

Semi-Annual Environmental Monitoring Report

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

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CHAPTER 4
RESULTS AND DISCUSSIONS
4 RESULTS AND DISCUSSIONS
4.1 Weekly sampling- Field test results
Table 4-1: Weekly Sampling Field Test Results: Sampling date: 01/08/2019

Water quality field test parameters (weekly sample-1 st week);Month: August/2019										
Date:01- 08-2019						Time: 10-12				
Sample	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 (0.5m depth)	30.5	7.5	0.03	79.5	33.7	6.36	14.9	40	0.23	139
2nd grab sample (4m depth)	30.4	7.2	0.03	75.2	31.8	6.51	17.04	40	0.27	142
3rd grab sample (8m depth)	30.5	7.2	0.03	75.8	31.9	6.79	16.86	40	0.3	145
Composite sample (1st+2nd+3rd grab sample)	30.3	7.2	0.03	78	33	6.77	12.13	40	0.24	140
Max	30.5	7.5	0.03	79.5	33.7	6.79	17.04	40	0.3	145
Min	30.3	7.2	0.03	75.2	31.8	6.36	12.13	40	0.23	139
Avg.	30.41667	7.30	0.03	77.20	32.65	6.60	15.02	40	0.26	141.67

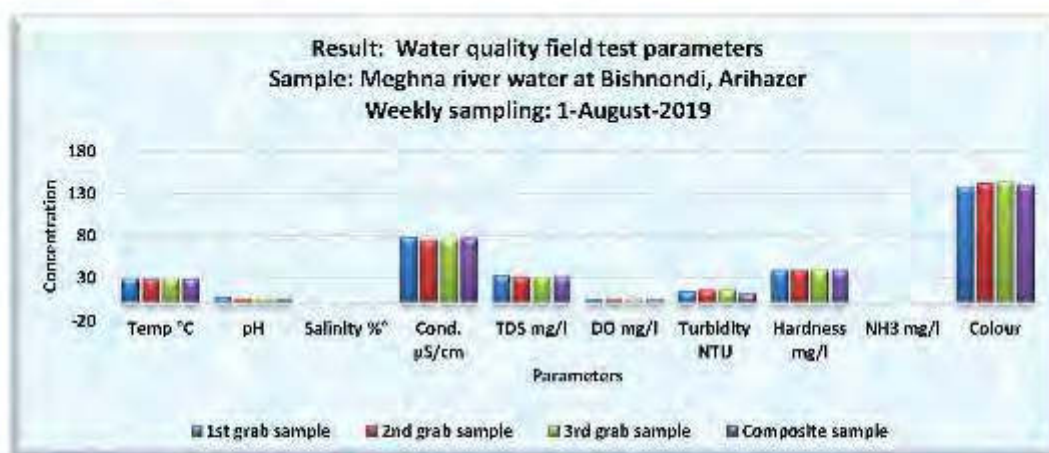

Figure 4:1 Comparison of different water quality parameters at different depths; 1st week.



Table 4-2: Weekly Sampling Field Test Results: Sampling date: 08/08/2019

Water quality field test parameters (weekly sample-2 nd week); Month: August/2019										
Date: 08-08-2019						Time: 10-12				
Sample	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 (0.5m depth)	30.6	7.5	0.03	74.5	35.6	6.3	12.4	40	0.24	139
2nd grab sample (4m depth)	30.5	7.3	0.03	72.3	30.5	6.86	18.45	40	0.27	146
3rd grab sample (8m depth)	30.4	7.1	0.03	76.3	32.2	6.91	17.64	60	0.31	116
Composite sample (1st+2nd+3rd grab sample)	30.3	7.3	0.03	83	34.8	6.86	17.69	40	0.21	127
Max	30.6	7.5	0.03	83	35.6	6.91	18.43	60	0.31	146
Min	30.3	7.1	0.03	72.3	30.5	6.3	12.4	40	0.21	116
Avg	30.45	7.30	0.03	76.90	33.2	6.69	16.17	46.66	0.26	131.67

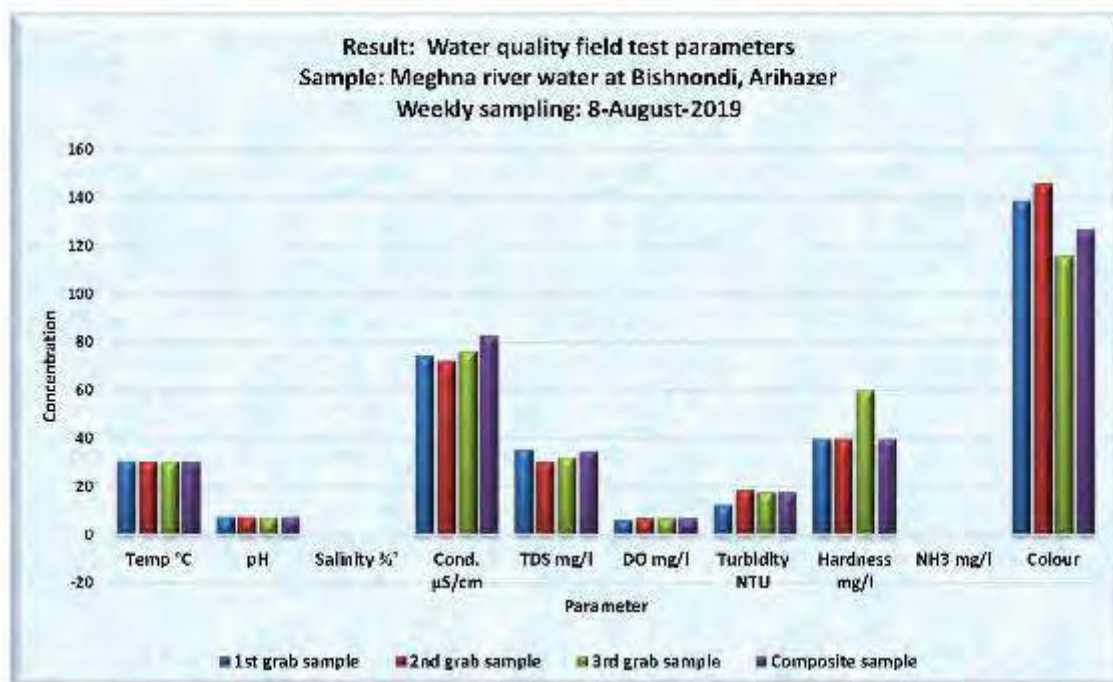
Figure 4.2 Comparison of different water quality parameters at different depth; 2nd week.



