2012 was predicted using these tidal/harmonic constituents and compared with the measured data. The comparison plot is furnished in the Figure 3-3 and it shows quite good agreement between observed and predicted data. Figure 3-4 shows the water level for entire 2012. The observed water level is furnished in **Appendix-A**.

Table-3 List and value of constituent

Sl. No.	Name	Amplitude	Phase	Sl. No.	Name	Amplitude	Phase
1	Z0	0.4542	0	31	M2	1.3463	318.04
2	SSA	0.0151	238.94	32	MKS2	0.0039	185.44
3	MSM	0.0096	359.67	33	LDA2	0.0108	23.73
4	MM	0.0124	204.92	34	L2	0.022	26.82
5	MSF	0.0299	227.53	35	S2	0.6175	355.14
6	MF	0.006	228.08	36	K2	0.1317	350.7
7	ALP1	0.0008	154.52	37	MSN2	0.0102	243.28
8	2Q1	0.0013	17.88	38	ETA2	0.001	197.7
9	SIG1	0.0012	15.94	39	MO3	0.0032	91.02
10	Q1	0.0113	260.14	40	M3	0.0011	285.06
11	RHO1	0.0011	191.77	41	SO3	0.0018	97.35
12	O1	0.0477	305.52	42	MK3	0.0055	95.17
13	TAU1	0.004	44.52	43	SK3	0.0017	189.14
14	BET1	0.0014	252.95	44	MN4	0.0046	120.94
15	NO1	0.0018	78.73	45	M4	0.0077	150.21
16	CHI1	0.0019	227.67	46	SN4	0.004	104.6
17	P1	0.0547	338.7	47	MS4	0.0063	134.48
18	K1	0.1737	339.57	48	MK4	0.0012	52.13
19	PHI1	0.0008	254.72	49	S4	0.004	153.75
20	THE1	0.0018	275.71	50	SK4	0.001	221.24
21	J1	0.003	100.66	51	2MK5	0.0033	222.71
22	SO1	0.005	165.87	52	2SK5	0.0019	262.01
23	OO1	0.0031	145.83	53	2MN6	0.0143	230.32
24	UPS1	0.002	232.19	54	M6	0.0232	248.12
25	OQ2	0.0022	102.76	55	2MS6	0.0346	287.6
26	EPS2	0.0153	126.73	56	2MK6	0.0058	287.19
27	2N2	0.0125	176.44	57	2SM6	0.0115	330.61
28	MU2	0.0559	148.1	58	MSK6	0.0066	328.75
29	N2	0.272	300.96	59	3MK7	0.0004	72.83
30	NU2	0.0134	11.29	60	M8	0.0051	35.49

Water Level

Time	29-Sep-12	30-Sep-12	1-Oct-12	2-Oct-12	3-Oct-12	4-Oct-12	5-Oct-12	6-Oct-12
0:00	0.623	1.213	1.323	1.493	1.673	1.383	1.073	0.653
0:30	0.283	0.823	0.983	1.383	1.523	1.463	1.273	0.913
1:00	-0.077	0.483	0.593	0.873	1.163	1.523	1.353	1.103
1:30	-0.367	0.123	0.153	0.473	0.873	1.453	1.383	1.193
2:00	-0.797	-0.237	-0.347	0.123	0.533	1.313	1.353	1.223
2:30	-1.207	-0.757	-0.697	-0.167	0.193	0.983	1.233	1.133
3:00	-1.507	-1.047	-0.937	-0.377	-0.157	0.693	1.003	0.923
3:30	-1.647	-1.457	-1.167	-0.677	-0.457	0.363	0.543	0.673
4:00	-1.927	-1.797	-1.517	-0.987	-0.777	0.003	0.383	0.393
4:30	-1.927	-2.027	-1.637	-1.287	-1.017	-0.247	0.093	0.073
5:00	-1.617	-2.127	-1.937	-1.597	-1.397	-0.737	-0.227	-0.227
5:30	-1.337	-1.917	-1.987	-1.867	-1.677	-1.007	-0.547	-0.387
6:00	-0.937	-1.537	-1.877	-2.007	-1.867	-1.217	-0.827	-0.627
6:30	-0.557	-1.087	-1.597	-1.807	-1.997	-1.627	-1.317	-0.897
7:00	-0.227	-0.677	-1.267	-1.497	-1.777	-1.787	-1.497	-1.047
7:30	0.053	-0.227	-0.677	-1.117	-1.477	-1.837	-1.627	-1.207
8:00	0.433	0.143	-0.347	-0.667	-1.187	-1.717	-1.587	-1.347
8:30	0.623	0.393	0.033	-0.147	-0.737	-1.387	-1.487	-1.297
9:00	0.843	0.683	0.433	0.053	-0.197	-1.067	-1.347	-1.137
9:30	1.293	0.833	0.853	0.293	-0.027	-0.827	-1.167	-0.997
10:00	1.483	1.123	1.093	0.573	0.153	-0.627	-0.887	-0.717
10:30	1.523	1.393	1.253	0.793	0.373	-0.317	-0.527	-0.437
11:00	1.493	1.503	1.453	0.983	0.563	-0.017	-0.177	-0.197
11:30	1.263	1.333	1.463	1.183	0.733	0.273	0.163	-0.007
12:00	0.973	1.043	1.303	1.363	0.963	0.523	0.523	0.293
12:30	0.493	0.703	1.003	1.283	1.203	1.053	0.773	0.453
13:00	0.233	0.343	0.623	1.073	1.363	1.143	0.923	0.573
13:30	-0.177	-0.137	0.293	0.773	1.523	1.073	0.973	0.723
14:00	-0.467	-0.477	0.043	0.543	1.373	0.973	0.923	0.743
14:30	-0.917	-0.837	-0.177	-0.177	0.933	0.823	-4.177	0.713
15:00	-1.337	-1.187	-0.497	-0.497	0.583	0.603	0.713	0.603
15:30	-1.757	-1.367	-0.827	-0.827	0.093	0.473	0.563	0.363
16:00	-1.947	-1.677	-1.087	-1.087	-0.277	0.223	0.343	0.103
16:30	-2.097	-1.857	-1.407	-1.407	-0.817	-0.087	0.043	-0.037
17:00	-1.987	-2.087	-1.777	-1.747	-1.057	-0.657	-0.227	-0.247
17:30	-1.667	-1.947	-2.007	-1.927	-1.357	-1.017	-0.547	-0.407
18:00	-1.287	-1.697	-1.827	-1.947	-1.607	-1.247	-0.857	-0.777
18:30	-0.857	-1.267	-1.607	-1.897	-1.907	-1.497	-1.147	-0.887
19:00	-0.487	-0.817	-1.447	-1.577	-1.877	-1.677	-1.387	-1.067
19:30	-0.147	-0.487	-0.887	-1.217	-1.727	-1.757	-1.527	-1.137
20:00	0.143	0.023	-0.407	-0.627	-1.377	-1.637	-1.487	-1.197
20:30	0.433	0.433	0.063	-0.297	-1.067	-1.557	-1.357	-1.157
21:00	0.783	0.923	0.473	0.063	-0.827	-1.217	-1.117	-1.047
21:30	1.193	1.143	0.703	0.463	-0.587	-0.867	-0.807	-0.737
22:00	1.463	1.413	0.993	0.753	-0.217	-0.347	-0.497	-0.547
22:30	1.633	1.573	1.233	1.033	-0.037	-0.067	-0.217	-0.387
23:00	1.703	1.593	1.413	1.353	0.723	0.363	0.123	-0.227
23:30	1.513	1.553	1.523	1.593	1.133	0.763	0.413	-0.037

Water Level

Time	7-Oct-12	8-Oct-12	9-Oct-12	10-Oct-12	11-Oct-12	12-Oct-12	13-Oct-12	14-Oct-12
0:00	0.293	-0.077	-0.407	-0.647	-0.627	-0.367	0.233	0.983
0:30	0.433	0.063	-0.277	-0.607	-0.767	-0.587	0.003	0.623
1:00	0.593	0.243	-0.167	-0.567	-0.847	-0.887	-0.607	0.473
1:30	0.733	0.433	-0.027	-0.487	-0.877	-0.967	-0.927	0.113
2:00	0.893	0.603	0.103	-0.397	-0.857	-1.067	-1.217	-0.477
2:30	0.933	0.743	0.233	-0.247	-0.797	-1.217	-1.427	-0.917
3:00	0.853	0.803	0.323	-0.127	-0.707	-1.207	-1.527	-1.567
3:30	0.853	0.743	0.403	0.003	-0.547	-1.137	-1.547	-1.757
4:00	0.663	0.643	0.463	0.153	-0.397	-0.987	-1.447	-1.797
4:30	0.393	0.523	0.513	0.313	-0.177	-0.767	-1.057	-1.707
5:00	0.153	0.383	0.493	0.383	0.023	-0.537	-0.897	-1.307
5:30	-0.147	0.223	0.433	0.443	0.213	-0.247	-0.597	-0.837
6:00	-0.287	0.003	0.373	0.503	0.413	0.053	-0.317	-0.637
6:30	-0.467	-0.047	0.263	0.503	0.543	0.303	-0.147	-0.437
7:00	-0.667	-0.147	0.143	0.433	0.653	0.563	0.073	-0.277
7:30	-0.807	-0.347	0.003	0.333	0.743	0.773	0.323	-0.037
8:00	-0.987	-0.537	-0.147	0.263	0.773	0.903	0.563	0.243
8:30	-1.097	-0.737	-0.297	0.143	0.733	0.963	0.773	0.543
9:00	-1.137	-0.867	-0.457	0.023	0.563	0.973	1.013	0.933
9:30	-1.057	-0.897	-0.567	-0.117	0.483	0.873	1.213	1.313
10:00	-0.897	-0.897	-0.697	-0.327	0.373	0.733	1.303	1.423
10:30	-0.667	-0.817	-0.797	-0.457	0.193	0.513	1.113	1.383
11:00	-0.467	-0.747	-0.837	-0.647	-0.047	0.293	0.833	1.353
11:30	-0.317	-0.667	-0.847	-0.777	-0.287	0.003	0.593	1.233
12:00	-0.117	-0.567	-0.837	-0.887	-0.587	-0.367	0.133	0.943
12:30	0.013	-0.517	-0.757	-0.977	-0.887	-0.677	-0.187	0.673
13:00	0.213	-0.347	-0.637	-0.977	-1.087	-0.957	-0.507	0.263
13:30	0.323	-0.237	-0.547	-0.957	-1.187	-1.247	-0.887	-0.137
14:00	0.423	-0.067	-0.427	-0.907	-1.267	-1.457	-1.277	-0.897
14:30	0.513	0.103	-0.297	-0.797	-1.247	-1.507	-1.557	-1.257
15:00	0.543	0.203	-0.137	-0.677	-1.147	-1.557	-1.787	-1.577
15:30	0.433	0.273	-0.007	-0.547	-1.067	-1.487	-1.887	-1.907
16:00	0.383	0.303	0.103	-0.327	-0.897	-1.357	-1.867	-2.077
16:30	0.293	0.333	0.203	-0.147	-0.707	-1.177	-1.657	-2.057
17:00	0.143	0.253	0.283	0.033	-0.547	-0.957	-0.987	-1.897
17:30	0.053	0.193	0.303	0.213	-0.437	-0.657	-0.847	-1.547
18:00	-0.097	0.113	0.273	0.343	-0.047	-0.267	-0.717	-1.197
18:30	-0.297	-0.017	0.233	0.403	0.173	0.073	-0.537	-0.497
19:00	-0.507	-0.177	0.163	0.463	0.433	0.383	-0.297	-0.297
19:30	-0.677	-0.297	0.093	0.473	0.673	0.673	-0.027	-0.057
20:00	-0.907	-0.407	0.013	0.463	0.793	0.913	0.503	0.353
20:30	-0.947	-0.527	-0.067	0.413	0.833	1.103	0.923	0.733
21:00	-0.997	-0.607	-0.187	0.263	0.823	1.163	1.243	1.133
21:30	-0.897	-0.687	-0.287	0.123	0.773	1.163	1.403	1.433
22:00	-0.787	-0.707	-0.367	-0.007	0.643	0.983	1.453	1.613
22:30	-0.637	-0.687	-0.497	-0.157	0.413	0.833	1.483	1.653
23:00	-0.427	-0.627	-0.577	-0.387	0.143	0.663	1.333	1.623
23:30	-0.227	-0.547	-0.627	-0.507	-0.107	0.473	1.253	1.403

Water Level

Time	15-Oct-12	16-Oct-12	17-Oct-12	18-Oct-12	19-Oct-12	20-Oct-12	21-Oct-12	22-Oct-12
0:00	1.273	1.813	1.943	1.973	1.693	1.073	0.353	-0.257
0:30	0.983	1.313	1.803	1.943	1.853	1.403	0.733	-0.027
1:00	0.583	1.073	1.383	1.803	1.893	1.623	0.973	0.293
1:30	0.223	0.723	0.963	1.473	1.763	1.703	1.223	0.583
2:00	-0.577	0.283	0.493	1.303	1.483	1.633	1.373	0.803
2:30	-1.007	-0.177	0.063	0.773	1.103	1.473	1.413	1.013
3:00	-1.207	-0.717	-0.457	0.403	0.923	1.123	1.343	1.083
3:30	-1.587	-1.167	-0.977	0.003	0.523	0.753	1.043	1.113
4:00	-1.917	-1.547	-1.457	-0.397	-0.137	0.593	0.883	1.033
4:30	-2.007	-1.877	-1.867	-1.067	-0.457	0.223	0.693	0.833
5:00	-1.977	-2.107	-2.137	-1.487	-0.947	-0.377	0.303	0.663
5:30	-1.817	-2.157	-2.317	-1.997	-1.397	-0.727	0.053	0.403
6:00	-1.517	-2.047	-2.397	-2.277	-1.647	-1.177	-0.347	0.143
6:30	-0.857	-1.667	-2.247	-2.377	-1.937	-1.517	-0.767	-0.127
7:00	-0.627	-1.247	-1.967	-2.237	-2.147	-1.787	-1.007	-0.387
7:30	-0.297	-0.857	-1.487	-2.017	-2.117	-1.947	-1.367	-0.677
8:00	-0.037	-0.527	-1.007	-1.577	-1.957	-2.017	-1.517	-0.907
8:30	0.193	-0.337	-0.597	-1.207	-1.757	-1.887	-1.637	-1.167
9:00	0.923	-0.117	-0.187	-0.877	-1.277	-1.607	-1.687	-1.387
9:30	1.233	0.423	0.263	-0.297	-1.097	-1.317	-1.597	-1.487
10:00	1.483	0.843	0.633	0.073	-0.857	-1.057	-1.467	-1.517
10:30	1.593	1.233	1.093	0.533	-0.387	-0.767	-1.337	-1.477
11:00	1.633	1.563	1.413	0.943	0.013	-0.367	-1.157	-1.277
11:30	1.583	1.703	1.613	1.253	0.383	0.013	-0.727	-1.077
12:00	1.403	1.643	1.683	1.573	0.743	0.283	-0.477	-0.897
12:30	1.033	1.353	1.583	1.663	1.103	0.643	-0.157	-0.687
13:00	0.673	1.253	1.493	1.573	1.283	0.983	0.163	-0.417
13:30	0.443	0.873	1.053	1.303	1.373	1.123	0.423	-0.177
14:00	0.193	0.533	0.613	1.123	1.293	1.203	0.713	0.063
14:30	-0.627	-0.477	0.173	0.893	1.153	1.113	0.963	0.283
15:00	-1.057	-0.937	-0.337	0.513	0.933	0.973	1.033	0.463
15:30	-1.397	-1.247	-0.867	-0.057	0.663	0.853	0.973	0.573
16:00	-1.837	-1.567	-1.277	-0.657	0.283	0.603	0.773	0.623
16:30	-2.137	-1.967	-1.687	-1.057	-0.187	0.253	0.563	0.623
17:00	-2.227	-2.217	-1.977	-1.487	-0.597	-0.137	0.373	0.533
17:30	-2.147	-2.287	-2.247	-1.817	-0.967	-0.547	0.083	0.403
18:00	-1.837	-2.167	-2.347	-2.107	-1.337	-0.857	-0.137	0.233
18:30	-1.427	-1.797	-2.277	-2.297	-1.647	-1.157	-0.487	0.063
19:00	-0.967	-1.517	-2.027	-2.227	-1.987	-1.467	-0.677	-0.217
19:30	-0.457	-0.997	-1.597	-2.017	-2.027	-1.617	-0.937	-0.367
20:00	-0.057	-0.437	-1.087	-1.647	-1.897	-1.717	-1.147	-0.597
20:30	0.083	-0.007	-0.567	-1.187	-1.417	-1.637	-1.297	-0.797
21:00	0.433	0.293	-0.177	-0.747	-1.167	-1.557	-1.377	-0.987
21:30	0.843	0.743	0.303	-0.567	-0.957	-1.437	-1.357	-1.087
22:00	1.293	1.203	0.753	0.063	-0.597	-1.137	-1.247	-1.147
22:30	1.633	1.623	1.183	0.573	-0.107	-0.717	-1.137	-1.127
23:00	1.853	1.883	1.523	0.983	0.293	-0.347	-0.867	-1.067
23:30	1.873	1.983	1.843	1.353	0.723	0.013	-0.567	-0.907

Water Level

Time	23-Oct-12	24-Oct-12	25-Oct-12	26-Oct-12	27-Oct-12	28-Oct-12	29-Oct-12
0:00	-0.767	-1.057	-0.887	-0.297	0.353	0.673	1.233
0:30	-0.547	-1.007	-1.007	-0.577	-0.057	0.203	0.923
1:00	-0.327	-0.927	-1.137	-1.027	-0.377	-0.067	0.573
1:30	-0.057	-0.797	-1.187	-1.227	-0.717	-0.597	0.043
2:00	0.203	-0.647	-1.167	-1.357	-0.967	-0.887	-0.257
2:30	0.363	-0.417	-1.077	-1.437	-1.227	-1.217	-0.717
3:00	0.563	-0.167	-0.937	-1.397	-1.447	-1.537	-1.087
3:30	0.773	0.063	-0.787	-1.327	-1.527	-1.737	-1.427
4:00	0.883	0.273	-0.537	-1.137	-1.467	-1.847	-1.697
4:30	0.923	0.453	-0.257	-0.857	-1.297	-1.827	-1.827
5:00	0.913	0.623	0.013	-0.547	-0.877	-1.677	-1.827
5:30	0.763	0.773	0.193	-0.327	-0.547	-1.427	-1.727
6:00	0.613	0.803	0.443	0.003	-0.037	-1.177	-1.377
6:30	0.453	0.793	0.673	0.373	0.133	-0.857	-1.027
7:00	0.233	0.743	0.793	0.653	0.373	-0.417	-0.787
7:30	0.003	0.643	0.863	0.803	0.673	-0.127	-0.297
8:00	-0.217	0.503	0.863	0.973	0.933	0.223	0.013
8:30	-0.337	0.323	0.773	1.083	1.093	0.563	0.483
9:00	-0.647	-0.047	0.603	1.093	1.213	0.903	0.713
9:30	-0.907	-0.257	0.403	1.033	1.223	1.113	1.013
10:00	-1.087	-0.427	0.153	0.863	1.183	1.233	1.203
10:30	-1.187	-0.687	-0.137	0.613	1.093	1.193	1.333
11:00	-1.277	-0.887	-0.377	0.373	0.883	1.023	1.293
11:30	-1.317	-1.057	-0.607	0.043	0.583	0.733	1.143
12:00	-1.277	-1.197	-0.907	-0.307	0.283	0.433	0.753
12:30	-1.147	-1.277	-1.157	-0.597	-0.077	0.163	0.403
13:00	-1.007	-1.307	-1.357	-0.867	-0.407	-0.287	0.003
13:30	-0.797	-1.257	-1.497	-1.107	-0.777	-0.647	-0.297
14:00	-0.597	-1.147	-1.557	-1.397	-1.087	-0.907	-0.787
14:30	-0.377	-0.967	-1.497	-1.597	-1.417	-1.237	-1.147
15:00	-0.057	-0.757	-1.417	-1.657	-1.627	-1.597	-1.407
15:30	0.153	-0.517	-1.247	-1.607	-1.797	-1.787	-1.717
16:00	0.343	-0.287	-1.017	-1.447	-1.777	-1.907	-1.947
16:30	0.503	-0.077	-0.757	-1.197	-1.717	-1.887	-2.017
17:00	0.633	0.243	-0.437	-0.907	-1.577	-1.787	-1.997
17:30	0.673	0.413	-0.027	-0.507	-1.277	-1.527	-1.917
18:00	0.703	0.583	0.303	-0.227	-0.927	-1.137	-1.837
18:30	0.583	0.673	0.543	0.103	-0.577	-0.597	-1.467
19:00	0.503	0.743	0.773	0.433	-0.167	-0.237	-1.107
19:30	0.333	0.753	0.943	0.713	0.183	0.123	-0.867
20:00	0.203	0.713	1.023	0.963	0.593	0.533	-0.387
20:30	-0.007	0.553	1.073	1.203	0.933	0.873	0.183
21:00	-0.267	0.393	1.043	1.313	1.213	1.253	0.513
21:30	-0.467	0.143	0.993	1.313	1.363	1.543	0.923
22:00	-0.627	-0.077	0.773	1.243	1.413	1.683	1.193
22:30	-0.767	-0.277	0.573	1.093	1.393	1.653	1.533
23:00	-0.877	-0.467	0.293	0.903	1.223	1.603	1.573
23:30	-1.027	-0.667	-0.027	0.723	0.943	1.453	1.523

Tidal Current

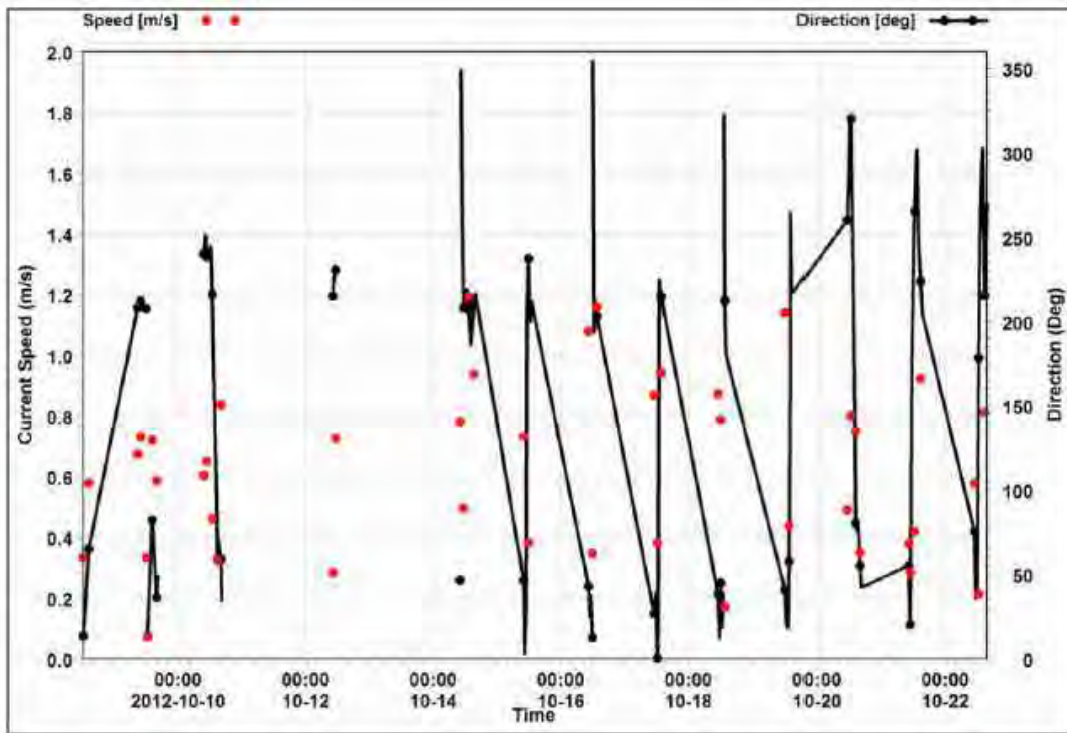


Figure -2 Variation of current speed and direction of location-1 at depth of 0.8y

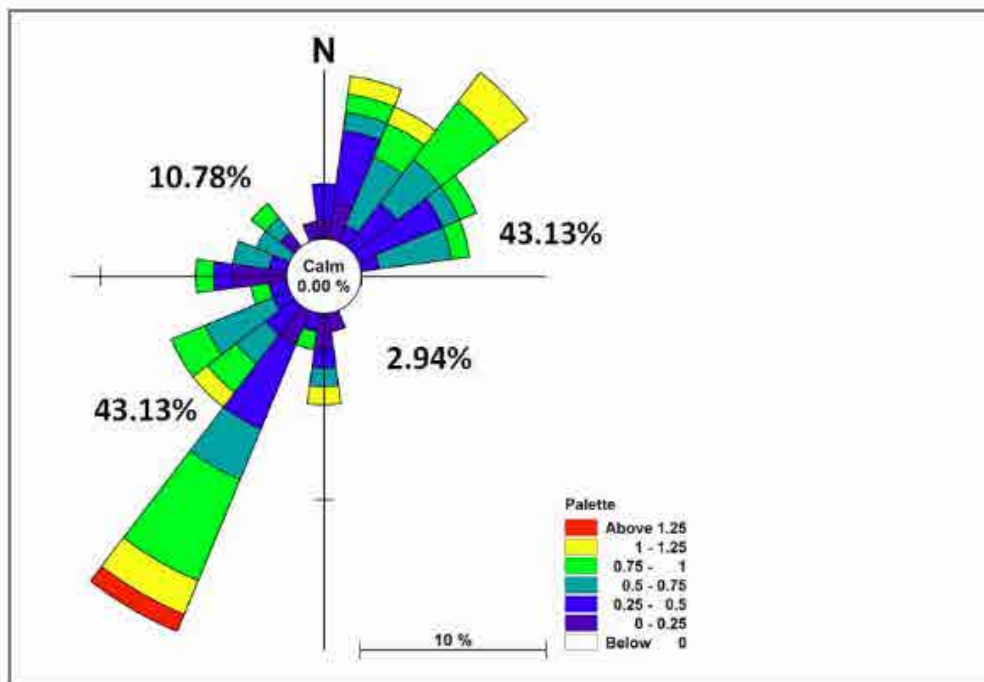


Figure -3 Current rose and of location-1 at depth of 0.8y

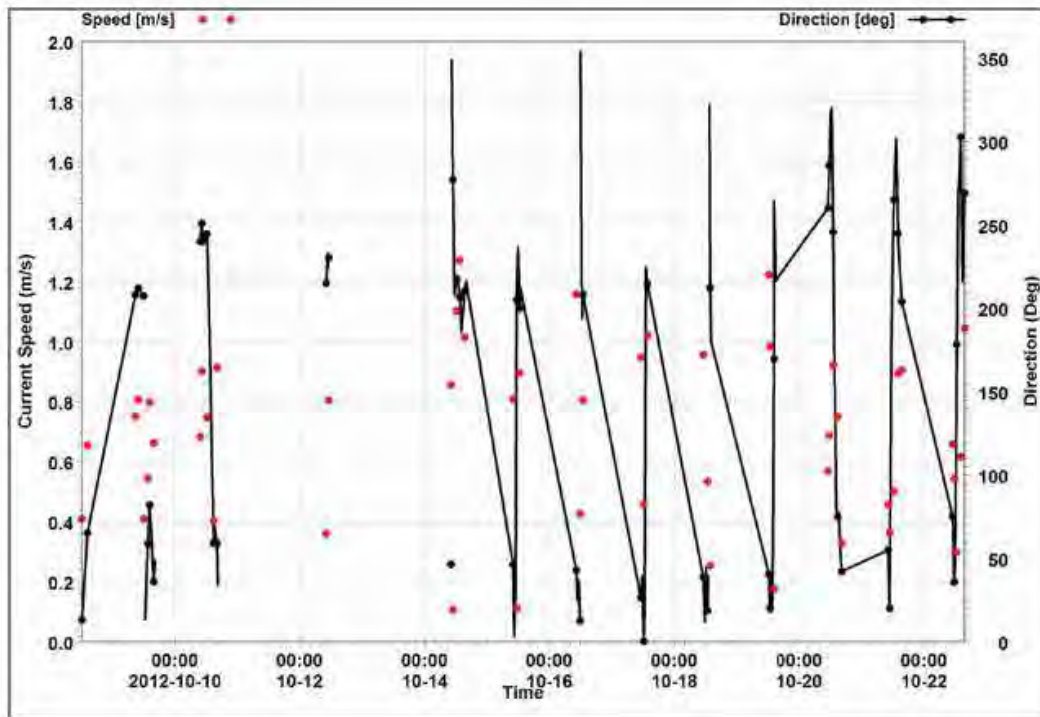


Figure -1 Variation of current speed and direction at location-1 at depth of 0.2y

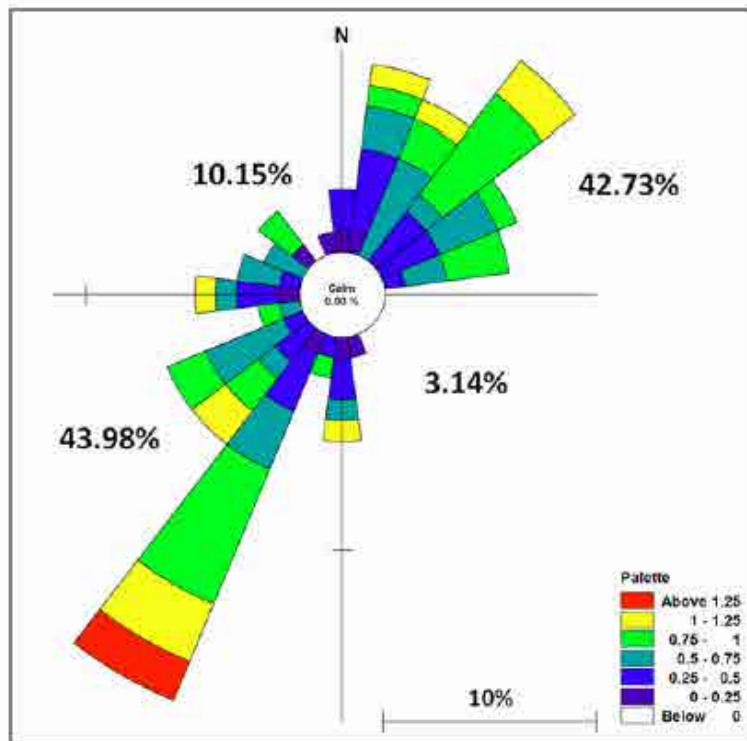


Figure -5 Current rose and of location-1 at depth of 0.2y

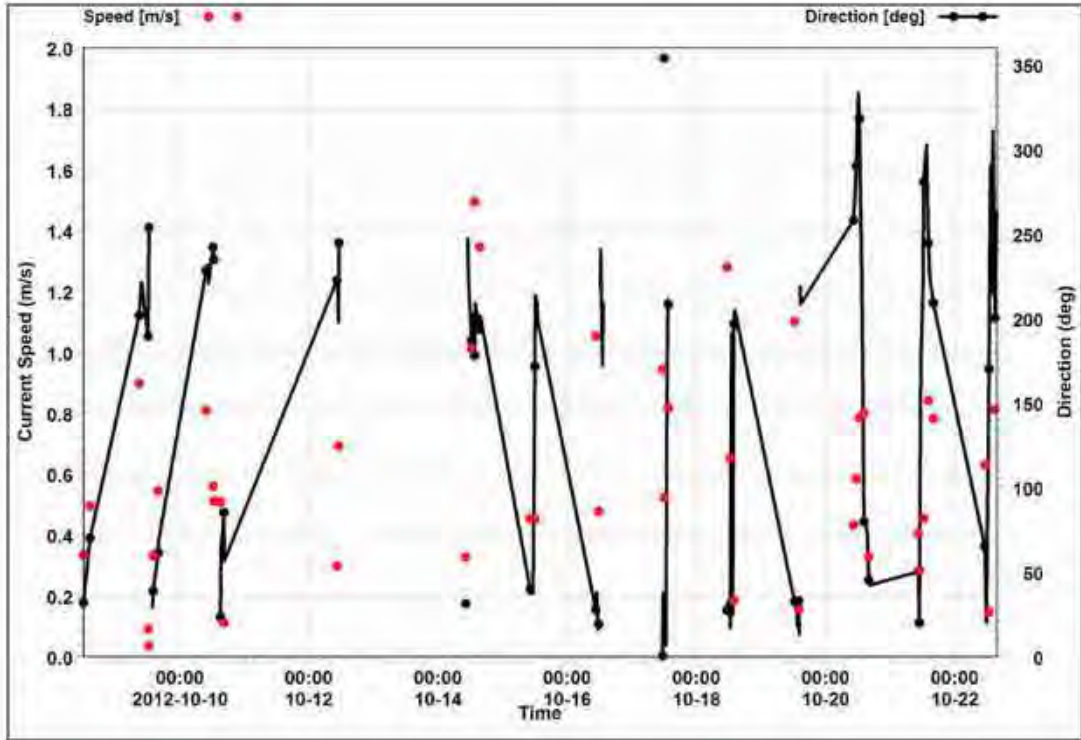


Figure -6 Variation of current speed and direction at location-2 at depth of 0.8y

