Semi-Annual Environmental Monitoring Report

Project number: 42173-013

Period: July – December 2019
Submission Date: July 2020

BAN: Dhaka Environmentally Sustainable Water Supply Project (PART C)

I. Water Quality

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ACRONYMS AND ABBREVIATIONS

AOI	Area of Interest
BMD	Bangladesh Meteorological Department
BWDB	Bangladesh Water Development Board
DAP	Detailed Area Plan
DCC	Dhaka City Corporation
DESWSP	Dhaka Environmentally Sustainable Water Supply Project
DMDP	Dhaka Metropolitan Development Plan
DMP	Drainage Master Plan
DNCC	Dhaka North City Corporation
DND	Dhaka Narayanganj Demra Flood Control, Drainage & Irrigation Project
DSCC	Dhaka South City Corporation
DWASA	Dhaka Water Supply and Sewerage Authority
FAP	Flood Action Plan
FCD	Flood Control and Drainage
GoB	Government of Bangladesh
GIS	Geographic information system
HWL	Highest Water Level
IWM	Institute of Water Modeling
JICA	Japan International Cooperation Agency
km	Kilometer
km^2	Kilo Meters squared, square kilo meters
LGED	Local Government Engineering Department
LWL	Lowest Water Level
m/s	Meter per second
m^2	Meter squared, square meter
m^3/s	Cubic meter per second (cumec)
MRT	Mass Rapid Transit
O & M	Operation and Maintenance
PWD	Public Works Department
RAJUK	Rajdhani Unnayan Kartripakkha
RDP	Regional Development Plan
RHD	Roads and Highways Department
SN	Serial Number
SoB	Survey of Bangladesh
ToR	Terms of Reference
WL	Water Level
WQ	Water Quality

EXCUTIVE SUMMARY

To assess the variation of surface water quality over the period of eighteen months for better understanding of appropriate surface water treatment facilities for the proposed 500MLD DWASA surface treatment plant which is going to install at Bishnondi Arihazer using Meghna river water for ensuring better quality water supply at mega-city Dhaka.

Targeting the above work, ONUSHANDHANI CREEDS LIMITED, a well reported consulting firm has been assigned to conduct surface water quality monitoring at proposed intake point at Bishnondi, Bank of Meghna River, Arihazar under DESWSP, DWASA [RFQW-3.32] for eighteen months.

This report, one of a series of monthly reports on the Surface Water Quality Monitoring (4th Phase) At Proposed Raw Water Intake Point at Bishnodi, Bank of Meghna River, Arihazar Under Dhaka Environmentally Sustainable Water Supply Project (DESWSP), DWASA. The report summarizes the results of the surface water quality monitoring for the month of July 2019.

Temperature, pH, Salinity, Conductivity, Turbidity, Dissolved Oxygen, TDS and Ammonia are measured for three grab sample and one composite sample [after immediate mixing of this three grab sample (1st, 2nd & 3rd Grab sample)] at field and record properly. Sampling frequency are weekly, monthly, seasonal and hourly basis.

Total 12 ammonia test have been conducted during three weeks with one-week interval in this month and no significant fluctuation of ammonia concentration has been found in different depth. It was observed that over the three weeks, the ammonia concentration has increased with the decreased of DO (Dissolved Oxygen).

Other water quality field test parameters like salinity, hardness did not show any changes during this three weeks' period and their concentration were found below permissible level.

CHAPTER 1

INTRODUCTION

1 INTRODUCTION

1.1 BACKGROUND

Water is continually moving around, though, and above the Earth. It moves as water vapor, liquid water, and ice. It is constantly changing its form. Water on Earth is known by different terms, depending on where it is and where it came from. Agricultural operations can be the source of non-point pollution in surface water. The major causes of surface water pollution associated with farming and ranching are sediment and nutrients. Soil erosion and resulting sedimentation is the leading cause of surface water pollution. Siltation is the leading cause of water quality problems in rivers. Although soil erosion is a natural process, it can be greatly accelerated by human activities such as farming. Major sources of sediment include runoff from cropland, forestry and urban/suburban development are the key points for surface water pollution.

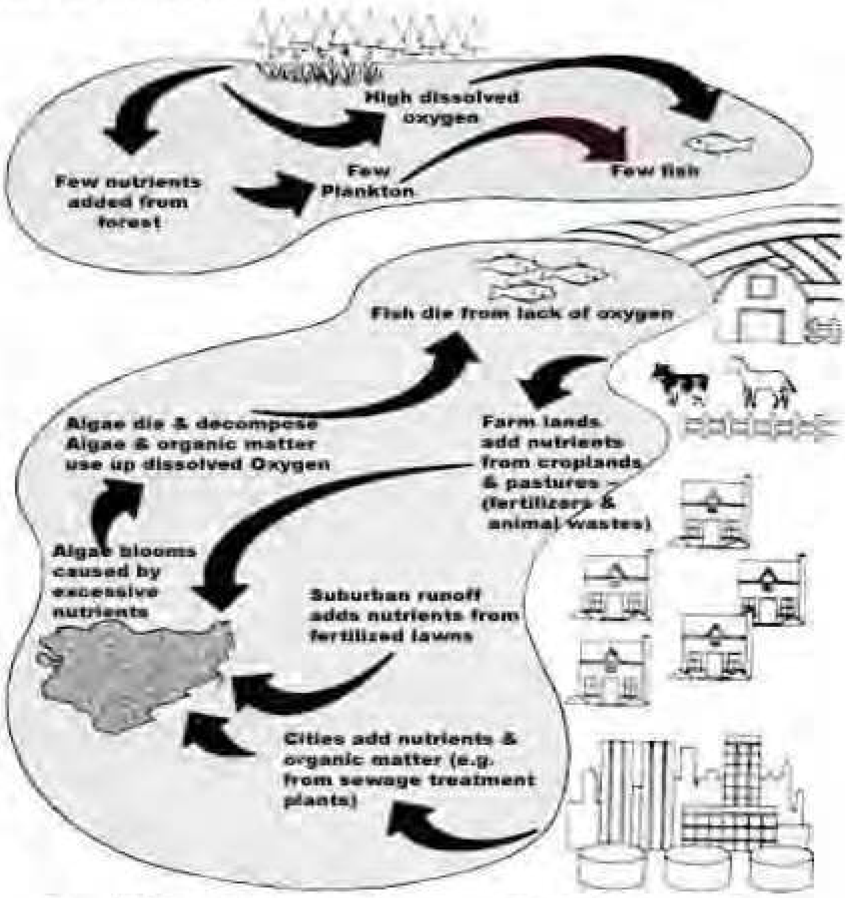

Figure 1:1 Schematic diagram- Different source for Surface water pollution

Water quality monitoring is an important aspect of overall water quality management and water resources development. A well-planned and well-managed water quality monitoring system is required to signal, control or predict the changes or trends in the quality of a particular water body, so that curative or preventive measures can be taken to restore and maintain water body properly. Monitoring is essential for the successful implementation of environmental legislation: to ensure the standards (BD Standard, Annex-1) and criteria set by government are maintained on a continuing basis. Monitoring involves the laboratory and /or spot testing of water sample collected from desire locations both source and supply system.

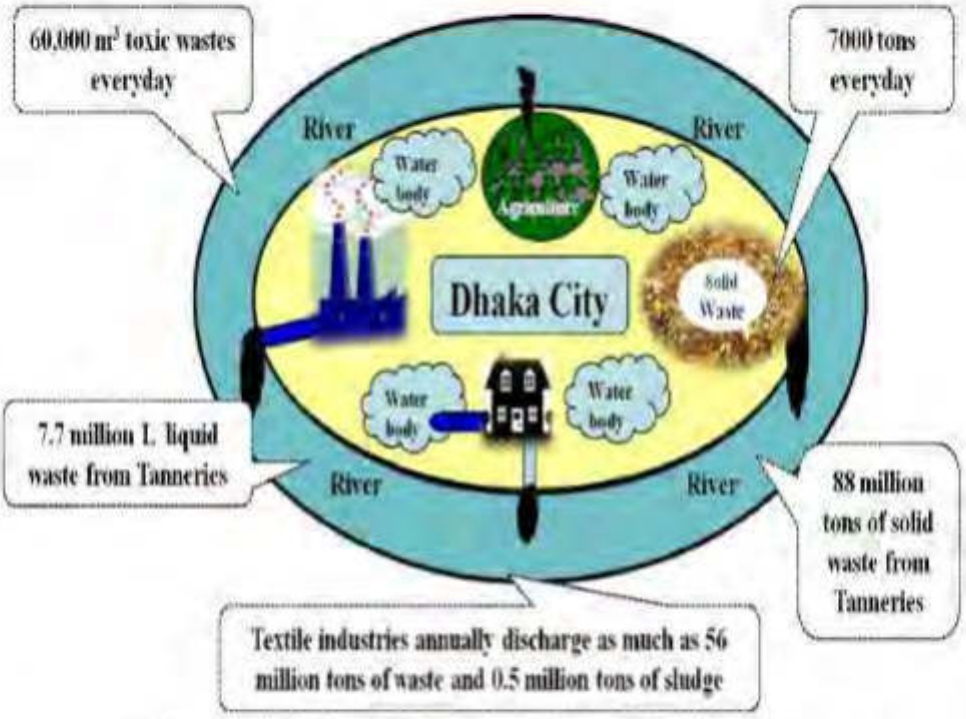

Figure 1:2 Schematic diagram-River pollution around Dhaka City

River pollution around Dhaka City from different pollution sources are exhibited in **Figure 1:3**. The main sources include industrial untreated wastewater, tannery waste, municipal solid waste, household waste etc. [Article Ref. Environments 2(3):280-294 - June 2015 (Article Alteration of Water Pollution Level with the Seasonal Changes in Mean Daily Discharge in Three Main Rivers around Dhaka City, Bangladesh)]

1.2 OBJECTIVES

There are many instances that surface water quality does not meet drinking water quality standard due to presence of inferior substances and the pollutants should not introduce in the water supply system without treatment. Rainfall, acid rain, storm water runoff, agriculture runoff, industrial waste and others can affect the color, odor, dissolved oxygen of water and also influences on major ion levels, bacteria level in surface water.

Due to cause of different factors for the pollution of surface water for drinking water quality aspect and the presence of different type of contaminants, before going a wide scale parameter testing as well as to know the change of water quality with respect to time, by testing some fundamental parameters which can represent or can give a synopsis of surface water quality is the target of this study.

To assess the variation of surface water quality over the period of eighteen months for better understand appropriate surface water treatment facilities for 500MLD capacity of DWASA surface treatment plant which is going to install at Bishnondi Arihazar using Meghna river water for ensuring better quality water supply at mega-city Dhaka.

In order fulfill the above objective, **Onushandhani CREEDS Ltd** has been assigned to conduct surface water quality monitoring at proposed intake point at Bishnondi, Bank of Meghna River, Arihazar under DESWSP, DWASA [RFQW-S.32] for eighteen months.

1.3 SCOPE OF WORKS

The actual works envisaged for implementation are quantified as follows:

a) Assessment of the existing surface water quality through field sampling at regular intervals at the intake point at Chaitankanda, Bishnondi. (Coordinates: 23° 45' 14.69" N, 90° 43' 18.07"E) through hourly, weekly, monthly and seasonal sampling
b) During sampling, conducting in-situ test for the following water quality parameters: pH, salinity, conductivity, TDS, hardness, ammonia, color using portable instrument and test kit
c) Conducting the laboratory tests and assessment of surface water quality from the samples collected during field investigations at DPHE Central Lab & BCSIR Lab
d) Data Analysis
e) Result Interpretation
f) Production of Monthly reports and submission to DWASA

1.4 DESCRIPTION OF SAMPLING AREA

Location of the sampling point: Chaitankanda, Bishnondi Arihazer

Geo-Coordinates: N=23° 44' 47.107" N, L=90° 43' 00.000"E

Distance from bank of Meghna River: 100m from bank of river where Surface Water Treatment Plant structure place is allocated.