Table 4-3: Weekly Sampling Field Test Results: Sampling date: 14/08/2019

Water quality field test parameters (weekly sample-3 rd week);Month: August/2019										
Date:14- 08-2019						Time: 10-12				
Sample	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 (0.5m depth)	30.5	7.5	0.03	64.2	30.25	6.4	19.4	40	0.33	151
2nd grab sample (4m depth)	30.4	7.5	0.03	67.4	33.2	6.32	18.89	40	0.29	180
3rd grab sample (8m depth)	30.1	7.3	0.03	68.5	32	6.69	18.5	40	0.32	144
Composite sample (1st+2nd+3rd grab sample)	30	7.3	0.03	66.1	30.1	6.78	17.7	40	0.25	170
Max	30.5	7.5	0.03	68.5	33.2	6.78	19.4	40	0.33	180
Min	30	7.3	0.03	64.2	30.1	6.32	17.7	40	0.25	144
Avg.	30.25	7.40	0.03	66.48	31.475	6.55	18.60	40	0.30	161.50

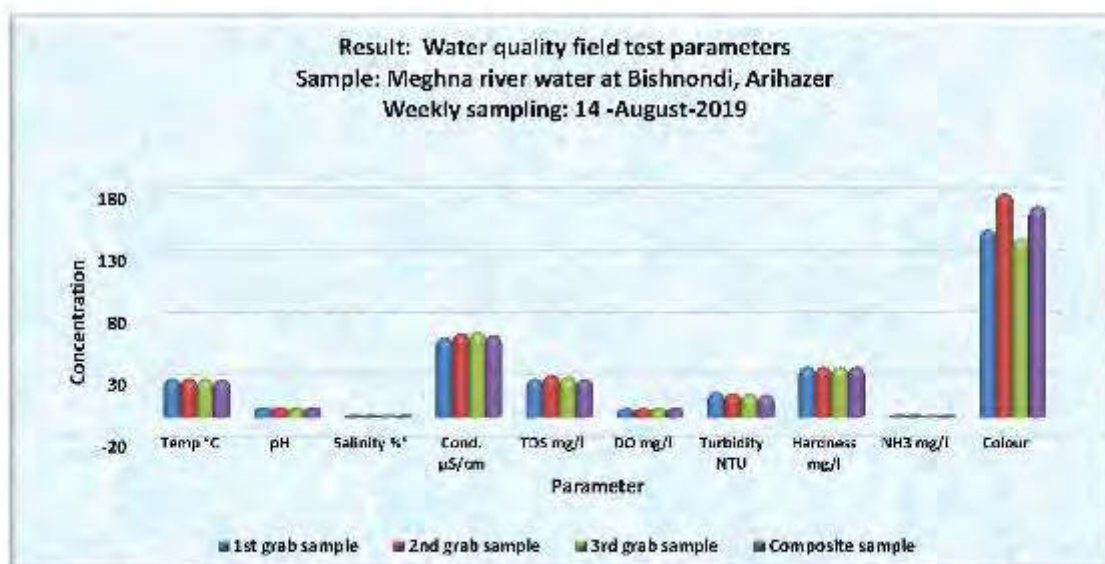
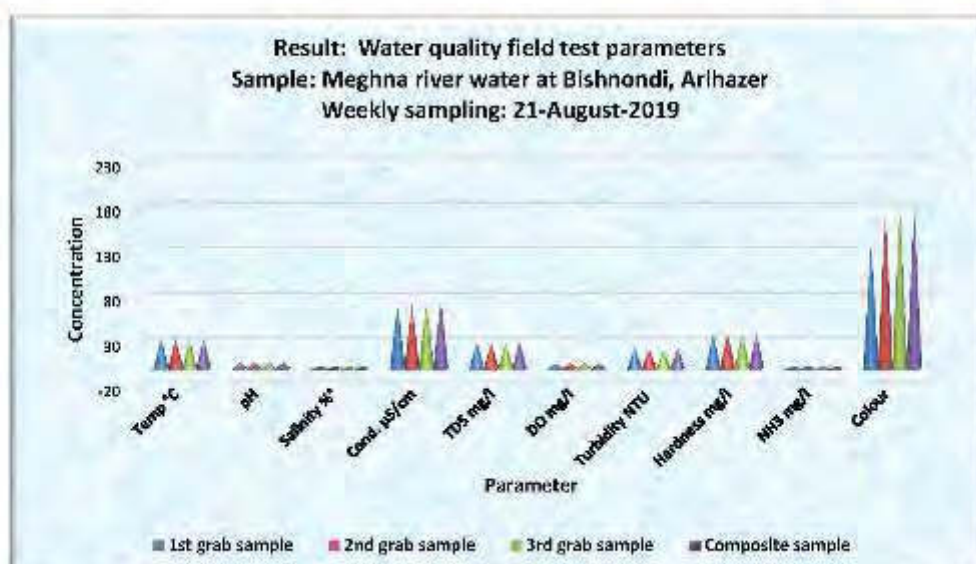

 Figure 4.3 Comparison of different water quality parameters at different depth; 3rd week.