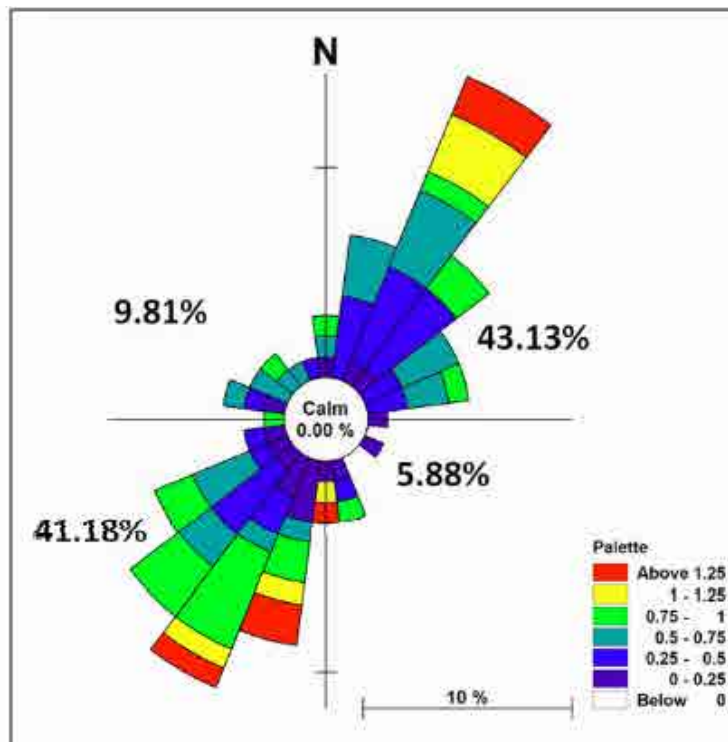


Figure -7 Current rose and of location-2 at depth of 0.8y

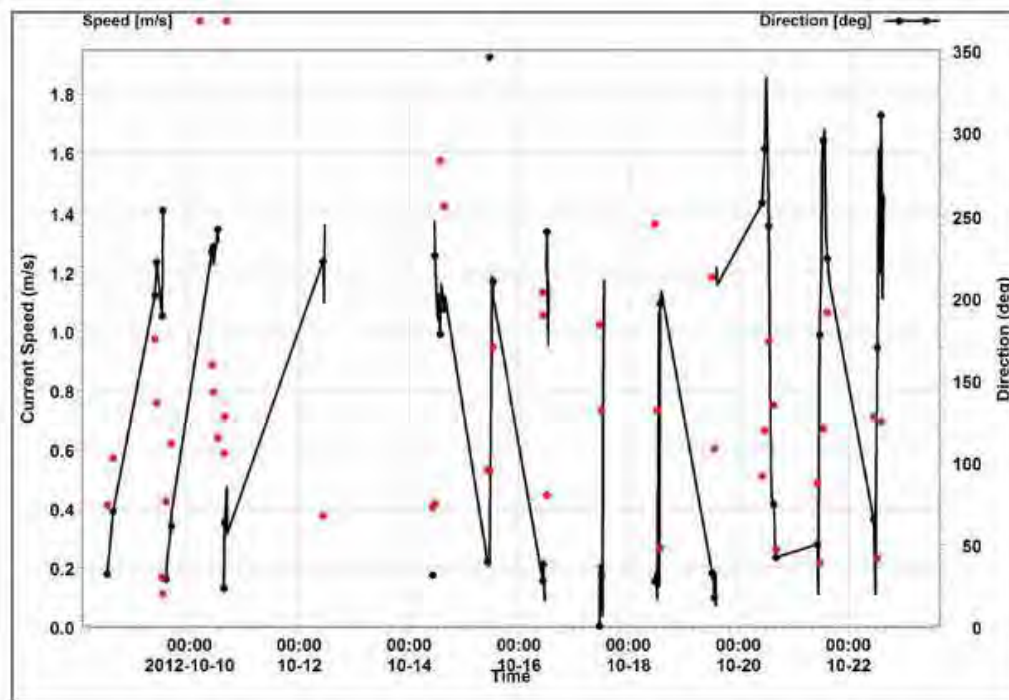


Figure -8 Variation of current speed and direction at location-2 at depth of 0.2y

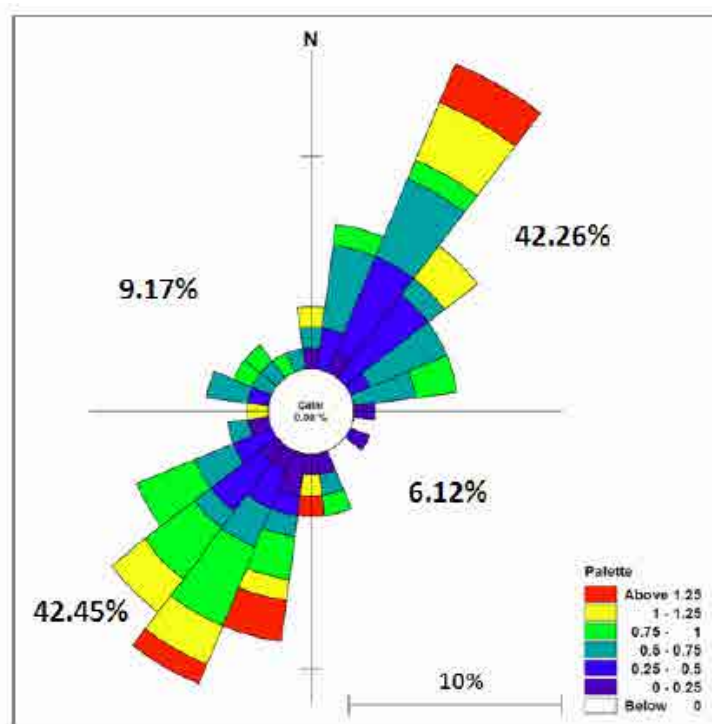


Figure -9 Current rose and of location-2 at depth of 0.2y

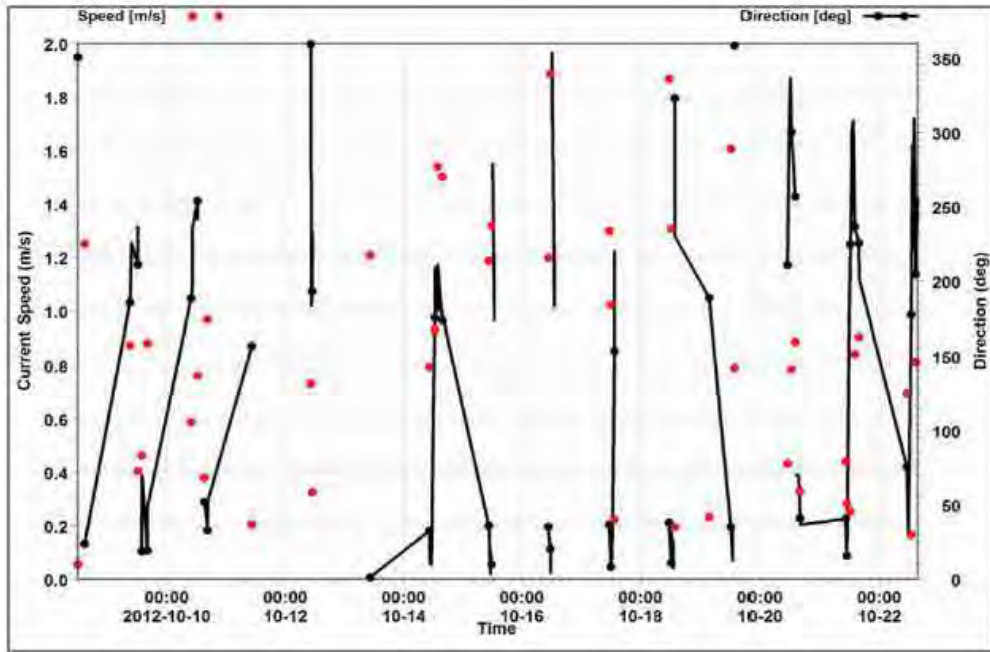


Figure -10 Variation of current speed and direction at location-3 at depth of 0.8y

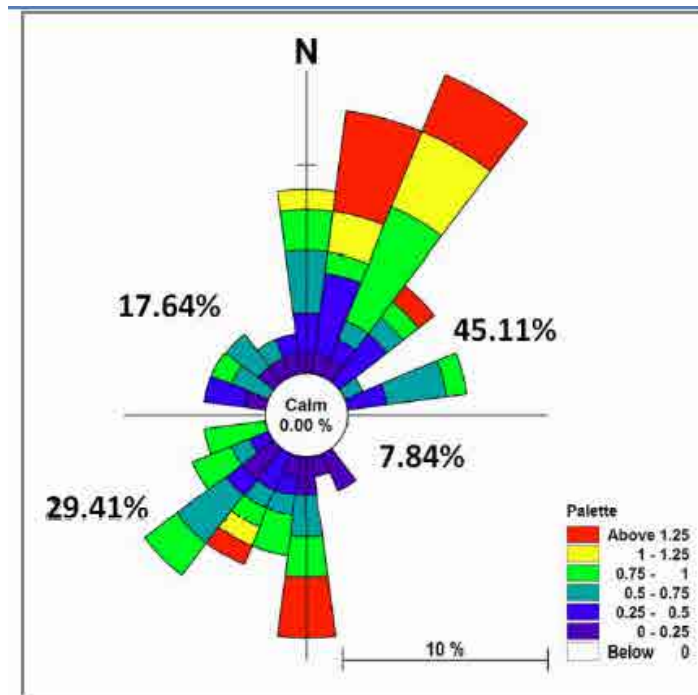


Figure -11 Current rose and of location-3 at depth of 0.8y

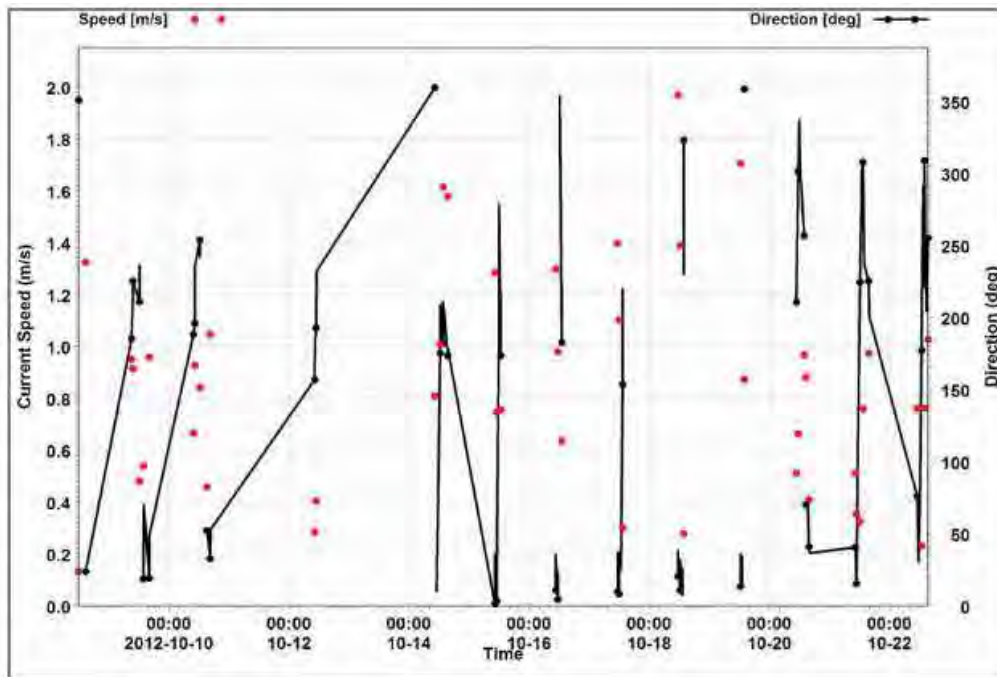


Figure -12 Variation of current speed and direction at location-3 at depth of 0.2y

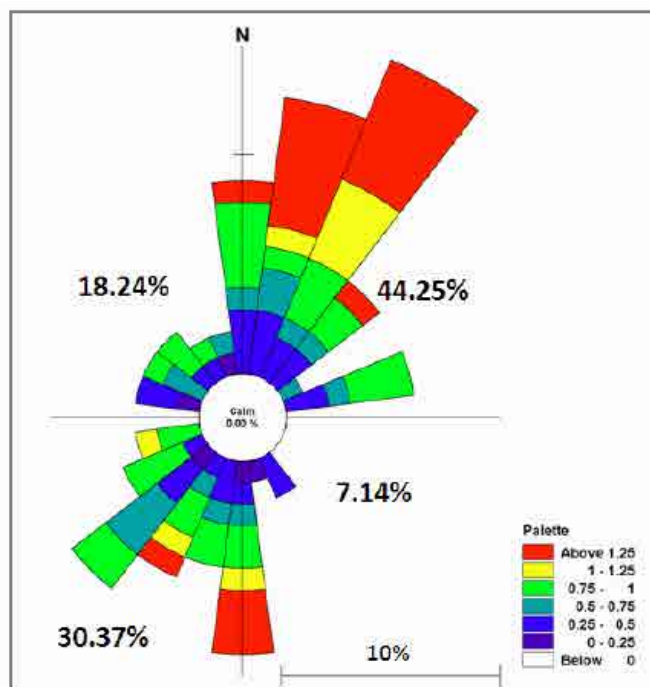


Figure -13 Current rose and of location-3 at depth of 0.2y

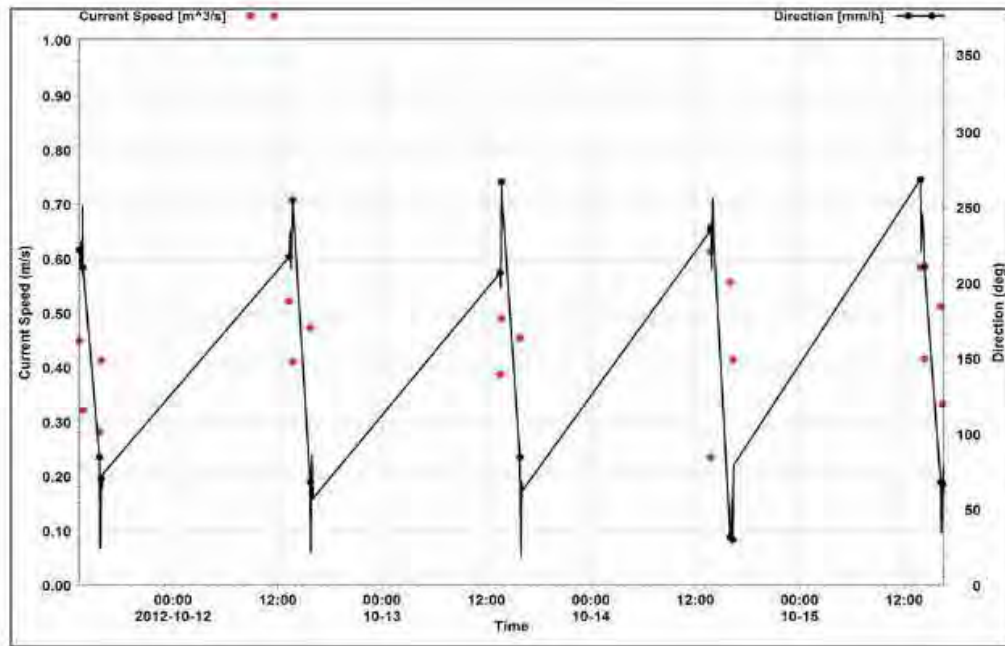


Figure -14 Variation of current speed and direction at location-4 at depth of 0.8y

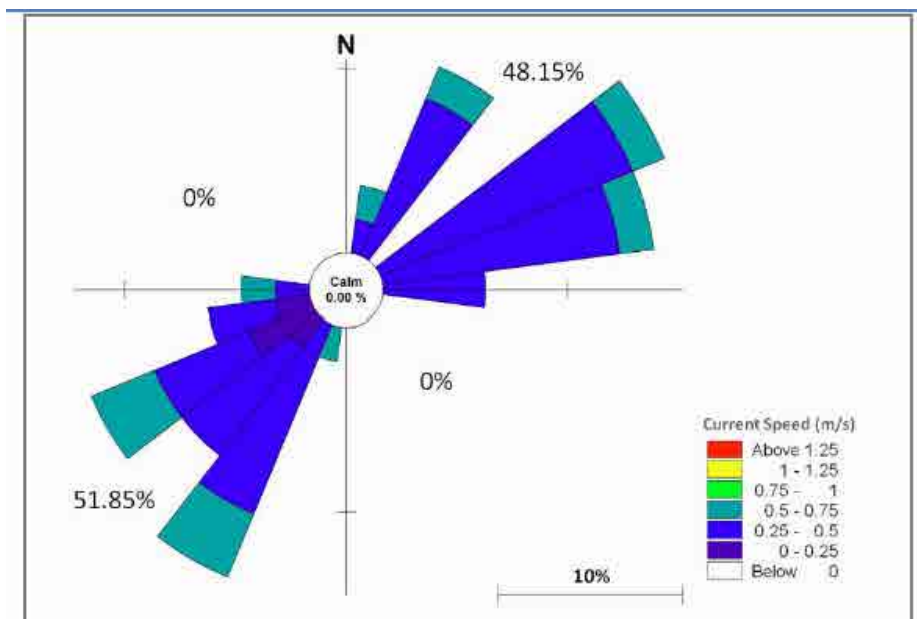


Figure -15 Current rose and of location-4 at depth of 0.8y

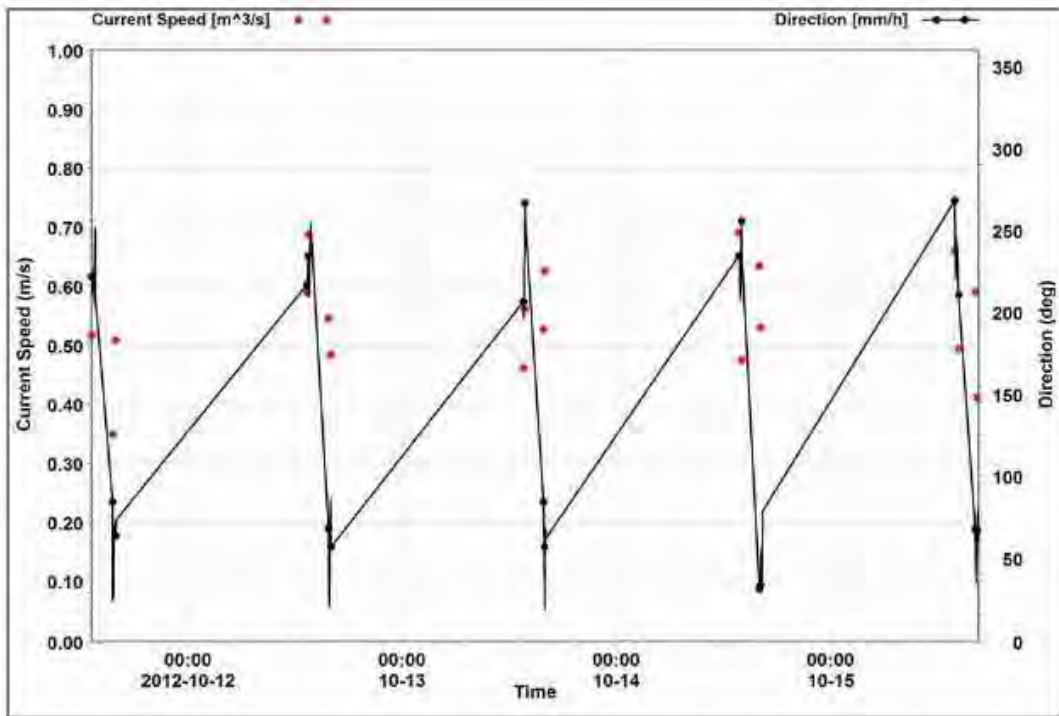


Figure -16 Variation of current speed and direction at location-4 at depth of 0.2y

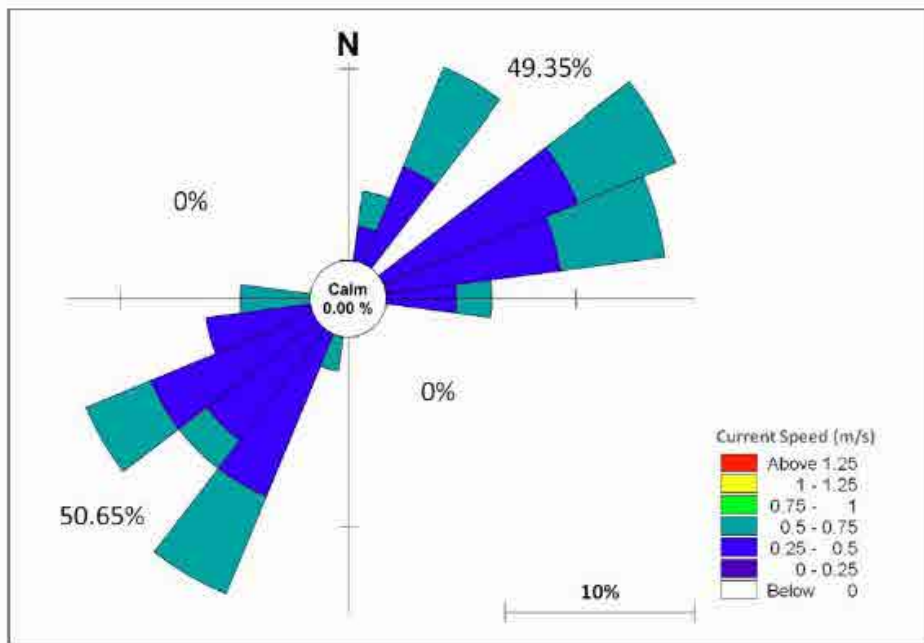


Figure-17 Current rose and of location-4 at depth of 0.2y

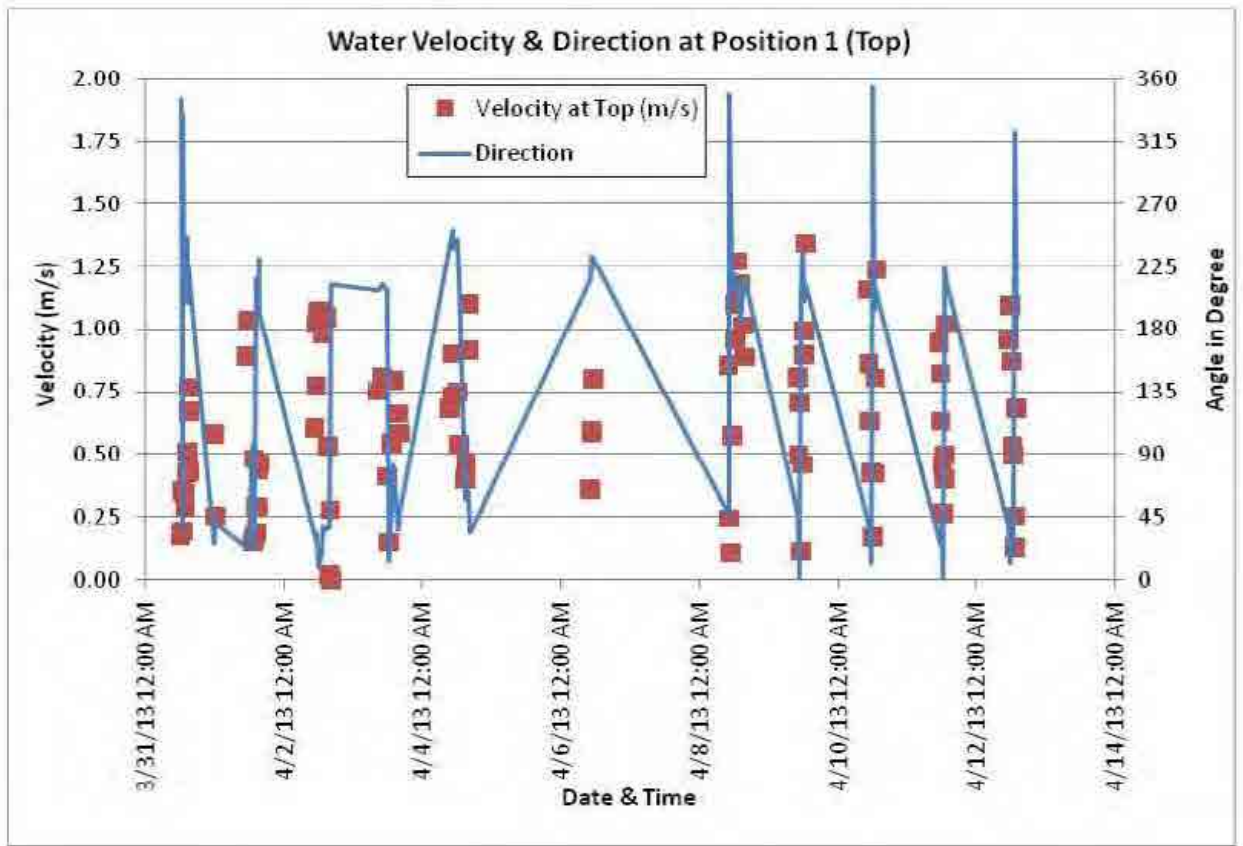


Figure -18 Variation of current speed and direction of location-1 at depth of top

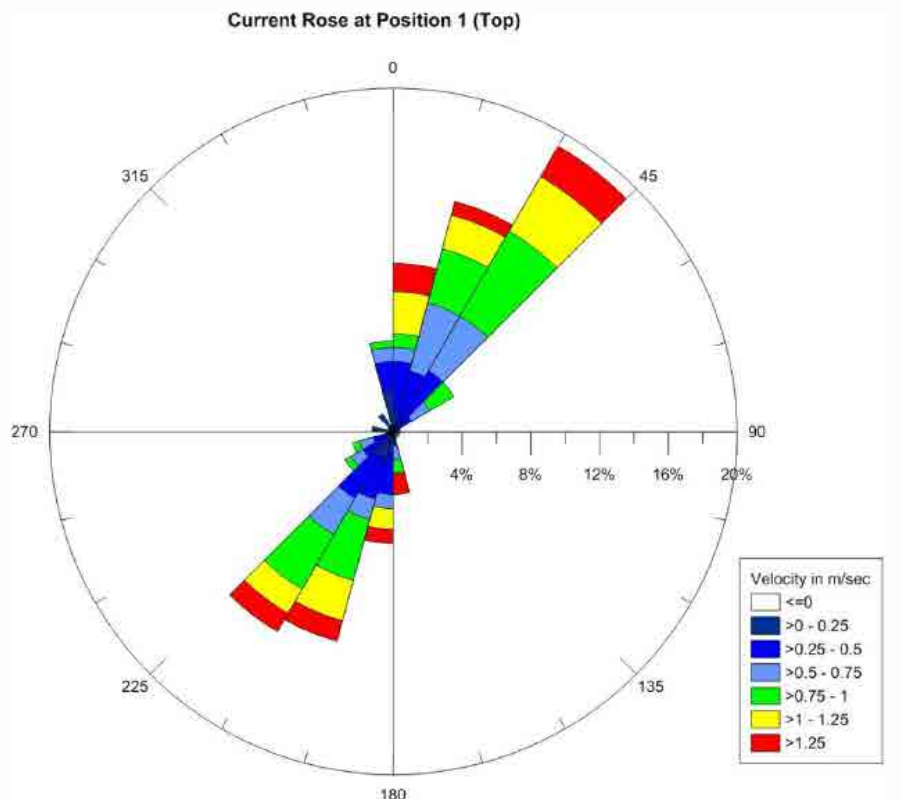


Figure -19 Current rose and of location-1 at depth of top

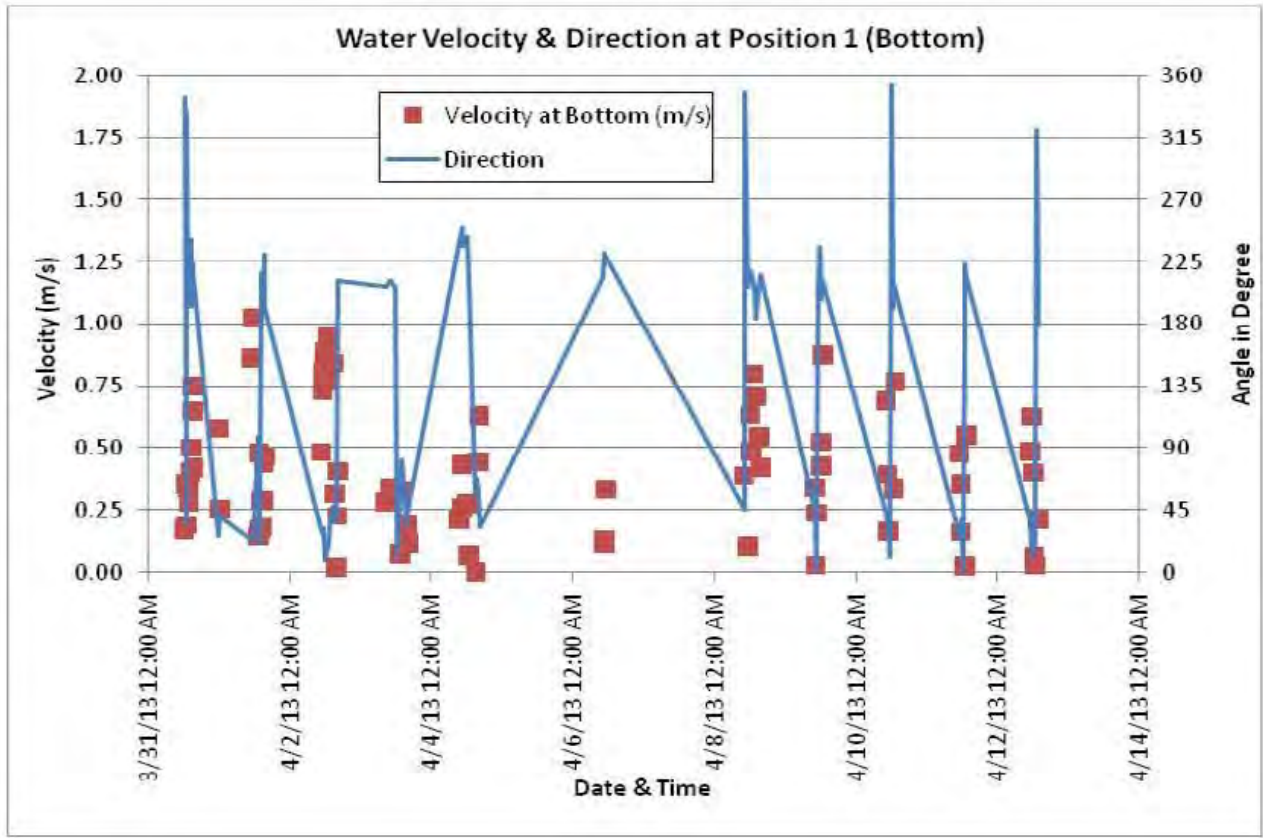


Figure -20 Variation of current speed and direction at location-1 at depth of bottom