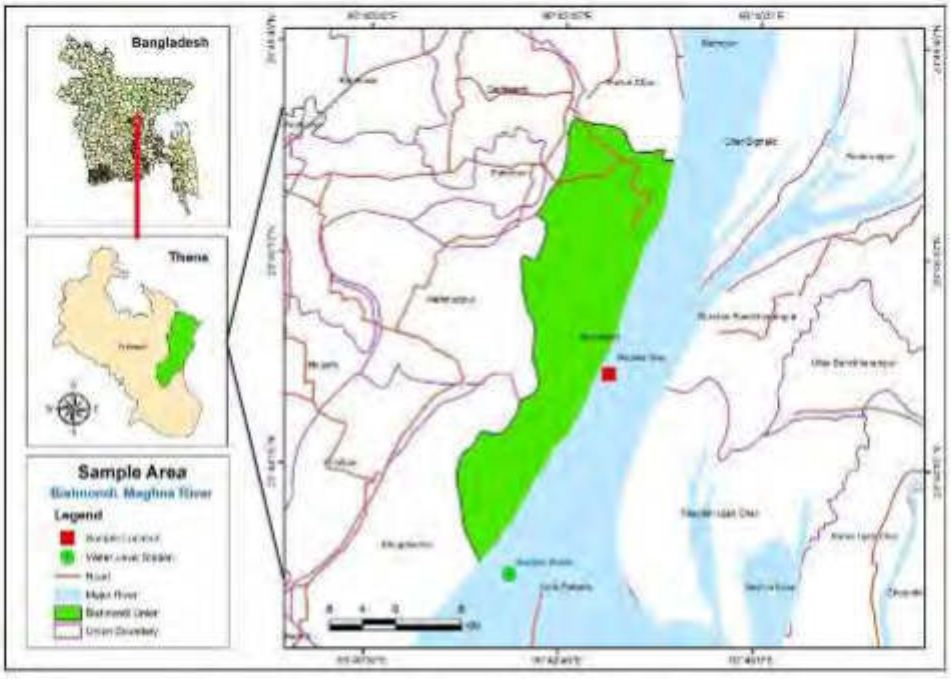

Figure 1:4 Study Area Map of Bishondi, Araihazar

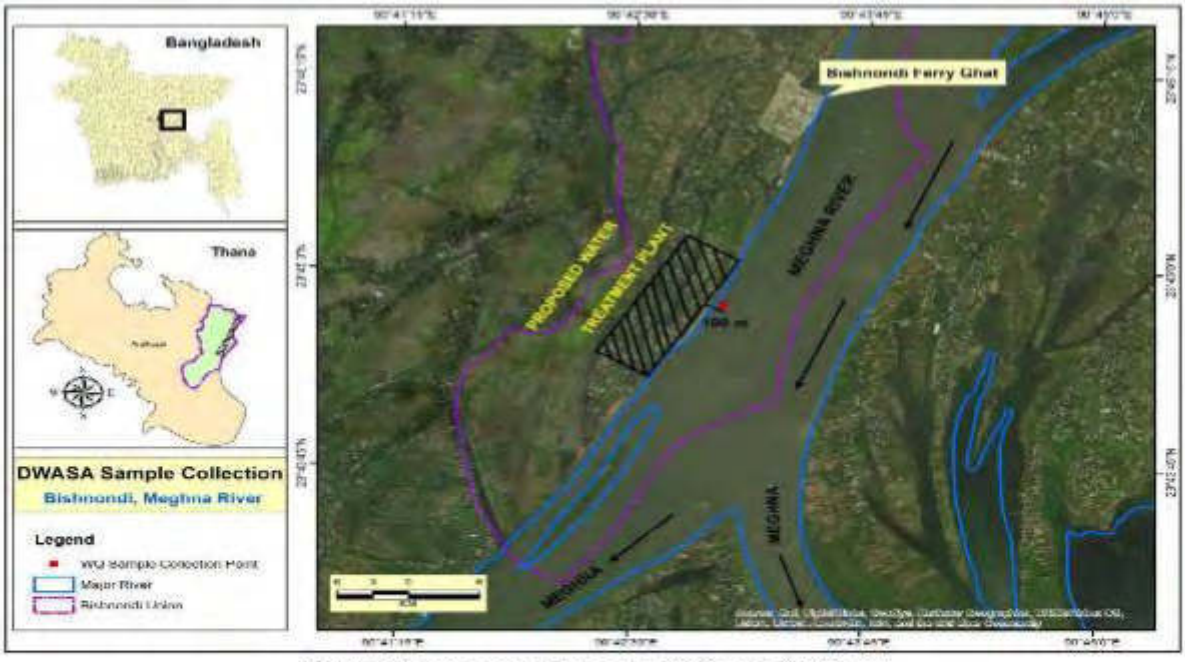

Figure 1:5 Sample collections point of Bishondi, Arailhazar

1.5 Work Plan and Professional Staffing

Schedule of Surface Water Quality Monitoring-Bishnondi, bank of Meghna River,Arihazer

[Chalonkanda, Bishnondi, Geo-Coordinates: N=23°44' 47.107" N, E=90°43' 00.000"E]]

Duration: July/2019 – Dec/2019; 6months

Duration: January/2020 – Dec/2020; 12months

Figure 1:6 Work Plan of the Project

Table 1-1: Staff months with experts and position according to the assigned tasks

Name of The Expert	Position
Dr. Jubair Tariqul Alam Chowdhury	Water Quality /Environment Specialist and adviser of this study
Dr. Syed Zakir Hossain	River Morphological Specialist
Md. Shahadat Hossain	Water Supply Specialist
Rayaan Jubair Chowdhury	Environmental Engineer
Mohimen Ur Rahman	Water Quality Analyzer
Mansura Khanum	GIS Expert
Mahbubul Alam	Hydro-geologist
Wakil Ahmed	Junior Engineer

CHAPTER 2

METHODOLOGY

2 METHODOLOGY

The Methods and instruments for different parameter analysis and sample collection were selected following the standard methods for the examination of water and wastewater proposed by APHA (American Public Health Association), AWWA (American Water Works association) & WEF (Water Environment Federation).

2.1 Sampling Approach and Methodology

a. **Sampling point:**

The sampling point is located at Bishnandi. GPS location of sampling points is N 23° 44' 47.107" N, E 90° 43' 00.000"E Distance between sampling point and bank of river is 100meters [minimum river bank in dry season]

b. **Water Sample:**

(i) 1st grab water sample should be collected from a depth of 0.5meter for every time. Measures some physicochemical parameters (Temperature, pH, Conductivity, Turbidity, Dissolved Oxygen, TDS and Ammonia) at field and record properly.

(ii) Sample in different depth: Made up of two equal parts collected at predetermined depth intervals between the surface and probable inlet point of the intake pipe which is approximately 8m from surface of the river. In this case, another two grab sample (2nd & 3rd Grab) will be collected from equal depth interval and measure some physicochemical parameters (Temperature, pH, Salinity, Conductivity, Turbidity, Dissolved Oxygen, TDS and Ammonia) at field for each grab sample separately and record properly.

(iii) A composite sample (combining portions of these three multiple grab samples) should be collected for detail chemical and microbiological analysis at laboratory. Composite sample should be composition of three grab samples.

(iv) Measure physicochemical parameters (Temperature, pH, Salinity, Conductivity, Turbidity, Dissolved Oxygen, TDS and Ammonia) for composite sample after immediate mixing of this three grab sample (1st, 2nd & 3rd Grab sample) at field and record properly.

(v) After field physicochemical measurements have been recorded, collect water sample for laboratory analysis both chemical and microbiological at the same location and same depth with same manner. It is mentioned that one grab sample (1st grab sample) and one composite sample (combining portions of 1st, 2nd & 3rd grab sample) should be collected for laboratory analysis during monthly sampling and seasonal variation for special pollutants sampling.

(vi) Salinity test during high tide: Measure salinity monthly basis during high tide only at Meghna Bridge spot. Measure salinity in three different depths [See b (i) & (ii)]. Additionally, Salinity test (at 4 points): Measure salinity at 4 (four) points in between Meghna Bridge and Intake point of SWTP (Bishnandi) with three equal intervals.

For other parameter analysis at laboratory, the volume of sample and the preservative are (1) four liter-without preservative ;(2) two liter-with preservative with HCl (3) four liter- preservative with HNO_3.

Water Level: Water Level shall be measured weekly at Bishmondi sampling point. The level shall be related to national datum. Other observation should be recorded properly according to a "Field Survey Form".

The following points should be considered during sampling:

- Sampling by Boat: Always collect samples upstream from the boat and as far away from the motor as possible, to minimize the chance of gas or oil contamination. Turn off the engine before collecting samples.
- When samples are collected during abnormally high or low flow, the abnormal conditions will be recorded in the field logbook and on the observation lines of the sample data form. It is important to include flow severity and days since last rainfall rain information with each sampling event. This information is very useful in interpreting the data.
- Upon arrival at the sampling site, record visual observations on the appearance of the water like color, unusual amount of suspended matter, debris or foam etc. and other information related to water quality and water use.
- Weather such as heavy rains, cold front, very dry, very wet etc. information should be recorded.
- Unusual incidences like presence of hydrogen sulfide, sewage and biological activity like excessive phytoplankton or algal growth should be recorded during sample collection and testing at field.
- The sample location should be strictly maintained in the same place during the whole period of this survey. Samples should not be collected at the time of rain shower.
- The required instruments to be used are Multi parameter analyzer, Turbidity meter, Ammonia kit, Flow meter, Depth measurement meter, surface water sampler, HDPE sample bottles, acid, cool box etc.

2.2 Duration of the monitoring:

The tentative duration of the study is 18 months, starting from July 2019 to December 2020.

CHAPTER 3

DESCRIPTION OF SAMPLING

3 DESCRIPTION OF SAMPLING

Following detailed discussion at DWASA office, the field survey for the study was scheduled. After the signing of the project on July 16, 2019, there were three weeks of scheduled weekly sampling.

3.1 Sampling Schedule:

Water sample will be collected under different time frequency such as weekly, monthly, seasonal and hourly. The detailed description is as follow:

Weekly sampling:

Duration: July/2019- Dec/2020; Total week= 78 weeks

Test type: Field-test using field kit and portable instrument. Weekly sample will not send to lab test.

(A) Test type: Field test: [using field kit and portable instrument]

Table 3-1: Field test parameters

Water quality parameter	1st grab sample	2nd grab sample	3rd grab sample	Composite Sample-1	Type of instrument/Kit
Temperature	78	78	78	78	Multi parameters Meter
pH.	78	78	78	78	Multi parameters Meter
Salinity	78	78	78	78	Multi parameters Meter
Conductivity	78	78	78	78	Multi parameters Meter
Turbidity	78	78	78	78	Multi parameters Meter
Dissolved Oxygen (DO)	78	78	78	78	Multi parameters Meter
TDS	78	78	78	78	Turbidity meter
Ammonia	78	78	78	78	Ammonia kit
Total Hardness	78	78	78	78	Hardness kit
Color	78	78	78	78	Colorimeter

*Orange Shade=Test by Portable instrument; Blue shade=Test by kit

Monthly sampling:

Duration: July/2019- Dec/2020; Total month= 18 months. Monthly sample will be collected 4th week of each month. Weekly sample of 4th week of each month will also be considered as monthly sample for field parameter.

Type of Test:

i. **Field test:** Same as before using field kit and portable instrument.

ii. **Laboratory test:** Sample will be send to DIHE central lab. Parameters are Nitrate; Nitrite; COD; TSS; BOD_5; Phosphate; Alkalinity; Ammonia; Total Hardness; Arsenic; Iron; Manganese and Aluminum.

Hourly /Seasonal sampling:

13 hourly samples, during daylight time, will be collected five times during study period. Hourly sample will be collected during seasonal sampling.

Test type: Field test [using field kit and portable instrument] and laboratory test

Sampling time: July/2019; Dec/2019; April/20120; July/2020 & Dec/2020

Frequency of sampling =5times during study period (18 month)

(A) Parameter test at field during hourly sampling including total number:

Table 3-2: Hourly Sampling parameters

Water quality parameter	1st grab sample	2nd grab sample	3rd grab sample	Composite Sample-1	Type of instrument/Kit
Temperature	13x5=65	13x5=65	13x5=65	13x5=65	Multi parameters Meter
pH	13x5=65	13x5=65	13x5=65	13x5=65	Multi parameters Meter
Salinity	13x5=65	13x5=65	13x5=65	13x5=65	Multi parameters Meter
Conductivity	13x5=65	13x5=65	13x5=65	13x5=65	Multi parameters Meter
Dissolved Oxygen (DO)	13x5=65	13x5=65	13x5=65	13x5=65	Multi parameters Meter
TDS (Total Dissolved Solid)	13x5=65	13x5=65	13x5=65	13x5=65	Multi parameters Meter
Turbidity	13x5=65	13x5=65	13x5=65	13x5=65	Turbidity meter
Ammonia	13x5=65	13x5=65	13x5=65	13x5=65	Ammonia kit
Total Hardness	13x5=65	13x5=65	13x5=65	13x5=65	Hardness kit

**Hours= 13; Season=5; *Orange Shade=Test by Portable instrument; Blue shade=Test by kit*

(B) List of water quality test parameter at laboratory during hourly sampling:

Arsenic; Algae; Antimony; Ammonia; Barium; Boron; Cadmium; Chloride; Chromium (Hexavalent); Coliform (fecal); Copper; BOD_{3day}; COD; Lead; Mercury; Nitrate; Nitrite; Nike; Phosphate; TOC; Pesticides (Organo-chorine); Pesticides (Organo-phosphorus); Oil & Grease; Fluoride; Selenium; Sulphate ; Sodium; Zinc.