Table 4-4: Weekly Sampling Field Test Results: Sampling date:21/08/2019

Water quality field test parameters (weekly sample-4 th week);Month: August/2019										
Date:21-08-2019						Time: 10-12				
Sample	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 (0.5m depth)	33.3	7.1	0.03	73.7	29.8	6.02	23.26	40	0.33	142
2nd grab sample (4m depth)	34.4	7.2	0.03	72.8	28.6	6.19	21.49	40	0.3	177
3rd grab sample (8m depth)	33.9	7.1	0.03	72.7	29	6.2	19.76	40	0.35	181
Composite sample (1st+2nd+3rd grab sample)	33.3	7.1	0.03	77.9	31.2	6.2	22.04	40	0.24	181
Max	34.4	7.2	0.03	77.9	31.2	6.2	23.26	40	0.35	181
Min	33.3	7.1	0.03	72.7	28.6	6.02	19.76	40	0.24	142
Avg.	33.76	7.13	0.03	74.62	29.73	6.14	21.60	40	0.30	167.33


 Figure 4:4 Comparison of different water quality parameters at different depth; 4th week.

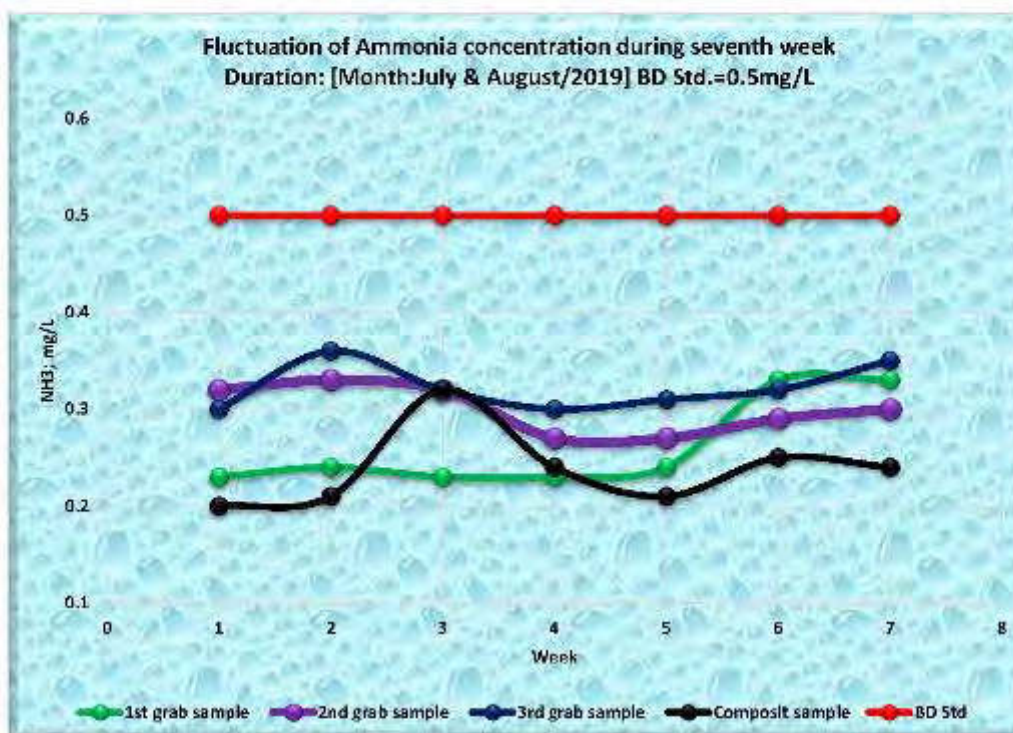
**Data of Fifth weekly sample (28/8/2019) = Date of seasonal sample in the same date



4.2 Observation on Weekly Sampling

Parameter= Ammonia; mg/L

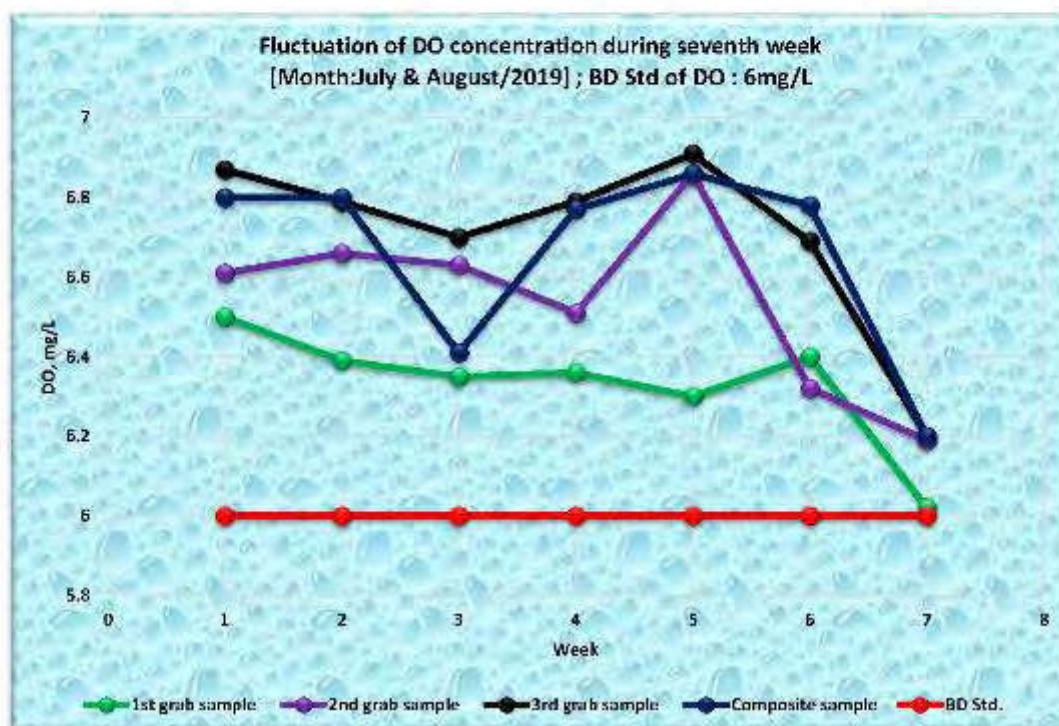
Date	1st grab sample	2nd grab sample	3rd grab sample	Composite sample	BD Std. Ammonia mg/L.
18/July/2019	0.2	0.32	0.3	0.2	0.5
25/July/2019	0.2	0.33	0.36	0.21	
31/July/2019	0.2	0.32	0.32	0.32	
1/Aug./2019	0.2	0.27	0.3	0.24	
8/August/2019	0.2	0.27	0.31	0.21	
14/August/2019	0.3	0.29	0.32	0.25	
21/August/2019	0.3	0.3	0.35	0.24	
Max	0.33	0.33	0.36	0.32	
Min	0.23	0.27	0.30	0.20	
Avg.	0.27	0.30	0.32	0.24	