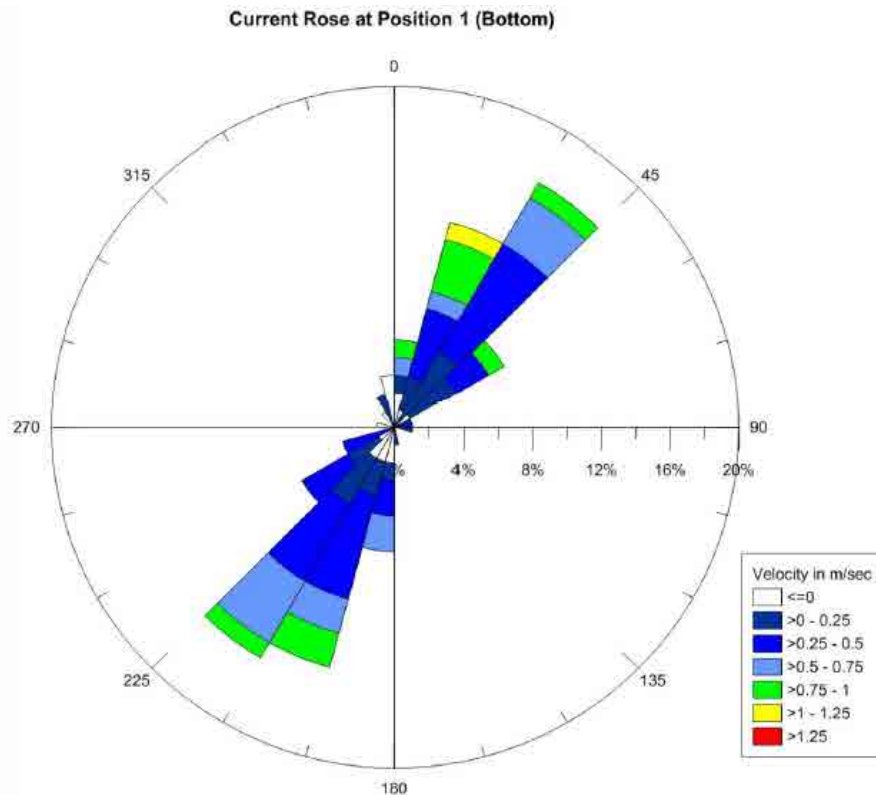


Figure -21 Current rose and of location-1 at depth of bottom

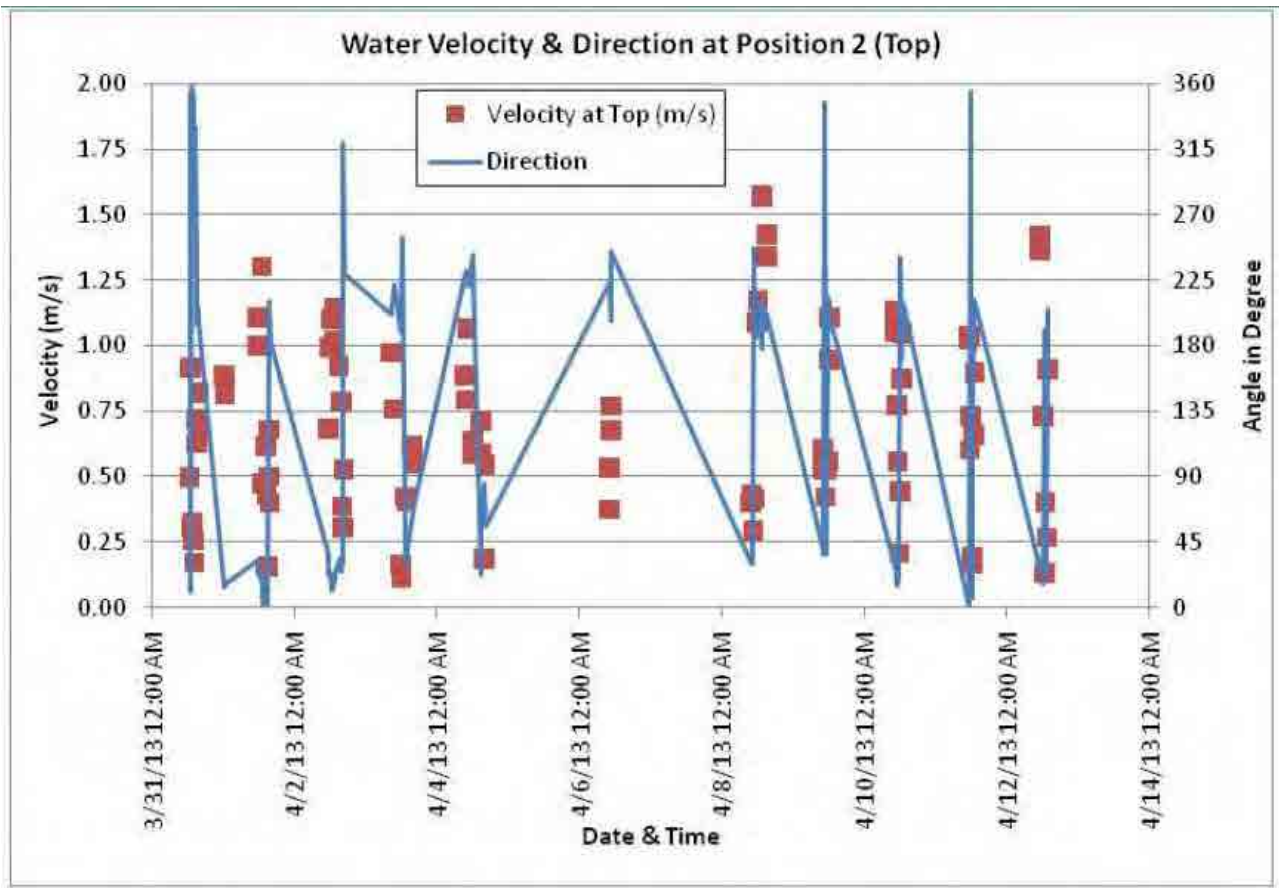


Figure -22 Variation of current speed and direction at location-2 at depth of top

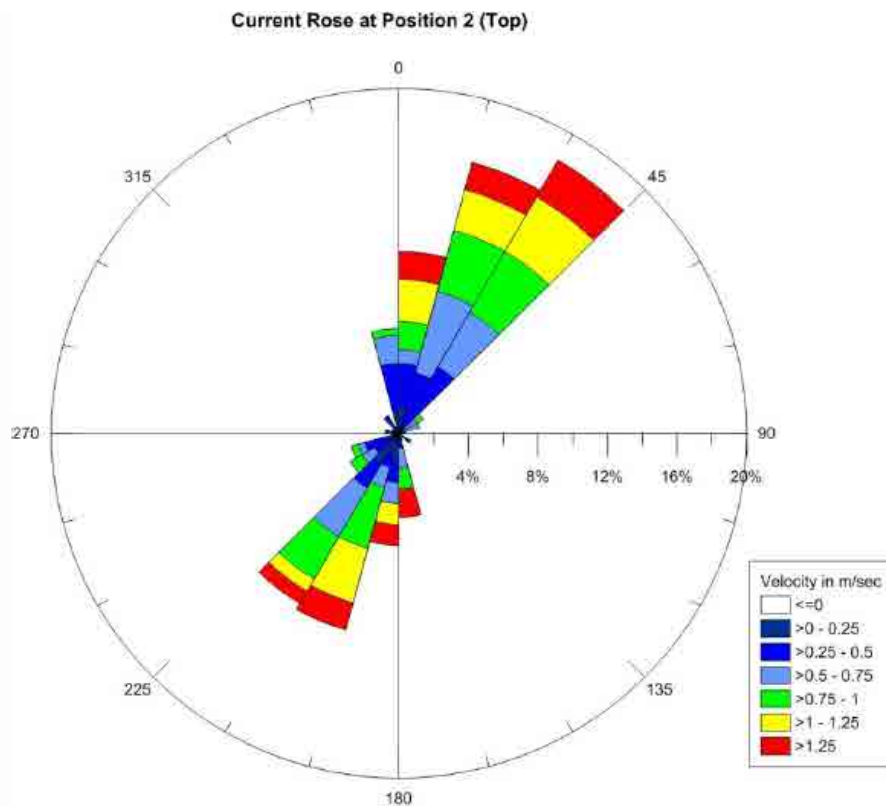


Figure -23 Current rose and of location-2 at depth of top

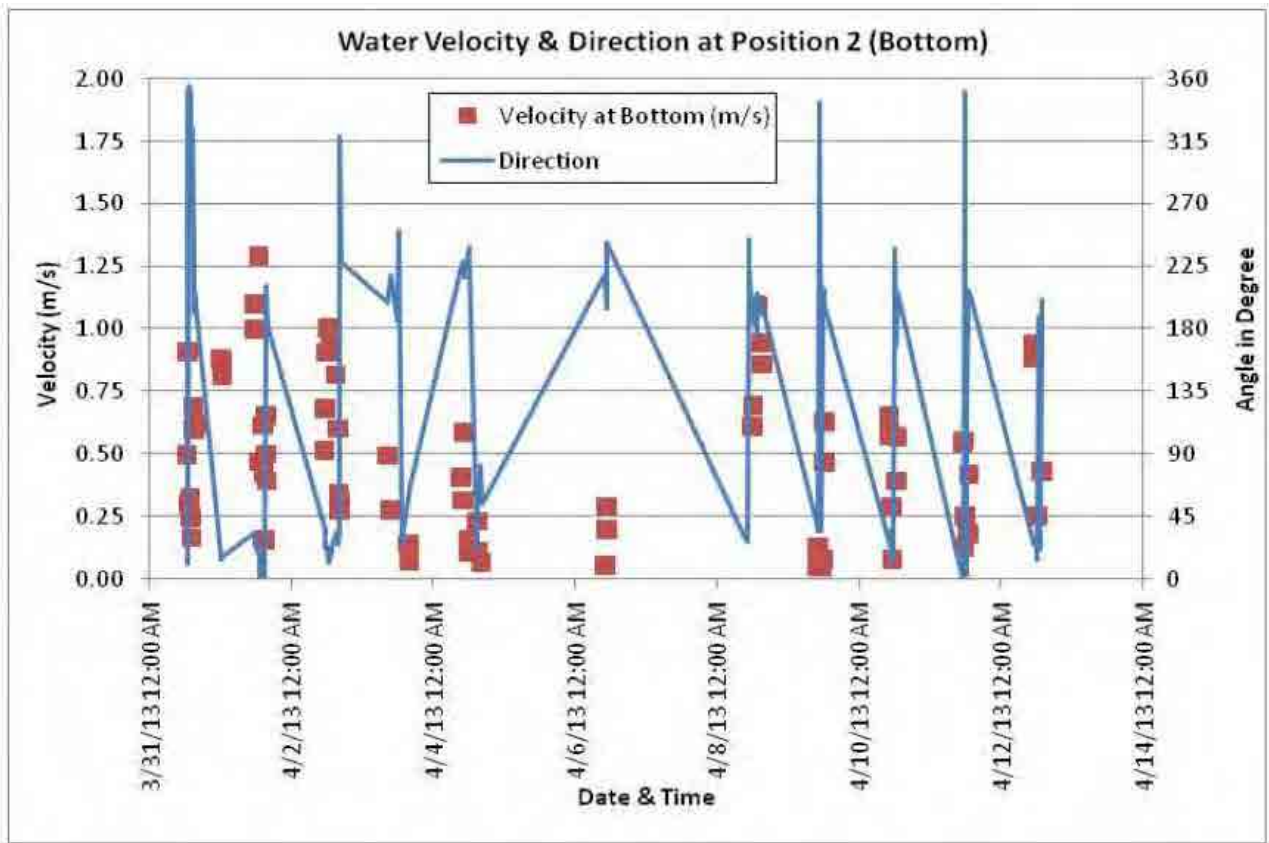


Figure -24 Variation of current speed and direction at location-2 at depth of bottom

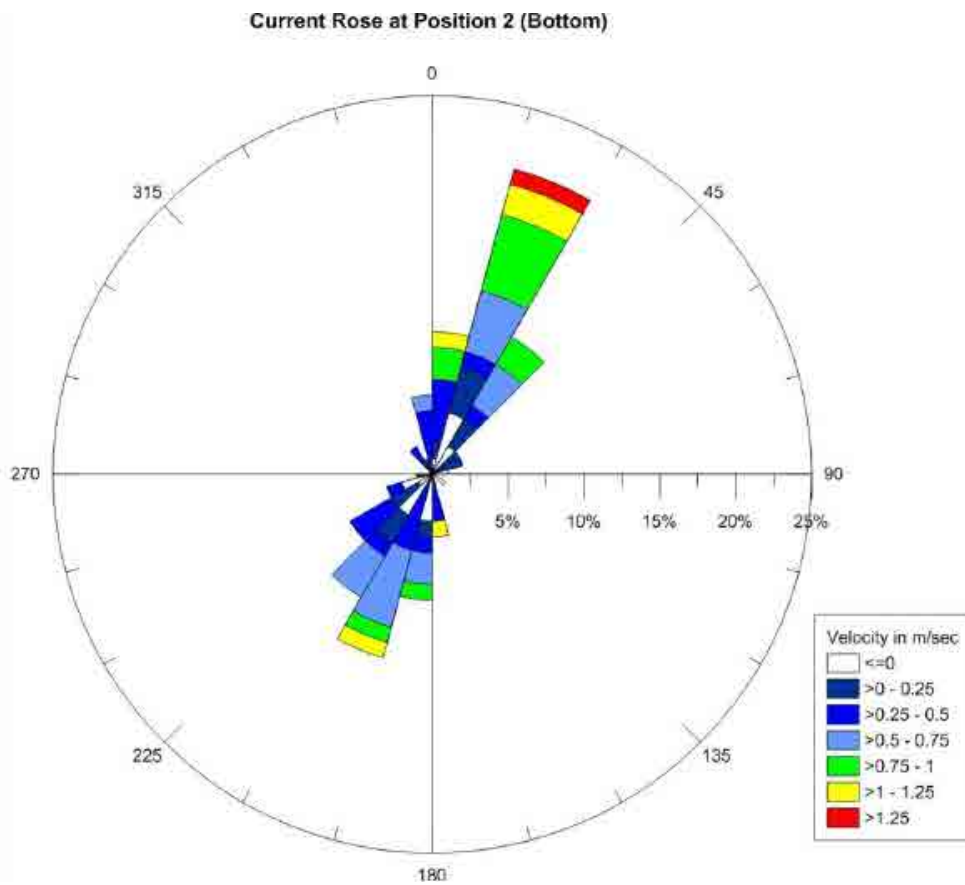


Figure -25 Current rose and of location-2 at depth of bottom

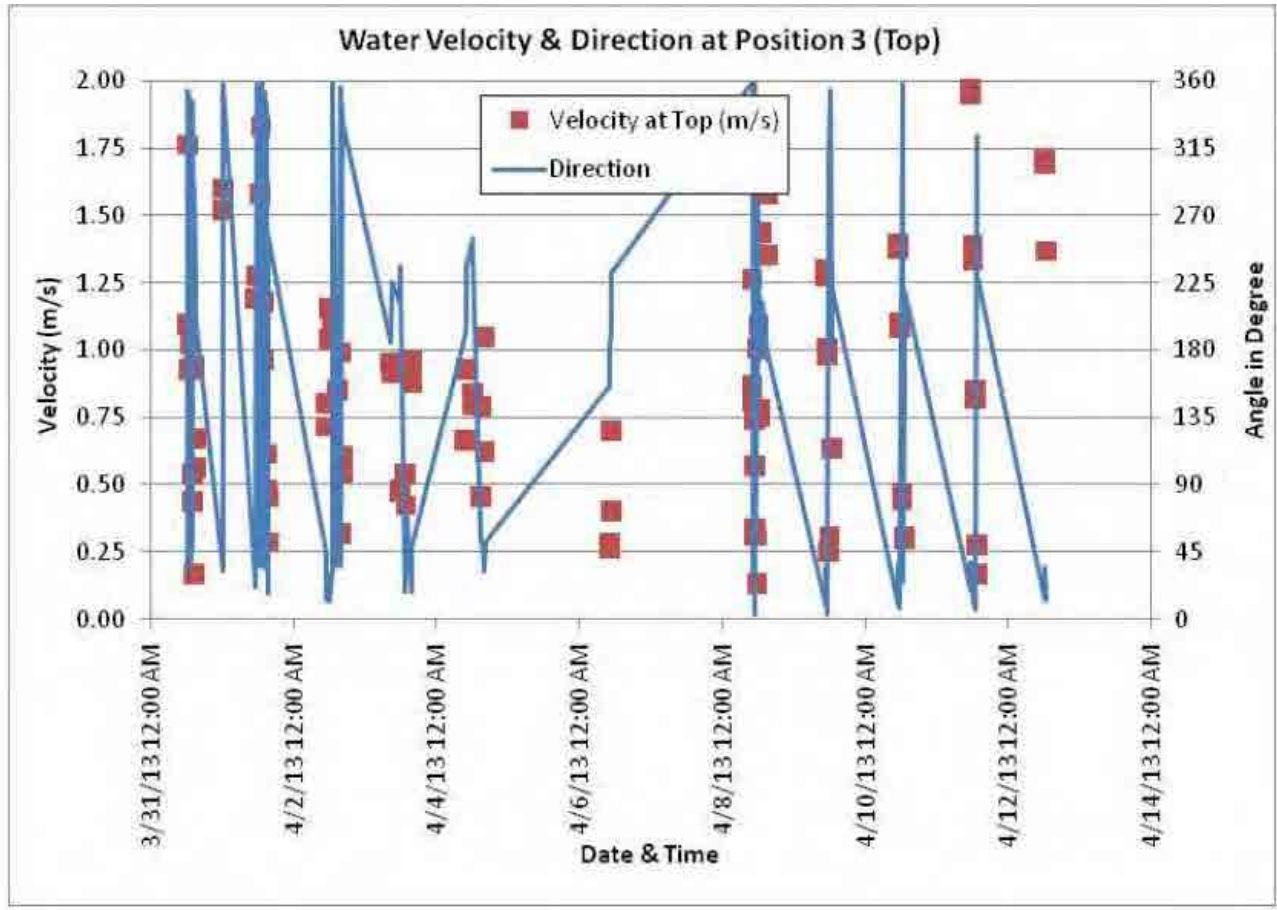


Figure -26 Variation of current speed and direction at location-3 at depth of top

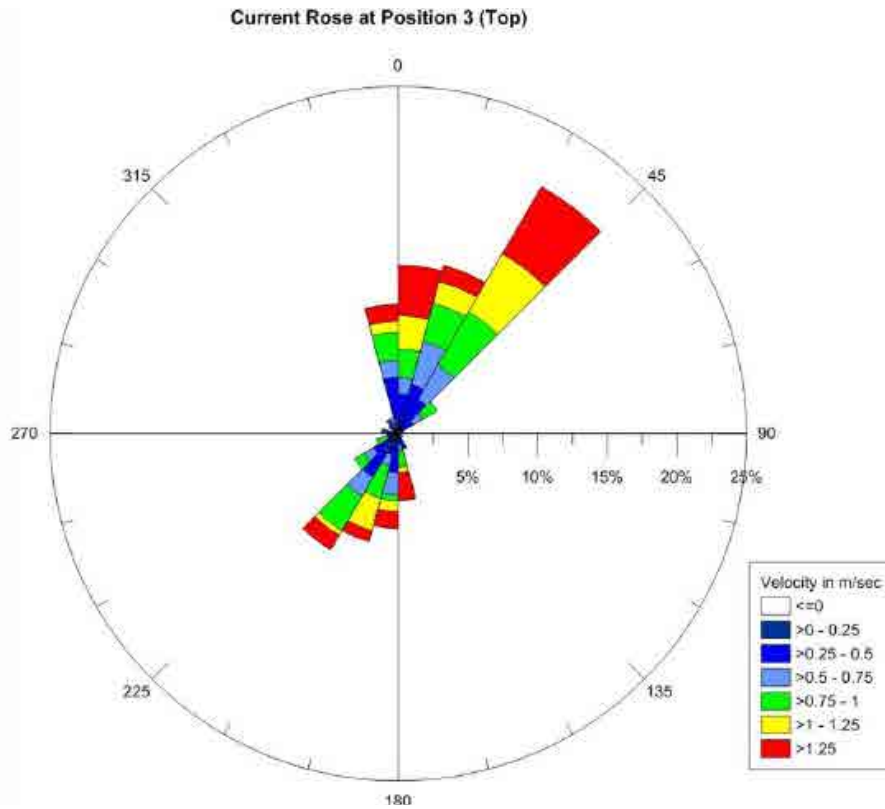


Figure -27 Current rose and of location-3 at depth of top

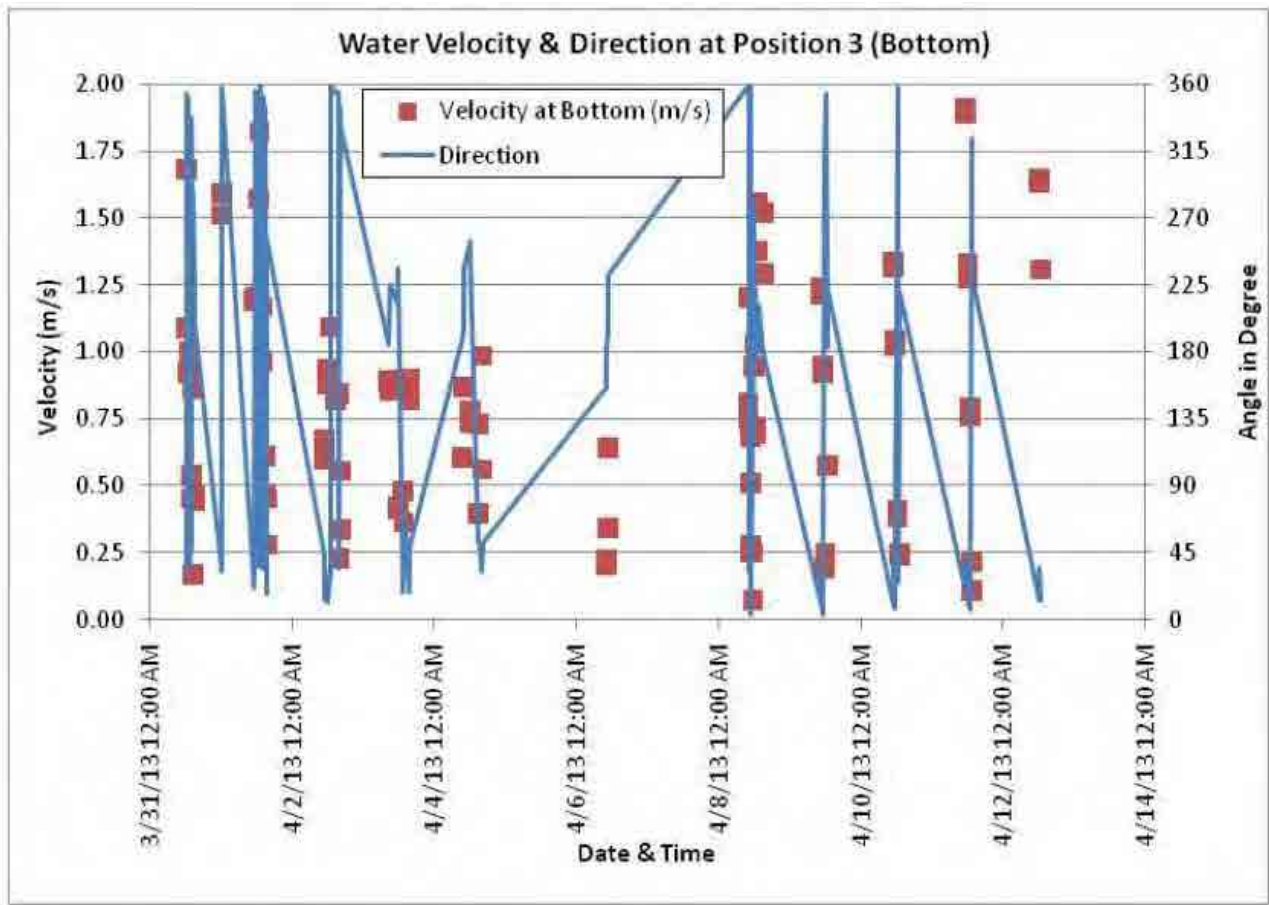


Figure -28 Variation of current speed and direction at location-3 at depth of bottom