3.2 Field Visits

A total of 03 (three) field visits were conducted during July 2019. The field visit schedule along with personnel involved is shown in table

Table 3-3: Field Visit Schedule

Date	Sampling Type	Personnel
18/07/2019	Weekly Sampling	Name: Dr. Jubair Tariqul Alam Chowdhury Designation: Water Quality Expert and Adviser of the Study Contact: 01819252485
		Name: Md. Nazimuzzaman Designation: Water Quality Analysis Assistant Contact: 01714737919
		Name: Sourav Kanti Paul Designation: Survey Assistant Contact: 01948123301
		Name: Fakhrul Islam Designation: Survey Assistant Contact: 01910571074
25/07/2019	Weekly Sampling	Name: Md. Shahadat Hossain Designation: Water Quality Analysis Specialist Contact: 01712955908
		Name: Md. Nazimuzzaman Designation: Water Quality Analysis Assistant Contact: 01714737919
		Name: Sourav Kanti Paul Designation: Survey Assistant Contact: 01948123301
		Name: Fakhrul Islam Designation: Survey Assistant Contact: 01910571074
31/07/2019	Weekly Sampling	Name: Dr. Jubair Tariqul Alam Chowdhury Designation: Water Quality Expert and Adviser of the Study Contact: 01819252485
		Name: Md. Nazimuzzaman Designation: Water Quality Analysis Assistant Contact: 01714737919
		Name: Sourav Kanti Paul Designation: Survey Assistant Contact: 01948123301
		Name: Fakhrul Islam Designation: Survey Assistant Contact: 01910571074

**Photo of field sampling activities are shown in Annexures 3.*

3.3 Laboratory Tests

(A) Laboratory test during monthly sampling including name of the parameter, total number of sample, type of sample and name of the lab are as below:

Table 3-4: Laboratory test parameters for monthly sample

Water quality parameter	Composite Sample	Name of the Lab
Nitrate	18	DPHE Center Lab, Mohakhali
Nitrite	18	
COD	18	
TSS	18	
BOD,	18	
Phosphate	18	
Alkalinity	18	
Ammonia	18	
Total Hardness	18	
Arsenic	18	
Iron	18	
Manganese	18	
Aluminium	18	

(B) Laboratory test during hourly sampling including name of the parameter, total number sample, name of the lab is as below:

Table 3-5: Laboratory test parameters for hourly sample

Water quality parameter	Composite Sample	Name of the Lab
Arsenic	5	DPHE
Algae	5	BCSIR
Barium	5	DPHE
Cadmium	5	DPHE
Chloride	5	DPHE
Chromium(Hexavalent)	5	BCSIR
Coliform(fecal)	5	DPHE
BOD	5	DPHE
COD	5	DPHE
Lead	5	DPHE
Mercury	5	BCSIR
Ammonia	5	DPHE
Nitrate	5	DPHE
Nitrite	5	DPHE
Phosphate	5	DPHE
TOC	5	BCSIR
Pesticides(Organo-chorine)	5	BCSIR
Pesticides(Organo-phosphorus)	5	BCSIR
Oil & Grease	5	BCSIR
Fluoride	5	DPHE
Selenium	5	DPHE
Zinc	5	DPHE
Sulphate	5	DPHE
Copper	5	DPHE
Antimony	5	BCSIR
Boron	5	BCSIR

Water quality parameter	Composite Sample	Name of the Lab
Nikel	5	DPHE
Sodium	5	DPHE

Major instrument for use in Lab

The below major instrument will be used during laboratory analysis as per "Standard Methods- For the Examination of Water and Wastewater"; 20th Edition: Prepared & Published by American Public Health Association (APHA), American Water Works Association(AWWA) and Water Environment Federation(WEF):

Table 3-6: Laboratory test equipment used for test

Parameter	Major equipment for test
Aluminum	Atomic absorption spectrophotometer
Alkalinity	Ion meter UV-Visible Spectrophotometer
Arsenic	Atomic absorption spectrophotometer(HVG)
Barium	Atomic absorption spectrophotometer
Cadmium	Atomic absorption spectrophotometer(heavy metal)
Chloride	Ion chromatograph(Anion)
Chromium(Hexavalent)	Ion chromatograph (Hexavalent chrome)
COD	COD Reactor, burette stand.
BOD5 20 °C	Incubator, BOD bottle
Coliform (Fecal)	Autoclave, incubator, filtration unit.
Lead	Atomic absorption spectrophotometer(heavy metal)
Mercury	Atomic absorption spectrophotometer for Hg analysis
Nitrate	Ion chromatograph (Anion)/UV-Visible Spectrophotometer
Nitrite	Ion chromatograph (Anion)/UV-Visible Spectrophotometer
Phosphate	Ion chromatograph (Anion)/ UV-Visible Spectrophotometer
S.S	Balance, Dehydrator, Desiccators, filtration unit
Sulfate	Ion chromatograph (Anion)/ UV-Visible Spectrophotometer
Silica	UV-Visible Spectrophotometer
Total dissolved solids	Balance, Dehydrator, Desiccators, filtration unit
Zinc	Atomic absorption spectrophotometer
TOC	TOC analyzer
Pesticides (Organo Chlorine)	GC-MS
Pesticides (Organo Phosphorus)	GC-MS
Oil & Grease	Solvent Extraction

Figure 3:1 Central Laboratory, DPHE, Mohakhali, Dhaka

Figure 3:2 Bangladesh Council for Scientific and Industrial Research (BCSIR)

3.4 List of portable instrument/ Test kit and others use during field activities:

The following requirements were arranged for the Water Quality Monitoring activities:

a. Multi parameters Meter (for pH, DO, Electrical Conductivity (EC), TDS. In addition, salinity test) HACH, USA.
b. Turbidity meter for the measurement of Turbidity, HACH, USA.
c. Testing Kits for NH3-N, As, Hardness, Alkalinity tests
d. Sampling bottles (different sizes)
e. Distilled water
f. Different acids (HCl, HNO3) for sample preservation, washing of sample bottle etc.
g. Required glassware, washing bottle etc.

3.5 Field Survey data form:

A field survey data form has been developed which is shown in the **Annexure 1** section of this report.

3.6 Drinking Water Quality Standard:

Bangladesh Drinking Water Quality standards [ENVIRONMENT CONSERVATION RULES 1997, Published: 28th August, 1997, Government of the People's Republic of Bangladesh; Ministry of Environment] are shown in the **Annexure-2** section of the report.

4 RESULTS AND DISCUSSIONS

4.1 Weekly sampling

Table 4-1: Weekly Sampling Results; 18/07/2019

Weekly sampling: Water quality field test parameters results; Month: July/2019											
Date: 18-07-2019					Time: 10-12						
Sample	Depth (m)	Temp °C	pH	Salinity ‰	Cond. µS/cm	TDS mg/l	DO mg/l	Turbidity NTU	Hardness mg/l	NH3 mg/l	Color Hazen Unit
1st grab sample	0.5	30.6	7.2	0.03	75.8	32.9	6.5	14.66	40	0.23	138
2nd grab sample	4	30.3	7.3	0.03	69.2	29.4	6.61	19.08	60	0.32	110
3rd grab sample	8	30.1	7.2	0.03	68.9	32	6.87	14.28	60	0.3	140
Composite sample (1st+2nd+3rd grab sample	-	30.1	7.2	0.03	66	30.9	6.8	16.32	40	0.2	122
	Max	30.6	7.3	0.03	75.8	32.9	6.87	19.08	60	0.32	140
	Min	30.1	7.2	0.03	66	29.4	6.5	14.28	40	0.2	110
	Avg.	30.3	7.23	0.03	70.28	31.25	6.69	16.28	50	0.26	126.67

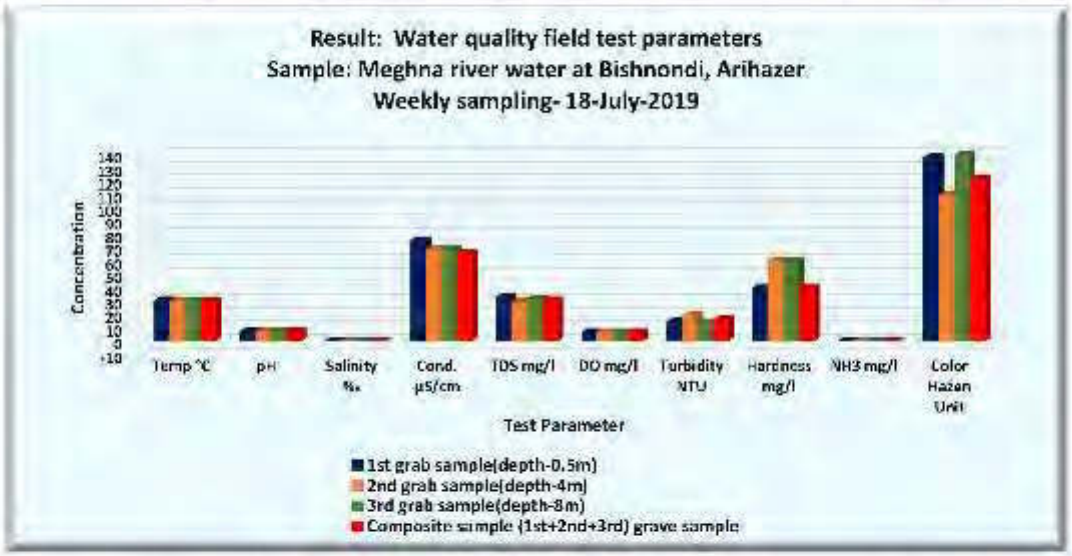

Figure 4:1 Water quality field test parameters Sample: Meghna river water at Bishnondi, Arihazer Weekly sampling- 18-July-201

Table 4-2: Weekly sampling results; 25/07/2019

Weekly sampling: Water quality field test parameters results ;Month: July/2019											
Date: 25-07-2019							Time: 10-12				
Sample	Depth (m)	Temp °C	pH	Salinity ‰	Cond. µS/cm	TDS mg/l	DO mg/l	Turbidity NTU	Hardness mg/l	NH3 mg/l	Color Hazen Unit
1st grab sample	0.5	30.3	7.5	0.03	75.9	32.4	6.39	12.1	60	0.24	139
2nd grab sample	4	30.4	7.4	0.03	78.9	33.4	6.66	19.48	40	0.33	140
3rd grab sample	8	30.5	7.2	0.03	82	34.2	6.79	14.28	60	0.36	145
Composite sample (1st+2nd+3rd) grab sample	-	30	7.2	0.03	78	31	6.8	17.89	40	0.21	145
	Max	30.5	7.5	0.03	82	34.2	6.8	19.48	60	0.36	145
	Min	30	7.2	0.03	75.9	31	6.39	12.1	40	0.21	139
	Avg.	30.28	7.33	0.03	78.78	32.7	6.64	15.89	50	0.29	142.17

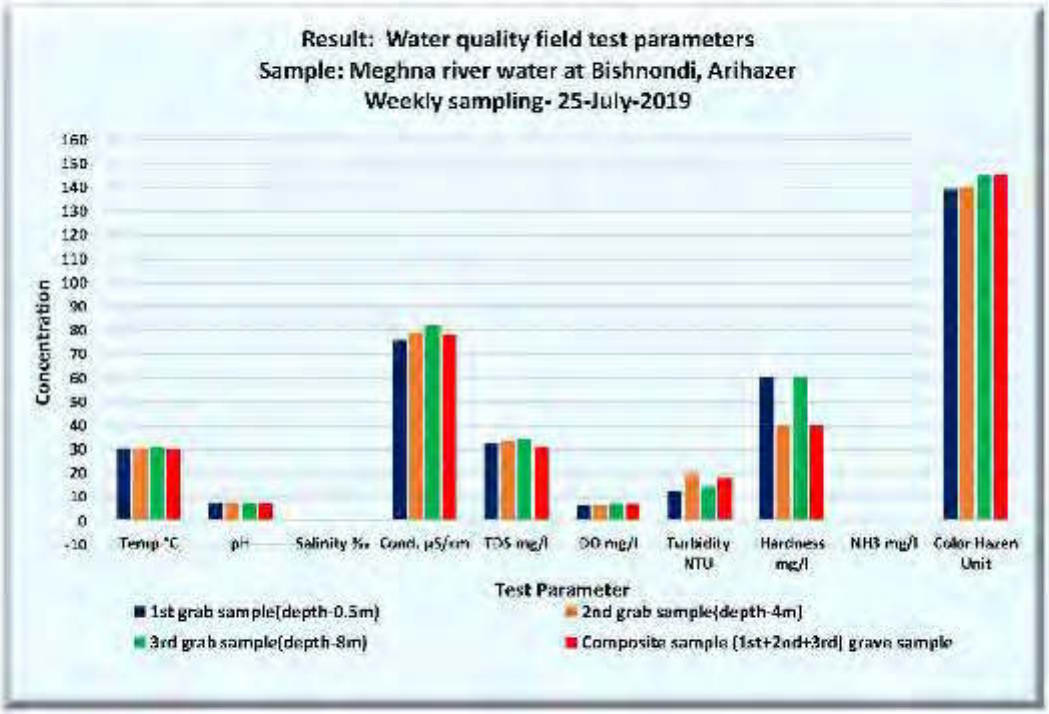

Figure 4:2 Water quality field test parameters Sample: Meghna river water at Bishnondi, Arihazer Weekly sampling- 25-July-201