Observation: Ammonia concentration is increasing small portion during seven week.


Parameter: Dissolved Oxygen (DO); mg/L

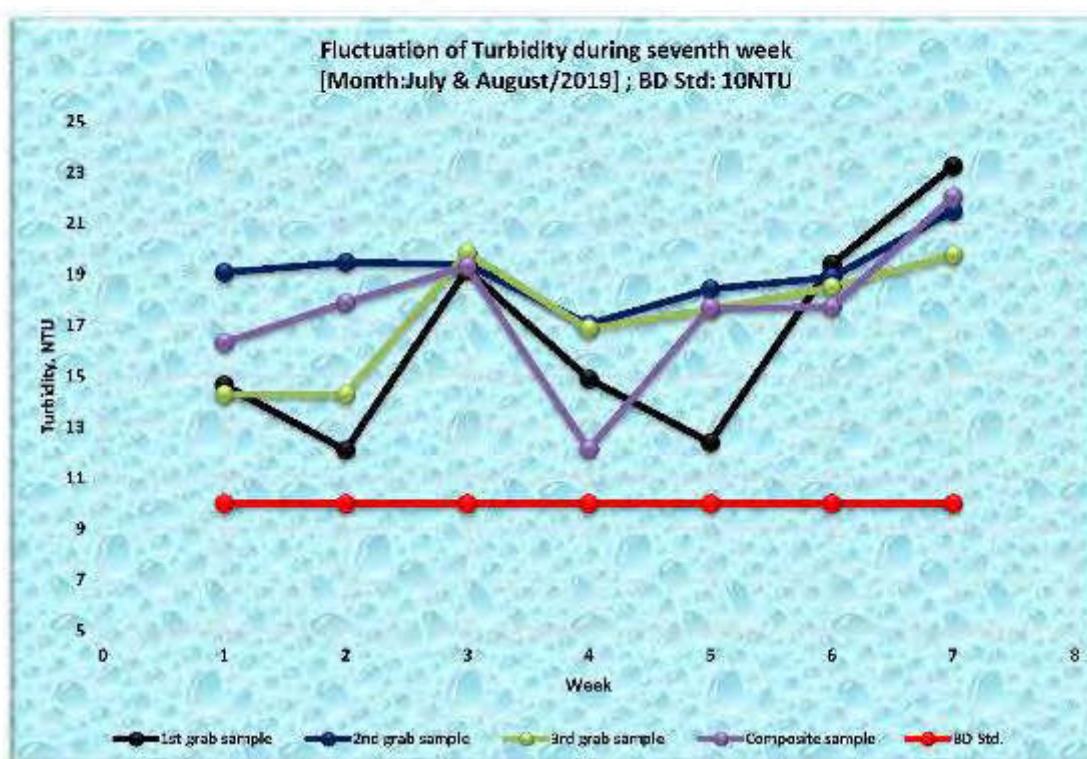
Sample	18/7/2019	25/7/2019	31/7/2019	1/8/2019	8/8/2019	14/8/2019	21/8/2019	Max	Min	Avg.
1st grab sample	6.5	6.39	6.35	6.36	6.3	6.4	6.02	6.5	6.02	6.32
2nd grab sample	6.61	6.66	6.63	6.51	6.86	6.32	6.19	6.86	6.19	6.54
3rd grab sample	6.87	6.79	6.7	6.79	6.91	6.69	6.2	6.91	6.2	6.67
Composite sample	6.8	6.8	6.41	6.77	6.86	6.78	6.2	6.86	6.2	6.63
BD Std.	6									



Observation: Concentration of dissolved oxygen is reducing over the period of seven week.