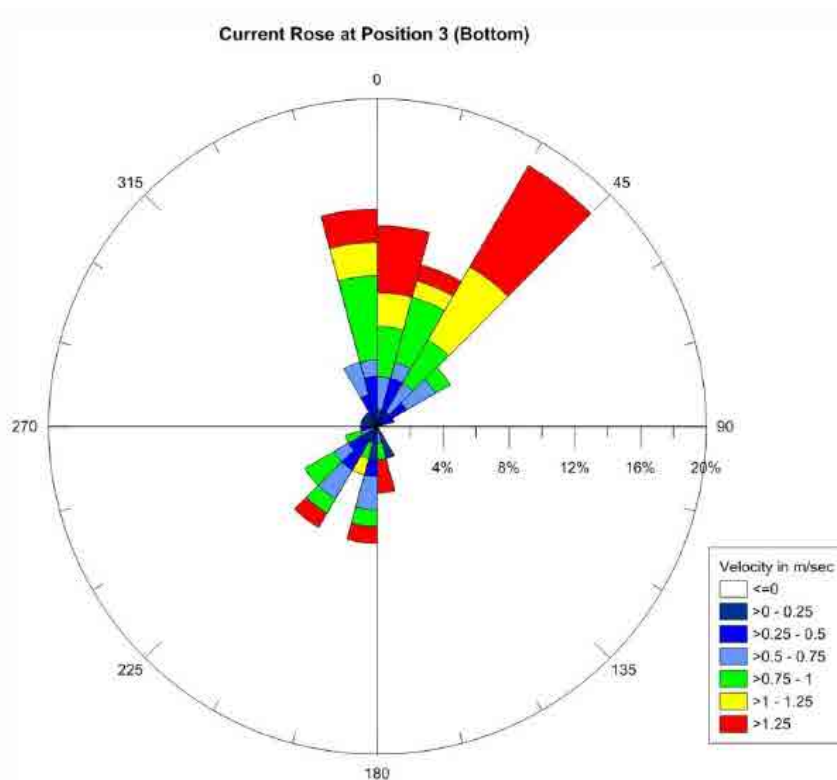


Figure -29 Current rose and of location-3 at depth of bottom

Salinity and Temperature

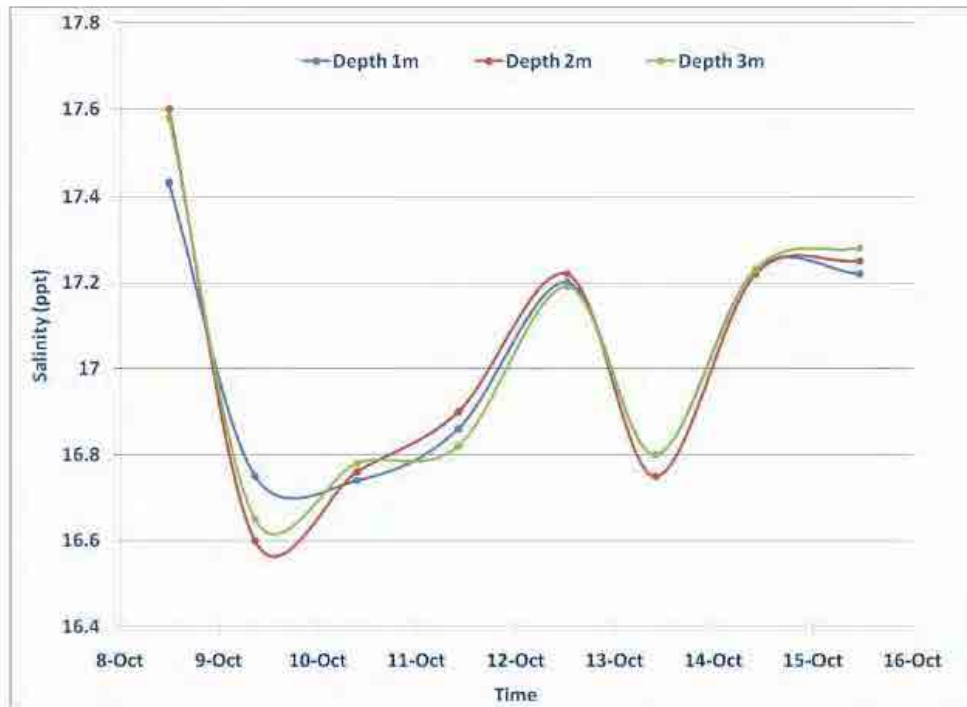


Figure-30 Salinity at position 1 with different depth

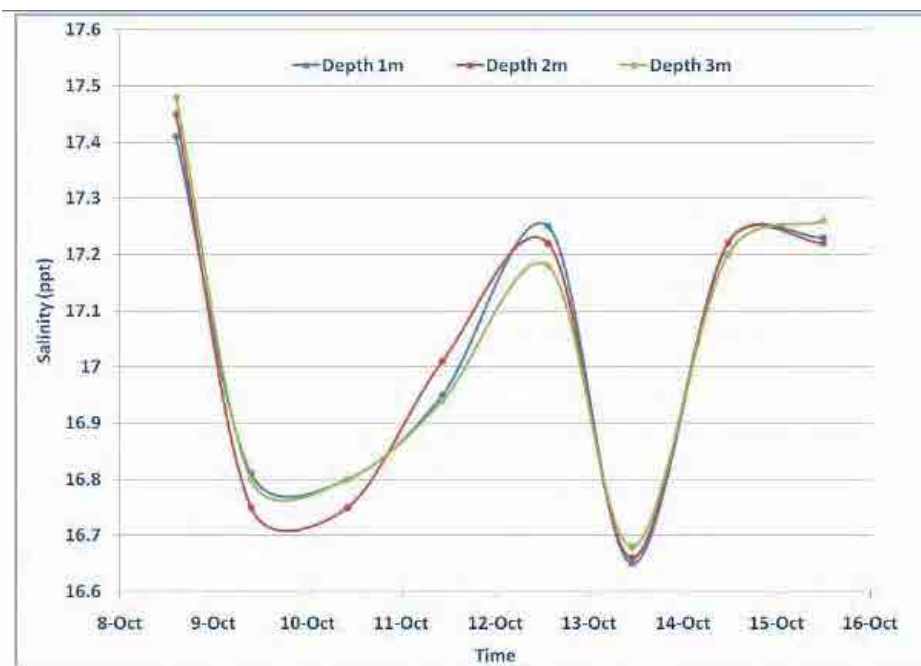


Figure-31 Salinity at position 2 with different depth

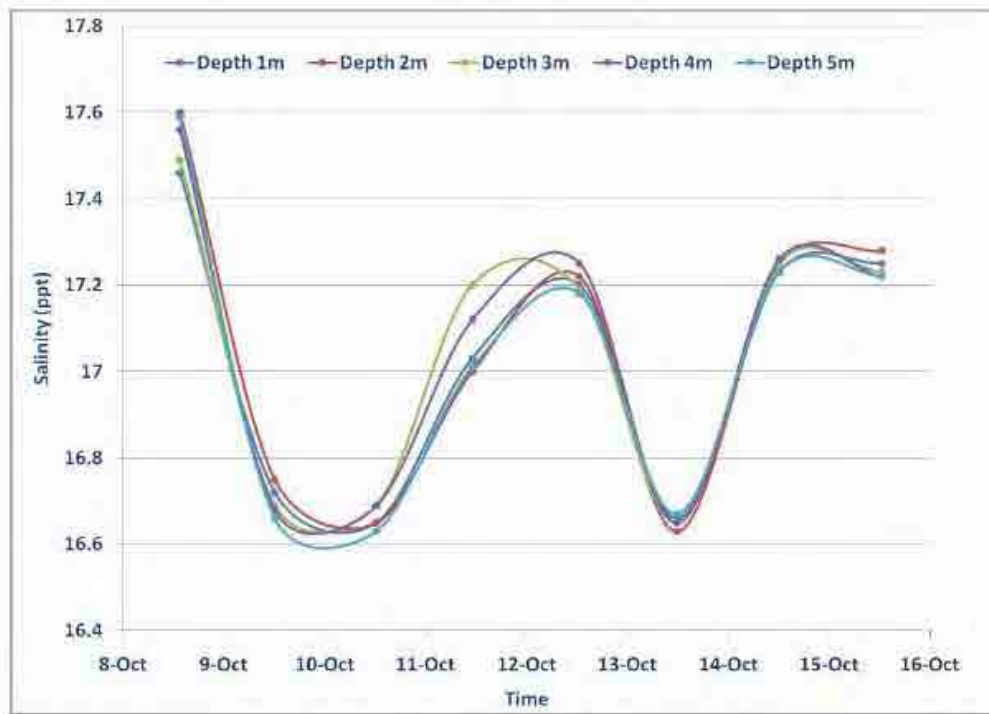


Figure-32(1) Salinity at position 3 with different depth

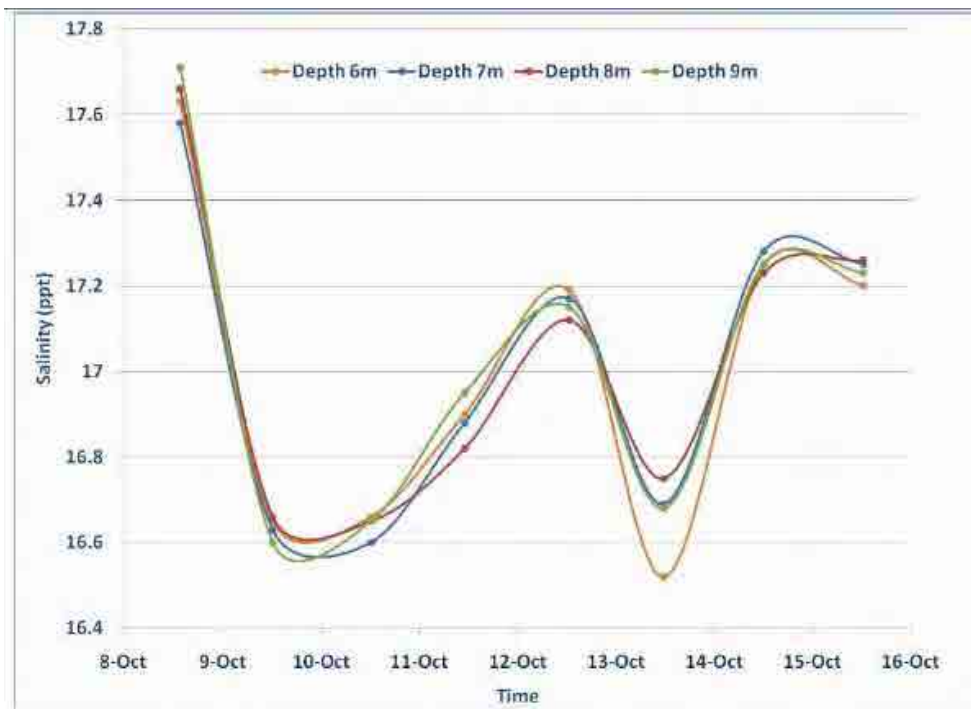


Figure-32(2) Salinity at position 3 with different depth

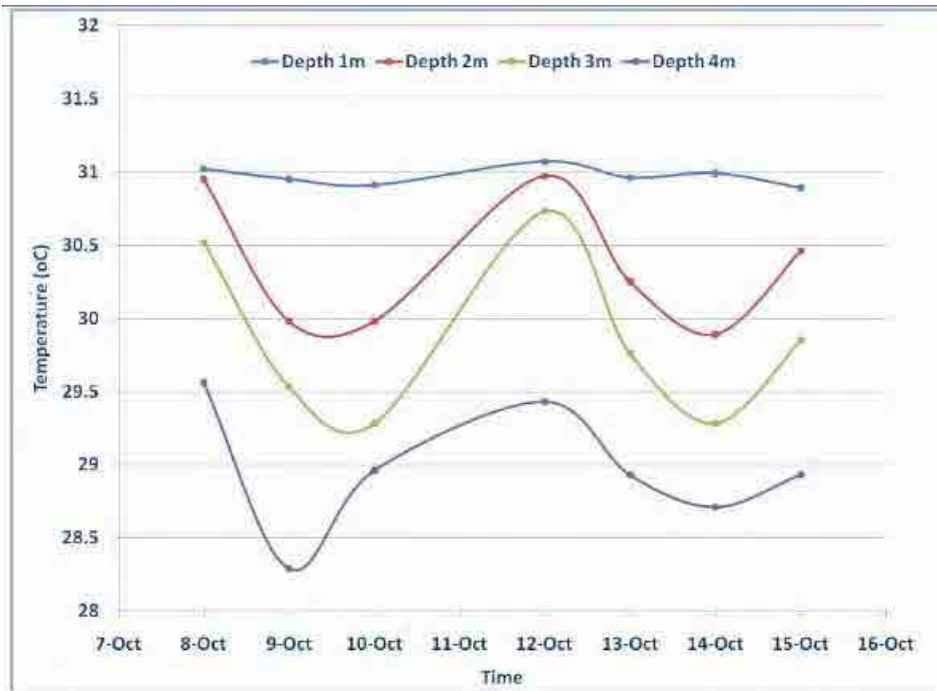


Figure-33 Temperature at position 1

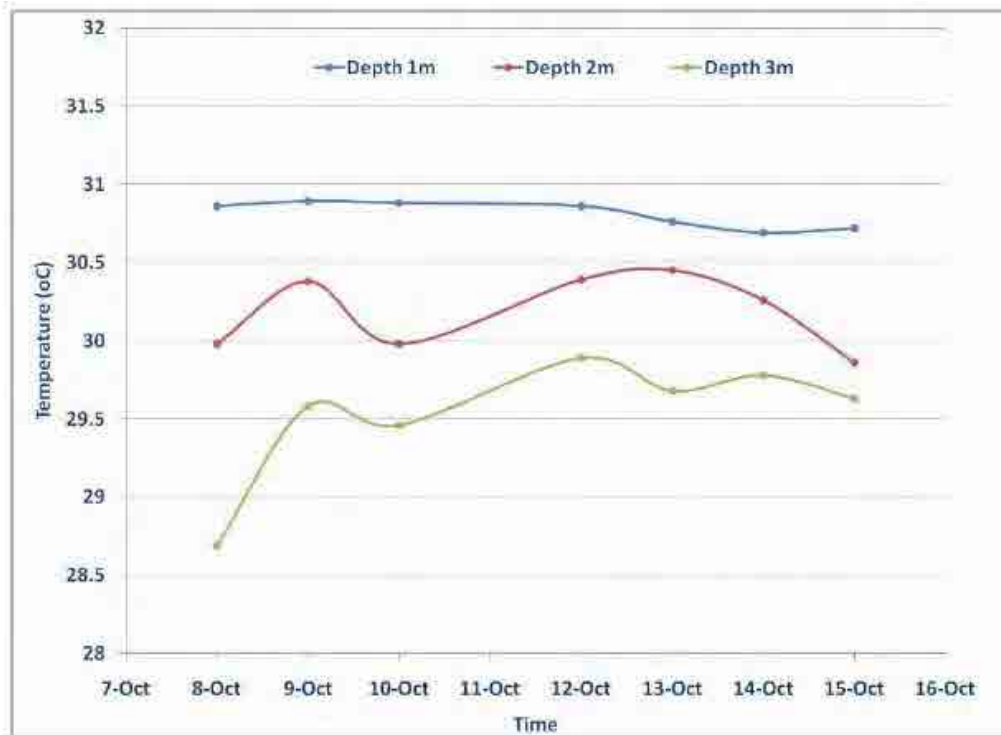


Figure-34 Temperature at position 2

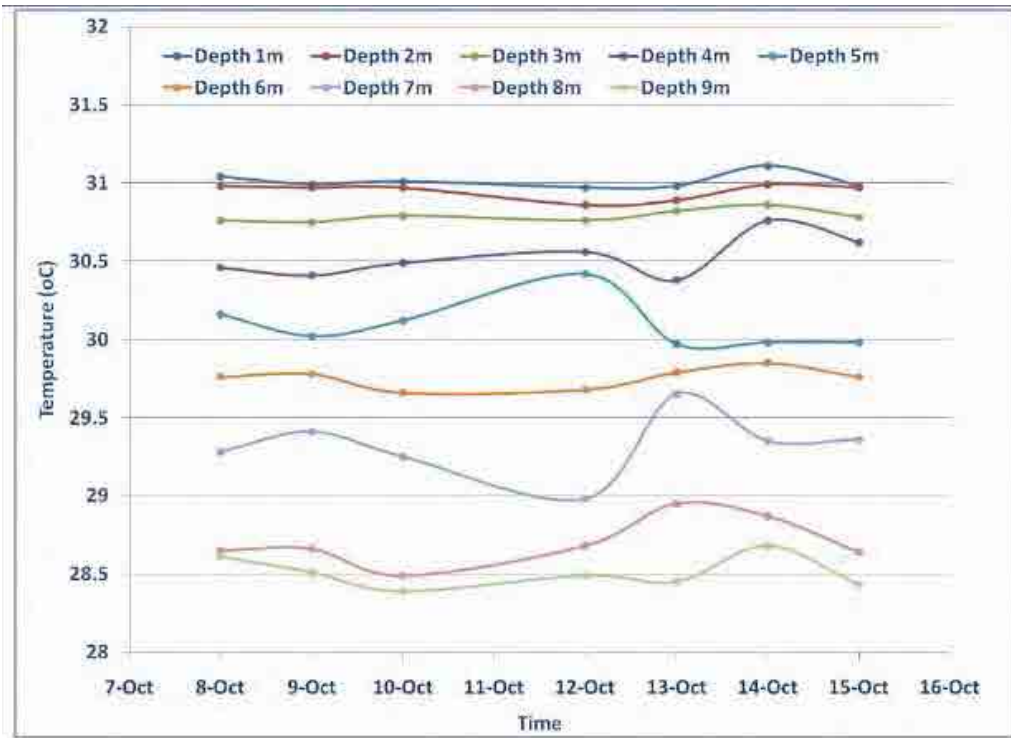


Figure-35 Temperature at position 3

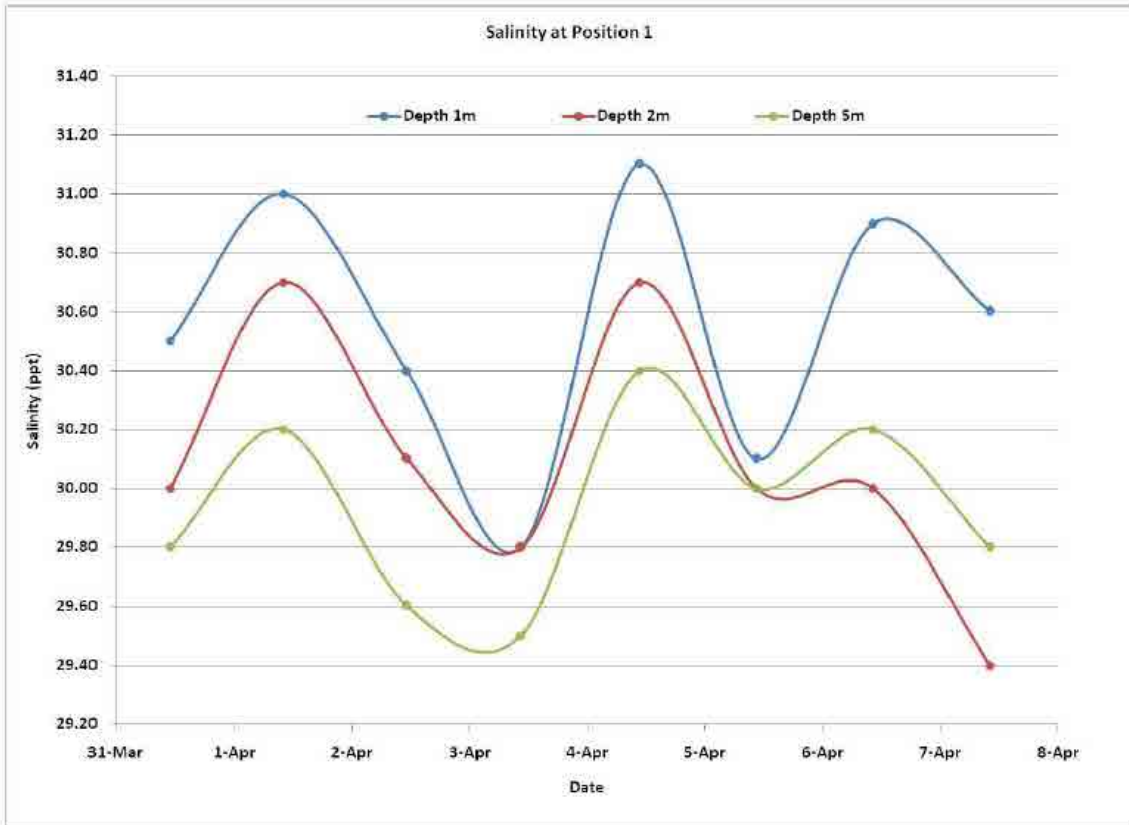


Figure-36 Salinity at position 1 with different depth

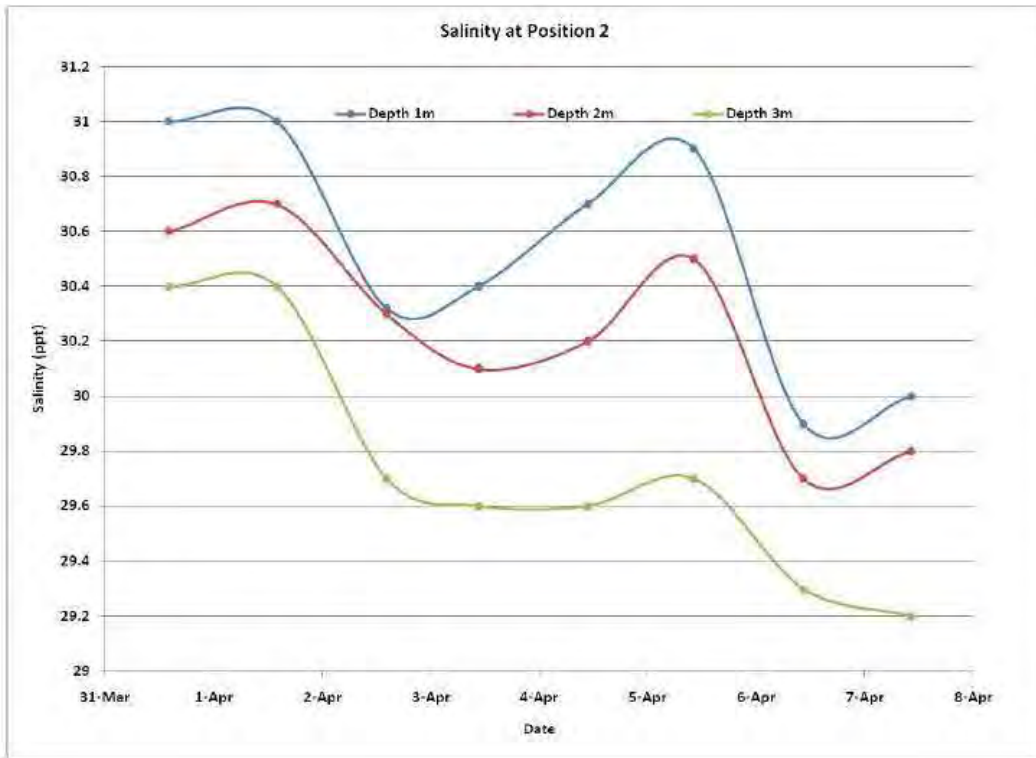


Figure-37 Salinity at position 2 with different depth

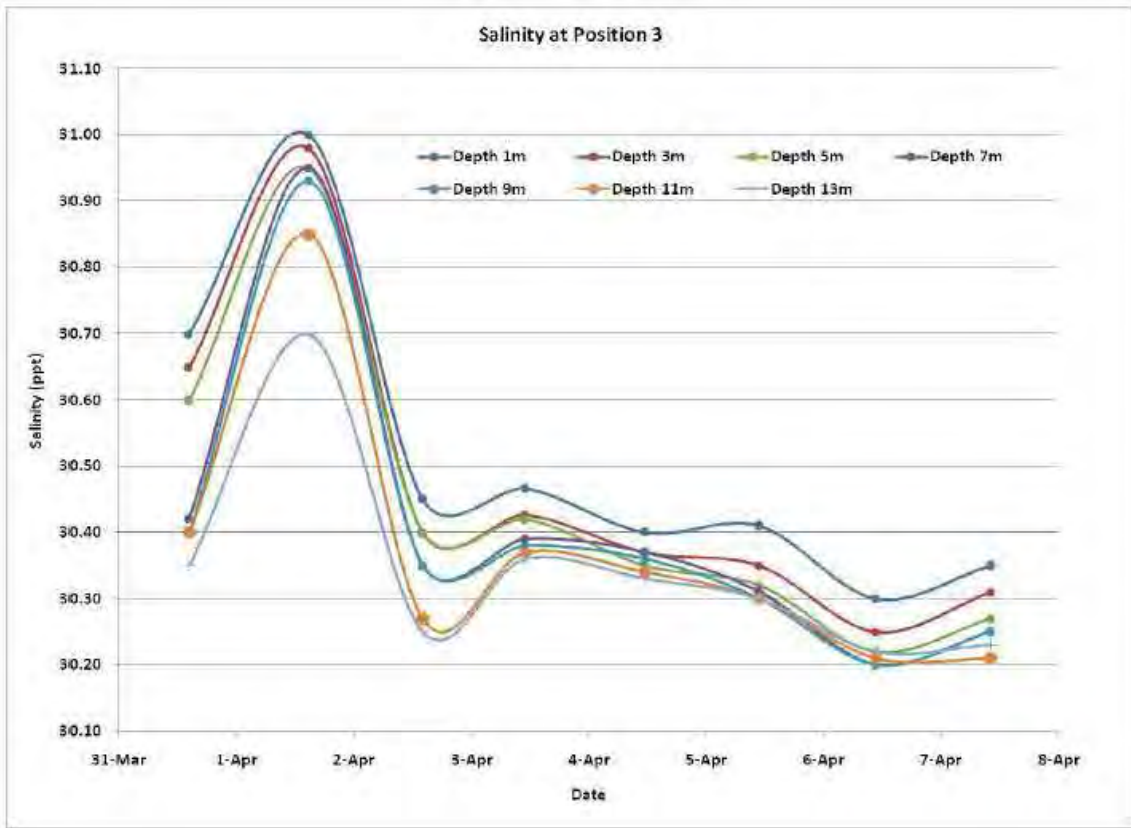


Figure-38 Salinity at position 3 with different depth

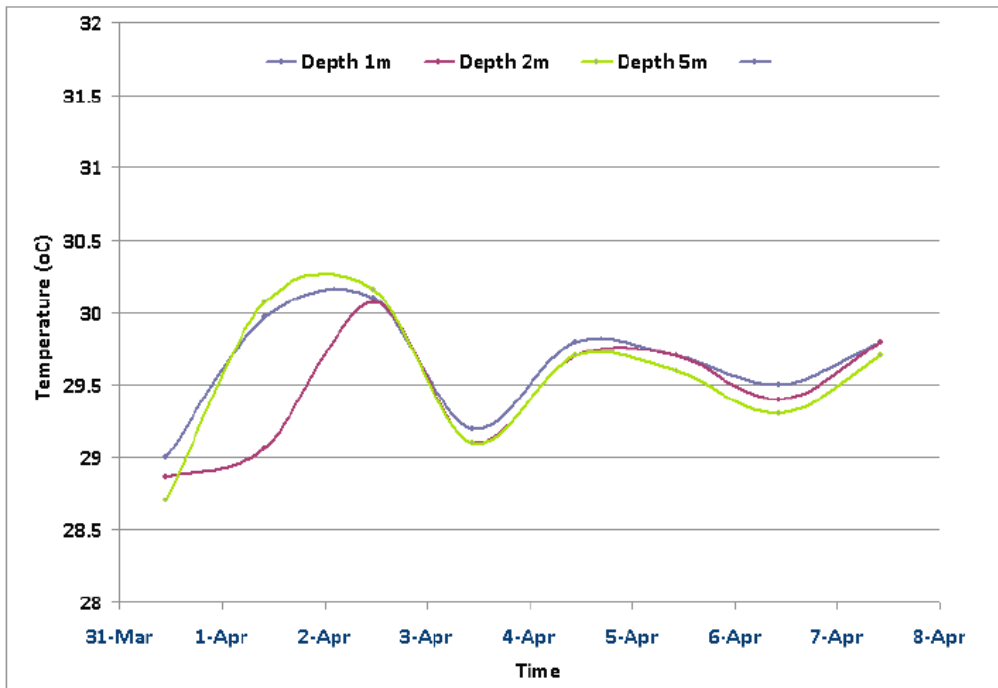


Figure-40 Temperature at position 1

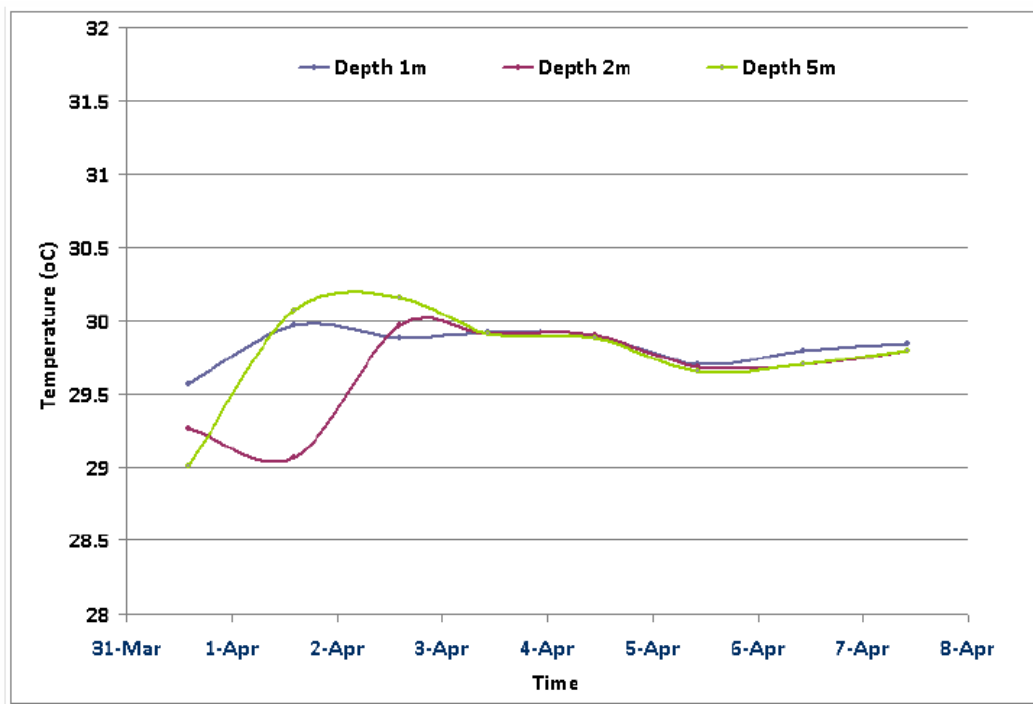


Figure-41 Temperature at position 2

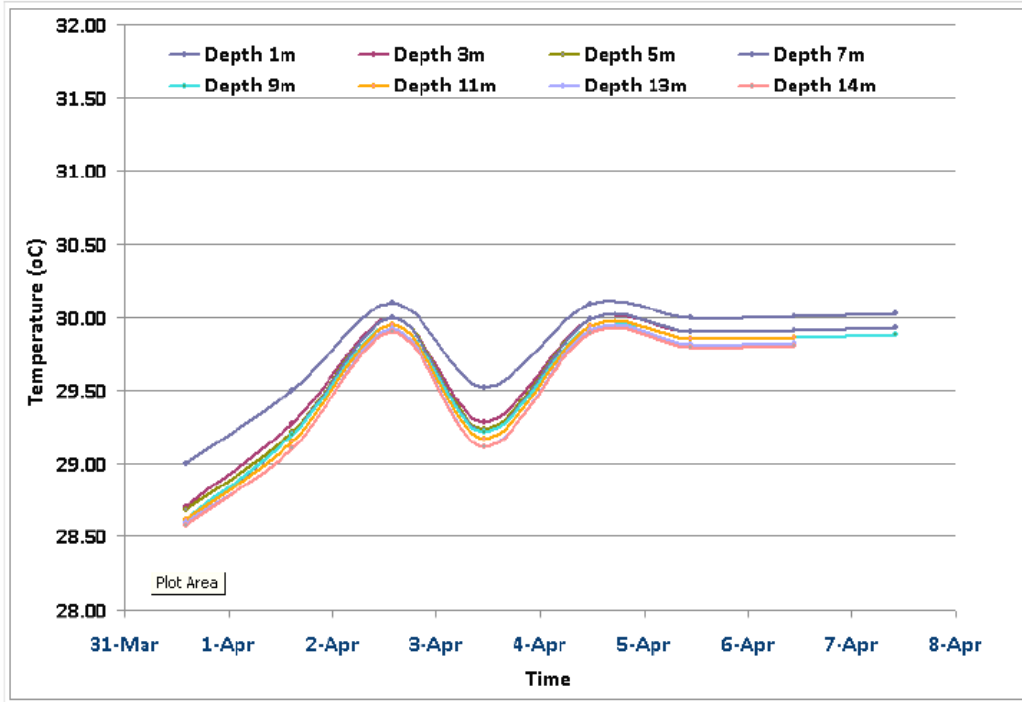


Figure-42 Temperature at position 3





Appendix-C10-1

Terms of Reference (TOR) for Design and Supervision

Consultant

Revised Draft

**Terms of Reference for Design and Supervision Consultant for Matarbari
Coal-Fired Power Plant Project in Bangladesh
- Access Road-**

Chapter1. Background

■ The Government of Bangladesh has received a loan from the Japan International Cooperation Agency (hereinafter referred to as "JICA") to finance the Matarbari Coal-Fired Power Plant Project including its Access Road in Bangladesh which is to secure the power supply and to develop a policy of power source diversification in the Power sector which highly depends on natural gas.

■ The Project comprises of the following components:

Lot 1(1): Power Plant- Port & Harbor and Civil Work

Lot 1(2): Power Plant- Boiler and Auxiliaries

Lot 1(3): Power Plant- Turbine, Generator and Auxiliaries

Lot 1(4): Power Plant- Coal and Ash handling

Lot 2: 400kV Transmission line to Anowara Substation

Lot 3: Access Road

- Construction of new road and new bridge
- Reconstruction of jetty
- Rehabilitation and repair of existing road
- Road repair work

ToR for the construction project of the access road for the Project (hereinafter referred to as "Access Road Project") has been designated as follows.

■ GOB intends to use part of the proceeds of the loan for eligible payments for consulting services for which this ToR is issued.

■ The Access Road Project is expected to be completed by December 2020.

■ Location of the Project: Chittagon Area

■ Executing Agency: Roads and Highways Department (hereinafter referred to as "RHD")

■ Technical information:

■ Feasibility Study Report, "Preparatory Survey on Matarbari Coal-Fired Power Plant Development Project in Bangladesh" (hereinafter referred to as "the F/S")

Chapter2. Objectives of consulting services

The consulting services shall be provided by an international consulting firm (hereinafter referred to as "the Consultant") in association with national consultants in compliance with Guidelines for the Employment of Consultants under Japanese ODA Loans (April 2012). The objective of the consulting services is to achieve the efficient and proper preparation and implementation of the Access Road Project through the following works;

- (1) Detailed design
- (2) Tender assistance
- (3) Construction supervision
- (4) Facilitation of implementation of Environmental Management Plan (EMP), Environmental Monitoring Plan (EMoP) and Resettlement Action Plan (RAP)

Chapter3. Scope of consulting services

3.1 General Terms of Reference

(1) Detailed design

The Consultant shall:

- (a) Review and verify all available primary and secondary data collected during the JICA's preparatory survey for the Access Road Project;
- (b) Carry out all the required engineering surveys and investigations such as topographical survey, hydrological survey, geotechnical survey, material availability survey, etc., as applicable to the concerned project components.
- (c) Prepare detailed work plan, progress reports and implementation schedule for the Access Road Project to ensure effective monitoring and timely project outputs, and regularly update the same; and
- (d) Prepare the detailed design of the Access Road Project in sufficient detail to ensure clarity and understanding by RHD, contractors and other relevant stakeholders. All the design should be in conformity with the Bangladesh's Standards (if available), or with the appropriate international standards. The detailed design will, as a minimum, include construction drawings, detailed cost estimates, necessary calculations to determine and justify the engineering details for the Access Road Project, associated contract documentation to include detailed specifications, bill of quantities (BOQ) and implementation schedule for the Access Road Project. Such specifications will contain those in relation to i) quality control of materials and workmanship, ii) safety, and iii) protection of the environment. The detailed design shall be prepared in close consultation with, and to meet the requirements of RHD and will be incorporated into the detailed design report to be submitted for approval of RHD.

(2) Tender assistance

- Assistance in Pre-Qualification (PQ)

The Consultant shall:

- (a) Define technical and financial requirements, capacity and/or experience for PQ criteria taking into consideration technical feature of the Access Road Project;
- (b) Prepare PQ documents in accordance with the latest version of Standard Prequalification Documents under Japanese ODA Loans;
- (c) Assist RHD in PQ announcement, addendum/corrigendum, and clarifications to the applicants' queries;
- (d) Evaluate PQ applications in accordance with the criteria set forth in PQ documents; and

(e) Prepare a PQ evaluation report for approval of the PQ evaluation committee.

● Assistance in the Bidding Procedures

The Consultant shall:

- (a) Prepare bidding documents in accordance with the latest version of Standard Bidding Documents under Japanese ODA Loans for Procurement of Works together with all relevant specifications, drawings and other documents;
- (b) Prepare bidding documents which includes the clauses to have Contractor comply with the requirement of the Environmental Management Plan (EMP) and JICA Guidelines for environmental and social considerations (April 2010) (JICA Environmental Guidelines);
- (c) Assist RHD in issuing bid invitation, conducting pre-bid conferences, issuing addendum/corrigendum, and clarifications to bidders' queries;
- (d) Evaluate bids in accordance with the criteria set forth in the bidding documents. In such evaluation, the Consultant shall carefully confirm that bidders' submissions in their technical proposal including, but not limited to, site organization, mobilization schedule, method statement, construction schedule, safety plan, and EMP have been prepared in harmony each other and will meet such requirements set forth in applicable laws and regulations, specifications and other parts of the bidding documents;
- (e) Prepare a bid evaluation report for approval of the bid evaluation committee;
- (f) Assist RHD in contract negotiation by preparing agenda and facilitating negotiations including preparation of minutes of negotiation meeting; and
- (g) Prepare a draft and final contract agreement.