Table 4-3: Weekly sampling results; Month: July/2019

Water quality field test parameters (weekly sample);Month: July/2019											
Date: 31-07-2019								Time: 10-12			
Sample	Depth (m)	Temp °C	pH	Salinity ‰	Cond. µS/cm	TDS mg/l	DO mg/l	Turbidity NTU	Hardness mg/l	NH3 mg/l	Color Hazen Unit
1st grab sample	0.5	30.1	7.6	0.03	65.5	32.8	6.35	19.2	40	0.32	147
2nd grab sample	4	30.1	7.4	0.03	68.4	34.25	6.63	19.4	40	0.33	152
3rd grab sample	8	30.1	7.2	0.03	68.9	37.7	6.7	19.85	40	0.35	160
Composite sample (1st+2nd+3rd grave sample	-	30.3	7.1	0.03	65.2	32.7	6.41	19.32	40	0.33	157
	Max	30.3	7.6	0.03	68.9	37.7	6.7	19.85	40	0.35	160
	Min	30.1	7.1	0.03	65.2	32.7	6.35	19.2	40	0.32	147
	Avg.	30.17	7.3	0.03	67.02	34.64	6.52	19.47	40	0.33	153.83

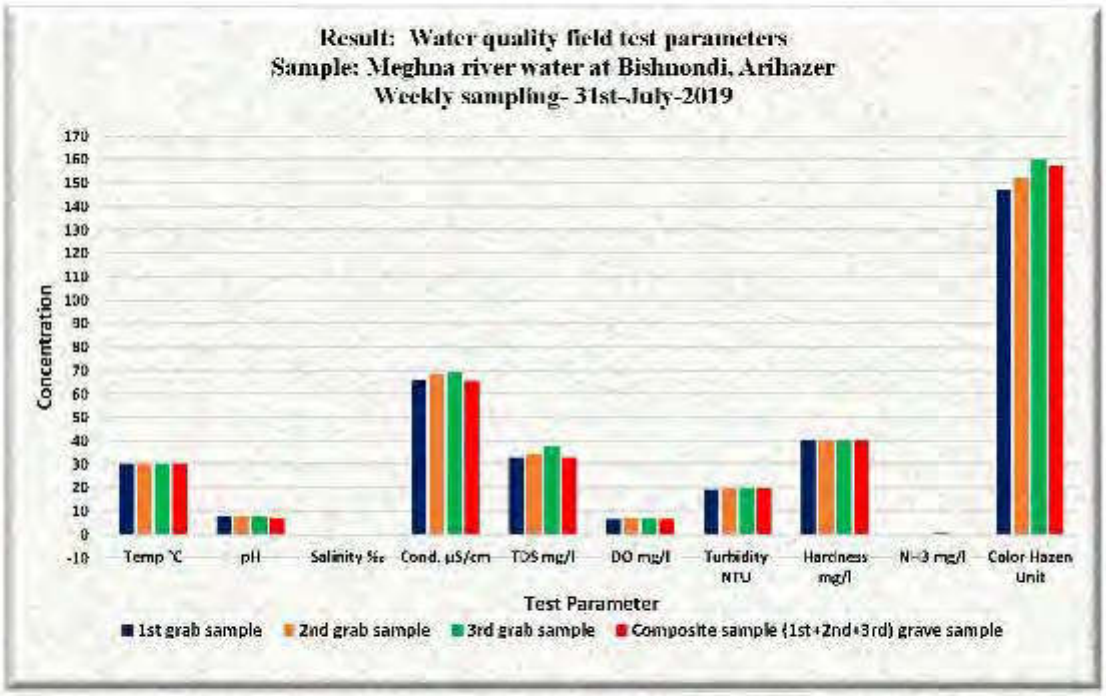

Figure 4:3 Water quality field test parameters Sample: Meghna river water at Bishnondi, Arihazer Weekly sampling- 31st-July-2019

4.2 Observation on Weekly Sampling

Total 12-ammonia test have been conducted during three weeks with one-week interval in this month and no significant fluctuation of ammonia concentration has been found in different depth.

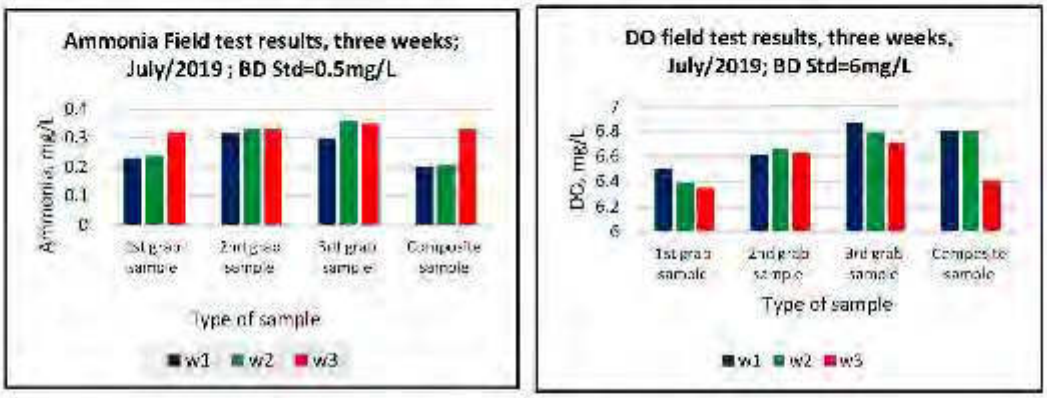

Figure 4:4 Ammonia and DO Field test results

It was observed that over the three weeks, the ammonia concentration has increased with the decreased of DO (Dissolved Oxygen).

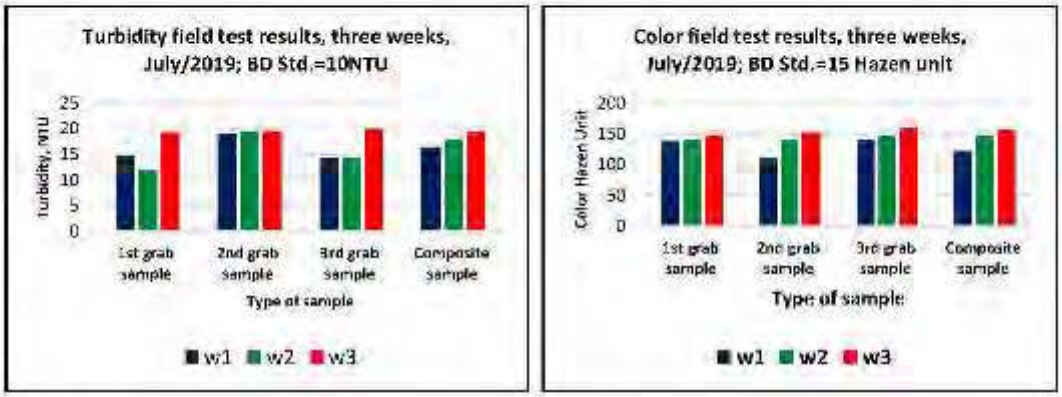

Figure 4:5 Turbidity and Color Field test results

It was observed that all samples contained turbidity above Bangladesh Standard as well as high concentration of color has been found which is above BD Standard.

pH, Conductivity, Total Dissolved Solids (TDS) did not show any significant level of changes within the three weeks' observations which is shown in the graphs below.

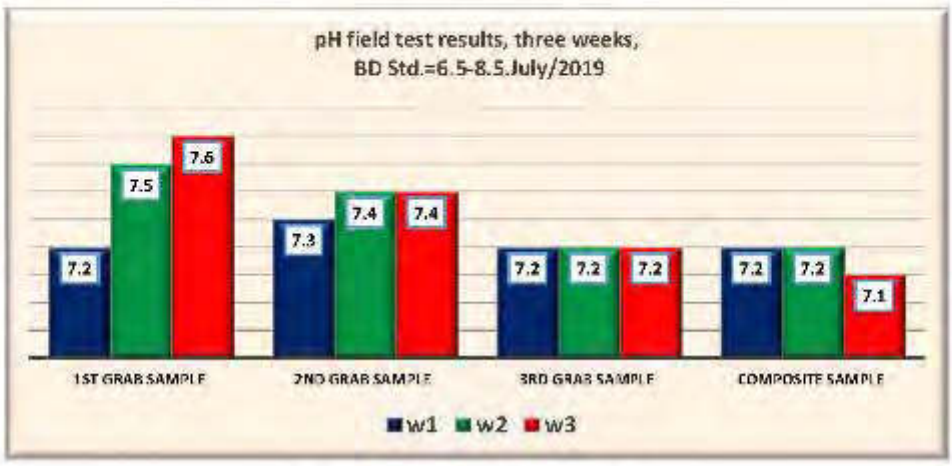

Figure 4:6 pH Field test results

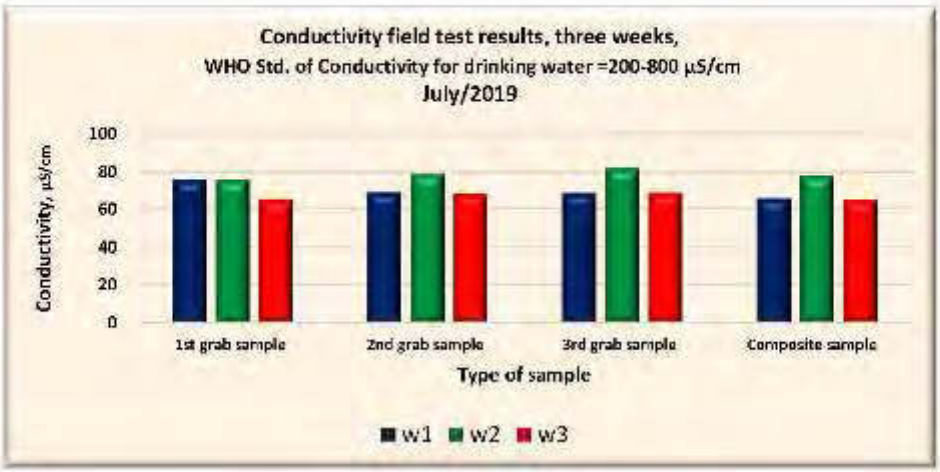

Figure 4:7 Conductivity Field test results

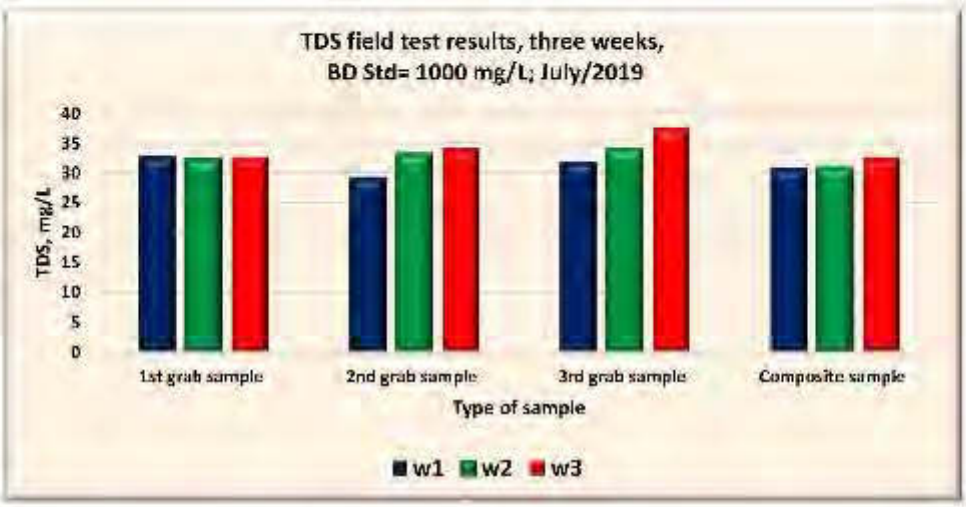

Figure 4:8 TDS Field test results

Other water quality field test parameters like salinity, hardness did not show any changes during this three weeks' period and their concentration were found below permissible level.

4.3 Laboratory Test- Seasonal Sample & Monthly sample

Due to long Eid vacation (From 9th August to 17th), laboratory was unable to take water sample, because significant number of parameter need to be analyzed which is time consuming as well as long duration of same parameter analytical procedural such as BOD (05 days) analysis. That is why, seasonal sampling was shifted for the end of next month (August/2019) and monthly sampling for the month of July/2019 was not taken.

CHAPTER 5

CONCLUSION

5 CONCLUSION

The month of July 2019 was the first month of the project since the official signing of the contract. Collected samples have undergone different tests i.e. in-situ field test, laboratory test etc. In-situ field tests were carried out using the Hatch Multi-parameter meter and other field test apparatus. Results of the laboratory samples are correlated with the field results and presented in the report.

Considering the progresses in mobilization, detailed field scheduling, pre-survey meetings and discussions, the entire professional team has been mobilized right from the singing of the contract. The initial weekly sampling took place on July 18, 2019 just two days after the agreement signing. The survey team had been mobilized and field survey works are completed in full operational capacity.

Although no significant fluctuation of ammonia concentration was found in different depths, there have been

The results of field and laboratory tests of the samples are presented in the report and copies of the original documents are attached in the Annexures section in this report. The analysis for the water quality data reveals steady water quality conditions for hourly and weekly variations. Monthly variations in water quality are yet to be assessed as only one monthly sample could be obtained in the period.