Parameter: Turbidity; NTU

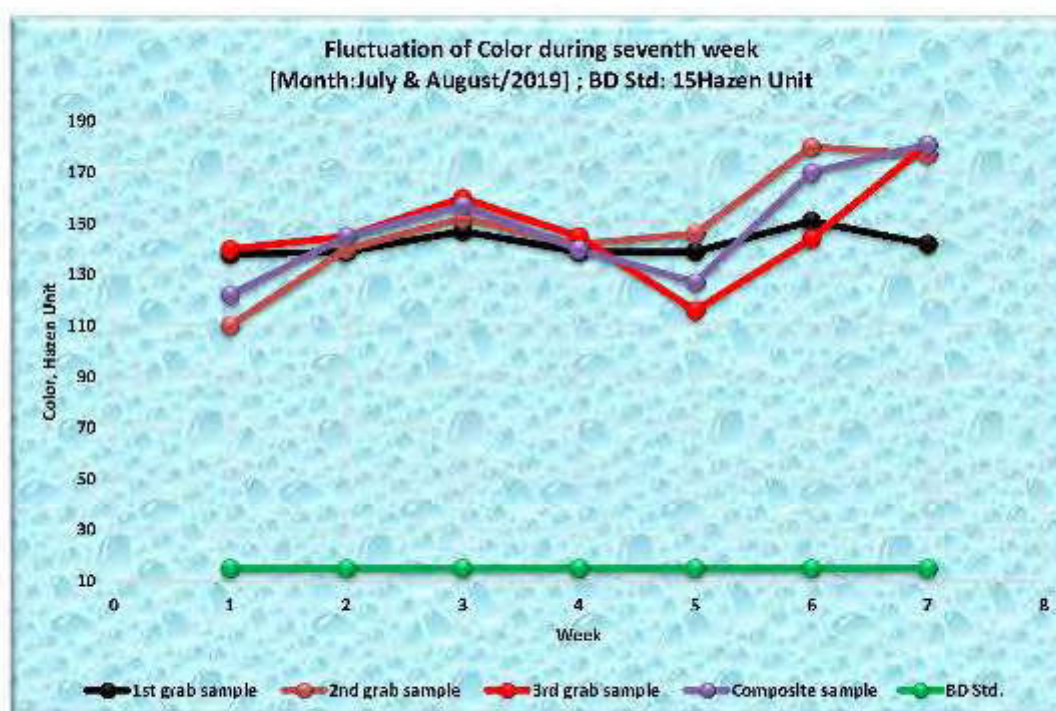
Sample	18/7/2019	25/7/2019	31/7/2019	1/8/2019	8/8/2019	14/8/2019	21/8/2019	Max	Min	Avg.	
1st grab sample	14.66	12.1	19.2	14.9	12.4	19.4	23.26	23.26	12.1	16.81	
2nd grab sample	19.08	19.48	19.4	17.04	18.43	18.89	21.49	21.49	17.04	19.15	
3rd grab sample	14.28	14.28	19.85	16.86	17.64	18.5	19.76	19.85	14.28	17.26	
Composite sample	16.32	17.89	19.32	12.13	17.69	17.7	22.04	22.04	12.13	17.47	
BD Std.	10										



Observation: All sample are containing high Turbidity and above Bangladesh Drinking Water Quality Standard and it is gradually increasing.


Parameter: Color; Hazen Unit; BD Std. =15

Sample	18/7/2019	25/7/2019	31/7/2019	1/8/2019	8/8/2019	14/8/2019	21/8/2019	Max	Min	Avg.	
1st grab sample	138	139	147	139	139	151	142	151	138	142.67	
2nd grab sample	110	140	152	142	146	180	177	180	110	148.56	
3rd grab sample	140	145	160	145	116	144	181	181	116	147.56	
Composite sample	122	145	157	140	127	170	181	181	122	149.44	
BD Std.	15										

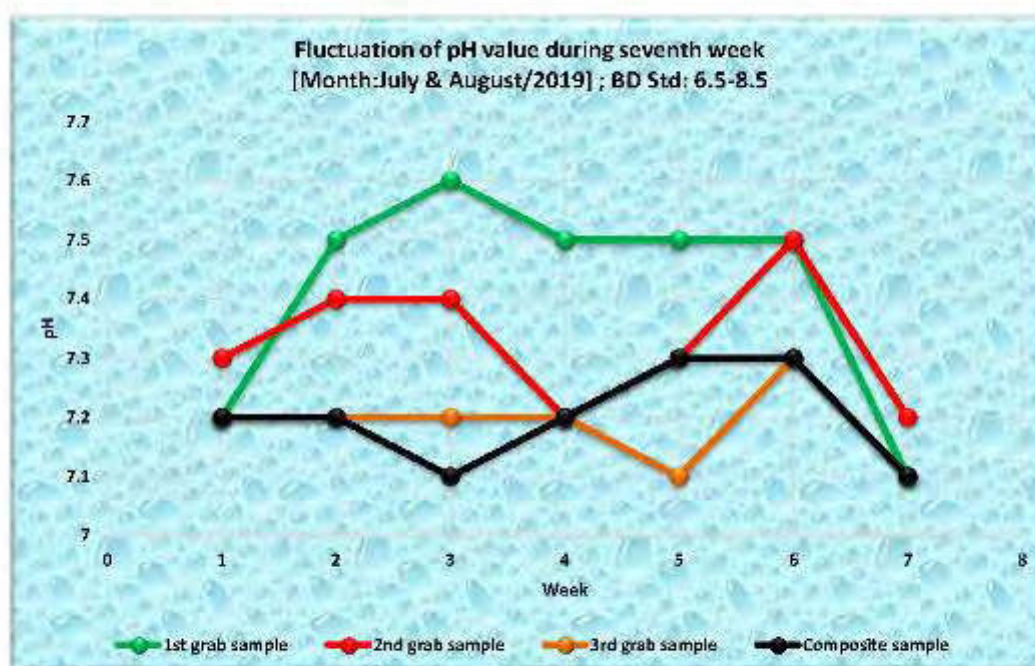


Observation: All samples are containing high color and above Bangladesh Drinking Water Quality Standard and it is gradually increasing.



Parameter: pH; BD Std. =6.5 – 8.5

Sample	18/7/2019	25/7/2019	31/7/2019	1/8/2019	8/8/2019	14/8/2019	21/8/2019	Max	Min	Avg.
1st grab sample	7.2	7.5	7.6	7.5	7.5	7.5	7.1	7.6	7.1	7.40
2nd grab sample	7.3	7.4	7.4	7.2	7.3	7.5	7.2	7.5	7.2	7.33
3rd grab sample	7.2	7.2	7.2	7.2	7.1	7.3	7.1	7.3	7.1	7.19
Composite sample	7.2	7.2	7.1	7.2	7.3	7.3	7.1	7.3	7.1	7.20
BD Std.	6.5 8.5									