(3) Construction supervision

The Consultant shall perform his duties during the construction period in accordance with the contracts to be executed between the Employer and the contractors. FIDIC MDB Harmonized Edition (2010) complemented with the Specific Provisions as included in the Standard Bidding Documents under Japanese ODA Loans for Procurement of Works will be applied to the civil works of the Project. In this context, the Consultant shall:

- (a) Act as the Engineer to execute construction supervision and contract administration services in accordance with the power and authority to be delegated by RHD;
- (b) Provide assistance to the Employer concerning variations and claims which are to be ordered/issued at the initiative of the Employer;
- (c) Issue the commencement order to the Contractors;
- (d) Provide recommendation to RHD for acceptance of the Contractor Performance security, advance payment security and required insurances;

- (e) Review and approve the proposals submitted by the contractors which include work program, method statements, material sources, manpower and equipment deployment. In light of Section 3.03 of Guidelines for the Employment of Consultants under Japanese ODA Loans (April 2012), the Consultant shall pay attention, in particular, to whether such proposals will meet the safety requirements set forth in the applicable laws and regulations, the specifications or other parts of the contract;
- (f) Explain and/or adjust ambiguities and/or discrepancies in the Contract Documents and issue any necessary clarifications or instructions;
- (g) Review, verify and further detail the design of the works, approve the Contractors' working drawings and, if necessary, issue further drawings and/or give instructions to the Contractor;
- (h) Liaise with the appropriate authorities to ensure that all the affected utility services are promptly relocated.
- (i) Carry out field inspections on the contractor's setting out to ensure that the works are carried out in accordance with drawings and other design details;
- (j) Regularly monitor physical and financial progress against the milestones as per the contract so as to ensure completion of contract in time;
- (k) Supervise the works so that all the contractual requirements will be met by the contractors, including those in relation to i) quality of the works, ii) safety and iii) protection of the environment. In light of Section 3.03 of Guidelines for the Employment of Consultants under Japanese ODA Loans (April 2012), the Consultant shall confirm that an accident prevention officer proposed by contractor is duly assigned at the project site and that construction works are carried out according to the requirements set forth in the applicable laws and regulations, the specifications or other parts of the contract;
- (l) Supervise field tests, sampling and laboratory test to be carried out by the contractors;
- (m) Inspect the construction method, equipment to be used, workmanship at the site, and attend shop inspection and manufacturing tests in accordance with the specifications;
- (n) Survey and measure the work output performed by the contractors and issue payment certificates such as interim payment certificates and final payment certificate as specified in the contract;
- (o) Coordinate the works among different contractors employed for the Access Road Project;
- (p) Modify the designs, technical specifications and drawings, relevant calculations and cost estimates as may be necessary in accordance with the actual site conditions and issue variation orders (including necessary actions in relation to the works performed by other contractors working for other projects, if any);
- (q) Carry out timely reporting to RHD for any inconsistency in executing the works and suggesting appropriate corrective measures to be applied;

- (r) Inspect, verify and determine claims issued by the parties to the contract (i.e. RHD and contractors) in accordance with the civil works contract;
- (s) Perform the inspection of the works and to issue certificates such as the Taking-Over Certificate, Performance Certificate as specified in the civil works contract;
- (t) Provide inspection services during defects liability period and if any defects are noted, instruct the contractor to rectify;
- (u) Check and certify as-built drawings for the parts of the works designed by the contractors, if any;
- (v)

(4) Facilitation of implementation of Environmental Management Plan (EMP), Environmental Monitoring Plan (EMoP) and Resettlement Action Plan (RAP)

The Consultant shall:

- (a) Update EMP as appropriate, incorporate necessary technical specifications with design and contract documentation;
- (b) During the preparation of bidding documents, clearly identify environmental responsibilities as explained in the EIA/IEE and EMP;
- (c) Assist RHD to review the Construction Contractor's Environmental Program to be prepared by the contractor in accordance with EMP, relevant plans and JICA Environmental Guidelines and to make recommendations to RHD regarding any necessary amendments for its approval;
- (d) Assist RHD to implement the measures identified in the EMP;
- (e) Monitor the effectiveness of EMP and negative impacts on environment caused by the construction works and provide technical advice, including a feasible solution, so that RHD can improve situation when necessary;
- (f) Assist RHD in monitoring the compliance with conditions stated in the EPC and the requirements under EMP and JICA Environmental Guidelines;
- (g) Assist RHD in preparation of the answer to the request from JICA's advisory committee for environmental and social considerations, if necessary;
- (h) Assist RHD in the capacity building of RHD staff on environmental management through on-the-job training on environmental assessment techniques, mitigation measure planning, supervision and monitoring and reporting;
- (i) Update and/or prepare RAP as necessary based on detailed design in accordance with the agreed resettlement framework, including entitlement matrix and compensation plan; coordinate with various agencies in preparing the procedures for timely land acquisition and disbursement of compensation to project affected persons (PAPs);

- (j) Assist RHD in identifying the eligible PAPs, and in preparation/updating of the list of eligible PAPs and 'Payment Statement' for individual eligible PAPs. The places where each eligible PAPs will relocate to are necessary to be recorded so that RHD could implement monitoring on income and living conditions of resettled persons;
- (k) Assist RHD in conducting social assessment during early stage of the detailed design stage and review the existing income restoration plan and special assistance plan for vulnerable PAPs and revise/update the contents of the plans, if necessary based on priorities identified with support of relevant government agencies and Non-Governmental Organizations (NGOs). The following contents should be included in the plans;
 - i. Skills Training
 - ii. Project related Job Opportunities
 - iii. Provision of social welfare grant
 - iv. Provision of Agricultural Extension Services
 - v. Provision of the special allowance to vulnerable PAPs
- (l) Assist RHD to implement the measures identified in the revised RAP;
- (m) Monitor land acquisition and compensation activities being undertaken by RHD and/or competent authorities, and report the results in monthly progress reports;
- (n) Assist in procurement of implementation NGO (INGO) and external monitoring agency (EMA);
- (o) Assist RHD in facilitating stakeholder's participation (including focus group discussions for vulnerable PAPs) and providing feedback their comments on RAP;
- (p) Assist RHD in establishment of grievance redress mechanism including formation of Grievance Redress Committee;
- (q) Assist RHD to ensure that the PAPs are fully aware of the grievance redress procedure and the process of bringing their complaints, investigate the veracity of the complaints, and recommends actions/measures to settle them amicably, fairly and transparently before they go to the redress committee or the courts of law; and
- (r) Provide technical services with grievance redress committee for keeping and updating records when necessary.

3.2 Specific Terms of Reference

(1) Safety Control of the Project

In an effort to assure the safety during the work of the Project, RHD shall take following actions and the Consultant shall obey the proposal related to the safety control from RHD;

- (a) Bidding documents for procurement of works require that;
 - i) The safety requirements in accordance with the laws and regulations in Bangladesh and relevant international standards (including guidelines of international organization), if any, shall be clearly stipulated in the contract.
 - ii) Bidders shall furnish a safety plan to meet the safety requirements stipulated in the bidding documents.
 - iii) The personnel for key positions to be proposed by bidders shall include an accident prevention officer.
- (b) The Consultant shall take following actions to secure the safety in the project;
 - i) When preparing or reviewing bidding documents for procurement of works, the Consultant shall make sure that the requirements stipulated in (a) above will fully be met.
 - ii) The Consultant shall review the safety plans submitted by the bidders.
 - iii) During the supervision of the construction work, the Consultant shall confirm that an accident prevention officer proposed by the contractor is duly assigned at the project site and that the construction work is carried out according to the safety requirements stipulated in the contract. If the Consultant recognize any questions regarding the safety measures including the ones mentioned above, the Consultant shall require the contractors to take appropriate remedies.

Chapter4. Expected Time Schedule

The total duration of consulting services will be 71 months follows by 12 months of defect liability period. The implementation schedule expected is as shown in Table 1.

Table 1 : Implementation Schedule Expected

(This table has been removed because of confidential information.)

Chapter5. Staffing (Expertise required)

4 of Professional (A) consultants and 30 of Professional (B) consultants will be engaged, over 71 month' duration of consulting services, for a total of 115 person-months for Professional (A) and 557 person-months for Professional (B) consultants. Total consulting input is 672 person-months.

(1) Qualification of key Team Members

The qualification of key Team Members is shown in Table 2.

Table 2 : Qualification of key Team Members

Designation	Qualification
International Consultants (Pro-A)	
Team Leader/ Civil Engineer 1	<u>Education:</u> • Graduate in Civil Engineering <u>Experience:</u> • Experience in Road Related Field: 15 years or more • Experience of design and construction supervision in road sector projects: 10 years or more • Experience of construction supervision for road project in ICB contract: 2 projects or more • Experience of leading a consultants' team as the Team Leader or the Deputy Team Leader: Once or more
Bridge Engineer 1	<u>Education:</u> Graduate in Civil Engineering <u>Experience:</u> • Experience in design of Road Bridges: 10 years or more • Experience of construction supervision for bridge project in ICB contract: 2 projects or more • Experience as a bridge design specialist/structure engineer: 2 projects or more
Local Consultants (Pro-B)	
Civil Engineer 2	<u>Education:</u> • Graduate in Civil Engineering <u>Experience:</u> • Experience in Road Related Field: 15 years or more • Experience of design and construction supervision in road sector projects: 15 years or more
Bridge Engineer 2	<u>Education:</u> • Graduate in Civil Engineering <u>Experience:</u> • Experience in design of road bridges: 10 years or more • Experience as a bridge design specialist: 2 projects or more

Geotechnical Engineer	<u>Education:</u> • Graduate in Civil Engineering <u>Experience:</u> • Experience in geotechnical engineer of road and/or bridge project: 5-8 years
Environmental Engineer	<u>Education:</u> • Graduate in Environmental Management <u>Experience:</u> • Experience in environmental management of road and/or bridge projects: 5-8 years
Resettlement Specialist	<u>Education:</u> • Graduate in Social Development <u>Experience:</u> • Experience in land acquisition of infrastructure projects: 5-8 years
Highway Engineer	<u>Education:</u> • Graduate in Civil Engineering <u>Experience:</u> • Experience in design of highway: 10 years or more • Experience as a road design engineer: 2 projects or more
Hydrologist	<u>Education:</u> • Graduate in Civil Engineering <u>Experience:</u> • Experience in hydrologist of road related field: 5-8 years
River Training Engineer	<u>Education:</u> • Graduate in Civil Engineering <u>Experience:</u> • Experience in river training engineer of road related field: 5-8 years
River Engineer	<u>Education:</u> • Graduate in Civil Engineering <u>Experience:</u> • Experience in river engineer of road related field: 5-8 years
Pavement Engineer	<u>Education:</u> • Graduate in Civil Engineering <u>Experience:</u> • Experience in pavement engineer of road and/or bridge project: 5-8 years
Structural Engineer	<u>Education:</u> • Graduate in Civil Engineering <u>Experience:</u> • Experience in structure engineer of road and/or bridge project: 5-8 years
Quantity Engineer	<u>Education:</u> • Graduate in Civil Engineering <u>Experience:</u> • Experience in road related field: 5-8 years

Quality Engineer	<u>Education:</u> • Graduate in Civil Engineering <u>Experience:</u> • Experience in road related field: 5-8 years
Material Engineer	<u>Education:</u> • Graduate in Civil Engineering <u>Experience:</u> • Experience in road related field: 5-8 years
Electrical Engineer	<u>Education:</u> • Graduate in Electrical Engineering <u>Experience:</u> • Experience in electrical engineer of infrastructure projects: 10 years or more
Cost Estimator	<u>Education:</u> • Graduate in Civil Engineering/ Construction Management <u>Experience:</u> • Experience in road related field: 5-8 years
Surveyor	<u>Education:</u> • Diploma in Survey <u>Experience:</u> • Experience in surveyor of infrastructure projects: 10 years or more
Document specialist	<u>Education:</u> • Graduate in Civil Engineering/ Construction Management <u>Experience:</u> • Experience in road related field: 5-8 years

Consultant may propose other experts and supporting staffs required to accomplish the tasks outlined in the ToR. It is the Consultant's responsibility to select the optimum team and to propose the professionals which he believes best meets the needs of RHD.

Chapter6. Reporting

Within the scope of consulting services, the Consultant shall prepare and submit reports and documents to RHD as shown in Table 3. The Consultant shall provide electronic copy of each of these reports.

Table 3 : List of submission report

Category	Type of Report	Timing	No. of Copies
Consultancy Services	Inception Report	Within 1 month after commencement of the services	10
	Monthly Progress Report	Every month	10
	Project Completion Report (for submission to JICA)	At the end of Services	10
Detailed Design	Project Definition Report	Within 3 months after commencement of the services	20
	Draft Detailed Design Report	Within 11 months after commencement of the services	20
	Cost Estimate Report	Within 12 months after commencement of the services	20
	Final Detailed Design Report	Within 12 months after commencement of the services	20
	Final Design Report	Within 12 months after commencement of the services	20
Tender Assistance	Pre-qualification Document Report	Within 12 months after commencement of the services	20
	Bidding Document Report	Within 12months after commencement of the services	20
	Pre-qualification Evaluation Report	Within 1 month after closing PQ	15
	Technical Evaluation Report	Within 1 month after closing Bidding	15
	Tender Evaluation Report	Within 1 month after closing Bidding	15
Construction Supervision	Quarterly Progress Report	Every quarter	10
	Quality Control Report	Every month	10
	Construction Completion Report (and As-built Drawings, if any)	At the end of the Project	20
	Performance report	At the end of the defect reliability period	20
Environment and Social Safeguard	Land Acquisition and Resettlement Monitoring Report	First stage of the Access Road Project	10
	Environmental and Social Plan Report	First stage of the Access Road Project	20
Other Report	Technical Report	As required or upon request	As required

Contents to be included in each report are as follows:

(Monthly Progress report and Inception report)

a) Monthly Progress Report: Describes briefly and concisely all activities and progress for the previous month by the 10th day of each month. Problems encountered or anticipated will be clearly stated, together with actions to be taken or recommendations on remedial measures for correction. Also indicates the work to be performed during the coming month.

b) Inception Report, to be submitted within 1 month after the commencement of the services, presenting the methodologies, schedule, organization, etc.

(Detailed Design)

a) Project Definition Report, to be submitted in the 3rd month after the commencement of services, presenting the design criteria and standards.

b) Draft Detailed Design Report, to be submitted in the 11th month after the commencement of services, presenting detailed engineering design.

c) Cost Estimate Report, to be submitted in the 12th month after the commencement of services, presenting detailed cost estimate.

d) Final Detailed Design Report, to be submitted in the 12th month after the commencement of services, compiling all the items carried out during services.

e) Final Design Report, to be submitted in the 12th month after the commencement of services, finalizing detailed design, cost estimate, bid plan, bid evaluation criteria, technical evaluation criteria and bidding documents through the incorporation of comments on the Draft Design Report, provided by RHD and the Consultant.

(Tender Assistance)

a) Pre-qualification Document Report, to be submitted in the 12th month after the commencement of the services, presenting the pre-qualification documents and its evaluation criteria.

b) Bidding Document Report, to be submitted in the 12th month after the commencement of the services, presenting the bidding documents and bid evaluation criteria.

c) Pre-qualification Evaluation Report, to present the results of the evaluation and to select the qualified applicants.

d) Technical Evaluation Report, to present the results of technical evaluation and to recommend the qualified applicants.

e) Tender Evaluation Report, to present the results of the tenders to select the most responsible

contractors.

(Construction Supervision)

a) Quarterly Progress Report, to be submitted at every three (3) months during construction, presenting the progress status of the Project.

b) Quality Control Report, to be submitted at every month during construction, containing record of quality control activities for the appropriate quality of all project facilities.

c) Construction Completion Report, to be submitted within three (3) month after completion of construction, which comprises a full size of as-built drawings for all the structures and facilities completed, and the final details of the construction completed together with all data, records, material tests results, field books.

d) Performance Report, to be submitted at the end of the defect reliability period, containing record of quality of all facilities whether those are satisfied with specification of tender documents.

(Assistance in Environmental and Social Monitoring)

a) Land Acquisition and Resettlement Monitoring Report, to be submitted at first stage of the Access Road Project.

b) Environmental and Social Safeguard Evaluation Report, to be submitted at first stage of the Access Road Project, presenting the EMP, EMoP and RAP prepared.

(Other Report)

a) Technical Report, to be submitted as required or upon request, advising on technical issues that need to be resolved.

Chapter7. Obligations of RHD

A certain range of arrangements and services will be provided by RHD to the Consultant for smooth implementation of the Consulting Services. In this context, RHD will:

(1) Report and data

Make available to the Consultant existing reports and data related to the Access Road Project;

(2) Office space

Provide an office spaces in the Headquarters of RHD with necessary equipment, furniture and utility. However, the Consultant's requirement for office space, including necessary equipment, furniture and utilities, should be clearly stated in the proposal with its rental cost for the case where RHD would be unable to provide such facilities;

(3) Cooperation and counterpart staff

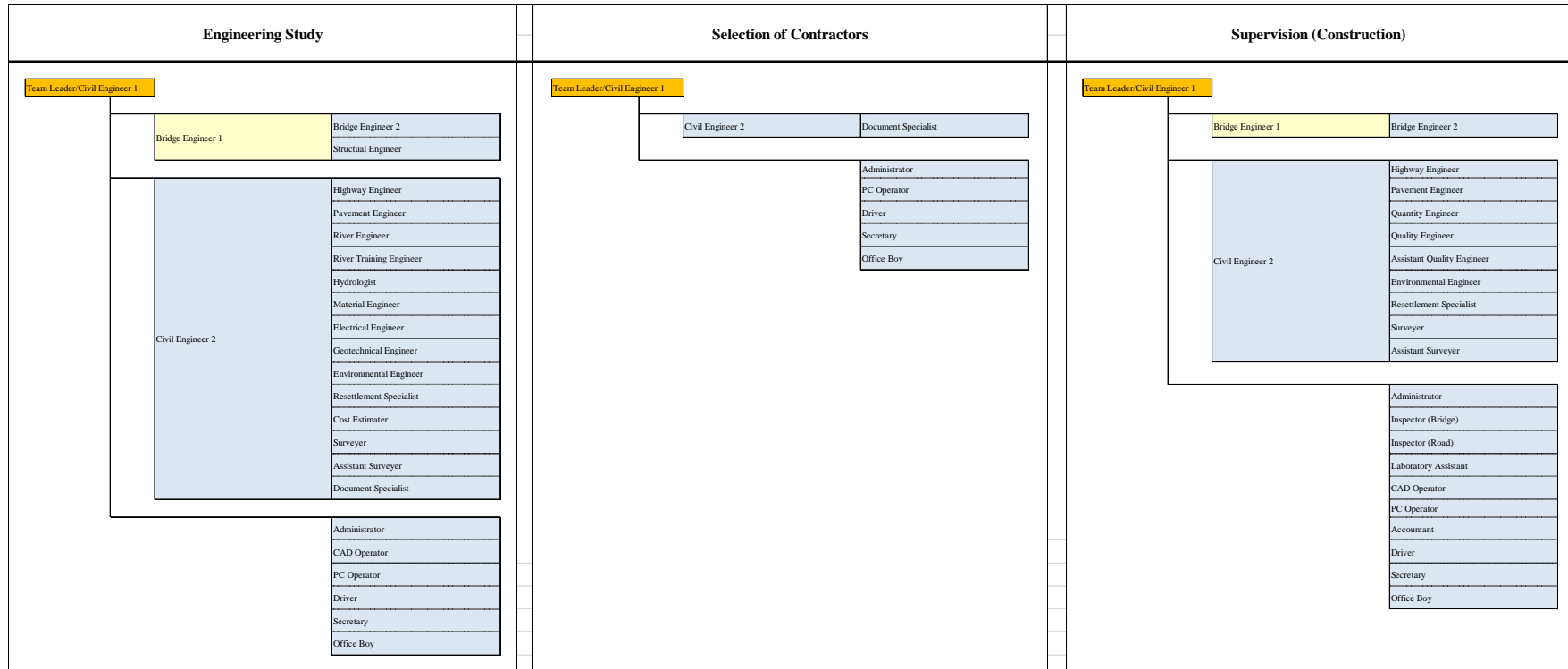
Appoint counterpart officials, agent and representative as may be necessary for effective implementation of the Consulting Services;

(4) Assistance and exemption

Use its best efforts to ensure that the assistance and exemption, as described in the Standard Request for Proposal issued by JICA, will be provided to the Consultant, in relation to

- work permit and such other documents;
- entry and exit visas, residence permits, exchange permits and such other documents;
- clearance through customs;
- instructions and information to officials, agent and representatives of Bangladesh;
- exemption from any requirement for registration to practice their profession;
- privilege pursuant to the applicable law in Bangladesh.

Chapter 8. Structure of Consultant Team



Chapter 9. Role of Professionals

Professionals	Role of Professionals during Engineering Study, Selection of Contractors and Supervision
[International Professional]	
Team Leader/ Civil Engineer 1	Overall management during engineering study, contractor selection and supervision stage.
Bridge Engineer 1	Plan, survey, design and control on construction of bridge and structures.
[Local Professional]	
Civil Engineer 2	Overall management and assistance of team leader.
Bridge Engineer 2	Plan, survey, design and control on construction of bridge. Assisting the expert
Geotechnical Engineer	Conduct of geotechnical survey and plan and review of geotechnical matters. Assisting the expert
Environmental Engineer	Assisting the expert for review of EIA, conduct of supplemental assessment during engineering stage and monitor of environmental management plan at beginning of construction stage.
Resettlement Specialist	Survey, plan and review of resettlement matters. Assisting the expert
Highway Engineer	Plan, survey, design and control on construction of road and structures Assisting the expert
Hydrologist	Survey, plan and review of hydrological matters. Assisting the expert
River Training Engineer	Plan, survey, design and control on construction of river structure. Assisting the expert
River Engineer	Plan, survey, design and review on plans submitted in regard to river engineering matters. Assisting the expert
Pavement Engineer	Plan, survey, design and control on construction of pavement. Assisting the expert
Structural Engineer	Plan, survey, design and control on construction of structure. Assisting the expert
Quantity Engineer	Plan and control on quantity Assisting the expert
Quality Engineer	Plan and control on quality. Assisting the expert
Material Engineer	Survey, plan and review of material matters submitted Assisting the expert
Electrical Engineer	Survey, plan and review of electrical matters. Assisting the expert
Cost Estimator	Calculation & analysis of construction costs and assisting the expert.
Surveyor	Conduct of topographical survey.
Document specialist	Compilation of specification and review of documents.

Appendix-C12-01

Draft Accounting Policy

Draft Accounting Policy

The principle accounting policy applied in the preparation of the financial statements are set out below. The policy is to be applied consistently to all the years presented, unless otherwise stated. The policy is selected and applied by the company's management for significant transactions and events that have a material effect within the framework of BAS-1 "Presentation of Financial Statements" in preparation and presentation of financial statements. Accounting and valuation methods are disclosed properly for reasons of clarity.

1. Basis of preparation of the financial statements

(1) Accounting Standards

The financial statements of the company are to be prepared in accordance with Bangladesh Accounting Standards (BAS) and Bangladesh Financial Reporting Standards (BFRS) adopted by the Institute of Chartered Accountants of Bangladesh (ICAB).

(2) Accounting Convention

The financial statements of the company are to be made up to 30 June each year and are prepared under the historical cost convention.

(3) Legal Compliance

The financial statements are to be prepared and the disclosures of information made in accordance with the requirements of the Companies Act 1944 and BAS and BFRS adopted by ICAB.

(4) Critical Accounting Estimates, Assumptions and Judgments

The preparation of the financial statements requires the use of certain critical accounting estimates in accordance with BFRS. It also requires management to exercise its judgment in the process of applying the company's accounting policy.

2. Functional and Presentation Currency

The financial statements are to be prepared in Bangladesh Taka which comprises the company's functional currency.

3. Level of Precision

The figures of the financial statements are to be presented in Taka which are to be rounded off to the nearest integer.

4. Foreign Currency Translation

Foreign currency transactions are to be translated and recorded at the applicable rates of exchange ruling at the date of transaction in accordance with BAS 21 “The Effects of Changes in Foreign Exchange Rates”. Foreign currency monetary assets and liabilities at the balance sheet date are to be translated at the rates prevailing on that date. The exchange differences at the balance sheet date are to be adjusted and recorded to the balance sheet and/or profit and loss statement.

5. Reporting Period

The financial statements are to cover one year starting from July 1 to June 30 of the succeeding year.

6. Cash Flow Statement

BAS 1 “Presentation of Financial Statements” requires that a cash flow statement is to be prepared as it provides information about cash flows of the enterprise which is useful in providing users of financial statements with a basis to assess the ability of the enterprise to generate cash and cash equivalents and the needs of the enterprise to utilize those cash flows. Cash flow statement of the company is to be prepared under the direct method for the period, classified by operating, investing and financing activities as prescribed in BAS 7 “Cash Flow Statements”.

7. Comparative Information

As per guided in BAS 1 “Presentation of Financial Statements” comparative information in respect of the previous year is to be presented in all numerical information in the financial statements and the narrative and descriptive information where it is relevant for understanding of the current year’s financial statements.

8. Assets and their Valuation

8.1 Property, Plant and Equipment

Tangible fixed assets are to be accounted according to BAS 16 “Property, Plant and Equipment” at their historical cost less cumulative depreciation and the capital work-in-progress is to be stated at cost. The historical cost includes expenditure that is directly attributable to the acquisition of the items. The cost of an item of property, plant and equipment comprises its purchase price, import duties and non-refundable taxes, after deducting trade discount and rebates and any costs directly attributable to bringing the assets to the location and condition

necessary for it to be capable of operating in the intended manner. The software that is integral to the functionality of the related equipment is to be capitalized as a part of the equipment.

8.2 Subsequent Costs

Subsequent costs are to be included in the asset's carrying amount or recognized as separate asset, as appropriate, only when it is probable that future economic benefits associate with the item will flow to the company and the cost of the item can be measured reliably. The carrying amount of the replaced part is to be de-recognized. All other repairs and maintenance are to be charged to the profit and loss account during the financial period in which they are incurred.

8.3 Depreciation of the Fixed Assets

No depreciation is to be charged on land, land development and capital work-in-progress. For addition of fixed assets during the year, depreciation is to be charged at a half of the full rate. In case of disposal of fixed assets, no depreciation is to be charged in the year of disposal. Depreciation of all properties is to be computed using the straight line method. Considering the estimated useful life of the assets, the rates of depreciation are fixed as follows;

- Building: _____ %
- Plant & Machinery: _____ %
- Motor Vehicles: _____ %
- Office equipment: _____ %
- Computer and Peripherals: _____ %
- Furniture & Fixtures: _____ %
- Other Assets: _____ %

8.4 Capital Work-in-Progress

The capital work-in-progress consists of all costs related to projects including civil construction, land development, consultancy, interest, exchange gain/loss, import duties, non-refundable taxes and VAT. Property, plant and equipment that is being under construction and/or acquisition is also accounted for as the capital work-in-progress until the construction and/or acquisition is completed and measured at cost.

8.5 Retirement and Disposal

An item of property, plant and equipment is de-recognized on disposal or when no further economic benefits are expected from its use, whichever comes earlier. Gains or losses arising from the retirement or disposal of property, plant and equipment are to be determined by comparing the proceeds from disposal with the carrying amount of the same, and are to be

recognized the net in the 'other income' account in the profit and loss statement.

9. Inventories

Inventories consisting of spare parts and materials are to be valued at lower of cost and net realizable value in accordance with the provision of BAS 2 'Inventories'. The cost of inventories include the expenditure incurred in acquiring the inventories and other cost incurred in bringing them to their existing location and condition. The cost of inventories is to be determined by using the weighted average cost formula. The net realizable value is to be based on the estimated selling price less estimated costs necessary to make the sale.

10. Financial Instruments

Non derivative financial instruments comprise of cash and cash equivalents, accounts and other receivables, loans and borrowings and other payables.

10.1 Cash and Cash Equivalents

Cash and cash equivalents comprise of cash on hand and cash at bank including fixed deposits having maturity up to one year which are available for use by the company without restriction.

10.2 Accounts and other Receivables

Accounts and other receivables are to be recognized initially at cost which is the fair value of the consideration given in return. After initial recognition, these are to be carried at cost less impairment losses due to uncollectibility of any amount so recognized.

11. Provisions

A provision is to be made in the balance sheet when the company has a legal or constructive obligation and the probable impairment of the assets as a result of past event and it is probable that an outflow of economic benefits will be required to settle the obligation and the impairment of the assets and a reliable estimate can be made of an amount of the obligation. Provision is ordinarily measured at the best estimate of the expenditure required to settle the present obligation and the probable impairment of the assets at the balance sheet date

12. Deferred Tax

Deferred tax is recognized using the balance sheet method, providing for temporary differences between the carrying amounts of assets and liabilities for financial reporting purposes and amounts used for taxation purposes. Deferred tax is measured at the tax rates that are expected to be applied to the temporary differences when they are reversed, based on the income tax law that has been enacted or substantively enacted by the reporting date. Deferred tax assets and

liabilities are offset if there is a legally enforceable right to offset current tax liabilities and assets, and they relate to income taxes levied by the same tax authority on the same taxable entity. A deferred tax asset is to be recognized to the extent that it is probable that future taxable profits will be available against which the deductible temporary difference can be utilized. Deferred tax assets are reviewed at each reporting date and are reduced to the extent that it is no longer probable that the related tax benefit will be realized.

13. Contingent Liabilities and Assets

Contingent liabilities and assets are current or possible obligations or assets, arising from past events and whose existence is due to the occurrence or non-occurrence of one or more uncertain future events which are not within the control of the company. The contingent liabilities and assets are to be recognized in the balance sheet in accordance with BAS 37 “Provisions, Contingent Liabilities and Contingent Assets”.

14. Employee Benefit

14.1 Contributory Provident Fund

The company maintains a Contributory Provident Fund (CPF) under which the employees contribute 10% of their salary to the fund. The company contributes to the fund an equal amount. The company recognizes contribution to the fund as an expense when an employee has rendered services in exchange for such contribution. The legal and constructive obligation is limited to the amount it agrees to contribute to the fund.

14.2 Gratuity

The company also maintains an unfunded gratuity scheme for permanent employees, provision for which is to be made in profit and loss account. Employees are entitled to gratuity benefits after completion of minimum ____ years of service in the company but provisions are to be made for persons who have not completed ____ years. The gratuity is calculated on the last basic salary and is payable at the rate of ____ months basic salary for every completed year or service.

14.3 Workers Profit Participation Fund

The company makes a regular allocation of ____% on net profit before tax to this fund and payment is made to the eligible workers as per provision of the company's profit under Labor Law 2006 Chapter 15 and Workers Profit Participation Act 1968..

15. Offsetting

Financial assets and financial liabilities are to be offset and the net amount reported in the balance sheet when there is a legally enforceable right to offset the recognized amounts and there is an intention to settle on a net basis, or realize the assets and settle the liability simultaneously.

16. Share Capital

Paid up capital represents total amount of issued share capital. Holders of ordinary shares are entitled to receive dividends as declared from time to time and are entitled to vote at shareholders' meetings. In the event of a winding up of the company, ordinary shareholders rank after other shareholders and creditors. The ordinary shareholders are entitled to any residual proceeds of liquidation after settlement of due to all other parties.

17. Revenue Recognition

Revenue comprises the sales of electricity. The revenue is to be recognized in the profit and loss account after meeting recognition criteria in accordance with the requirement of BAS 18 "Revenue". Revenues are to be measured at fair value of the consideration received or receivable, net of sale related taxes (VAT).

18. Finance Income and Expense

Finance income comprises interest income on funds invested. Interest income is to be recognized on accrual basis. Finance expense comprises interest on loans and foreign exchange gain/loss on translation of foreign currency. All finance expenses are to be recognized in the profit and loss account.

19. Borrowing Cost

Borrowing cost relating to projects already in commercial operation is to be charged as the expenses for the year in accordance with the requirements stated in BAS 23 "Borrowing Costs". In respect of projects that have not yet commenced commercial operation, borrowing costs are to be adjusted with capital work-in-progress.