ANNEXURES

ANNEXURE-1: Field Survey Data Form

DWASA Surface Water Quality Monitoring Program

(1) Sample location : Bishnoudi (Bank of Meghna River), Arihazar

[Chaitonkanda, Bishnoudi, Geo-Coordinates: N=23° 44' 47.107" N, E=90° 43' 00.000"E)]

[Distance: 100m from bank of river where SWTP structure place is allocated]

(2) Field Observations:

Upon arrival at a sampling site, record visual observations on the appearance of the water and other information related to water quality and water use as bellow:

Parameter	Observation
a. Water Colour	Greenish /reddish / yellowish / Muddy / Colour less
b. Water appearance	Unusual amount of suspended matter / debris / foam
c. Rain fall	Heavy / Medium/ Low / None
d. Day	Cloudy day/ very dry/very wet
e. Unusual Odors	Hydrogen sulfide odor/ musty odor /sewage oder/ none
f. Biological Activity	Excessive growth of algal / Phytoplankton/ others……/ none

(3) Water quality field test parameters (Weekly sample / Monthly sample)

Date: **Time:**

Sample	Depth (m)	Temp °C	pH	Salinity ‰	Cond. µS/cm	TDS mg/l	DO mg/l	Turbidity NTU	Hardness mg/l	NH_3 mg/l	Color	Flow ft³/s
1st grab sample	0.5											
2nd grab sample	4											
3rd grab sample	8											
Composite Sample (1st+2nd+3rd Grave sample)	-											

Note-1:
Field test parameters (Weekly & Monthly): Temp=Temperature; pH; Salinity; Cond=Conductivity; DO=Dissolved Oxygen; Turbidity; TDS=Total Dissolve Solid; Hardness; NH_3 = Ammonia; Color

Note-2:

Lab test parameters (Monthly sampling): Nitrate; Nitrite; COD; TSS; BOD; Phosphate; Alkalinity; Ammonia; Total Hardness; Arsenic; Iron; Manganese; Aluminum

(4) Seasonal Sample:

(4.A) Water quality field test parameters (Hourly sampling-1st grab sample)

Date: **Depth: 0.5meter**

Time	Temp. °C	pH	Salinity ‰	Cond. µS/cm	TDS mg/l	DO mg/l	Turbidity NTU	Hardness mg/l	NH_3 mg/l	Color	Flow ft³/s
6AM											
7AM											
8AM											
9AM											
10AM											
11AM											
12											
1PM											
2PM											
3PM											
4PM											
5PM											
6PM											

Note-3:
Seasonal Sampling (Composite sample) for Lab Test: Arsenic; Algae; Barium; Cadmium; Chloride; Chromium(Hexavalent); Coliform(fecal); BOD; COD; Lead; Mercury; Ammonia; Nitrate; Nitrite; Phosphate; TOC; Pesticides (Organo-chorine); Pesticides (Organo-phosphorus); Oil & Grease; Fluoride; Selenium; Zinc; Sulphate; Copper; Antimony; Boron; Nickel and Sodium.

Note-4:
Hourly sample will be collected during seasonal sampling

Note-5:
Sample volume and preservative
(a) Non-preservative sample – four liter
(b) Preservative-HCl – One liter
(c) Preservative-HNO_3 – Two liter
(d) Preservative-H_2SO_4 –One liter

(4.B) Water quality field test parameters (Hourly sampling -2nd grab sample)

Date: Depth: 4 meter

Time	Temp. °C	pH	Salinity ‰	Cond. µS/cm	TDS mg/l	DO mg/l	Turbidity NTU	Hardness mg/l	NH_3 mg/l	Color	Flow ft^3/s
6AM											
7AM											
8AM											
9AM											
10AM											
11AM											
12											
1PM											
2PM											
3PM											
4PM											
5PM											
6PM											

(4.C) Water quality field test parameters (Hourly sampling: 3rd -grab sample)

Date: Depth: 8 meter

Time	Temp. °C	pH	Salinity ‰	Cond. µS/cm	TDS mg/l	DO mg/l	Turbidity NTU	Hardness mg/l	NH_3 mg/l	Color	Flow ft^3/s
6AM											
7AM											
8AM											
9AM											
10AM											
11AM											
12											
1PM											
2PM											
3PM											
4PM											
5PM											
6PM											

(4.D) Water quality test parameters (Hourly sampling -Composite sample)

Date: Depth= [Sample-1:0.05m+ Sample-2:4m+ Sample-3: 8m]

Time	Temp. ^0C	pH	Salinity ‰	Cond. µS/cm	TDS mg/l	DO mg/l	Turbidity NTU	Hardness mg/l	NH_3 mg/l	Color	Flow ft^3/s
6AM											
7AM											
8AM											
9AM											
10AM											
11AM											
12											
1PM											
2PM											
3PM											
4PM											
5PM											
6PM											

4) Any other observations/comments:

Performed by (O.CREEDS) : Date:

Name Designation Signature

PMU Staff:

Name	Designation	Signature

Annexure-2: Bangladesh Drinking Water Quality standards

ENVIRONMENT CONSERVATION RULES 1997

Published: 28th August, 1997

Government of the Peoples' Republic of Bangladesh

Ministry of Environment

SL	Parameter	Unit	Standard
1	Aluminum	mg/L	0.2
2	Ammonia	,,	0.5
3	Arsenic	,,	0.05
4	Barium	,,	0.01
5	Benzene	,,	0.01
6	BOD5 20 °C	,,	0.2
7	Boron	,,	1.0
8	Cadmium	,,	0.005
9	Calcium	,,	75
10	Chloride	,,	150-600*
11	Chlorinated alkenes carbon tetrachloride	,,	0.01
	1.1 Dichloroethylene	,,	0.001
	1.2 Dichloroethylene	,,	0.03
	Tetrachloroethylene	,,	0.03
	Trichloroethlene	,,	0.09
12	Chlorinated phenols pentachlorophenol	,,	0.03
	2.4.6 Trichloropheno	,,	0.03
13	Chlorine(residual)	,,	0.2
14	Chloroform	,,	0.09
15	Chromium (Hexavalent)	,,	0.05
16	Chromium (Total)	,,	0.05
17	COD	,,	4
18	Coliform (Fecal)	n/100 ml	0
19	Coliform (total) * At sea beach 1000	n/100 ml	0
20	Colour	Hazen Unit	15
21	Copper	mg/L	1.0
22	Cyanide	,,	0.1
23	Detergent	,,	0.2
24	D.O	,,	6.0
25	Fluoride	,,	1.0
26	Hardness (as CaCO3)	,,	200- 500
27	Iron	mg/L	0.3-1.0
28	Kjeldahl nitrogen (Total)	,,	1.0
29	Lead	,,	0.05
30	Magnesium	,,	30-35
31	Manganese	,,	0.1
32	Mercury	,,	0.001
33	Nickel	,,	0.1

SL	Parameter	Unit	Standard
34	Nitrate	,,	10
35	Nitrite	,,	<1.0
36	Odor	,,	Odorless
37	Oil and Grease	,,	0.01
38	pH	,,	6.5-8.5
39	Phenol compounds	,,	0.002
40	Phosphate	,,	6
41	Phosphorus	,,	0
42	Potassium	,,	12
43	Radioactive substances (Total-radiation)	Bq/l	0.01
44	Total B B-radiation		0.1
45	Selenium	mg/l	0.01
46	Silver	,,	0.02
47	Sodium	,,	200
48	S.S	,,	10
49	Sulfide	,,	0
50	Sulfate	,,	400
51	Total dissolved solids	,,	1000
52	Temperature	°C	20-30
53	Tin	mg/l	2
54	Turbidity	JTU/NTU	10
55	Zinc	mg/l	5

**Chloride 1000mg/l (for coastal Area)*

ANNEXURE-3: PHOTOGRAPH DURING FIELD SAMPLING IN DIFFERENT DATE

Figure A:1 Weekly Sampling Conducted on 18/07/2019

Figure A:2 Weekly Sampling Conducted on 25/07/2019

Figure A:3 Weekly Sampling Conducted on 31/07/2019

ANNEXURE-4: FIELD SURVEY DATA FORMS

O.CREEDS

ONUSONDHANI CREEDS

Field Survey Data Form

DWASA Surface Water Quality Monitoring Program

(1) Sample location : Bishnondi (Bank of Meghna River), Arihazer
(Chaitonkonda, Bishnondi, Geo-Coordinates: N=23°44'47.107"N, E=90°43'00.006"E)
(Distance: 100m from bank of river where SWTP structure place is allocated)

(2) Field Observations:
Upon arrival at a sampling site, record visual observations on the appearance of the water and other information related to water quality and water use as bellow:

Parameter	Observation
a. Water Colour	Greenish /reddish / yellowish / Muddy / Colour less
b. Water appearance	Unusual amount of suspended matter / debris / foam
c. Rain fall	Heavy / Medium/ Low / None
d. Day	Cloudy day/ very dry/very wet
e. Unusual Odors	Hydrogen sulfide odor/ musty odor /sewage odor/ none
f. Biological Activity	Excessive growth of algal / Phytoplankton/ others / none

(3) Water quality field test parameters (Weekly sample / Monthly sample)

Date: 18/07/2019 Time: 10 a.m - 12 p.m

Sample	Depth (m)	Temp °C	pH	Salinity ‰	Cond. µS/cm	TDS mg/l	DO mg/l	Turbidity NTU	Hardness mg/l	NH3 mg/l	Color	Flow ft/s
1st grab sample	0.5	30.6	7.2	0.03	75.8	32.9	6.50	11.66	40	0.23	138	
2nd grab sample	4	30.2	7.3	0.03	69.2	29.4	6.61	19.08	60	0.32	110	
3rd grab sample	8	30.1	7.2	0.03	68.9	32.0	6.87	14.28	60	0.30	140	
Composite Sample (1st+2nd+3rd Grave sample)	-	30.1	7.2	0.03	66.0	30.9	6.30	16.82	40	0.20	122	

Note-1:
Field test parameters (Weekly & Monthly): Temp=Temperature; pH; Salinity; Cond=Conductivity; DO=Dissolved Oxygen; Turbidity; TDS=Total Dissolve Solid; Hardness; NH3 = Ammonia; Color

Note-2:
Lab test parameters (Monthly sampling): Nitrate; Nitrite; COD; TSS; BOD; Phosphate; Alkalinity; Ammonia; Total Hardness; Arsenic; Iron; Manganese; Aluminum

House # 135, Road # 05, 3rd Floor, Mohakhali DOHS, Dhaka-1206
Contact: +8801712955908 E-mail: ocreedsbd@gmail.com
www.ocreeds.com

(4) Any other observations/comments:

SITE CONDITIONS ARE OKAY
RIVER WATER DEPTH : 16.4m

Water Quality/ Environmental Specialist
Name: MD. SHAHADAT HOSSAIN
Date:

Water Quality Analyzer
Name: Md. Nazimuzzaman
Date: 18/07/2019

DWASA PMU Representative
Name:
Designation:
Date:

O.CREEDS
ONUSONDHANI CREEDS

Field Survey Data Form

DWASA Surface Water Quality Monitoring Program

(1) Sample location : Bishnondi (Bank of Meghna River), Araazer
[Chaitankanda, Bishnondi, Geo-Coordinates: N=23° 44' 47.107" N, E=90° 43' 00.000"E)]
[Distance: 100m from bank of river where SWTP structure place is allocated]

(2) Field Observations:
Upon arrival at a sampling site, record visual observations on the appearance of the water and other information related to water quality and water use as bellow:

Parameter	Observation
a. Water Colour	Greenish /reddish / yellowish / Muddy / Colour less
b. Water appearance	Unusual amount of suspended matter / debris / foam
c. Rain fall	Heavy / Medium/ Low / None
d. Day	Cloudy day/ very dry/very wet
e. Unusual Odors	Hydrogen sulfide odor/ musty odor /sewage odor/ none
f. Biological Activity	Excessive growth of algal / Phytoplankton/ others ...../ none

(3) Water quality field test parameters (Weekly sample / Monthly sample)

Date: 25/07/2019 Time: 10am - 12 pm

Sample	Depth (m)	Temp °C	pH	Salinity ‰	Cond. µS/cm	TDS mg/l	DO mg/l	Turbidity NTU	Hardness mg/l	NH_3 mg/l	Color	Flow ft³/s
1st grab sample	0.3	30.3	7.5	0.03	75.9	32.4	6.39	12.10	60	0.24	139	
2nd grab sample	4	30.4	7.4	0.03	78.9	33.4	6.66	19.48	40	0.33	140	
3rd grab sample	8	30.5	7.2	0.03	82.0	34.2	6.79	14.28	60	0.36	145	
Composite Sample (1st+2nd+3rd Grave sample)	-	30.0	7.2	0.03	78.0	31.0	6.80	17.85	40	0.21	145	

Note-1:
Field test parameters (Weekly & Monthly): Temp=Temperature; pH; Salinity; Cond=Conductivity; DO=Dissolved Oxygen; Turbidity; TDS=Total Dissolve Solid; Hardness; NH_3 = Ammonia; Color

Note-2:
Lab test parameters (Monthly sampling): Nitrate; Nitrite; COD; TSS; BOD; Phosphate; Alkalinity; Ammonia; Total Hardness; Arsenic; Iron; Manganese; Aluminum

House # 135, Road # 05, 3rd Floor, Mohakhali DOHS, Dhaka-1206
Contact: +8801712955908 E-mail: ocreedsbd@gmail.com
www.ocreeds.com

(4) Any other observations/comments:

SITE Conditions are ok.
River water depth stable 16.3 meter.