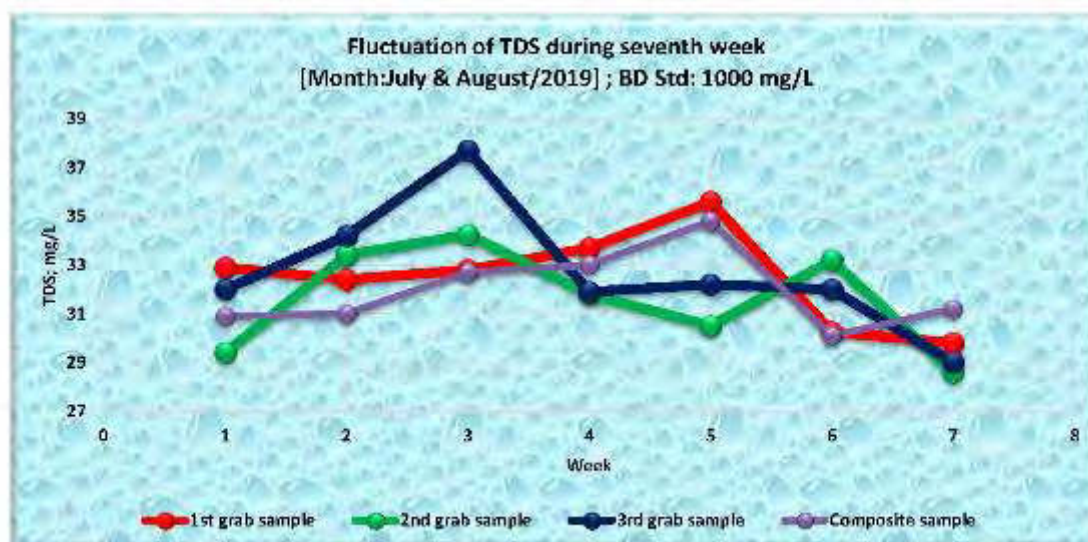


Observation: pH value is gradually decreasing over the period of seven weeks.



Parameter: Total Dissolved Solid (TDS); BD Std. = 1000mg/L

Sample	18/7/2019	25/7/2019	31/7/2019	1/8/2019	8/8/2019	14/8/2019	21/8/2019	Max	Min	Avg.
1st grab sample	32.9	32.4	32.8	33.7	35.6	30.25	29.8	35.6	29.8	32.54
2nd grab sample	29.4	33.4	34.25	31.8	30.5	33.2	28.6	34.25	28.6	31.56
3rd grab sample	32	34.2	37.7	31.9	32.2	32	29	37.7	29	32.86
Composite sample	30.9	31	32.7	33	34.8	30.1	31.2	34.8	30.1	32.07
BD Std.	1000									



Observation: No significant change in TDS value over time.



4.3 Seasonal Sampling:

Samples were collected at hourly basis for a total time of 13 hours in a same day. Sampling date_ 28-08-2019 - Field test results

Table 4-5: Seasonal Sampling Field Test Results-1st grab sample

Seasonal Sampling: Water quality field test parameters(1hourly sampling-1st grab sample)										
Date: 28-08-2019										
Depth: 0.5 meter										
Time	Temp °C	pH	Salinity ‰	Cond. µS/cm	TDS mg/l	DO mg/l	Turbidity NTU	Hardness mg/l	NH3 mg/l	Color Hazen Unit
6AM	30	7.6	0.03	71.2	31	6.6	10.05	40	0.23	179
7AM	30.1	7.5	0.03	65.1	29	6.5	16.96	40	0.25	169
8AM	30.4	7.4	0.03	63.9	28.6	6.52	18.18	40	0.23	168
9AM	30.3	7.3	0.03	62.6	28.8	6.5	14.71	40	0.28	142
10AM	30.5	7.5	0.03	63	29.5	6.4	18.95	40	0.29	149
11AM	30.5	7.6	0.03	62	29.1	6.32	19.31	40	0.32	147
12PM	30.5	7.6	0.03	65.5	32.7	6.3	19.2	40	0.31	147
1PM	30.4	7.5	0.03	64.3	32.2	6.4	18.9	40	0.3	148
2PM	30.5	7.4	0.03	63.1	31.5	6.4	19.27	40	0.31	149
3PM	30.4	7.6	0.03	62.7	31.3	6.3	19.2	40	0.28	139
4PM	30.3	7.4	0.03	63.3	31.6	6.42	19.32	40	0.29	143
5PM	30.3	7.4	0.03	63.5	32.4	6.5	18.9	40	0.3	145
6PM	30.1	7.4	0.03	62.7	31.3	6.5	18.95	40	0.3	149
Max	30.5	7.6	0.03	71.2	32.7	6.6	19.32	40	0.32	179
Min	30	7.4	0.03	62	28.6	6.3	10.05	40	0.23	139
Avg	30.32	7.49	0.03	64.41	30.69	6.44	17.42	40	0.28	152.8