20. Earnings per Share

The company presents basic earnings per share (EPS) data for its ordinary shares. Basic EPS is to be calculated by dividing the net profit for the year attributable to ordinary shareholders by the weighted average number of ordinary shares outstanding during the year and split ordinary shares in accordance with the requirement stated in BAS 33 "Earnings per Share".

21 Income Tax

Current tax represents the expected tax payable on the taxable income for the year, using the tax rate enacted or substantively enacted at the reporting date, and any adjustment to tax payable in respect of previous years. Provision for tax is to be made on the basis of Finance Act 20_____.

22. Proposed Dividend

The amount of proposed dividend is to be disclosed in the notes to the accounts along with dividend per share in accordance with the requirements stated in BAS 1 “Presentation of Financial Statements”. Also, the proposed dividend is not considered as the liability of the company in accordance with the requirement stated in BAS 10 “Events after the Reporting Period” because no obligation exists at the time of approval of the accounts and recommendation of dividend by the Board of Directors.

23. Statement of Cash Flows

The statement of cash flows is to be prepared in accordance with the requirements stated in BAS 7 “Statement of Cash Flows”. The cash generated from operating activities is to be prepared using the direct method as prescribed by Securities and Exchange Rules 1987 and as the benchmark treatment of BAS 7, whereby major classes of gross cash receipts and gross cash payments from operating activities are to be disclosed.

24. Events after the Balance Sheet Date

Events after the balance sheet date that provide additional information about the company's position at the balance sheet date are to be reflected in the financial statements. Events after the balance sheet date that are not adjusting events are disclosed in the notes when material.

25. Comparative Information

Relevant comparative information is to be presented in the financial statements. Previous year's figures to be rearranged/reclassified and restated wherever possible and considered necessary to conform to current year's presentation.

Appendix-C12-02

Draft Accounting Manual

Draft Accounting Manual

I. General

1. Objective

This manual describes the general accounting procedures for expenditures which include, among others, procedures on the general book keeping system for expenditures, the books of accounts and other accounting records, and the system of accounts to be used. The system has been designed to facilitate and provide adequate recording of transactions, strengthen internal control, and provide for better execution of the accounting function.

2. Basic Principles for Accounting

The Accounting Policy and Accounting Manual of the company adhere to the rules, regulations and practices of the country in recording the business transactions in accordance with the on-going accounting principles and other standards that are deemed fair and reasonable.

The guiding principles in executing the accounting process and preparing the financial statements are summarized as follows;

- (1) **Going Concern basis** – accounts are to be prepared as though the company will continue for a long period (unless the company is on the verge of bankruptcy or there is no alternative except to revoke the license or trading at insolvency);
- (2) Statements are to be prepared on an ‘accrual’ basis rather than on a ‘cash’ basis;
 - 1) **Accrual basis** – right to earn or liability to pay (income and expenses reflect the correct affairs of the company), and
 - 2) **Cash basis** – only when cash is exchanged and hence may not represent the occurrence of the financial affairs.
- (3) **Matching principle** – function matching and period matching – expenses are recognized on the basis of costs incurred and income earned within the same time period, e.g. unbilled sale of electricity and unpaid costs;
- (4) **Consistency** – unless significant changes occur (which anyway should be separately disclosed), form of presentation and classification of expenses should be consistent from year to year;
- (5) Form of **Balance Sheet** – as given in the Companies Act 1994;
- (6) **Materiality and Aggregation** – material items should be disclosed separately (materiality is defined as the piece of information which can influence the user’s decision);
- (7) **Offsetting** – assets and liabilities should be shown separately without offsetting one against the other, e.g. receivables from the sale of power should not be set off against the security deposit

received from consumers (unless the consumer has permanently ceased to be a consumer of the company);

(8) **Comparative information** – as per the requirements of the Company Act, the previous year's figures are required to be provided and if necessary to be re-arranged in order to be able to understand the trend; and

(9) **Accounting measurements** - this refers to the way the accounting transactions are to be measured and reported in the financial statements. These may be based on the historical cost or inflation accounting or the replacement basis, etc. Accounting measurements are defined under the accounting standards for various situations.

3. Roles and Function to be Covered by Accounting

The Accounting Function is responsible for the proper posting of journals and entries to the general ledger and for the maintenance of the accounts to ensure accuracy, validity and reliability of financial records.

The roles and functions of the Finance and Accounts Department encompasses the following transactions that take place at the company and/or involve the company in the matters of;

- (1) The receipts, safe-keeping, payments and disposition of cash, bank deposits, promissory notes, bills of exchange, and other negotiable instruments;
- (2) The identification of the sources, raising, procuring, maintaining, investing, and appropriating the funds appropriately;
- (3) The control of the company's receivables, payables, other assets and liabilities;
- (4) Accounting and management of the inventory;
- (5) Accounting and management of the fixed assets;
- (6) Budgeting and account closing;
- (7) Taxes and duties;
- (8) Preparation, execution and filing of the accounting vouchers, accounting ledgers and books, and financial reports;
- (9) Research and study on the accounting and finance; and
- (10) Other related matters.

4. Responsible Officer

The responsibility of the accounting function and of the Finance and Accounts Department is vested upon the Director (Finance) who reports to Member (Finance) and to Managing Director. Director (Finance) appoints and supervises the Group General Managers with the assistance of Deputy Director (Finance). The Accounting Group is in charge of the execution of the

accounting process and works assigned.

5. Internal Control

In order for the company to cover with the effective network of internal control so that the financial statements and information concerning the financial statements are kept with integrity and reliability, the company establishes and executes the internal control system with respect to the followings;

- (1) Controls on financial reporting encompassing the preparation of reliable financial statements and other financial information;
- (2) Operational controls covering the company's basic business objectives, including adherence to performance standards and the safeguarding of resources; and
- (3) Compliance controls concerning the laws and regulations to which the company is obliged to so as to avoid damages to the company's reputation or other negative consequences.

6. Fiscal Year

The fiscal year of the company starts on July one of any year and ends up on June 30 of the succeeding year.

7. General Ledger and Accounting Unit

The company maintains an uniform accounting system under which all the entries for book keeping are to be made into the company's central accounting system and the general ledger and associated ledgers and journals are to be created at the Headquarter of the company.

II. Chart of Accounts and Ledgers

8. Basic Principles

Any transactions that are affecting the company's assets, liabilities, profit, loss and/or equity must be classified under the appropriate accounting heads and be recorded clearly and accurately in the vouchers, books and journals.

The classification and journalization has to be made in due consideration of the basic principles afore mentioned;

- (1) **Matching principle** – function matching and period matching – expenses are recognized on the basis of costs incurred and income earned within the same time period, e.g. unbilled sale of electricity and unpaid costs;
- (2) **Offsetting** – assets and liabilities should be shown separately without offsetting one against the

other, e.g. receivables from the sale of power should not be set off against the security deposit received from consumers (unless the consumer has permanently ceased to be a consumer of the company);

9. Chart of Accounts

The processing under the Chart of Accounts should be made in compliance with the Procedure Manuals for Processing under the Chart of Accounts. The contents of the Chart of Accounts may be updated by the discretion of Director (Finance) from time to time.

The Chart of Accounts of the company are tabulated in the following table;

Chart of Accounts (Balance Sheet)

Asset		Equity and Liabilities	
Main Head	Sub-main Head	Main Head	Sub-main Head
Utility Plant	Utility Plant in Service	Account Payable	Account Payable – Custom Duties
	Utility Plant in Process of Reclassification		Account Payable – VAT
	Utility Plant held for Future Use		Account Payable – Contractors & Suppliers
	Capital Work- in-Progress		Others
	Others	Accrued Liabilities	Accrued Interest on Loans
Investment	Investment	Accrued Liabilities	Accrued Salaries and Allowances
			Accrued Expenses
Materials and Supplies Inventory	Fuel Stock		Bank Overdraft
	Materials for Operation Supplies	Other Current and	
	Construction Stores	Accrued Liabilities	Withholding Tax
	Goods in Transit	Accrued Liabilities	Security Deposit- Contractors & Suppliers
	Others		Employee Benevolent Fund Collection
Account Receivable	Others		
Account Receivable	Account Receivable- Consumers	Long Term Liabilities	Due to Government & Agencies
	Account Receivable- Others		Foreign Loans
Advances	Advances to Contractors & Suppliers		Long Term Liabilities
	Advances to Officers and Employees		
	Temporary Advances		

Asset		Equity and Liabilities	
Main Head	Sub-main Head	Main Head	Sub-main Head
	Others		Others
Cash at Banks	Cash in Bank- Central Bank Account	Capital	Capital
	Cash in Bank – Deposit Account	Retained Earnings	Retained Earnings
	Cash in Bank- Local Collection Account		
	Cash in Bank- Pension Account		
	Others		
Cash in Hand	Petty Cash Fund		
Prepaid Expense	Prepaid Rent		
	Prepaid Insurance		
	Others		
Deferred Assets	Claims receivable from Government		
	Preliminary Survey and Investigation Expenses		
	Adjustment and Suspense Account		
	Others		
Other Assets	Security Deposits		
	Others		
Accumulated Depreciation	Accumulated Depreciation – Generation Plant		
	Accumulated Depreciation – Utility Plant		
	Accumulated Depreciation – Non-utility Property		
	Others		

Chart of Accounts (Income Statement)

Profit and Loss		
Main Head	Sub-main Head	Tertiary Head
Revenues	Energy Sales	
	Accrued Sales	

Profit and Loss		
Main Head	Sub-main Head	Tertiary Head
	Others	
Other Income	Other Operating Income	
Generation Expenses	Generation Operating Expenses	Salary
		Allowances
		Overtime Allowances
		Travelling Expense and Allowances
		Medical Expenses
		Bonus
		Stationary & Printing
		Taxes, Licenses and Fees
		Office Rent
		Water Charge
		Electricity Charge
		Post and Telegram
		Telephone, Telex and Fax
		Advertising and Promotion
		Audit Fees
		Legal Expenses
		Books & Periodicals
		Fuel used for Electricity Generation
		Petrol, Diesel & Lubricant used for Transport
		Transportation Expense
	Store & Spare used	
Custom Duties		
VAT		
	Demurrages	
	Generation Maintenance Expenses	
Financial & Other Charges	Interest Expenses on Loans (Foreign)	
	Interest Expenses on Loans (Local)	
	Losses on Foreign Exchange Fluctuations	
	Revaluation of Accumulated Depreciation	
	Others	
Development Overhead Account	Development General Overhead Account	

10. Vouchers and Ledgers

The company is ruled to prepare and utilize the following vouchers, ledgers and reports;

- (1) Vouchers
 - Cash Voucher (for Receiving and Expending)
 - Non-cash Voucher (for Receiving and Expending)
- (2) Ledgers
 - General Ledger
 - Supplementary Ledgers
- (3) Other Reports
 - Trial Balance
 - Monthly Financial Closing Reports

11. Accounting Vouchers

All transactions of the Company have to be recorded in the accounting vouchers and account entries must be made based on the vouchers created and approved by responsible officers before they are entered in the books of accounts.

The accounting vouchers shall be created by the Departments that are responsible for the transactions and be accompanied by the evidence or documents that justify the genuineness and rationality of the transactions covered.

The accounting vouchers have to be approved by the General Manager, Accounting Group, together with the supporting evidences attached.

The accounting vouchers, in principle, shall describe, in unambiguous manner, the date, the accounting head, the Department responsible, the amount and the brief contents of the underlying transaction.

No one is permitted to void or amend the vouchers for which the entries to the accounting book are completed. Modification of the voucher has to be made in such manner that with the consent of the responsible Department and the Finance and Accounts Department, create a voucher cancelling the original one and issue new voucher and obtain approval of the General Manager of Accounting Group.

12. Accounting Evidences

The term “accounting evidences” means the document that endorses the genuineness and

righteousness of the transaction and includes the documents such as; the receipt issued by the counterparty of the transaction, inspection certificate, delivery receipt, invoice, contract with the counterparty, memorandum, reference material, etc.

The accounting voucher and the evidence shall be given serial numbers and stored in organized and orderly manner.

The receipts, delivery receipts and invoices are to be stored at and in the responsibility of the Accounting Group.

No adjustment or amendment shall be made to the evidences received from the counterparty. In case of necessity arises, a request has to be made to the counterparty for modification or amendment.

13. Carry-over of Accounting Books

A new book shall be opened at the beginning of the fiscal year and closed at the end.

14. General Ledger

The general ledger classifies and records the amount of the transactions entered based on the accounting voucher and classified into the account heads.

15. Supplemental Ledgers

In relation to the general ledger, sub-ledgers shall be created and organized for each accounting head. The sub-ledgers shall be prepared based on the entries made from the accounting vouchers and the general ledger on an integrated linkage.

The balances recorded shall be reconciled with those of the general ledger at the end of each month.

The company shall establish a separate rule for the specifics of the general ledger and sub-ledger system.

16. Trial Balance

The trial balance sheet shall be prepared at the end of each month indicating the assets, liabilities, equity, profit and loss, and generation cost for the period starting from the beginning of the fiscal period.

17. Reconciliation

The accounting books, vouchers, input data and output data shall be reconciled in timely manner when the entries have been made on each of the transactions. Should any discrepancy is identified in the accounting books for error and/or omissions, the accounting officer in charge shall report to his/her supervisor, General Manager and/or Director (Finance) and take necessary actions for correction.

18. Accounting System

For development, updating, modification and/or deletion on any part of the accounting system shall be discussed and agreed between the Directors of the Departments concerned and is to be approved by Director (Finance) before execution.

The company establishes a separate rule for administration of the accounting system.

19. Storing and Disposal of Accounting Books and Documents

The files of financial statements, ledgers, vouchers and evidences shall be written with the storing period which shall be determined based on the following storing period;

- (1) Financial statements: _____ years counting from the end of the accounting period; and
- (2) Accounting books and evidences: _____ years counting from the end of the accounting period.

Disposition of the ledgers, books and evidences shall be made by the instruction of Director (Finance).

The company establishes a separate rule for administration of the accounting ledgers, books and evidences.

III. Accounting of Monetary Item

20. Definition of Monetary Item

The term “monetary item” in this Manual refers to the cash and the balances recorded at bank accounts.

The term “cash” refers to, in addition to the currency notes and coins, the checks, postal transfer

checks, etc. that can be deemed and tradable as the substitute of the currency notes.

The promissory notes, bills of exchange, negotiable instruments, coupons of bonds that have matured on the payment dates are treated as the monetary item under this Article.

21. Responsible Office for Receiving and Disbursing

Subject to the delegation of power established by the company, Finance Group, Finance and Accounts Department shall be responsible for receiving and disbursing of monetary item.

22. Treasury Manager

At the headquarter, General Manager, Treasury Group, Finance and Accounts Department, shall be designated as the officer in charge and remain responsible for receiving and disbursing (hereinafter referred to as “Treasurer”). At the power generation plants, the plant manager is designated as the Treasurer

23. Cashier

The Treasurer shall appoint the individual officer to be in charge of receiving and disbursing the monetary items (hereinafter referred to as “Cashier”). Similarly, the Treasurer of the power generation plants shall appoint its Cashier for the same function.

The Cashier shall be segregated from the functions of accounting process and operation including the preparation of accounting voucher and its verification which should be handled by a separate individual appointed for account processing.

The Cashier shall not be permitted to be engaged in preparing accounting vouchers.

The Cashier shall not be engaged in entering and preparing the accounting books and ledgers.

24. Receiving and Disbursing

The receiving and disbursing of monetary items shall be handled, in principle, directly by the Cashier. Should anyone except the Cashier happen to receive any monetary items, the person receiving such item must hand over the items received to the Cashier.

25. Issuance of Receipt

When a monetary item is received, a receipt shall be prepared and issued but in case of the money item received by the bank transfer, the company may not issue the receipt, if not required

by the counterparty.

The company establishes separately the format of the receipt to be used for issuance.

The receipt shall contain the corporate seal of the company and the signature of the Cashier who has prepared and issued such.

Should it happen to be the case that the issuance of the receipt is requested in advance of actual receiving of the monetary item, the issuance of receipt shall be made upon approval of the Treasurer.

26. Disposition of Monetary Item Received

The monetary item received shall be deposited, in principle, to the bank accounts of the company which Finance Group administers.

The bank accounts to be used for receiving the monetary item shall be administered by the Finance Group, Finance and Accounts Department and no other office is permitted to administer such bank accounts.

In case any monetary items are expected to be received by the offices other than Finance Group, the company shall specify the objects of such transactions within the separate rule for delegation of financial power.

Any of the monetary item received by the offices other than Finance Group must be transferred immediately to the Finance Group and shall never be used for any expending.

27. Disposition of Checks, Promissory Notes and Bills of Exchange Received

Any item of checks, promissory notes and bills of exchange received at the offices other than the Finance Group shall be transferred to the Finance Group.

The collection of checks, promissory notes and bills of exchange shall be handled by the Finance Group.

28. Obtainment of Receipt for Payment

For any of the payment the company makes, a receipt shall be collected from the party whom the payment has been made.

In case the payment has been made through the bank transfer, the copy of the transfer application certified by the bank can replace the receipt of the counterparty.

29. Payment Term

The term of payment for the purchasing of materials, goods and services shall be in accordance with the one specifically agreed to in the relevant contract.

In case no payment term is specified in the contract, the company shall make payment in accordance with the general practice of the company which rules that for the invoices delivered and verified by the end of any month, payment shall be made through bank transfer by the end of succeeding month.

30. Instruction for Payment

With regard to the payment for purchases, the Department concerned for the purchase shall prepare the instruction for payment to Finance Group, based on the documents and evidence for the transaction, after obtaining the approval of the vested officer under the delegation of power and deliver such instruction to the Finance Group..

31. Disbursement

The Cashier verifies the instruction for payment to confirm whether the counterparty described in the instruction is true and valid payee through the below mentioned procedures and obtain approval of Treasurer for disbursement.

- (1) To verify that the instruction for payment has been prepared based on the invoice issued by the counterparty and the related evidences for the transaction;
- (2) To verify that the instruction for payment has been approved by the officer who is vested by the delegation of power; and
- (3) To verify that the payment term is meeting with that has been contracted.

32. Advance Payment or Suspense Payment

For any transactions that require advance or suspense payment, the Department concerned may issue the instruction for payment to Finance Group after obtaining the approval by the officer vested under the delegation of power.

In the transactions involving advance payment or suspense payment, such advance or suspense payment shall be collected upon settlement of the transaction, unless otherwise contracted. The

Department concerned for the transaction shall prepare the statement of settlement and send immediately to the Finance Group.

33. Issuance of check

The issuance of checks has to be done by Treasurer. The Cashier is not authorized to sign, seal, nor issue checks.

34. Issuance of promissory notes or bills of exchange

The issuance of checks has to be done by Treasurer upon approval of Managing Director. The Cashier is not authorized to sign, seal nor issue the promissory notes or bills of exchanges.

35. Voiding of Checks, Promissory Notes, Bills of Exchange and Receipts

In case when any of the checks, promissory notes, bills of exchange and receipts are mistakenly or unnecessarily created, those checks, notes, bills of exchange and receipts must be stored after making them void and unusable.

36. Reconciliation of Balances

The Cashier reconciles daily the actual balance of cash against the balance of cash sub-ledger. In case any discrepancies be identified by the Cashier, the Cashier probes the reason for such discrepancy and notify Treasurer immediately and take appropriate actions according to the instruction to be given by Treasurer.

The Cashier reconciles monthly the balance of deposit against the banks and prepares the bank reconciliation statement. The Cashier submits the statement for approval of Treasurer.

At the end of the fiscal term, the Cashier shall request the banks to issue the certificates of account balances.

The Treasurer is responsible for safe-keeping in the vault the cash and its equivalent, corporate seal stamp and valuable documents while conducting periodical inspection and verification.

The inspection and verification to be conducted by the Treasurer shall follow the following procedures;

- (1) For cash verification, the Treasurer shall perform the physical counting monthly, create the denomination table and reconcile with the supplementary ledger;
- (2) For the bank accounts, the Treasurer reconciles the monthly bank statements against the

sub-ledger, prepare the bank reconciliation statement and submit it to Director (Finance);
and

- (3) For the promissory notes or bills of exchange received, conduct the physical counting monthly and reconcile with the sub-ledger.

37. Petty Cash

The Treasurer is authorized to maintain the petty cash for daily payment of small sums (expense and/or suspense payment)

The petty cash shall be handled in accordance with the following procedures;

- (1) The Treasurer determines a fixed amount that is to be handed over to the petty cash holding;
- (2) Daily cash payment shall be made in using and within the amount transferred to petty cash;
- (3) The total amount of the petty cash shall be maintained within a certain limit that is to be established in consideration of the daily necessities.
- (4) The petty cash shall be periodically settled and replenished as necessity requires; and
- (5) The balance of petty cash shall be reconciled with the balance in the petty cash accounts and total cash shall be reconciled with the sub-ledger.

38. Name to be used for Checks and Notes

Any and all issuing of checks, promissory notes and bills of exchange shall be made in the name of the company represented by the Managing Director.

39. Corporate Seal

The corporate seal to be used for receiving and disbursing of monetary items shall be controlled by the Director (Finance) and the Treasurer.

IV. Funds Accounting

40. Objective

The objective of fund accounting is to achieve the facilitation of the business activities and strengthening of the financial foundation of the company through the efficiency improvement in fund raising and utilization based on the careful planning and budgeting.

41. Responsible Office

The Financial Group of the Finance and Accounts Department is assigned to administer the raising and application of funds.

42. Financing Plan

The General Manager of the Financial Group, Finance and Accounts Department (hereinafter referred to as “Financial Manager” shall be engaged in forecasting the future funding needs for implementation of the company’s business plan and prepare the financing plans for long and short terms.

43. Funds Required at the Generation Plant

The funds required at the generation plants shall be remitted by the Financial Group based on the financing plan and budget, etc. There should be no misuse, diversion or appropriation of funds collected for other purposes.

44. Banking Transactions

The Financial Manager shall be responsible for opening, closing or conducting transactions for the bank accounts, including deposit, investment, overdraft, borrowing, etc.

The opening and/or closing of accounts with banks is subject to the prior approval of Managing Director of the company through Director (Finance).

45. Account Name

Any and all of the accounts at banks shall be made in the name of the company represented by the Managing Director.

46. Issue of New Shares

The issue of new shares shall be made based on a resolution adopted at the General Shareholders Meeting which shall decide the date, amount and usage of funds.

47. Borrowing

In order to procure the funds required for the company’s business activities, the Financial Manager shall negotiate with banks and/or financial institutions for the borrowing within the limit prescribed by the company and its details including the timing of financing method, amount, delivery schedule, repayment period, rate of interest, collaterals, etc. and make decisions upon approval of Managing Director.

Any borrowings other than what has been stated above shall be subject to the approval of the Board of Directors’ Meeting.

Any and all of the borrowings from banks and financial institutions shall be made in the name of the company represented by the Managing Director.

48. Ceiling Limit for Borrowing

The ceiling limit of the borrowing shall be resolved at the Board of Directors' Meeting.

49. Securities

Should the company be required to render any assets as the securities for borrowing, issuing of debentures and/or guarantees, Director (Finance) shall obtain the prior approval from the relevant authorities vested under the delegation of power.

The Financial Group shall monitor and reconcile the movement of the liabilities and securities surrendered in the following manner;

- (1) To reconcile the balance of borrowing monthly,
- (2) To reconcile the balance of securities (deposit certificates, notes, negotiable instruments, etc.) monthly, and
- (3) To reconcile the balance of guarantee issued monthly.

50. Usage of Funds

The Financial Manager is held responsible for applying the funds in a efficient manner.

51. Investment, Lending and Debt Guarantee

The Financial Group is the sole Group authorized to do the investment, lending, debt guarantee upon the prior approval by the authorities vested under the delegation of power.

For any transactions of investment, lending and debt guarantee, the Financial Manager shall keep close watch and monitoring on the financial conditions and business performances of the counterparty to protect the interests of the company.

52. Administration of Promissory Notes, Bills of Exchange and Negotiable Instruments

The Financial Manager shall appoint the individual officer to be in charge of receiving and storing of the promissory notes, bills of exchange and other negotiable instruments.

The acquisition and disposal of the negotiable instruments shall be made upon the instruction issued by the Department concerned and subject to approval of the Financial Manager, Director

(Finance) and Managing Director.

The promissory notes, bills of exchange and negotiable instruments shall be administered by a statement to be prepared at the end of every month.

Any of the negotiable instruments subject to the registration in the owner's name shall be processed for re-registration of name transfer in favor of the company immediately after its obtainment.

53. Valuation of Negotiable Instruments

The assessment and re-assessment of the negotiable instruments received shall be made in accordance with the following methods;

- (1) Negotiable instruments for short term investment: _____,
- (2) Bonds to be held until maturity: _____,
- (3) Shares of related companies: _____,
- (4) Other negotiable instruments:

The instruments having market value: _____, and

The instruments having no market value: _____.

V. Business Operation Accounting

54. Recognition of Sales

The company recognizes the sales at the time invoices are sent out for the monthly delivery of electricity to the buyer.

55. Discount

Should the company be claimed for discount of the invoice due to reasonable grounds or failure to comply with the power purchasing agreement, the Department concerned shall investigate such claim and obtain approval of the responsible Director for its disposition.

56. Collection

The Department concerned shall collect the account receivable within the due date determined in the power purchase agreement.

57. Purchasing

The company recognizes the purchasing at the time of delivery receipt from the seller and

verification of the goods and services purchased.

For any transactions in which the seller deliver the goods and services directly to the third party designated by the sales contract, the company recognizes the purchasing at the time of shipment made by the seller to the designated third party.

58. Payment

The payment against the account payable shall be made based on the instruction to be issued by the Department concerned within the due date determined in the respective contract.

59. Settlement of Other Accounts Receivable and Payable

In case of occurrence of other account receivable and/or payable, the responsible Department shall take actions of issuing or accepting invoices, making payment and/or collecting the account receivable based on the respective contracts and evidences with prior approval of the Director in charge and issuing the instruction to receive or pay to the Treasurer.

60. Accounting Process for Receivables and Payables

The Accounting Group shall process entries of the receivables and payables to the accounting system based on the accounting voucher and the evidence approved by the responsible officer for those transactions.

The receivables and payables shall be administered in using supplementary books separately for each buyer or seller from their occurrences till settlement while recording outstanding balances for each day.

61. Occurrence of Arrear

In case any or whole part of the account receivables, loans, advances or suspense payment face a delay in timely settlement or the promissory notes or bills of exchange are returned unpaid, the Director in charge of the account shall immediately report it to Managing Director, make proposal for protecting and remedial measures, obtain approval of Managing Director on such proposal and take actions according to the instruction to be given by Managing Director.

In the event the arrear occurred as above is deemed uncollectible, the company write off the receivables and others subject to the approval of Managing Director or Board of Directors' Meeting as provided under the delegation of power.

62. Offsetting

Should it happen that the company maintain any balances of account receivable and account payable at the one and any time of the year, the responsible Department can negotiate with the counterparty to offset the receivable against the payable upon obtaining prior approval of the Director in charge. For exercising the offsetting, the Department responsible shall exchange with the counterparty receipts for payment of the payable or notices on offsetting.

63. Confirmation of Balances

The Accounting Group shall be held responsible to perform or cause to perform periodically the confirmation and reconciliation of the balances of the account receivable and account payable.

64. Report on Arrear

The Department responsible for business operation shall issue the report on arrear to Director (Finance) at the end of each month covering the arrear that have not been settled upon their due dates.

VI. Store and Inventory Accounting

65. Definition of Store and Inventory

The store and inventory includes the followings;

- (1) Fuel stock
- (2) Plant materials
- (3) Operating supplies
- (4) Construction stores
- (5) Goods in transit
- (6) Others

66. Office Responsible for Store and Inventory Management

The responsibility of the store and inventory control is vested upon the _____ . The Purchasing Group of the Finance and Accounts Department is in charge of the procurement of the goods and materials to be stored.

The responsible Department of the store and inventory shall manage or cause to be managed the stores and inventories in orderly and good workable conditions and protect them from the deterioration in quality and/or from disasters.

The company establishes a separate rule for administration of the store and inventory.

67. Recording of Store and Inventory

The department responsible for procurement of the stores and inventory shall record the purchasing and delivery receipt of the items acquired into the format established by the company in accurate and continuous manner.

68. Value of the Items Acquired

The values of the items acquired are based on the following principles.

- (1) The invoice price (net of discounts),
- (2) The freight and other transportation charges,
- (3) The commissions, insurance, and other incidental expenses, and
- (4) The taxes and duties.

69. Valuation of the Store and Inventory

The valuation of the store and inventory shall be made in accordance with the moving average of the total stocks.

70. Recognition of Sale for Store and Inventory

The company recognizes the sales of stores and inventory at the same time with the sale of electricity prescribed earlier.

71. Inventory Count

The Department responsible for the administration of the store and inventory conducts physical counting of the store and inventory at the end of every month, reconciled with the balance in the sub-ledger and reports its result in the inventory report to Managing Director.

72. Return of Store and Inventory

In case any of the store and inventory are found with faults, damages, deficiencies, that do not suffice the purchase contract, the Department responsible for purchasing shall take immediate action to return the item purchased or for fixing the faults at the seller's expense.

The return of the items purchased shall be made in using the voucher for returning the store and inventory.

73. Value Impaired Store and Inventory

In case that the value of any store and inventory item is found impaired due to aging, obsolescence, damage, broken package, quality deterioration, etc. and deemed unable to recover the value, the responsible Department report such to Director (Finance) and take actions according to the instruction to be given by Director (Finance).

VII. Fixed Assets and Deferred Assets

74. Definition of Fixed Assets and Deferred Assets

The fixed assets include the followings;

- (1) Tangible Fixed Assets; Land or Land Rights; Structure & Improvements; Transportation Equipment; Heavy & Other Power Operated Equipment; Office Furniture & Equipment; Communication Equipment; Tools, Shop and Garage Equipment; Laboratory Equipment; Stores Equipment; and Miscellaneous Equipment.
- (2) Intangible Fixed Assets; Land Rights; Software; Telephone Subscription; and Other Intangible Assets.
- (3) Investment; Shares Invested; Shares of Related Companies; Equity; Long Term Loan; Long Term Deposits Submitted for Surety; Long Term Prepaid Expense; Long Term Account Receivable; Long Term Insurance Premium Paid; and Other Investments.
- (4) Deferred Assets; Share Issuing Expenses; Bond Issuing Expenses; Inauguration Expense; Development Expense; and Preliminary Survey and Investigation Expense.

75. Office Responsible for Fixed Assets Management

The ultimate responsibility of the management of the fixed assets is vested upon the _____. Each of the Department appoints the officer in charge of the management of the fixed assets to control the fixed assets that belong to its own Department.

The Director of the Department of ultimate responsibility for the fixed assets shall manage or cause to be managed the fixed assets in orderly and good workable conditions and protect them from the deterioration in quality and/or from disasters while maintaining the accurate records on the acquisition, transfer, and other relevant history for each of the assets.

76. Acquisition or Disposition of Fixed Assets

The acquisition, sale, disposal or mortgaging shall be subject to the prior approval of Directors in charge, Managing Director or Board of Director's Meeting in accordance with the delegation of power.

77. Valuation of Fixed Assets

The fixed assets acquired shall be value and booked in applying the monetary value calculated as below. Any fixed assets, with exception of the land, shall not be classified as the fixed assets when the value of one unit is not exceeding Tk _____ or the useful life is less than _____ year.

- (1) The fixed asset acquired through purchase, the value of the asset shall be the purchase price plus the associated expenses of transportation cost, commissions, insurance, taxes and other incidental expenses;
- (2) The fixed asset constructed by the company, the value shall be the total cost required for the construction of the asset;
- (3) The asset acquired through exchange, the value shall be the one not less than the value of the asset surrendered for the exchange; and
- (4) The asset acquired through grant, the value shall be the one that is fair market value of the asset at the time of grant.