Water Quality/ Environmental Specialist
Name: Engr. Md. Shahadat Hossain
Date:

Water Quality Analyzer
Name: MOHIMEN UR RAHMAN
Date: 25/07/2013

DWASA PMU Representative
Name:
Designation:
Date:

O.CREEDS

ONUSONDHANI CREEDS

Field Survey Data Form

DWASA Surface Water Quality Monitoring Program

(1) Sample location : Bishnondi (Bank of Meghna River), Arihazer
Chotorkanda, Bishnondi, Geo-Coordinates: N=23°44' 47.107" N, E=90°43' 00.000"E)
[Distance: 100m from bank of river where SWTP structure place is allocated]

(2) Field Observations:
Upon arrival at a sampling site, record visual observations on the appearance of the water and other information related to water quality and water use as bellow:

Parameter	Observation
a. Water Color	Greenish reddish / yellowish / muddy / colorless
b. Water appearance	Unusual amount of suspended matter / debris / foam/ none
c. Rain fall	Heavy / moderate / low / none
d. Day	Cloudy day / very dry very wet
e. Unusual Odors	Hydrogen sulfide odor/ musty odor /sewage odor/ none
f. Biological Activity	Excessive growth of algae / phytoplankton/ others ...../ none

(3) Water quality field test parameters (Weekly sample / Monthly sample)

Date: 31/7/2019 Time: 10 AM - 1 PM

Sample	Depth (m)	Temp (°C)	pH	Salinity (‰)	Cond. (µS/cm)	TDS (mg/l)	DO (mg/l)	Turbidity (NTU)	Hardness (mg/l)	NH_3 (mg/l)	Color (TCU)	Flow (ft³/s)
1st grab sample	0.5	30.1	7.1	0.03	655	328	6.35	19.20	40	0.32	147	
2nd grab sample	4	30.1	7.1	0.03	68.4	342	6.63	19.40	40	0.33	152	
3rd grab sample	8	30.1	9.2	0.03	68.9	337	6.70	19.85	40	0.35	160	
Composite Sample (1st+2nd+3rd Grab sample)		30.3	7.1	0.03	65.2	327	6.41	19.32	40	0.35	159	

Note-1:
Field test parameters (Weekly & Monthly): Temp=Temperature; pH; Salinity; Cond=Conductivity; DO=Dissolved Oxygen; Turbidity; TDS=Total Dissolve Solid; Hardness; NH_3 = Ammonia; Color

Note-2:
Lab test parameters (Monthly sampling): Nitrate; Nitrite; COD; TSS; BOD; Photohate; Alkalinity; Ammonia; Total Hardness; Arsenic; Iron; Manganese; Aluminum

House # 135, Road # 05, 3rd Floor, Mohakhali DOHS, Dhaka-1206
Contact: +8801712955908 E-mail: ocreedsbd@gmail.com
www.ocreeds.com

(4) Any other observations/comments:

Too much wave in the River — Wind blowing strongly.
It is raining.

Water Quality/ Environmental Specialist
Name:
Date:

Rayaan Jubaiso
Water Quality Analyzer
Name
Date: 31/07/2019

DWASA PMU Representative
Name:
Designation:
Date

EXECUTIVE SUMMARY

To assess the variation of surface water quality over the period of eighteen months for better understanding of appropriate surface water treatment facilities for the proposed 500MLD DWASA surface treatment plant which is going to install at Bishmondi Arihazer using Meghna river water for ensuring better quality water supply at mega-city Dhaka.

Targeting the above work, ONUSHANDHANI CREEDS LIMITED, a well reported consulting firm has been assigned to conduct surface water quality monitoring at proposed intake point at Bishmondi, Bank of Meghna River, Arihazar under DESWSP, DWASA [RFQW-3.32] for eighteen months.

This report, one of a series of monthly reports on the Surface Water Quality Monitoring (4th Phase) At Proposed Raw Water Intake Point at Bishmodi, Bank of Meghna River, Arihazar Under Dhaka Environmentally Sustainable Water Supply Project (DESWSP), DWASA. The report summarizes the results of the surface water quality monitoring for the month of August/2019 including July/2019.

Measurement of physicochemical parameters are Temperature, pH, Salinity, Conductivity, Turbidity, Dissolved Oxygen (DO),Total Dissolved Solid (TDS), Ammonia (NH_3), Total Hardness and color at field during weekly sampling.

During monthly sampling, composite sample were send to DPHE Central laboratory for the analysis of a wide range of water quality parameter and parameters are Nitrate; Nitrite; COD; TSS; BOD_5; Phosphate; Alkalinity; Ammonia; Total Hardness; Arsenic; Iron; Manganese and Aluminium and field parameter ware tested as same as weekly sample parameters.

During eighteen months study period, a total of five seasonal samples need to be collected which is on an hourly basis. Sampling duration is 13 hours during daylight time and composite sample were send to DPHE Central laboratory and BCSIR Laboratory for the analysis of a wide range of water quality parameters. The parameters are Arsenic, Algae, Barium, Cadmium, Chloride, Chromium (Hexavalent), Coliform (fecal), BOD, COD, Lead, Mercury, Ammonia, Nitrate, Nitrite, Phosphate, TOC, Pesticides (Organo-chorine), Pesticides (Organo-phosphorus), Oil & Grease, Fluoride, Selenium, Zinc, Sulphate, Copper, Antimony, Boron, Nickel and Sodium. Field parameter ware tested as same as weekly sample parameters.

BOD and COD values have been found 18 mg/l and 68mg/L respectively during monthly sample analysis. On the other hand, BOD value has been found 8mg/L, and COD value has been found 36mg/L during seasonal sample analysis which indicate up trend of river contamination. More observation for other months is needed to understand the trend of pollution.

Although ammonia concentration of all samples are in the safe limit as per Bangladesh Drinking Water Quality Standard (NH_3 0.5mg/L), increasing tendency of ammonia concentration with respect to time have been found in the last two months. In conjunction, decreasing of dissolved oxygen (DO), reducing of pH value, increasing of turbidity, increasing of color unit have been found. On the other hand, presence of algae and zooplankton have been detected during this period where river are full of bank.

Presence of other water quality parameter like pesticides (Organo-chorine); Pesticides (Organo-phosphorus); Oil & Grease; Fluoride; Selenium; Zinc; Sulphate; Copper; Antimony; Boron; Nickel and Sodium not found.

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ACRONYMS AND ABBREVIATIONS

AOI	Area of Interest
BMD	Bangladesh Meteorological Department
BWDB	Bangladesh Water Development Board
DAP	Detailed Area Plan
DCC	Dhaka City Corporation
DESWSP	Dhaka Environmentally Sustainable Water Supply Project
DMDP	Dhaka Metropolitan Development Plan
DMP	Drainage Master Plan
DNCC	Dhaka North City Corporation
DND	Dhaka Narayanganj Demra Flood Control, Drainage & Irrigation Proje...
DSCC	Dhaka South City Corporation
DWASA	Dhaka Water Supply and Sewerage Authority
FAP	Flood Action Plan
FCD	Flood Control and Drainage
GoB	Government of Bangladesh
GIS	Geographic information system
HWL	Highest Water Level
IWM	Institute of Water Modeling
JICA	Japan International Cooperation Agency
km	Kilometer
km^2	Kilo Meters squared, square kilo meters
LGED	Local Government Engineering Department
LWL	Lowest Water Level
m/s	Meter per second
m^2	Meter squared, square meter
m^3/s	Cubic meter per second (cumec)
MRT	Mass Rapid Transit
O & M	Operation and Maintenance
PWD	Public Works Department
RAJUK	Rajdhani Unnayan Kartripakkha
RDP	Regional Development Plan
RHD	Roads and Highways Department
SN	Serial Number
SoB	Survey of Bangladesh
ToR	Terms of Reference
WL	Water Level
WQ	Water Quality

CHAPTER 1
INTRODUCTION

1 INTRODUCTION

1.1 Background

Water is continually moving around, though, and above the Earth. It moves as water vapor, liquid water, and ice. It is constantly changing its form. Water on Earth is known by different terms, depending on where it is and where it came from. Agricultural operations can be the source of non-point pollution in surface water. The major causes of surface water pollution associated with farming and ranching are sediment and nutrients. Soil erosion and resulting sedimentation is the leading cause of surface water pollution. Siltation is the leading cause of water quality problems in rivers. Although soil erosion is a natural process, it can be greatly accelerated by human activities such as farming. Major sources of sediment include runoff from cropland; forestry and urban/suburban development are the key points for surface water pollution.

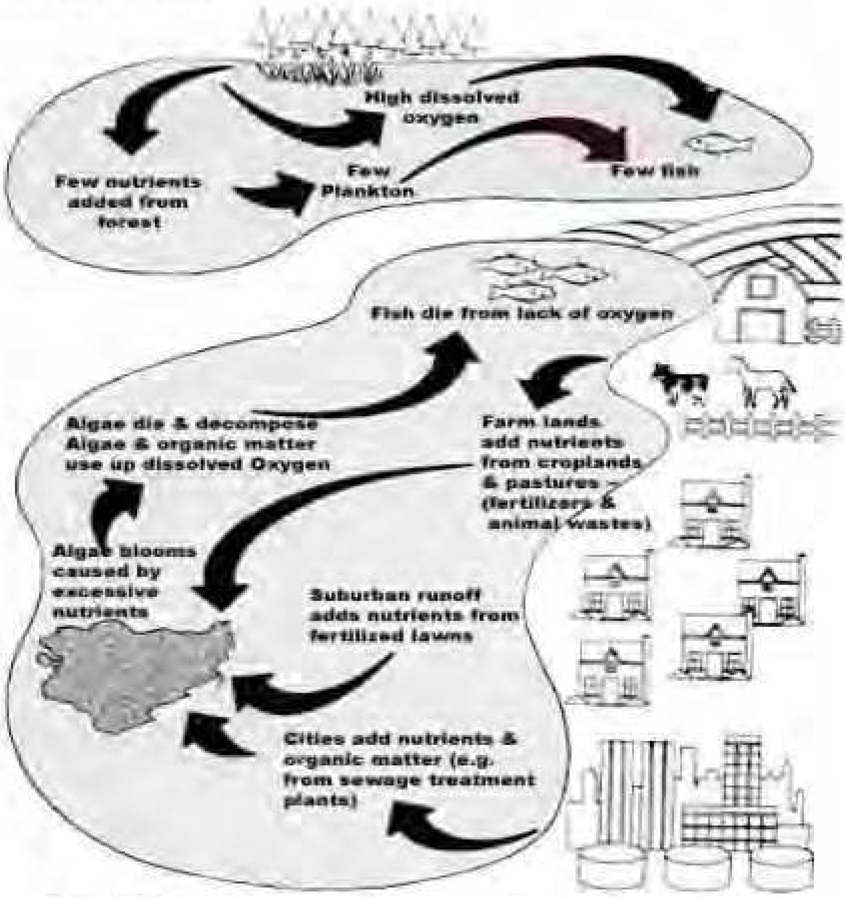


Figure 1:1 Schematic diagram- Different source for Surface water pollution

Water quality monitoring is an important aspect of overall water quality management and water resources development. A well-planned and well-managed water quality monitoring system is required to signal, control or predict the changes or trends in the quality of a particular water body, so that curative or preventive measures can be taken to restore and maintain water body properly. Monitoring is essential for the successful implementation of environmental legislation: to ensure the standards (BD Standard, Annex-1) and criteria set by government are maintained on a continuing basis. Monitoring involves the laboratory and /or spot testing of water sample collected from desire locations both source and supply system.