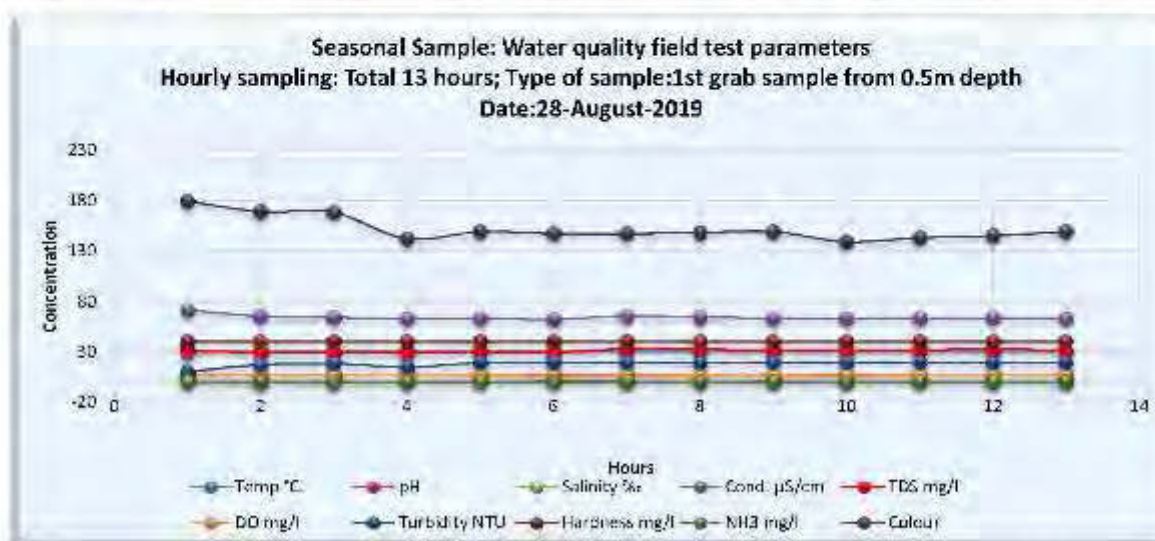


Figure 4-5 Concentration variation with respect to time (13hours)-1st grab sample

Table 4-6: Seasonal Sampling Field Test Results-2nd grab sample



Seasonal Sampling: Water quality field test parameters(Hourly sampling-2nd grab sample)										
Date: 28-08-2019										
Depth: 4 meter										
Time	Temp °C	pH	Salinity ‰	Cond. µS/cm	TDS mg/l	DO mg/l	Turbidity NTU	Hardness mg/l	NH3 mg/l	Color Hazen Unit
6AM	30.3	7.4	0.03	65.8	29.1	6.3	19.49	40	0.3	195
7AM	30.2	7.4	0.03	66.6	29.8	6.6	17.35	40	0.3	190
8AM	30.2	7.4	0.03	66	29.3	6.54	12.36	40	0.25	185
9AM	30.1	7.5	0.03	68.5	31.4	6.6	15.29	40	0.27	190
10AM	30.1	7.5	0.03	68.7	31.3	6.55	15.4	40	0.22	180
11AM	30.4	7.5	0.03	67.8	30.7	6.4	7.5	40	0.26	189
12PM	30.3	7.45	0.03	68.5	34.25	6.55	16.35	40	0.26	180
1PM	30.3	7.52	0.03	67.4	33.7	6.52	12.9	40	0.2	180
2PM	30.3	7.51	0.03	67.1	33.2	6.41	15.67	40	0.32	181
3PM	30.2	7.52	0.03	67.7	33.4	6.5	15.79	40	0.3	180
4PM	30.2	7.5	0.03	68.5	34.2	6.62	7.607	40	0.23	175
5PM	30.1	7.45	0.03	68.2	34.2	6.5	14.74	40	0.25	165
6PM	30.1	7.4	0.03	68.4	34.25	6.63	14.07	40	0.32	182
Max	30.4	7.52	0.03	68.7	34.25	6.63	19.49	40	0.32	195
Min	30.1	7.4	0.03	65.8	29.1	6.3	12.36	40	0.2	165
Avg.	30.23	7.47	0.03	67.71	32.36	6.47	15.61	40	0.27	183.36

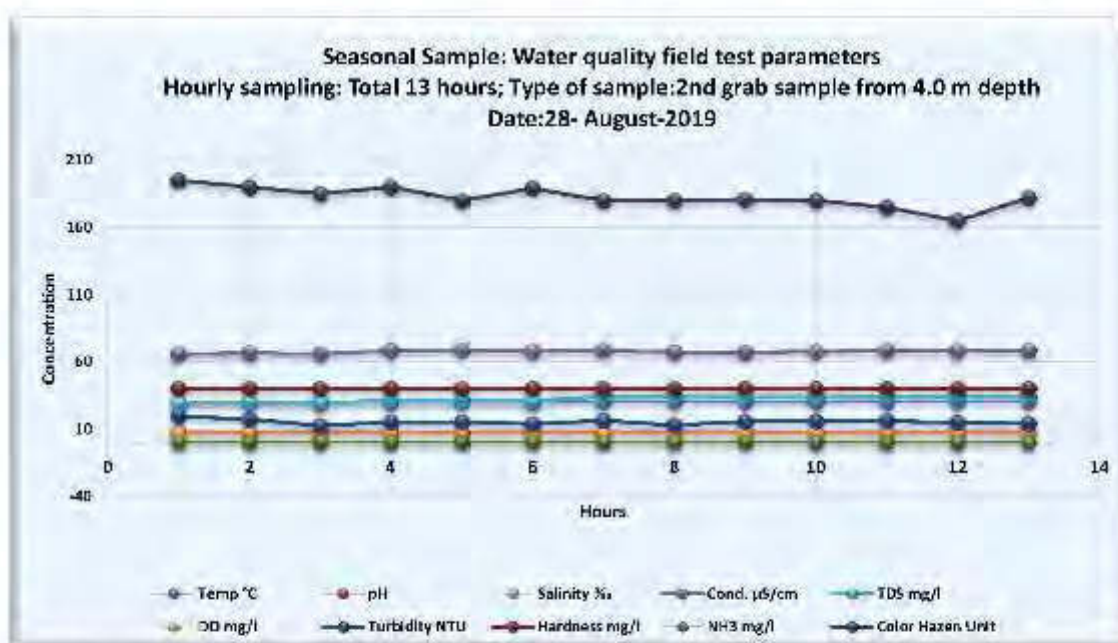

 Figure 4:6 Concentration variation with respect to time(13hours)- 2nd grab sample