78. Repair or Improvement of Fixed Assets

In case any repair or improvement is made to the fixed assets accompanying any increase in the value of the assets or extension of useful life, the cost required for such repair or improvement shall be treated as the capital expenditure and recorded under the fixed assets.

79. Deferred Assets

The following deferred assets shall be amortized over the number of years described below;

- (1) Share Issuing Expense; _____ years,
- (2) Bond Issuing Expense; _____ years,
- (3) Inauguration Expense; _____ years,
- (4) Development Expense; _____ years, and
- (5) Preliminary survey and investigation; _____ years.

The deferred assets such as the development expense, preliminary survey and investigation expense shall be capitalized in case they are expended in conjunction with a specific project and such project is placed under construction.

80. Depreciation

The tangible fixed assets, intangible fixed assets and the long term prepaid expenses shall be depreciated and booked annually in accordance with the straight line method.

81. Leased Assets

The leased assets do not belong to the company's assets but shall be placed under the management and maintenance by the company in accordance with the specifications made in the relevant contracts.

The signing, terminating or modifying the contents of the lease contracts shall be subject to the prior approval of Directors in charge, Managing Director or Board of Director's Meeting in accordance with the delegation of power.

82. Office Responsible for Management of Leased Assets

The ultimate responsibility of the management of the fixed assets is vested upon the _____. Each of the Department appoints the officer in charge of the management of the leased assets to control the leased assets that belong to its own Department.

The Director of the Department of ultimate responsibility for the leased assets shall manage or cause to be managed the leased assets in orderly and good workable conditions and protect them from the deterioration in quality and/or from disasters while maintaining the accurate records on the acquisition, transfer, and other relevant history for each of the assets.

83. Procedures for Administration of Fixed Assets

The company establishes a separate rule for administration of the fixed assets.

84. Physical Count of Fixed Assets

The Department responsible for the administration of the fixed assets conducts physical counting of the fixed assets at the end of every six months, reconciled with the balance in the sub-ledger and reports its result in the fixed assets report to Managing Director.

VIII. Cost Accounting

85. Cost Accounting

The company establishes a separate rule for cost accounting of the company.

IX. Annual Settlement of Accounts

86. Objective

The objective of annual settlement of accounts is to close, fix and settle all the accounting

records for the fiscal year ended, calculate the profit and loss of the company during the period and to reveal the state of financial conditions at the end of the fiscal year.

87. Frequency for Account Settlement

The settlement of the accounts is executed for the interval of; (i) monthly; (ii) quarterly; (iii) Semi-annual and (iv) annually.

88. Monthly Settlement of Accounts

Director (Finance) prepares the following reports for the monthly settlement of the accounts;

- (1) Trial balance, Balance sheet, Profit and loss Statement, and Generation cost report; and
- (2) Other reports to be specifically adopted by the company.

89. Quarterly Settlement of Accounts

Director (Finance) prepares the following reports for the monthly settlement of the accounts;

- (1) Trial balance, Balance sheet, Profit and loss Statement, and Generation cost report; and
- (2) Other reports to be specifically adopted by the company.

90. Annual and Semi-annual Settlement of Accounts

The annual settlement of accounts shall be conducted at the end of the fiscal year as of June 30, each year and the Semi-annual settlement shall be executed as of December 31, each year.

Following procedures shall be followed in execution of the settlement of accounts;

- (1) To complete and finish the processing and book entries of all the transactions taken place during the fiscal term;
- (2) To execute the account settling procedure through;
 - 1) Inventory count,
 - 2) Calculation of accruals,
 - 3) Calculation of the depreciation,
 - 4) Calculation of provisions,
 - 5) Calculation of assets valuation,
 - 6) Others,
- (3) To prepare the trial balance sheet,.
- (4) Closing of the general ledger and sub-ledgers; and
- (5) Preparation of the financial statements.

The Semi-annual settlement shall be executed in the same manner and procedure as the annual settlement of accounts.

91. Reports to be Prepared

Director (Finance) prepares the following reports for the annual settlement of the accounts;

- (1) Balance sheet,
- (2) Profit and loss statement,
- (3) Statement of changes in equity,
- (4) Cash flow statement,
- (5) Specified breakdown report of each account,
- (6) Notes, comprising a summary of significant accounting policies and explanatory notes, and
- (7) Other reports adopted by the company.

92. Reports to Board of Directors' Meeting

Director (Finance) shall submit the reports created upon the monthly, quarterly and annual settlement of accounts to the Board of Directors' Meeting.

93. Consolidation of Related Companies

The settlement of accounts shall be executed in consolidating all of the related companies. The related companies deemed insignificant may be exempted from the consolidation.

X. Budget Control

94. Objective

The objective of budget control is to guide and control the business activities in line with the business plan established based on the company's policy, and to clarify the targets to be achieved during the budget period and to facilitate and improve the efficiency of the company.

95. Period Covered

The budget period shall be synchronized with that of accounting period which is sub-divided into month, quarter, semi-annual and annual in its operation.

96. Types of Budget

The budget of the company is comprised of two types; the capital budget and the recurrent budget.

The capital budget shall cover the budget to be established for the development and creation of the plant and equipment for productive purposes.

The recurrent budget shall cover the operation and maintenance of the existing plants and equipment at the company.

97. Preparation of Budget

For the capital budget, Director in charge of Project Development acts as the nodal person, coordinates with the Departments concerned and compiles the annual development plan and the capital budget plan of the company. The plans compiled shall be submitted to the Board of Directors' Meeting for approval.

For the capital budget that requires funding from or through the Government, the annual development plan and the capital budget plan have to be approved by the Government ministries concerned. Upon obtaining the approval at the Board of Directors' Meeting the capital budget plan shall be submitted to the Ministry of Energy and Mineral Resources and then to Planning Commission. When approved by the Planning Commission, the capital budget requested shall be incorporated into the Annual Development Plan of the national budget and the budget shall become executable.

For the capital budget that do not require the funding by or through the Government, the company shall adopt the budget plan approved by the Board of Directors' Meeting and the budget thus approved shall become enforceable.

For the recurrent budget, Director (Finance) compiles the annual recurrent budget after consultation with the Departments concerned and submit to the Board of Directors' Meeting for approval and adoption.

98. Budget Control System

The company establishes a separate rule for budget control system

XI. Tax Accounting

99. Objective

The tax accounting under this manual covers any and all of the account processing in relation to the tax and duties the company is involved and the activities associated therewith.

100. Basic Principles

The processing of the taxes and duties shall comply with the following basic principles;

- (1) The Department responsible for tax processing shall understand the rules and regulations concerned to the utmost extent, adopt such to the company, prepare appropriate tax returns and pay the taxes imposed;
- (2) The Department responsible shall make sure that no errors and omissions are involved with the processing of the taxes and duties and the activities associated therewith and shall make efforts to secure the best choice of taxing alternatives.
- (3) The company shall process the account entry and book keeping before the Value Added Tax (VAT). The VAT shall be booked separately into the sub-ledger and at the end of the fiscal period, the balance of VAT payable and total amount of VAT paid are offset each other. Any amount remained shall be classified as the VAT payable pending the actual payment of such balance to the tax authority.

101. Filing of Tax Return

The Director (Finance) shall prepare and file the tax return prescribed by the tax authority based on the settlement of the accounts and make payment of the taxes imposed by the time limit established by the tax authority.

Appendix-C12-03

Financial Model

Note: The financial model has been prepared in EXCEL file which is not attached here but is to be submitted separately.

Appendix-C12-04-1

Draft Subsidiary Loan Agreement

DRAFT SUBSIDIARY LOAN AGREEMENT

BETWEEN

THE GOVERNMENT OF THE PEOPLE'S REPUBLIC OF BANGLADESH

AND

COAL GENERATION COMPANY OF BANGLADESH LIMITED (CPGCBL)

FOR

**MATARBARI COAL FIRED GENERATION PLANT
(CONSTRUCTION OF 600MW COAL FIRED GENERATION PLANT
AND ASSOCIATED FACILITIES)**

(FINANCED BY JAPAN INTERNATIONAL COOPERATION AGENCY)

DATED _____, 2014

SUBSIDIARY LOAN AGREEMENT

This Subsidiary Loan Agreement (hereinafter called “SLA”) made on this ___th of _____, 2014

BETWEEN

The Government of the People’s Republic of Bangladesh represented by the Finance Division, Ministry of Finance (hereinafter referred to as “the Government”) on the ONE PART

AND

Coal Power Generation Company of Bangladesh Limited (hereinafter referred to as “CPGCBL”) on the OTHER PART which expression includes its successors or assignees.

WHEREAS

- A. The Government has concluded a Loan Agreement No. BD-P__ dated ___th _____, 2014 (hereinafter referred to as “the Loan Agreement”) with JAPAN INTERNATIONAL COOPERATION AGENCY (hereinafter referred to as “JICA”) for CONSTRUCTION OF MATARBARI 600MW COAL FIRED POWER GENERATION PLANT AND ASSOCIATED FACILITIES (hereinafter referred to as “the Project”) as described in Annexure-2 and 3 of this Agreement and Annexure-4 (Loan Agreement);
- B. In Section 1 of Article I of the Loan Agreement, “JICA” has agreed to lend to the Government for the implementation of the Project, on the terms and conditions set forth in the Loan Agreement an amount for JPY _____ (_____ Japanese Yen) out of which JPY _____ (_____ Japanese Yen); has been allocated for CPGCBL as its loan component (hereinafter referred to as “the Loan”);
- C. By separate Project Memorandum concluded between JICA and the Government of Bangladesh, the Government has agreed to cause CPGCBL to use the proceeds of the Loan in accordance with the terms and conditions set forth in the Loan Agreement;

D. Section ____ of Article III of the Loan Agreement provides that out of the proceeds of the Loan, the Government makes financing to the Executing Agency (hereinafter referred to as “the Subsidiary Loan”) for an amount equivalent to JPY _____ (_____ Japanese Yen) required for implementation of the Project under Subsidiary Loan Agreement (hereinafter referred to as “the SLA”) upon terms and conditions satisfactory to JICA, the Government of Bangladesh and CPGCBL; and

E. In view of the foregoing the parties hereto have agreed to enter into this Agreement which is the SLA as stated under Article III of the Loan Agreement.

Now therefore the parties hereto agree to enter into this SLA on the terms and conditions hereinafter contained as follows:

ARTICLE-I Definitions

Section 1.01:

Whenever used in this SLA, unless the context otherwise requires, additional terms shall have the meanings described thereafter.

- a. “CPGCBL” means Coal Power Generation Company of Bangladesh Limited, incorporated as a company under the Companies Act 1994 of Bangladesh as amended;
- b. “the Subsidiary Loan” means the loan made available by the Government to CPGCBL pursuant to Section 2.01 of this SLA;
- c. “the Government” means “the Government of the People’s Republic of Bangladesh”; and
- d. “PPR 2008” means Public Procurement Rules 2008.

ARTICLE-II Subsidiary Loan

Section 2.01:

Unless otherwise agreed to by and between JICA and the Government, the Government hereby agrees to extend Subsidiary Loan to CPGCBL for the total amount of

JPY _____ (_____ Japanese Yen)

subject to and upon the terms and conditions set forth in the Loan Agreement and this SLA for the purpose of carrying out Schedule __, Section __ of the Loan Agreement for its component __, __, __ and __ of the Project. Unless and until expressly revoked by the Government at its sole discretion, the Government hereby appoints CPGCBL as its agent for the purpose of taking actions or entering into agreements required or permitted under Article III of this SLA.

Section 2.02:

Out of the total amount of the Subsidiary Loan, the Government agrees to provide CPGCBL with the loan (hereinafter referred to as “Subsidiary Loan (Loan)”).

Section 2.03

CPGCBL shall use the proceeds of the Subsidiary Loan for the purpose of procuring the eligible goods and services necessary for the implementation of the Project from the engineering, procurement and construction contractors (EPC Contractors) and the consultants (collectively hereinafter referred to as “the Suppliers”) from the eligible source countries in accordance with the terms and conditions set forth in the Loan Agreement and PPR-2008 (if and whenever applicable).

Section 2.04:

The Government shall, if the Subsidiary Loan is not sufficient for the implementation of the Project, make arrangement to provide CPGCBL with such funds in local currency as are needed subject to the budgetary and planning procedures of the Government.

Section 2.05:

The Government shall open a Subsidiary Loan Account in its books in the name of CPGCBL. Each part of the Subsidiary Loan shall be deemed to be withdrawn by CPGCBL from such Subsidiary Loan Account on the date given in the official payment advice of JICA in the amounts and in the equivalent Taka amounts of the corresponding withdrawals from the Loan Account.

ARTICLE-III

Terms and Conditions

Section 3.01:

CPGCBL shall repay the principal amount of the Subsidiary Loan to the Government in the equivalent local currency. The equivalent amount of local currency shall be determined at the

official rate of exchange prevailing on such date(s) of actual payment. The principal amount of the Subsidiary Loan shall be repayable in thirty four (34) years including a grace period of ten (10) years in forty eight (48) semi-annual consecutive installments as per Amortization Schedule at Annexure-1 which shall be modified subject to actual disbursement.

Section 3.02:

CPGCBL shall pay interest to the Government in local currency at the rate of one over one hundredth percent (0.01%) per annum. The interest shall be calculated on the total principal amount in the original currency disbursed and on the outstanding amounts of the Subsidiary Loan from time to time and shall be paid semi-annually along with the installment of the principal. The interest to be accrued during the grace period shall be payable at a time along with the first installment of principal. The interest shall be payable semi-annually on January 15 and July 15 in each year.

Section 3.03:

The foreign exchange risk shall be born by CPGCBL.

Section 3.04:

The Government shall delegate to CPGCBL the authority to make withdrawal of the funds from the relevant loan account and any amount so withdrawn by CPGCBL on behalf of the Government shall be deemed to have been lent by the Government to CPGCBL on the same date in the same amount.

Section 3.05:

CPGCBL shall (a) maintain or cause to be maintained records and accounts adequate to reflect, in accordance with the consistently maintained sound accounting principles the expenditures financed out of the Subsidiary Loan and (b) have such records and accounts audited for each fiscal year in accordance with appropriate auditing principles consistently applied by an independent auditor whose qualifications, experience and terms of reference are acceptable to the Government.

ARTICLE-IV

Conditions for Withdrawal and Procurement Procedures

Section 4.01:

The conditions for withdrawal of the funds and procurement procedures applicable under the

Loan Agreement and PPR-2008 apply to the proceeds of the Subsidiary Loan and procurement utilizing such funds under the Project.

ARTICLE-V

Obligations under the Loan Agreement

Section 5.01:

CPGCBL shall do everything on its part to enable the Government to fulfill its obligations under the Loan Agreement.

Section 5.02:

The Government on its part shall do and cause everything to be done to enable CPGCBL to fulfill its obligations under the Loan Agreement.

Section 5.03:

No right or obligations under this SLA shall be assigned, amended, abrogated or waived without prior concurrence of the Government and JICA.

ARTICLE-VI

Effectiveness and Termination

Section 6.01:

This SLA shall come into force and take effect on the date upon which the Loan Agreement becomes effective.

Section 6.02:

This SLA and all obligations hereunder shall terminate if and when the entire principal amount of the Subsidiary Loan provided under this SLA and all the interest and other charges which shall have accrued thereon shall have been paid or repaid to the Government by CPGCBL in their entirety.

Section 6.03:

Notwithstanding any other provisions of this SLA, if the Government's right under the Loan Agreement to make withdrawals is suspended or terminated in whole or in part, the right of CPGCBL to receive further amount on account of the Subsidiary Loan under the SLA shall also be suspended or terminated, if any of the following events shall have happened and be

continuing:

- a) The Government or CPGCBL shall have failed to perform any of their obligations under this SLA, or
- b) The Government shall have failed to perform any of its obligations under the Loan Agreement.

Section 6.04:

CPGCBL shall be bound by the provisions of the Loan Agreement in executing the Project and shall safeguard the interest of both the Government and the funds under the Loan Agreement.

Section 6.05:

Nothing contained herein shall prejudice or otherwise affect the rights and remedies of the Government that may be otherwise available under the Loan Agreement.

ARTICLE-VII

Miscellaneous

Section 7.01:

Any notice or request permitted to be given or made under this SLA and any Agreement between the parties contemplated by this SLA shall be in writing. Such notice or request shall be deemed to have been duly given or made when it shall be delivered by hand or by mail, telegram, cable, telex, e-mail, or radiogram to the party to which it is required or permitted to be given or made at its address hereinafter specified, or at such other address as such party shall have designated by notice to the party giving such notice or making such request. The addresses so specified are;

For the Government
Finance Division
Ministry of Finance
Bangladesh Secretariat
Dhaka-1000

For CPGCBL

Dhaka _____

Section 7.02:

No delay in exercising or omission to exercise any right, power or remedy accruing to either party under this SLA upon any default shall impair any such right, power or remedy or be construed to be a waiver thereof or an acquiescence in such party in respect of any default, or any acquiescence in any default affect or impair any right, power or remedy of such party in respect of any other or subsequent default.

ARTICLE-VIII
Dispute Settlement

Section 8.01:

Any dispute arising out of this SLA shall be settled amicably.

IN WITNESS WHEREOF the parties hereto acting through their representatives duly authorized have caused this Subsidiary Loan Agreement to be signed in their respective names as of the day and year first above written.

For and on behalf of the Government of
the People's Republic of Bangladesh

Witness

1. By

(Authorized Representative)

For CPGCBL

2. By

(Authorized Representative)

AMORTIZATION SCHEDULE

DESCRIPTION OF THE PROJECT

1. Objective:

2. Location

3. Scope of the Project

COMPONENTS OF THE PROJECTS TO BE IMPLEMENTED BY CPGCBL

1. Generation Plant

2. Port and Harbor Facilities

LOAN AGREEMENT BETWEEN THE GOVERNMENT AND JICA

Appendix-C12-04-2

Draft Subsidiary Loan Agreement

DRAFT SUBSIDIARY LOAN AGREEMENT

BETWEEN

THE GOVERNMENT OF THE PEOPLE'S REPUBLIC OF BANGLADESH

AND

POWER GRID COMPANY OF BANGLADESH LTD. (PGCB)

FOR

**MATARBARI COAL FIRED GENERATION PLANT
(CONSTRUCTION OF 600MW COAL FIRED GENERATION PLANT
AND ASSOCIATED FACILITIES)**

(FINANCED BY JAPAN INTERNATIONAL COOPERATION AGENCY)

DATED _____, 2014

SUBSIDIARY LOAN AGREEMENT

This Subsidiary Loan Agreement (hereinafter called “SLA”) made on this ___th of _____, 2014

BETWEEN

The Government of the People’s Republic of Bangladesh represented by the Finance Division, Ministry of Finance (hereinafter referred to as “the Government”) on the ONE PART

AND

Power Grid Company of Bangladesh Ltd. (hereinafter referred to as “PGCB”) on the OTHER PART which expression includes its successors or assignees.

WHEREAS

- A. The Government has concluded a Loan Agreement No. BD-P__ dated ___th _____, 2014 (hereinafter referred to as “the Loan Agreement”) with JAPAN INTERNATIONAL COOPERATION AGENCY (hereinafter referred to as “JICA”) for CONSTRUCTION OF MATARBARI 600MW COAL FIRED POWER GENERATION PLANT AND ASSOCIATED FACILITIES (hereinafter referred to as “the Project”) as described in Annexure-2 and 3 of this Agreement and Annexure-4 (Loan Agreement);

- B. In Section 1 of Article I of the Loan Agreement, “JICA” has agreed to lend to the Government for the implementation of the Project, on the terms and conditions set forth in the Loan Agreement an amount for JPY _____ (_____ Japanese Yen) out of which JPY _____ (_____ Japanese Yen); has been allocated for PGCB as its loan component (hereinafter referred to as “the Loan”);

- C. By separate Project Memorandum concluded between JICA and the Government of Bangladesh, the Government has agreed to cause PGCB to use the proceeds of the Loan in accordance with the terms and conditions set forth in the Loan Agreement;

D. Section ____ of Article III of the Loan Agreement provides that out of the proceeds of the Loan, the Government makes financing to the Executing Agency (hereinafter referred to as “the Subsidiary Loan”) for an amount equivalent to JPY _____ (_____ Japanese Yen) required for implementation of the Project under Subsidiary Loan Agreement (hereinafter referred to as “the SLA”) upon terms and conditions satisfactory to JICA, the Government of Bangladesh and PGCB; and

E. In view of the foregoing the parties hereto have agreed to enter into this Agreement which is the SLA as stated under Article III of the Loan Agreement.

Now therefore the parties hereto agree to enter into this SLA on the terms and conditions hereinafter contained as follows:

ARTICLE-I Definitions

Section 1.01:

Whenever used in this SLA, unless the context otherwise requires, additional terms shall have the meanings described thereafter.

- a. “PGCB” means Power Grid Company of Bangladesh Ltd., incorporated as a company under the Companies Act 1994 of Bangladesh as amended;
- b. “the Subsidiary Loan” means the loan made available by the Government to PGCB pursuant to Section 2.01 of this SLA;
- c. “the Government” means “the Government of the People’s Republic of Bangladesh”; and
- d. “PPR 2008” means Public Procurement Rules 2008.

ARTICLE-II Subsidiary Loan

Section 2.01:

Unless otherwise agreed to by and between JICA and the Government, the Government hereby agrees to extend Subsidiary Loan to PGCB for the total amount of JPY _____ (_____ Japanese Yen) subject to and upon the terms and conditions set forth in the Loan Agreement and this SLA for the purpose of carrying out

Schedule __, Section __ of the Loan Agreement for its component __, __, __ and __ of the Project. Unless and until expressly revoked by the Government at its sole discretion, the Government hereby appoints PGCB as its agent for the purpose of taking actions or entering into agreements required or permitted under Article III of this SLA.

Section 2.02:

Out of the total amount of the Subsidiary Loan, the Government agrees to provide PGCB with the loan (hereinafter referred to as “Subsidiary Loan (Loan)”).

Section 2.03

PGCB shall use the proceeds of the Subsidiary Loan for the purpose of procuring the eligible goods and services necessary for the implementation of the Project from the engineering, procurement and construction contractors (EPC Contractors) and the consultants (collectively hereinafter referred to as “the Suppliers”) from the eligible source countries in accordance with the terms and conditions set forth in the Loan Agreement and PPR-2008 (if and whenever applicable).

Section 2.04:

The Government shall, if the Subsidiary Loan is not sufficient for the implementation of the Project, make arrangement to provide PGCB with such funds in local currency as are needed subject to the budgetary and planning procedures of the Government.

Section 2.05:

The Government shall open a Subsidiary Loan Account in its books in the name of PGCB. Each part of the Subsidiary Loan shall be deemed to be withdrawn by PGCB from such Subsidiary Loan Account on the date given in the official payment advice of JICA in the amounts and in the equivalent Taka amounts of the corresponding withdrawals from the Loan Account.

ARTICLE-III

Terms and Conditions

Section 3.01:

PGCB shall repay the principal amount of the Subsidiary Loan to the Government in the equivalent local currency. The equivalent amount of local currency shall be determined at the official rate of exchange prevailing on such date(s) of actual payment. The principal amount of the Subsidiary Loan shall be repayable in thirty four (34) years including a grace period of ten

(10) years in forty eight (48) semi-annual consecutive installments as per Amortization Schedule at Annexure-1 which shall be modified subject to actual disbursement.

Section 3.02:

PGCB shall pay interest to the Government in local currency at the rate of one over one hundredth percent (0.01%) per annum. The interest shall be calculated on the total principal amount in the original currency disbursed and on the outstanding amounts of the Subsidiary Loan from time to time and shall be paid semi-annually along with the installment of the principal. The interest to be accrued during the grace period shall be payable at a time along with the first installment of principal. The interest shall be payable semi-annually on January 15 and July 15 in each year.

Section 3.03:

The foreign exchange risk shall be born by PGCB.

Section 3.04:

The Government shall delegate to PGCB the authority to make withdrawal of the funds from the relevant loan account and any amount so withdrawn by PGCB on behalf of the Government shall be deemed to have been lent by the Government to PGCB on the same date in the same amount.

Section 3.05:

PGCB shall (a) maintain or cause to be maintained records and accounts adequate to reflect, in accordance with the consistently maintained sound accounting principles the expenditures financed out of the Subsidiary Loan and (b) have such records and accounts audited for each fiscal year in accordance with appropriate auditing principles consistently applied by an independent auditor whose qualifications, experience and terms of reference are acceptable to the Government.

ARTICLE-IV

Conditions for Withdrawal and Procurement Procedures

Section 4.01:

The conditions for withdrawal of the funds and procurement procedures applicable under the Loan Agreement and PPR-2008 apply to the proceeds of the Subsidiary Loan and procurement utilizing such funds under the Project.

ARTICLE-V
Obligations under the Loan Agreement

Section 5.01:

PGCB shall do everything on its part to enable the Government to fulfill its obligations under the Loan Agreement.

Section 5.02:

The Government on its part shall do and cause everything to be done to enable PGCB to fulfill its obligations under the Loan Agreement.

Section 5.03:

No right or obligations under this SLA shall be assigned, amended, abrogated or waived without prior concurrence of the Government and JICA.

ARTICLE-VI
Effectiveness and Termination

Section 6.01:

This SLA shall come into force and take effect on the date upon which the Loan Agreement becomes effective.

Section 6.02:

This SLA and all obligations hereunder shall terminate if and when the entire principal amount of the Subsidiary Loan provided under this SLA and all the interest and other charges which shall have accrued thereon shall have been paid or repaid to the Government by PGCB in their entirety.

Section 6.03:

Notwithstanding any other provisions of this SLA, if the Government's right under the Loan Agreement to make withdrawals is suspended or terminated in whole or in part, the right of PGCB to receive further amount on account of the Subsidiary Loan under the SLA shall also be suspended or terminated, if any of the following events shall have happened and be continuing:

- a) The Government or PGCB shall have failed to perform any of their obligations under

this SLA, or

- b) The Government shall have failed to perform any of its obligations under the Loan Agreement.

Section 6.04:

PGCB shall be bound by the provisions of the Loan Agreement in executing the Project and shall safeguard the interest of both the Government and the funds under the Loan Agreement.

Section 6.05:

Nothing contained herein shall prejudice or otherwise affect the rights and remedies of the Government that may be otherwise available under the Loan Agreement.

ARTICLE-VII

Miscellaneous

Section 7.01:

Any notice or request permitted to be given or made under this SLA and any Agreement between the parties contemplated by this SLA shall be in writing. Such notice or request shall be deemed to have been duly given or made when it shall be delivered by hand or by mail, telegram, cable, telex, e-mail, or radiogram to the party to which it is required or permitted to be given or made at its address hereinafter specified, or at such other address as such party shall have designated by notice to the party giving such notice or making such request. The addresses so specified are;

For the Government
Finance Division
Ministry of Finance
Bangladesh Secretariat
Dhaka-1000

For PGCB

Dhaka _____

Section 7.02:

No delay in exercising or omission to exercise any right, power or remedy accruing to either party under this SLA upon any default shall impair any such right, power or remedy or be construed to be a waiver thereof or an acquiescence in such party in respect of any default, or any acquiescence in any default affect or impair any right, power or remedy of such party in respect of any other or subsequent default.

ARTICLE-VIII
Dispute Settlement

Section 8.01:

Any dispute arising out of this SLA shall be settled amicably.

IN WITNESS WHEREOF the parties hereto acting through their representatives duly authorized have caused this Subsidiary Loan Agreement to be signed in their respective names as of the day and year first above written.

For and on behalf of the Government of
the People's Republic of Bangladesh

Witness

1. By

(Authorized Representative)

For PGCB

2. By

(Authorized Representative)

AMORTIZATION SCHEDULE

DESCRIPTION OF THE PROJECT

1. Objective:

2. Location

3. Scope of the Project

COMPONENTS OF THE PROJECTS TO BE IMPLEMENTED BY PGCB

1. Transmission Lines

LOAN AGREEMENT BETWEEN THE GOVERNMENT AND JICA

Appendix-C12-05-1

Draft Shareholder's Agreement

DRAFT SHAREHOLDER’S AGREEMENT

BETWEEN

THE GOVERNMENT OF THE PEOPLE’S REPUBLIC OF BANGLADESH

AND

COAL GENERATION COMPANY OF BANGLADESH LIMITED (CPGCBL)

FOR

**MATARBARI COAL FIRED GENERATION PLANT
(CONSTRUCTION OF 600MW COAL FIRED GENERATION PLANT
AND ASSOCIATED FACILITIES)**

DATED _____, 2014

SHAREHOLDER'S AGREEMENT

This Shareholder's Agreement (hereinafter called "SA") made on this ____th of _____, 2014

BETWEEN

The Government of the People's Republic of Bangladesh represented by the Power Division, Ministry of Power, Energy and Mineral Resources (hereinafter referred to as "the Government") on the ONE PART

AND

Coal Power Generation Company of Bangladesh Limited (hereinafter referred to as "CPGCBL") on the OTHER PART which expression includes its successors or assignees.

WHEREAS

- A. The Government has established and registered a public company named CPGCBL under the Companies Act 1994 on the fifth of September 2011 with the objective of implementing the electricity generation and sale fired by the coal imported and/or domestically produced.
- B. The Government has invested 100% of the shares issued of the company. On behalf of the Government, Power Division, Ministry of Power, Energy and Mineral Resources has authorized Bangladesh Power Development Board (hereinafter referred to as "BPDB") to hold the shares of the company.
- C. In view of the foregoing the parties hereto have agreed to enter into this Agreement.

Now therefore the parties hereto agree to enter into this SA on the terms and conditions hereinafter contained as follows:

ARTICLE-I

Definitions

Section 1.01:

Whenever used in this SA, unless the context otherwise requires, following additional terms shall have the meanings described herein.

- a. “CPGCBL” means Coal Power Generation Company of Bangladesh Limited, incorporated as a company under the Companies Act 1994 of Bangladesh as amended;
- b. “the Government” means “the Government of the People’s Republic of Bangladesh”;
and
- c. “MPEMR” means “Ministry of Power, Energy and Mineral Resources”.

ARTICLE-II

Shareholding

Section 2.01:

The authorized share capital of CPGCBL is Tk 6,000,000,000 (Six hundred crore Taka) divided into 600,000 (sixty lakh) Ordinary Shares with the face value of Tk 1,000 (one thousand Taka) each, out of which 10 (ten) shares have been issued, subscribed and paid in. The Government of Bangladesh has invested 100% of the shares issued by CPGCBL. On behalf of the Government, Power Division, Ministry of Power, Energy and Mineral Resources has authorized BPDB to hold the shares of the company.

Section 2.02:

The Government shall, if the extent of the shares issued is not sufficient for the implementation of the Project, make arrangement to increase the number of shares issued to provide CPGCBL with additional capital as is needed subject to the budgetary and planning procedures of the Government.

ARTICLE-III

Terms and Conditions

Section 3.01:

CPGCBL shall (a) maintain or cause to be maintained records and accounts adequate to reflect, in accordance with the consistently maintained sound accounting principles the expenditures financed out of the share capital and (b) have such records and accounts audited for each fiscal year in accordance with appropriate auditing principles consistently applied by an independent auditor whose qualifications, experience and terms of reference are acceptable to the Government.

ARTICLE-IV
Shareholder's Covenants

Section 4.01:

The Government on its part covenants that it shall provide the assistances to CPGCBL for the implementation of the Project, if so requested and deemed indispensable for the smooth and orderly implementation of the Project. The assistances shall include but not limited to the followings;

- a) The Government shall, if the finance to be extended under the Budget Financing and under the Loan Agreement between the Government and JICA is not sufficient for the implementation of the Project, make arrangement to provide CPGCBL with such funds as are needed subject to the budgetary and planning procedures of the Government.
- b) The Government shall make arrangements with the agencies concerned so that the Subsidiary Loan in providing the ODA Loan from JICA shall be extended to CPGCBL in loan with the interest rate of 0.01% p.a. and for the duration of 34 years with the grace period of 10 years;
- c) The government shall make arrangements with the agencies concerned so that the Budget Financing shall provide CPGCBL with the funds whose 60% shall be in equity and 40% in loan; and
- d) The government shall make arrangements with the agencies concerned so that the loan portion of the Budget Financing shall be extended to CPGCBL at the interest rate of 3.0% p.a. for the duration of 20 years with the grace period of 10 years.