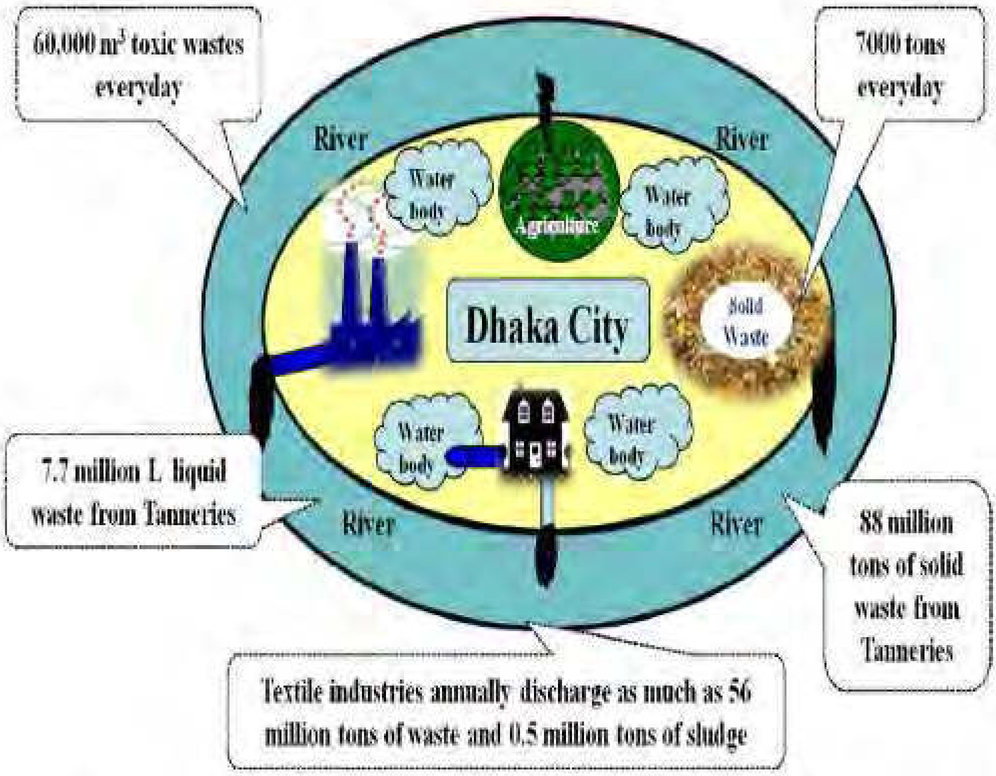


Figure 1.2 Schematic diagram-River pollution around Dhaka City

River pollution around Dhaka City from different pollution sources are exhibited in **Figure 1.2**. The main sources include industrial untreated wastewater, tannery waste, municipal solid waste, household waste etc. [Article Ref. Environments 2(3):280-294 · June 2015 (Article Alteration of Water Pollution Level with the Seasonal Changes in Mean Daily Discharge in Three Main Rivers around Dhaka City, Bangladesh)]

1.2 Objectives

There are many instances that surface water quality does not meet drinking water quality standard due to presence of inferior substance and the pollutants should not introduce in the water supply system without treatment. Rainfall, acid rain, storm water runoff, agriculture runoff, industrial waste and others can affect the color, odor, dissolved oxygen of water and also influences on major ion levels, bacteria level in surface water.

Due to cause of different factors for the pollution of surface water for drinking water quality aspect and the presence of different type of contaminants, before going a wide scale parameter testing as well as to know the change of water quality with respect to time, by testing some fundamental parameters which can represent or can give a synopsis of surface water quality is the target of this study.

To assess the variation of surface water quality over the period of eighteen months for better understand appropriate surface water treatment facilities for 500MLD capacity of DWASA surface treatment plant which is going to install at Bishnondi Arihazer using Meghna river water for ensuring better quality water supply at mega-city Dhaka. In order fulfill the above objective, **Onushandhani CREEDS** Ltd has been assigned to conduct surface water quality monitoring at proposed intake point at Bishnondi, Bank of Meghna River, Arihazar under DESWSP, DWASA [RFQW-3.32] for eighteen months.

1.3 Scope of Works

The actual works envisaged for implementation are quantified as follows:

1. Conduct hourly, weekly, monthly and seasonal sampling.
2. Conduct some water quality parameter like pH, salinity, conductivity, TDS, hardness, ammonia, color by using portable instrument and test kit
3. Organize laboratory tests for monthly and seasonal sample at DPHE Central Lab & BCSIR Lab
4. Data Analysis
5. Result Interpretation
6. Monthly report to be produced and submitted to DWASA.

1.4 Description of Sampling Area

Location of the sampling point:

Chaitankanda, Bishnondi Arihazer

Geo-Coordinates: N=23° 44' 47.107" N, E=90° 43' 00.000"E

Distance from bank of Meghna River: 100m from bank of river where Surface Water Treatment Plant structure place is allocated.

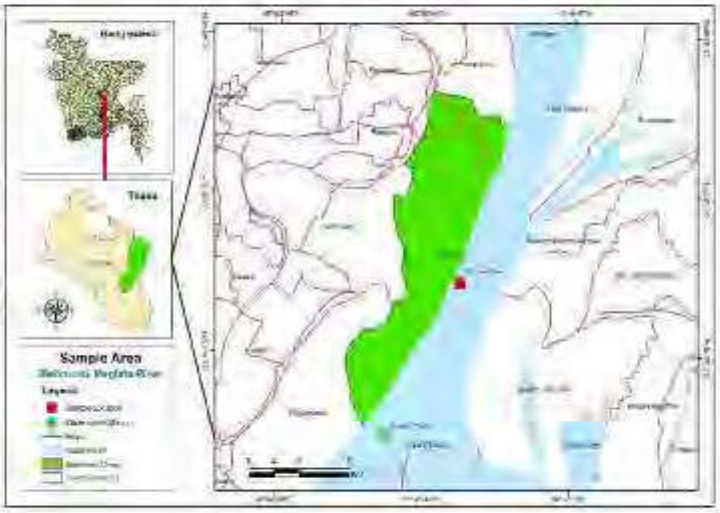


Figure 1:3 Study Area Map of Bishondi, Araihazar

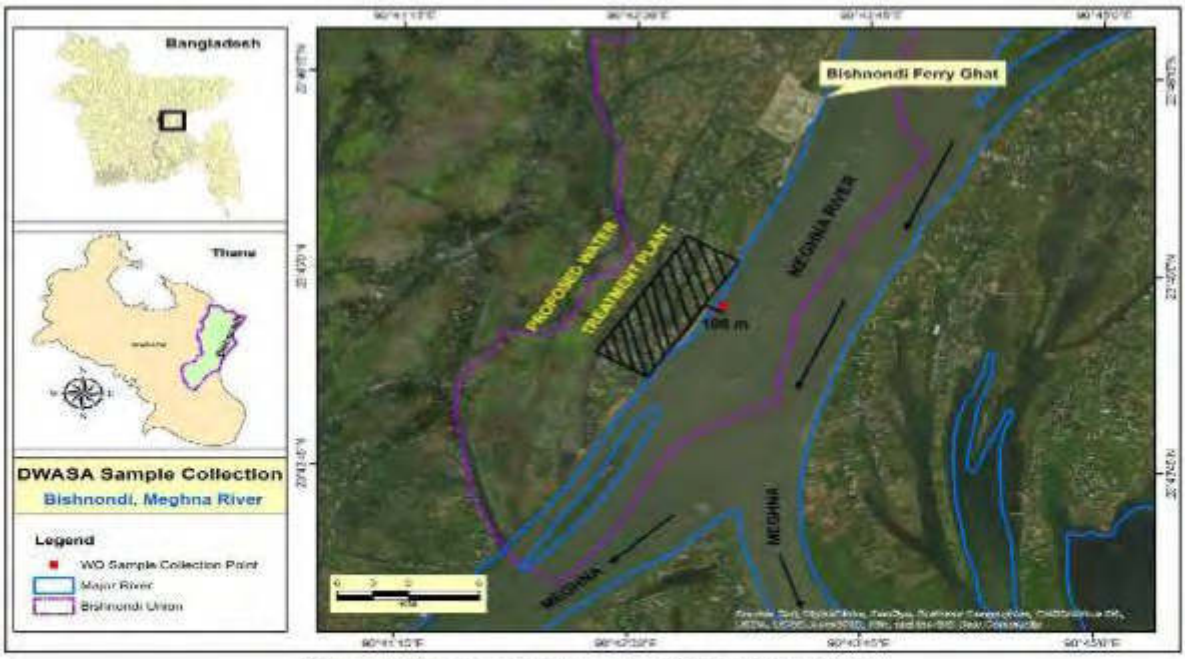


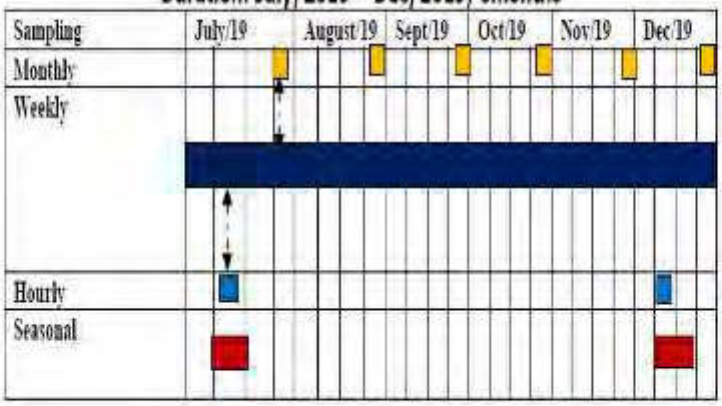
Figure 1:4 Sample collections point of Bishondi, Araihazar

1.5 Work Plan and Professional Staffing

Schedule of Surface Water Quality Monitoring-Bishnondi, bank of Meghna River,Arihazer

[Chaitankanda, Bishnandi, Geo-Coordinates: N=23° 44' 47.107" N, E=90° 43' 00.000"E)]

Duration: July/2019 – Dec/2019; 6months



Duration: January/2020 – Dec/2020; 12months

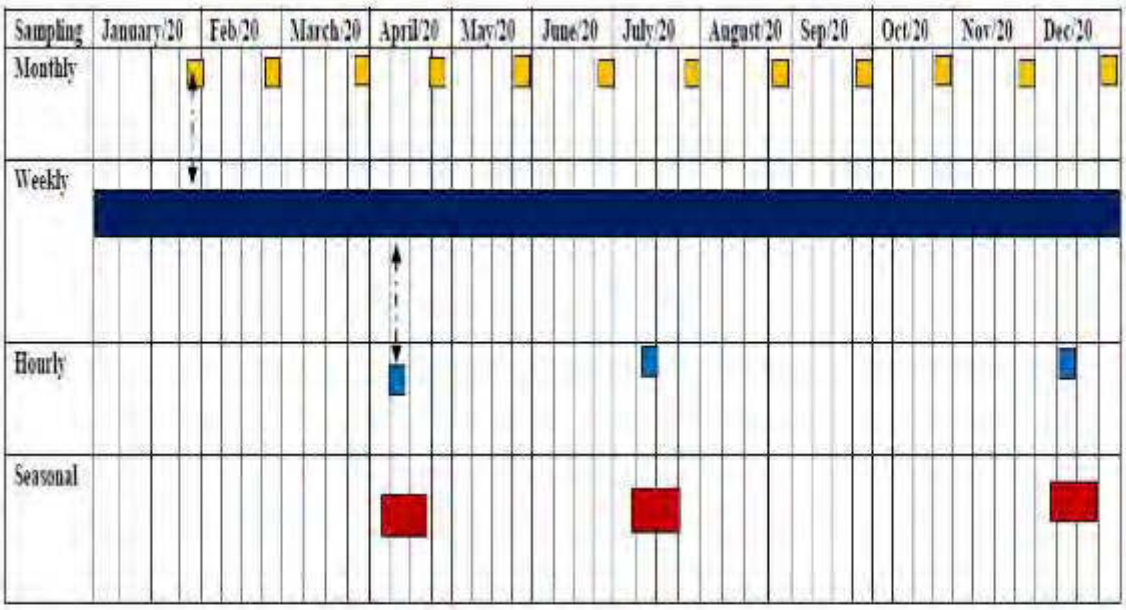


Figure 1:5 Work Plan of the Project

Table 1-1: List of Professional staff involved in this study

Name of The Expert	Position
Dr. Jubair Tariqul Alam Chowdhury	Water Quality /Environment Specialist and Adviser
Dr. Syed Zakir Hossain	River Morphological Specialist
Md. Shahadat Hossain	Water Supply Specialist
Rayaan Jubair Chowdhury	Environmental Engineer
Mohimen Ur Rahman	Water Quality Analyzer
Mansura Khanum	GIS Expert
Mahbubul Alam	Hydro-geologist
Wakil Ahmed	Junior Engineer

Progress Index

Monitoring duration: July/2019 to December/2020
Reporting Month: August/2019
Progress month=Two month - July/2019 & August/2019)

Figure 1:6 Project Progress.

CHAPTER 2
METHODOLOGY

2 METHODOLOGY

The Methods and instruments for different parameter analysis and sample collection were selected following the standard methods for the examination of water and wastewater proposed by APHA (American Public Health Association), AWWA (American Water Works association) & WEF (Water Environment Federation).

2.1 Sampling Approach and Methodology

a. **Sampling point:**

The sampling point is located at Bishnondi. GPS location of sampling points is N 23° 44' 47.107" N, E 90° 43' 00.000"E Distance between sampling point and bank of river is 100meters [minimum river bank in dry season]

b. **Water Sample:**

(i) 1st grab water sample should be collected from a depth of 0.5meter for every time. Measures some physicochemical parameters (Temperature, pH, Conductivity, Turbidity, Dissolved Oxygen, TDS and Ammonia) at field and record properly.

(ii) Sample in different depth: Made up of two equal parts collected at predetermined depth intervals between the surface and probable inlet point of the intake pipe which is approximately 8m from surface of the river. In this case, another two grab sample (2nd & 3rd Grab) will be collected from equal depth interval and measure some physicochemical parameters (Temperature, pH, Salinity, Conductivity, Turbidity, Dissolved Oxygen, TDS and Ammonia) at field for each grab sample separately and record properly.

(iii) A composite sample (combining portions of these three multiple grab samples) should be collected for detail chemical and microbiological analysis at laboratory. Composite sample should be composition of three grab samples.