Section 4.02:

The Government covenants that CPGCBL shall obey the governing law, rules and regulations including the Companies Act 1994, the Bangladesh Corporate Governance Code 2004 and other relevant jurisdictions concerned and the Government shall extend any assistances, if necessary, to CPGCBL for complying with those rules and regulations..

ARTICLE-V

Obligations under the Shareholder's Agreement

Section 5.01:

CPGCBL shall do everything on its part to enable the Government to fulfill its obligations under the Shareholder's Agreement.

Section 5.02:

The Government on its part shall do and cause everything to be done to enable CPGCBL to fulfill its obligations under the Shareholder's Agreement.

Section 5.03:

No right or obligations under this SA shall be assigned, amended, abrogated or waived without prior concurrence of the Government.

ARTICLE-VI

Effectiveness and Termination

Section 6.01:

This SA shall come into force and take effect on the date first above written and the date on which the Loan Agreement between the Government and JICA shall have been signed, whichever comes later, becomes effective.

Section 6.02:

This SA and all obligations hereunder shall terminate if and when the entire principal amount of the shares issued under this SA and all the interest and other charges which shall have accrued thereon shall have been paid to the Government by CPGCBL in their entirety.

Section 6.03:

Notwithstanding any other provisions of this SA, if the Government's right under the Loan Agreement between the Government and JICA to make withdrawals is suspended or terminated in whole or in part, the right of CPGCBL to receive further amount on account of the SA shall also be suspended or terminated, if any of the following events shall have happened and be continuing:

- a) The Government or CPGCBL shall have failed to perform any of their obligations under this SA, or

- b) The Government shall have failed to perform any of its obligations under the Loan Agreement between the Government and JICA.

Section 6.04:

CPGCBL shall be bound by the provisions of this SA in executing the Project and shall safeguard the interest of both the Government and the funds under the SA.

Section 6.05:

Nothing contained herein shall prejudice or otherwise affect the rights and remedies of the Government that may be otherwise available.

ARTICLE-VII

Miscellaneous

Section 7.01:

Any notice or request permitted to be given or made under this SA and any Agreement between the parties contemplated by this SA shall be in writing. Such notice or request shall be deemed to have been duly given or made when it shall be delivered by hand or by mail, telegram, cable, telex, e-mail, or radiogram to the party to which it is required or permitted to be given or made at its address hereinafter specified, or at such other address as such party shall have designated by notice to the party giving such notice or making such request. The addresses so specified are;

For the Government

Power Division

Ministry of Power, Energy and Mineral Resources

Bangladesh Secretariat

Dhaka-1000

For CPGCBL

Dhaka _____

Section 7.02:

No delay in exercising or omission to exercise any right, power or remedy accruing to either party under this SA upon any default shall impair any such right, power or remedy or be construed to be a waiver thereof or an acquiescence in such party in respect of any default, or any acquiescence in any default affect or impair any right, power or remedy of such party in respect of any other or subsequent default.

ARTICLE-VIII
Dispute Settlement

Section 8.01:

Any dispute arising out of this SA shall be settled amicably.

IN WITNESS WHEREOF the parties hereto acting through their representatives duly authorized have caused this Shareholder's Agreement to be signed in their respective names as of the day and year first above written.

For and on behalf of the Government of
the People's Republic of Bangladesh

Witness

1. By

(Authorized Representative)

For CPGCBL

2. By

(Authorized Representative)

DESCRIPTION OF THE PROJECT

1. Objective:

2. Location

3. Scope of the Project

COMPONENTS OF THE PROJECTS TO BE IMPLEMENTED BY CPGCBL

1. Generation Plant

2. Port and Harbor Facilities

Appendix-C12-05-2

Draft Establishment Support Agreement

DRAFT ESTABLISHMENT SUPPORT AGREEMENT

BETWEEN

BANGLADESH POWER DEVELOPMENT BOARD (BPDB)

AND

COAL GENERATION COMPANY OF BANGLADESH LIMITED (CPGCBL)

FOR

**MATARBARI COAL FIRED GENERATION PLANT
(CONSTRUCTION OF 600MW COAL FIRED GENERATION PLANT
AND ASSOCIATED FACILITIES)**

DATED _____, 2014

ESTABLISHMENT SUPPORT AGREEMENT

This Establishment Support Agreement (hereinafter called “ESA”) made on this ___th of _____, 2014

BETWEEN

Bangladesh Power Development Board (hereinafter referred to as “BPDB”) on the ONE PART

AND

Coal Power Generation Company of Bangladesh Limited (hereinafter referred to as “CPGCBL”) on the OTHER PART which expression includes its successors or assignees.

WHEREAS

- A. The Government of Bangladesh (hereinafter referred to as “the Government) has established and registered a public company named CPGCBL under the Companies Act 1994 on the fifth of September 2011 with the objective of implementing the electricity generation and sale fired by the coal imported and/or domestically produced.
- B. The Government has invested 100% of the shares issued of the company. On behalf of the Government, Power Division, Ministry of Power, Energy and Mineral Resources has authorized BPDB to hold the shares of the company.
- C. In view of the foregoing the parties hereto have agreed to enter into this Agreement.

Now therefore the parties hereto agree to enter into this SA on the terms and conditions hereinafter contained as follows:

ARTICLE-I

Definitions

Section 1.01:

Whenever used in this ESA, unless the context otherwise requires, following additional terms

shall have the meanings described herein.

- a. "CPGCBL" means Coal Power Generation Company of Bangladesh Limited, incorporated as a company under the Companies Act 1994 of Bangladesh as amended;
- b. "the Government" means "the Government of the People's Republic of Bangladesh";
- c. "MPEMR" means "Ministry of Power, Energy and Mineral Resources"; and
- d. "BPDB" means Bangladesh Power Development Board.

ARTICLE-II

Establishment Support

Section 2.01:

BPDB shall provide CPGCBL with the financial support in providing temporary loans (hereinafter referred to as "Establishment Support Loan") to cover the funding requirement of CPGCBL during its phase of initial establishment and construction of the Project whereas the funds required for the implementation of the Project shall be obtained through the Budget Financing and the Subsidiary Loan of JICA's ODA Loan.

Section 2.02:

The amount to be lent by BPDB to CPGCBL shall be the sums required for establishing and maintaining the corporate activities that are indispensable but are not included in the budget for the Project less the amount of the paid-up capital of CPGCBL that has been separately agreed under the Shareholder's Agreement.

ARTICLE-III

Terms and Conditions

Section 3.01:

BPDB shall extend the Establishment Support Loan to CPGCBL during the period prior to the completion of the Project and shall be repayable in the equal installments during the five (5) years succeeding the commercial operation date of the Project.

Section 3.02:

CPGCBL shall pay interest to BPDB at the rate of ____ (___) % per annum. The interest shall be calculated on the total principal amount in the original currency disbursed and on the outstanding amounts of the Subsidiary Loan from time to time and shall be paid semi-annually

along with the installment of the principal. The interest to be accrued during the grace period shall be payable at a time along with the first installment of principal.

Section 3.03:

CPGCBL shall (a) maintain or cause to be maintained records and accounts adequate to reflect, in accordance with the consistently maintained sound accounting principles the expenditures financed out of the share capital and (b) have such records and accounts audited for each fiscal year in accordance with appropriate auditing principles consistently applied by an independent auditor whose qualifications, experience and terms of reference are acceptable to the Government.

ARTICLE-IV Covenants

Section 4.01:

BPDB on its part covenants that it shall provide the assistances to CPGCBL for the implementation of the Project, if so requested and deemed indispensable for the smooth and orderly implementation of the Project.

Section 4.02:

CPGCBL shall obey the governing law, rules and regulations including the Companies Act 1994, the Bangladesh Corporate Governance Code 2004 and other relevant jurisdictions concerned and the Government shall extend any assistances, if necessary, to CPGCBL for complying with those rules and regulations..

ARTICLE-V Obligations under the Establishment Support Agreement

Section 5.01:

CPGCBL shall do everything on its part to enable the Government to fulfill its obligations under the Establishment Support Agreement.

Section 5.02:

The Government on its part shall do and cause everything to be done to enable CPGCBL to fulfill its obligations under the Establishment Support Agreement.

Section 5.03:

No right or obligations under this ESA shall be assigned, amended, abrogated or waived without prior concurrence of the Government.

ARTICLE-VI

Effectiveness and Termination

Section 6.01:

This ESA shall come into force and take effect on the date first above written and the date on which the Loan Agreement between the Government and JICA shall have been signed, whichever comes later, becomes effective.

Section 6.02:

This ESA and all obligations hereunder shall terminate if and when the entire principal amount of the shares issued under this ESA and all the interest and other charges which shall have accrued thereon shall have been paid to the Government by CPGCBL in their entirety.

Section 6.03:

Notwithstanding any other provisions of this ESA, if the Government's right under the Loan Agreement between the Government and JICA to make withdrawals is suspended or terminated in whole or in part, the right of CPGCBL to receive further amount on account of the ESA shall also be suspended or terminated, if any of the following events shall have happened and be continuing:

- a) The Government, BPDB or CPGCBL shall have failed to perform any of their obligations under this ESA, or
- b) The Government shall have failed to perform any of its obligations under the Loan Agreement between the Government and JICA.

Section 6.04:

CPGCBL shall be bound by the provisions of this ESA in executing the Project and shall safeguard the interest of both the Government, BPDB and the funds under the ESA.

Section 6.05:

Nothing contained herein shall prejudice or otherwise affect the rights and remedies of the

Government that may be otherwise available.

ARTICLE-VII

Miscellaneous

Section 7.01:

Any notice or request permitted to be given or made under this ESA and any Agreement between the parties contemplated by this ESA shall be in writing. Such notice or request shall be deemed to have been duly given or made when it shall be delivered by hand or by mail, telegram, cable, telex, e-mail, or radiogram to the party to which it is required or permitted to be given or made at its address hereinafter specified, or at such other address as such party shall have designated by notice to the party giving such notice or making such request. The addresses so specified are;

For the Government

Power Division

Ministry of Power, Energy and Mineral Resources

Bangladesh Secretariat

Dhaka-1000

For CPGCBL

Dhaka _____

Section 7.02:

No delay in exercising or omission to exercise any right, power or remedy accruing to either party under this ESA upon any default shall impair any such right, power or remedy or be construed to be a waiver thereof or an acquiescence in such party in respect of any default, or any acquiescence in any default affect or impair any right, power or remedy of such party in respect of any other or subsequent default.

ARTICLE-VIII

Dispute Settlement

Section 8.01:

Any dispute arising out of this ESA shall be settled amicably.

IN WITNESS WHEREOF the parties hereto acting through their representatives duly authorized have caused this Establishment Support Agreement to be signed in their respective names as of the day and year first above written.

For and on behalf of BPDB

Witness

1. By

(Authorized Representative)

For CPGCBL

2. By

(Authorized Representative)

DESCRIPTION OF THE PROJECT

1. Objective:

2. Location

3. Scope of the Project

COMPONENTS OF THE PROJECTS TO BE IMPLEMENTED BY CPGCBL

1. Generation Plant

2. Port and Harbor Facilities

Appendix-C12-06-1

Draft Budget Financing Agreement

DRAFT BUDGET FINANCING AGREEMENT

BETWEEN

THE GOVERNMENT OF THE PEOPLE'S REPUBLIC OF BANGLADESH

AND

COAL GENERATION COMPANY OF BANGLADESH LIMITED (CPGCBL)

FOR

**MATARBARI COAL FIRED GENERATION PLANT
(CONSTRUCTION OF 600MW COAL FIRED GENERATION PLANT
AND ASSOCIATED FACILITIES)**

DATED _____, 2014

BUDGET FINANCING AGREEMENT

This Budget Financing Agreement (hereinafter called “BFA”) made on this ____th of _____, 2014

BETWEEN

The Government of the People’s Republic of Bangladesh represented by the Finance Division, Ministry of Finance (hereinafter referred to as “the Government”) on the ONE PART

AND

Coal Power Generation Company of Bangladesh Limited (hereinafter referred to as “CPGCBL”) on the OTHER PART which expression includes its successors or assignees.

WHEREAS

- A. The Government has approved the Development Project Proforma/Proposal (hereinafter referred to as “the DPP”) No. _____ dated ____th _____ 2014 submitted by CPGCBL to and discussed at Executive Committee of National Economic Council (hereinafter referred to as “ECNEC”) for CONSTRUCTION OF MATARBARI 600MW COAL FIRED POWER GENERATION PLANT AND ASSOCIATED FACILITIES (hereinafter referred to as “the Project”) as described in Annexure-2 and 3 of this Agreement vide the letter No. _____ dated ____th _____, 2014;
- B. ECNEC has approved adoption of the Project into the Annual Development Programme (hereinafter referred to as “ADP”) Budget of the Government for the total amount of TK _____ (_____ Taka) for the implementation of the Project;
- C. The Government has concluded a Loan Agreement with Japan International Cooperation Agency (hereinafter referred to as “JICA”) for extending a long term loan for the total amount of JPY _____ (_____ Japanese Yen) to the Government for on-lending to CPGCBL for the implementation of the Project;

- D. Out of the total Project cost approved by ECNEC, The Loan to be provided by JICA shall cover a part, whereas there shall remain a certain part that is not covered by JICA's Loan. The Government makes a combination of loan(s) and equity(s) to CPGCBL (hereinafter referred to as "the Budget Financing") for an amount to Taka _____ (_____ Taka) required for implementation of the Project upon terms and conditions satisfactory to the Government and CPGCBL. The Budget Financing shall be comprised of the equity for sixty percent (60%) of the total (hereinafter referred to as "Budget Financing (Equity)" and the loan for remaining forty percent (40%) of the Budget Financing (hereinafter referred to as "Budget Financing (Loan) ; and
- E. In view of the foregoing the parties hereto have agreed to enter into this Agreement.

Now therefore the parties hereto agree to enter into this BFA on the terms and conditions hereinafter contained as follows:

ARTICLE-I Definitions

Section 1.01:

Whenever used in this BFA, unless the context otherwise requires, following additional terms shall have the meanings described thereafter.

- a. "CPGCBL" means Coal Power Generation Company of Bangladesh Limited, incorporated as a company under the Companies Act 1994 of Bangladesh as amended;
- b. "the Budget Finance" means the package of equity and loan made available by the Government to CPGCBL pursuant to Article II of this BFA;
- c. "the Budget Finance (Equity)" means the equity funds made available by the Government to CPGCBL pursuant to Section 2.01, Article II of this BFA;
- d. "the Budget Finance (Loan)" means the loan made available by the Government to CPGCBL pursuant to Section 2.01, Article II of this BFA;
- e. "the Government" means "the Government of the People's Republic of Bangladesh"; and
- f. "PPR 2008" means Public Procurement Rules 2008.

ARTICLE-II

Budget Finance

Section 2.01:

Unless otherwise agreed to by the Government, the Government hereby agrees to provide CPGCBL with the total amount Tk _____ (_____ Taka) covering the gap between the amount of the Project approved by ECNEC and the amount determined to be extended by JICA subject to and upon the terms and conditions set forth in this BFA. Unless and until expressly revoked by the Government at its sole discretion, the Government hereby appoints CPGCBL as its agent for the purpose of taking actions or entering into agreements required or permitted under Article III of this BFA.

Section 2.02:

The Budget Finance (Equity) shall be in the total amount of Tk _____ (_____ Taka) and the Budget Finance (Loan) shall be in the total amount of Tk _____ (_____ Taka).

Section 2.03:

CPGCBL shall use the proceeds of the Budget Finance for the purpose of procuring the goods and services and paying expenditures necessary for the implementation of the Project in accordance with the terms and conditions set forth PPR-2008 (if and whenever applicable).

Section 2.04:

The Government shall, if the Budget Finance is not sufficient for the implementation of the Project, make arrangement to provide CPGCBL with such funds as are needed subject to the budgetary and planning procedures of the Government.

Section 2.05:

The Government shall open a Budget Finance (Equity) Account and a Budget Finance (Loan) Account in its books in the name of CPGCBL. Each part of the Budget Finance shall be deemed to be withdrawn by CPGCBL from such Budget Finance Accounts on the date given in the official payment advice of Finance Division, Ministry of Finance of the Government.

ARTICLE-III

Terms and Conditions

Section 3.01:

CPGCBL shall repay the principal amount of the Budget Finance (Loan) to the Government. The principal amount of the Budget Financing (Loan) Loan shall be repayable in twenty (20) years including a grace period of ten (10) years in twenty (20) semi-annual consecutive installments as per Amortization Schedule at Annexure-1 which shall be modified subject to actual disbursement.

Section 3.02:

CPGCBL shall pay interest to the Government at the rate of three percent (3.0%) per annum. The interest shall be calculated on the total principal amount disbursed and on the outstanding amounts of the Budget Finance (Loan) from time to time and shall be paid semi-annually along with the installment of the principal. The interest to be accrued during the grace period shall be payable at a time along with the first installment of principal. The interest shall be payable semi-annually on _____ and _____ in each year.

Section 3.03:

The Government shall delegate to CPGCBL the authority to make withdrawal of the funds from the relevant account and any amount so withdrawn by CPGCBL shall be deemed to have been invested and lent by the Government to CPGCBL on the same date in the same amount.

Section 3.04:

CPGCBL shall (a) maintain or cause to be maintained records and accounts adequate to reflect, in accordance with the consistently maintained sound accounting principles the expenditures financed out of the Budget Finance and (b) have such records and accounts audited for each fiscal year in accordance with appropriate auditing principles consistently applied by an independent auditor whose qualifications, experience and terms of reference are acceptable to the Government.

ARTICLE-IV

Conditions for Withdrawal and Procurement Procedures

Section 4.01:

Each time CPGCBL request the Government for disbursement of the Budget Finance, the total amount of the request shall be divided into the Budget Finance (Equity) for sixty percent (60 %) and into the Budget Finance (Loan) for forty percent (40%) and respective amount shall be booked into the account of CPGCBL.

Section 4.02:

The conditions for withdrawal of the funds and procurement procedures applicable under PPR-2008 apply to the proceeds of the Budget Finance and procurement utilizing such funds under the Project.

ARTICLE-V

Obligations under the Budget Financing Agreement

Section 5.01:

CPGCBL shall do everything on its part to enable the Government to fulfill its obligations under the BFA.

Section 5.02:

The Government on its part shall do and cause everything to be done to enable CPGCBL to fulfill its obligations under the BFA.

Section 5.03:

No right or obligations under this BFA shall be assigned, amended, abrogated or waived without prior concurrence of the Government.

ARTICLE-VI

Effectiveness and Termination

Section 6.01:

This BFA shall come into force and take effect on the date first above written and the date on which the Loan Agreement between the Government and JICA shall have been signed, whichever comes later, becomes effective.

Section 6.02:

This BFA and all obligations hereunder shall terminate if and when the entire principal amount of the Budget Finance provided under this BFA and all the interest and other charges which shall have accrued thereon shall have been paid to the Government by CPGCBL in their entirety.

Section 6.03:

Notwithstanding any other provisions of this BFA, if the Government's right under the Loan Agreement between the Government and JICA to make withdrawals is suspended or terminated in whole or in part, the right of CPGCBL to receive further amount on account of the Budget Finance under the BFA shall also be suspended or terminated, if any of the following events shall have happened and be continuing:

- a) The Government or CPGCBL shall have failed to perform any of their obligations under this BFA, or
- b) The Government shall have failed to perform any of its obligations under the Loan Agreement between the Government and JICA.

Section 6.04:

CPGCBL shall be bound by the provisions of this BFA in executing the Project and shall safeguard the interest of both the Government and the funds under the BFA.

Section 6.05:

Nothing contained herein shall prejudice or otherwise affect the rights and remedies of the Government that may be otherwise available.

ARTICLE-VII

Miscellaneous

Section 7.01:

Any notice or request permitted to be given or made under this BFA and any Agreement between the parties contemplated by this BFA shall be in writing. Such notice or request shall be deemed to have been duly given or made when it shall be delivered by hand or by mail, telegram, cable, telex, e-mail, or radiogram to the party to which it is required or permitted to be given or made at its address hereinafter specified, or at such other address as such party shall have designated by notice to the party giving such notice or making such request. The addresses so specified are;

For the Government
Finance Division
Ministry of Finance
Bangladesh Secretariat

Dhaka-1000

For CPGCBL

Dhaka _____

Section 7.02:

No delay in exercising or omission to exercise any right, power or remedy accruing to either party under this BFA upon any default shall impair any such right, power or remedy or be construed to be a waiver thereof or an acquiescence in such party in respect of any default, or any acquiescence in any default affect or impair any right, power or remedy of such party in respect of any other or subsequent default.

ARTICLE-VIII
Dispute Settlement

Section 8.01:

Any dispute arising out of this BFA shall be settled amicably.

IN WITNESS WHEREOF the parties hereto acting through their representatives duly authorized have caused this Budget Financing Agreement to be signed in their respective names as of the day and year first above written.

For and on behalf of the Government of
the People's Republic of Bangladesh

Witness

1. By

(Authorized Representative)

For CPGCBL

2.

By

(Authorized Representative)

AMORTIZATION SCHEDULE

DESCRIPTION OF THE PROJECT

1. Objective:

2. Location

3. Scope of the Project

COMPONENTS OF THE PROJECTS TO BE IMPLEMENTED BY CPGCBL

1. Generation Plant

2. Port and Harbor Facilities

LOAN AGREEMENT BETWEEN THE GOVERNMENT AND JICA

Appendix-C12-06-2

Draft Budget Financing Agreement

DRAFT BUDGET FINANCING AGREEMENT

BETWEEN

THE GOVERNMENT OF THE PEOPLE'S REPUBLIC OF BANGLADESH

AND

POWER GRID COMPANY OF BANGLADESH LTD. (PGCB)

FOR

**MATARBARI COAL FIRED GENERATION PLANT
(CONSTRUCTION OF 600MW COAL FIRED GENERATION PLANT
AND ASSOCIATED FACILITIES)**

DATED _____, 2014

BUDGET FINANCING AGREEMENT

This Budget Financing Agreement (hereinafter called “BFA”) made on this ____th of _____, 2014

BETWEEN

The Government of the People’s Republic of Bangladesh represented by the Finance Division, Ministry of Finance (hereinafter referred to as “the Government”) on the ONE PART

AND

Power Grid Company of Bangladesh Ltd. (hereinafter referred to as “PGCB”) on the OTHER PART which expression includes its successors or assignees.

WHEREAS

- A. The Government has approved the Development Project Proforma/Proposal (hereinafter referred to as “the DPP”) No. _____ dated ____th _____ 2014 submitted by PGCB to and discussed at Executive Committee of National Economic Council (hereinafter referred to as “ECNEC”) for CONSTRUCTION OF MATARBARI 600MW COAL FIRED POWER GENERATION PLANT AND ASSOCIATED FACILITIES (hereinafter referred to as “the Project”) as described in Annexure-2 and 3 of this Agreement vide the letter No. _____ dated ____th _____, 2014;
- B. ECNEC has approved adoption of the Project into the Annual Development Programme (hereinafter referred to as “ADP”) Budget of the Government for the total amount of TK _____ (_____ Taka) for the implementation of the Project;
- C. The Government has concluded a Loan Agreement with Japan International Cooperation Agency (hereinafter referred to as “JICA”) for extending a long term loan for the total amount of JPY _____ (_____ Japanese Yen) to the Government for on-lending to PGCB for the implementation of the Project;

D. Out of the total Project cost approved by ECNEC, The Loan to be provided by JICA shall cover a part, whereas there shall remain a certain part that is not covered by JICA's Loan. The Government makes a combination of loan(s) and equity(s) to PGCB (hereinafter referred to as "the Budget Financing") for an amount to Taka _____ (_____ Taka) required for implementation of the Project upon terms and conditions satisfactory to the Government and PGCB. The Budget Financing shall be comprised of the equity for sixty percent (60%) of the total (hereinafter referred to as "Budget Financing (Equity)" and the loan for remaining forty percent (40%) of the Budget Financing (hereinafter referred to as "Budget Financing (Loan) ; and

E. In view of the foregoing the parties hereto have agreed to enter into this Agreement.

Now therefore the parties hereto agree to enter into this BFA on the terms and conditions hereinafter contained as follows:

ARTICLE-I

Definitions

Section 1.01:

Whenever used in this BFA, unless the context otherwise requires, following additional terms shall have the meanings described thereafter.

- a. "PGCB" means Power Grid Company of Bangladesh Ltd., incorporated as a company under the Companies Act 1994 of Bangladesh as amended;
- b. "the Budget Finance" means the package of equity and loan made available by the Government to PGCB pursuant to Article II of this BFA;
- c. "the Budget Finance (Equity)" means the equity funds made available by the Government to PGCB pursuant to Section 2.01, Article II of this BFA;
- d. "the Budget Finance (Loan)" means the loan made available by the Government to PGCB pursuant to Section 2.01, Article II of this BFA;
- e. "the Government" means "the Government of the People's Republic of Bangladesh"; and
- f. "PPR 2008" means Public Procurement Rules 2008.

ARTICLE-II

Budget Finance

Section 2.01:

Unless otherwise agreed to by the Government, the Government hereby agrees to provide PGCB with the total amount Tk _____ (_____ Taka) covering the gap between the amount of the Project approved by ECNEC and the amount determined to be extended by JICA subject to and upon the terms and conditions set forth in this BFA. Unless and until expressly revoked by the Government at its sole discretion, the Government hereby appoints PGCB as its agent for the purpose of taking actions or entering into agreements required or permitted under Article III of this BFA.

Section 2.02:

The Budget Finance (Equity) shall be in the total amount of Tk _____ (_____ Taka) and the Budget Finance (Loan) shall be in the total amount of Tk _____ (_____ Taka).

Section 2.03:

PGCB shall use the proceeds of the Budget Finance for the purpose of procuring the goods and services and paying expenditures necessary for the implementation of the Project in accordance with the terms and conditions set forth PPR-2008 (if and whenever applicable).

Section 2.04:

The Government shall, if the Budget Finance is not sufficient for the implementation of the Project, make arrangement to provide PGCB with such funds as are needed subject to the budgetary and planning procedures of the Government.

Section 2.05:

The Government shall open a Budget Finance (Equity) Account and a Budget Finance (Loan) Account in its books in the name of PGCB. Each part of the Budget Finance shall be deemed to be withdrawn by PGCB from such Budget Finance Accounts on the date given in the official payment advice of Finance Division, Ministry of Finance of the Government.

ARTICLE-III

Terms and Conditions

Section 3.01:

PGCB shall repay the principal amount of the Budget Finance (Loan) to the Government. The principal amount of the Budget Financing (Loan) Loan shall be repayable in twenty (20) years including a grace period of ten (10) years in twenty (20) semi-annual consecutive installments as per Amortization Schedule at Annexure-1 which shall be modified subject to actual disbursement.

Section 3.02:

PGCB shall pay interest to the Government at the rate of three percent (3.0%) per annum. The interest shall be calculated on the total principal amount disbursed and on the outstanding amounts of the Budget Finance (Loan) from time to time and shall be paid semi-annually along with the installment of the principal. The interest to be accrued during the grace period shall be payable at a time along with the first installment of principal. The interest shall be payable semi-annually on _____ and _____ in each year.

Section 3.03:

The Government shall delegate to PGCB the authority to make withdrawal of the funds from the relevant account and any amount so withdrawn by PGCB shall be deemed to have been invested and lent by the Government to PGCB on the same date in the same amount.

Section 3.04:

PGCB shall (a) maintain or cause to be maintained records and accounts adequate to reflect, in accordance with the consistently maintained sound accounting principles the expenditures financed out of the Budget Finance and (b) have such records and accounts audited for each fiscal year in accordance with appropriate auditing principles consistently applied by an independent auditor whose qualifications, experience and terms of reference are acceptable to the Government.

ARTICLE-IV

Conditions for Withdrawal and Procurement Procedures

Section 4.01:

Each time PGCB request the Government for disbursement of the Budget Finance, the total amount of the request shall be divided into the Budget Finance (Equity) for sixty percent (60 %) and into the Budget Finance (Loan) for forty percent (40%) and respective amount shall be booked into the account of PGCB.

Section 4.02:

The conditions for withdrawal of the funds and procurement procedures applicable under PPR-2008 apply to the proceeds of the Budget Finance and procurement utilizing such funds under the Project.

ARTICLE-V

Obligations under the Budget Financing Agreement

Section 5.01:

PGCB shall do everything on its part to enable the Government to fulfill its obligations under the BFA.

Section 5.02:

The Government on its part shall do and cause everything to be done to enable PGCB to fulfill its obligations under the BFA.

Section 5.03:

No right or obligations under this BFA shall be assigned, amended, abrogated or waived without prior concurrence of the Government.

ARTICLE-VI

Effectiveness and Termination

Section 6.01:

This BFA shall come into force and take effect on the date first above written and the date on which the Loan Agreement between the Government and JICA shall have been signed, whichever comes later, becomes effective.

Section 6.02:

This BFA and all obligations hereunder shall terminate if and when the entire principal amount of the Budget Finance provided under this BFA and all the interest and other charges which shall have accrued thereon shall have been paid to the Government by PGCB in their entirety.

Section 6.03:

Notwithstanding any other provisions of this BFA, if the Government's right under the Loan Agreement between the Government and JICA to make withdrawals is suspended or terminated

in whole or in part, the right of PGCB to receive further amount on account of the Budget Finance under the BFA shall also be suspended or terminated, if any of the following events shall have happened and be continuing:

- a) The Government or PGCB shall have failed to perform any of their obligations under this BFA, or
- b) The Government shall have failed to perform any of its obligations under the Loan Agreement between the Government and JICA.

Section 6.04:

PGCB shall be bound by the provisions of this BFA in executing the Project and shall safeguard the interest of both the Government and the funds under the BFA.

Section 6.05:

Nothing contained herein shall prejudice or otherwise affect the rights and remedies of the Government that may be otherwise available.

ARTICLE-VII

Miscellaneous

Section 7.01:

Any notice or request permitted to be given or made under this BFA and any Agreement between the parties contemplated by this BFA shall be in writing. Such notice or request shall be deemed to have been duly given or made when it shall be delivered by hand or by mail, telegram, cable, telex, e-mail, or radiogram to the party to which it is required or permitted to be given or made at its address hereinafter specified, or at such other address as such party shall have designated by notice to the party giving such notice or making such request. The addresses so specified are;

For the Government
Finance Division
Ministry of Finance
Bangladesh Secretariat
Dhaka-1000

For PGCB

Dhaka _____

Section 7.02:

No delay in exercising or omission to exercise any right, power or remedy accruing to either party under this BFA upon any default shall impair any such right, power or remedy or be construed to be a waiver thereof or an acquiescence in such party in respect of any default, or any acquiescence in any default affect or impair any right, power or remedy of such party in respect of any other or subsequent default.

ARTICLE-VIII
Dispute Settlement

Section 8.01:

Any dispute arising out of this BFA shall be settled amicably.

IN WITNESS WHEREOF the parties hereto acting through their representatives duly authorized have caused this Budget Financing Agreement to be signed in their respective names as of the day and year first above written.

For and on behalf of the Government of
the People's Republic of Bangladesh

Witness

1. By

(Authorized Representative)

For PGCB

2.

By

(Authorized Representative)

AMORTIZATION SCHEDULE

DESCRIPTION OF THE PROJECT

1. Objective:

2. Location

3. Scope of the Project

COMPONENTS OF THE PROJECTS TO BE IMPLEMENTED BY PGCB

1. Transmission Lines

LOAN AGREEMENT BETWEEN THE GOVERNMENT AND JICA