(iv) Measure physicochemical parameters (Temperature, pH, Salinity, Conductivity, Turbidity, Dissolved Oxygen, TDS and Ammonia) for composite sample after immediate mixing of this three grab sample (1st, 2nd & 3rd Grab sample) at field and record properly.

(v) After field physicochemical measurements have been recorded, collect water sample for laboratory analysis both chemical and microbiological at the same location and same depth with same manner. It is mentioned that one grab sample (1st grab sample) and one composite sample (combining portions of 1st, 2nd & 3rd grab sample) should be collected for laboratory analysis during monthly sampling and seasonal variation for special pollutants sampling.

(vi) Salinity test during high tide: Measure salinity monthly basis during high tide only at Meghna Bridge spot. Measure salinity in three different depths [See b (i) & (ii)]. Additionally, Salinity test (at 4 points): Measure salinity at 4 (four) points in between Megana Bridge and Intake point of SWTP (Bishnondi) with three equal intervals.

For other parameter analysis at laboratory, the volume of sample and the preservative are (1) four liter-without preservative :(2) two liter-with preservative with HCl (3) four liter- preservative with HNO_3

Water Level: Water Level shall be measured weekly at Bishmondi sampling point. The level shall be related to national datum. Other observation should be recorded properly according to a "Field Survey Form".

The following points should be considered during sampling:

- Sampling by Boat: Always collect samples upstream from the boat and as far away from the motor as possible, to minimize the chance of gas or oil contamination. Turn off the engine before collecting samples.
- When samples are collected during abnormally high or low flow, the abnormal conditions will be recorded in the field logbook and on the observation lines of the sample data form. It is important to include flow severity and days since last rainfall rain information with each sampling event. This information is very useful in interpreting the data.
- Upon arrival at the sampling site, record visual observations on the appearance of the water like color, unusual amount of suspended matter, debris or foam etc. and other information related to water quality and water use.
- Weather such as heavy rains, cold front, very dry, very wet etc. information should be recorded.
- Unusual incidences like presence of hydrogen sulfide, sewage and biological activity like excessive phytoplankton or algal growth should be recorded during sample collection and testing at field.
- The sample location should be strictly maintained in the same place during the whole period of this survey. Samples should not be collected at the time of rain shower.
- The required instruments to be used are Multi parameter analyzer, Turbidity meter, Ammonia kit, Flow meter, Depth measurement meter, surface water sampler, HDPE sample bottles, acid, cool box etc.

2.2 Duration of the monitoring:

The tentative duration of the study is 18 months, starting from July 2019 to December 2020.

CHAPTER 3

DESCRIPTION OF SAMPLING

3 DESCRIPTION OF SAMPLING

Following detailed discussion at DWASA office, the field survey for the study was scheduled. After the signing of the project on July 16, 2019, there were three weeks of scheduled weekly sampling.

3.1 Sampling Schedule:

Water sample will be collected under different time frequency such as weekly, monthly, seasonal and hourly. The detailed description is as follow:

Weekly sampling:

Duration: July/2019- Dec/2020; Total week= 78 weeks

Test type: Field-test using field kit and portable instrument. Weekly sample will not send to lab test.

(A) Test type: Field test: [using field kit and portable instrument]

Table 3-1: Field test parameters

Water quality parameter	1st grab sample	2nd grab sample	3rd grab sample	Composite Sample-1	Type of instrument/Kit
Temperature	78	78	78	78	Multi parameters Meter
pH,	78	78	78	78	Multi parameters Meter
Salinity	78	78	78	78	Multi parameters Meter
Conductivity	78	78	78	78	Multi parameters Meter
Turbidity	78	78	78	78	Multi parameters Meter
Dissolved Oxygen (DO)	78	78	78	78	Multi parameters Meter
TDS	78	78	78	78	Turbidity meter
Ammonia	78	78	78	78	Ammonia kit
Total Hardness	78	78	78	78	Hardness kit
Color	78	78	78	78	Colorimeter

*Orange Shade=Test by Portable instrument; Blue shade=Test by kit

Monthly sampling:

Duration: July/2019- Dec/2020; Total month= 18 months. Monthly sample will be collected 4th week of each month. Weekly sample of 4th week of each month will also be considered as monthly sample for field parameter.

Type of Test:

i. **Field test:** Same as before using field kit and portable instrument.

ii. **Laboratory test:** Sample will be send to DUPE central lab. Parameters are Nitrate; Nitrite; COD; TSS; BOD_5; Phosphate; Alkalinity; Ammonia; Total Hardness; Arsenic; Iron; Manganese and Aluminum.

Hourly /Seasonal sampling:

15 hourly samples, during daylight time, will be collected five times during study period. Hourly sample will be collected during seasonal sampling.

Test type: Field test [using field kit and portable instrument] and laboratory test

Sampling time: July/2019; Dec/2019; April/20120; July/2020 & Dec/2020

Frequency of sampling =5times during study period (18 month)

(A) Parameter test at field during hourly sampling including total number:

Table 3-2: Hourly Sampling parameters

Water quality parameter	1st grab sample	2nd grab sample	3rd grab sample	Composite Sample-1	Type of instrument/Kit
Temperature	13x5 65	13x5 65	13x5 65	13x5 65	Multi parameters Meter
pH	13x5=65	13x5=65	13x5=65	13x5=65	Multi parameters Meter
Salinity	13x5=65	13x5=65	13x5=65	13x5=65	Multi parameters Meter
Conductivity	13x5 65	13x5 65	13x5 65	13x5 65	Multi parameters Meter
Dissolved Oxygen (DO)	13x5 65	13x5 65	13x5 65	13x5 65	Multi parameters Meter
TDS (Total Dissolved Solid)	13x5=65	13x5=65	13x5=65	13x5=65	Multi parameters Meter
Turbidity	13x5=65	13x5=65	13x5=65	13x5=65	Turbidity meter
Ammonia	13x5 65	13x5 65	13x5 65	13x5 65	Ammonia kit
Total Hardness	13x5 65	13x5 65	13x5 65	13x5 65	Hardness kit

**Hours 13; Season 5; *Orange Shade Test by Portable instrument; Blue shade Test by kit*

(B) List of water quality test parameter at laboratory during hourly sampling:

Arsenic; Algae; Antimony; Ammonia; Barium; Boron; Cadmium; Chloride; Chromium (Hexavalent); Coliform (fecal); Copper; BOD_{3days}; COD; Lead; Mercury; Nitrate; Nitrite; Nike; Phosphate; TOC; Posticides (Organo-chorine); Posticides (Organo-phosphorus); Oil & Grease; Fluoride; Selenium; Sulphate ; Sodium; Zinc.

3.2 Field Visits

Total of 05 (five) field visits were conducted during August/2019. The field visit schedule along with personnel involved is shown in table

Table 3-3: Field Visit Schedule

Date	Sampling Type	Personnel
01/08/2019	Weekly Sampling	Name: Md. Shahadat Hossain Designation: Water Quality Analysis Specialist
		Name: Mohimen Ur Rahman Designation: Water Quality Analysis Assistant
		Name: Sourav Kanti Paul Designation: Water Quality Analysis Assistant
		Name: Fakhrul Islam Designation: Survey Assistant
08/08/2019	Weekly Sampling	Name: Md. Shahadat Hossain Designation: Water Quality Analysis Specialist
		Name: Mohimen Ur Rahman Designation: Water Quality Analysis Assistant
		Name: Sourav Kanti Paul Designation: Survey Assistant
		Name: Fakhrul Islam Designation: Survey Assistant
14/08/2019	Weekly Sampling	Name: Dr. J.T.A Chowdhury Designation: Water Quality Expert and Adviser of the Study
		Name: Rayaan Jubair Chowdhury Designation: Environmental Engineer
		Name: Mohimen Ur Rahman Designation: Water Quality Analysis Assistant
		Name: Sourav Kanti Paul Designation: Survey Assistant
		Name: Fakhrul Islam Designation: Survey Assistant
21/08/2019		Name: Mohimen Ur Rahman Designation: Water Quality Analysis Assistant
		Name: Sourav Kanti Paul Designation: Survey Assistant
		Name: Fakhrul Islam Designation: Survey Assistant
28/08/2019	Seasonal Sampling	Name: Dr. J.T.A Chowdhury Designation: Water Quality Expert and Adviser of the Study
		Name: Sourav Kanti Paul Designation: Survey Assistant
		Name: Fakhrul Islam Designation: Survey Assistant
		Name: Mohimen Ur Rahman Designation: Water Quality Analysis Assistant

**Photo of field sampling activities are shown in Annexures-3.*

3.3 Laboratory Tests

(A) Laboratory test during monthly sampling including name of the parameter, total number of sample, type of sample and name of the lab are as below:

Table 3-4: Laboratory test parameters for monthly sample

Water quality parameter	Composite Sample	Name of the Lab
Nitrate	18	DPHE Center Lab, Mohakhali
Nitrite	18	
COD	18	
TSS	18	
BOD_5	18	
Phosphate	18	
Alkalinity	18	
Ammonia	18	
Total Hardness	18	
Arsenic	18	
Iron	18	
Manganese	18	
Aluminium	18	

(B) Laboratory test during hourly sampling including name of the parameter, total number sample, name of the lab is as below:

Table 3-5: Laboratory test parameters for hourly sample

Water quality parameter	Composite Sample	Name of the Lab
Arsenic	5	DPHE
Algae	5	BCSIR
Barium	5	DPHE
Cadmium	5	DPHE
Chloride	5	DPHE
Chromium(Hexavalent)	5	BCSIR
Coliform(fecal)	5	DPHE
BOD	5	DPHE
COD	5	DPHE
Lead	5	DPHE
Mercury	5	BCSIR
Ammonia	5	DPHE
Nitrate	5	DPHE
Nitrite	5	DPHE
Phosphate	5	DPHE
TOC	5	BCSIR
Pesticides(Organo-chorine)	5	BCSIR
Pesticides(Organo-phosphorus)	5	BCSIR
Oil & Grease	5	BCSIR
Fluoride	5	DPHE
Selenium	5	DPHE
Zinc	5	DPHE
Sulphate	5	DPHE
Copper	5	DPHE
Antimony	5	BCSIR
Boron	5	BCSIR
Nikel	5	DPHE
Sodium	5	DPHE

Major instrument for use in Lab

The below major instrument will be used during laboratory analysis as per "Standard Methods- For the Examination of Water and Wastewater"; 20[th] Edition; Prepared & Published by American Public Health Association (APHA); American Water Works Association(AWWA) and Water Environment Federation(WEF):

Table 3-6: Laboratory test equipment used for test

Parameter	Major equipment for test
Aluminum	Atomic absorption spectrophotometer
Alkalinity	Ion meter/ UV-Visible Spectrophotometer
Arsenic	Atomic absorption spectrophotometer(HVG)
Barium	Atomic absorption spectrophotometer
Cadmium	Atomic absorption spectrophotometer(heavy metal)
Chloride	Ion chromatograph(Anion)
Chromium(Hexavalent)	Ion chromatograph (Hexavalent chrome)
COD	COD Reactor, burette stand.
BOD5 20 °C	Incubator, BOD bottle
Coliform (Fecal)	Autoclave, incubator, filtration unit.
Lead	Atomic absorption spectrophotometer(heavy metal)
Mercury	Atomic absorption spectrophotometer for Hg analysis
Nitrate	Ion chromatograph (Anion)/UV-Visible Spectrophotometer
Nitrite	Ion chromatograph (Anion)/UV-Visible Spectrophotometer
Phosphate	Ion chromatograph (Anion)/ UV-Visible Spectrophotometer
S.S	Balance, Dehydrator, Desiccators, filtration unit
Sulfate	Ion chromatograph (Anion)/ UV-Visible Spectrophotometer
Silica	UV-Visible Spectrophotometer
Total dissolved solids	Balance, Dehydrator, Desiccators, filtration unit
Zinc	Atomic absorption spectrophotometer
TOC	TOC analyzer
Pesticides (Organo Chlorine)	GC-MS
Pesticides (Organo Phosphorus)	GC-MS
Oil & Grease	Solvent Extraction

Figure 3:1 Central Laboratory, DPHE, Mohakhali, Dhaka

Figure 3:2 Bangladesh Council for Scientific and Industrial Research (BCSIR)

3.4 List of portable instrument/ Test kit and others use during field activities:

The following items are needed for the Water Quality Monitoring activities;

a. Multi parameters Meter (for pH, DO, Electrical Conductivity (EC), TDS, In addition, salinity test) HACH, USA.
b. Turbidity meter for the measurement of Turbidity, HACH, USA.
c. Testing Kits for NH_3-N, As, Hardness, Alkalinity tests
d. Sampling bottles (different sizes)
e. Distilled water
f. Different acids (HCl, HNO_3) for sample preservation, washing of sample bottle etc.
g. Required glassware, washing bottle etc.

3.5 Field Survey data form:

A field survey data form has been developed which is shown in the **Annexure-1** section of this report.

3.6 Drinking Water Quality Standard:

Bangladesh Drinking Water Quality standards [ENVIRONMENT CONSERVATION RULES 1997, Published: 28th August, 1997, Government of the People's Republic of Bangladesh; Ministry of Environment] are shown in the **Annexure-2** section of the report.