 Table 4-7: Seasonal Sampling Field Test Results-3rd grab sample



Seasonal Sample, Water quality field test parameters(Hourly sampling-3rd grab sample)										
Date: 28-08-2019										
Depth: 8meter										
Time	Temp °C	pH	Salinity ‰	Cond. µS/cm	TDS mg/l	DO mg/l	Turbidity NTU	Hardness mg/l	NH3 mg/l	Color Hazen Unit
6AM	30.1	6.19	0.03	69	30.1	6.8	18.89	40	0.3	143
7AM	30.3	6.9	0.03	66.2	30.5	6.84	18.57	40	0.28	133
8AM	30.2	6.9	0.03	66.4	30.3	6.62	18.2	40	0.32	145
9AM	30.2	7.2	0.03	68.2	31.2	6.79	16.82	40	0.31	140
10AM	30.1	7.1	0.03	68.5	31.3	6.74	15.92	40	0.3	140
11AM	30.1	7.3	0.03	69.4	31.3	6.8	18.34	40	0.25	187
12PM	30.1	6.9	0.03	69.5	34.75	6.75	18.4	40	0.26	162
1PM	30.2	7.1	0.03	69.34	34.55	6.65	18	40	0.33	158
2PM	30	7.1	0.03	68.4	34.25	6.69	18.57	40	0.35	161
3PM	30	7.1	0.03	68.35	33.9	6.73	16.45	40	0.32	162
4PM	30.1	7	0.03	66.69	33.67	6.7	16.9	40	0.3	160
5PM	30.1	7.2	0.03	68.9	34.7	6.7	16.8	40	0.28	160
6PM	30.1	7.3	0.03	68.82	34.8	6.74	16.8	40	0.25	190
Max	30.3	7.3	0.03	69.5	34.8	6.84	18.89	40	0.35	190
Min	30	6.19	0.03	66.2	30.1	6.62	15.57	40	0.25	133
Avg.	30.13	6.99	0.03	68.23	32.68	6.73	17.34	40	0.30	157.6

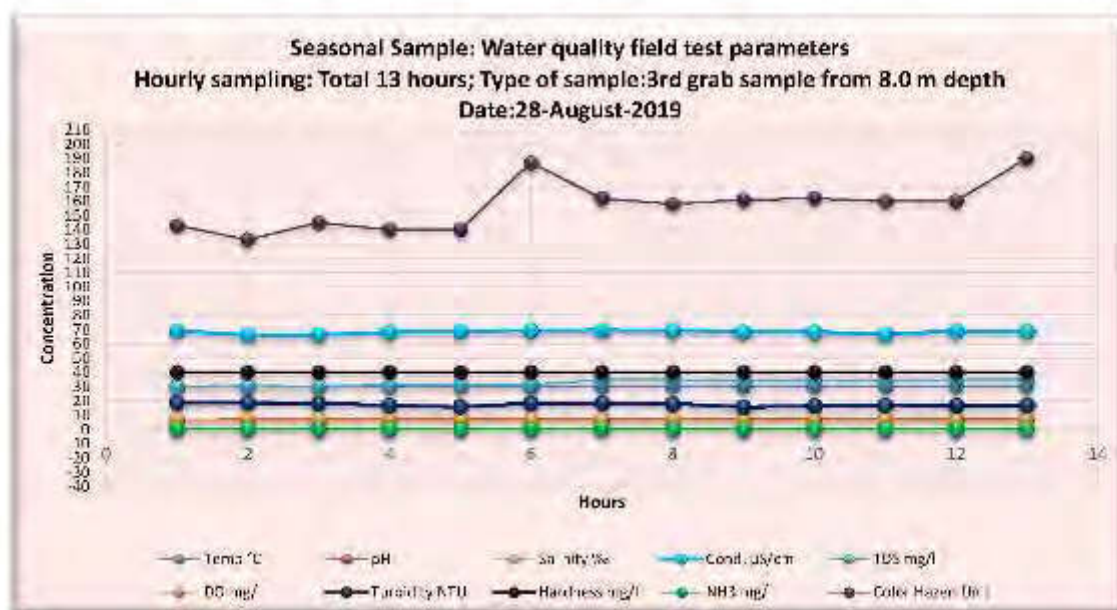


Figure 4:7 Concentration variation with respect to time(13hours)- 3rd grab sample



Table 4-8: Seasonal Sampling Field Test Results-Composite sample

Seasonal sampling: Water quality field test parameters(Hourly sampling- Composite sample)										
Date: 28-08-2019										
Depth=[Sample-1: 0.5m+Sample-2:4m+ Sample-3: 8m]										
Time	Temp °C	pH	Salinity ‰	Cond. µS/cm	TDS mg/l	DO mg/l	Turbidity NTU	Hardness mg/l	NH3 mg/l	Color Hazen Unit
6AM	30.1	7	0.03	66.2	29	6.4	15.76	40	0.16	160
7AM	30.2	7	0.03	68.5	26.4	6.82	16.78	40	0.16	160
8AM	30.1	7.1	0.03	65.2	29.8	6.79	16.92	40	0.17	162
9AM	30	7	0.03	64.3	30.2	6.8	19.78	40	0.16	168
10AM	30	7.2	0.03	68.4	31.4	6.8	18.54	40	0.16	170
11AM	30	7.3	0.03	66.1	30.1	6.78	17.73	40	0.24	170
12PM	30	7.1	0.03	68.4	33	6.9	18.5	40	0.17	165
1PM	30.1	7.1	0.03	66.4	33.1	6.9	17.74	40	0.16	172
2PM	30.1	7.2	0.03	65.3	32.7	6.75	18.45	40	0.19	163
3PM	30.3	7	0.03	65.7	32.85	6.77	18.49	40	0.2	163
4PM	30.3	7	0.03	64.9	33.1	6.8	19.9	40	0.21	169
5PM	30.2	7	0.03	65.2	32.72	6.77	19.4	40	0.2	165
6PM	30	7.1	0.03	65.8	32.85	6.79	19.7	40	0.21	162
Max	30.3	7.3	0.03	68.5	33.1	6.9	19.9	40	0.24	172
Min	30	7	0.03	64.3	26.4	6.4	15.76	40	0.16	160
Avg.	30.11	7.09	0.03	66.21	31.12	6.76	18.21	40	0.19	165.4

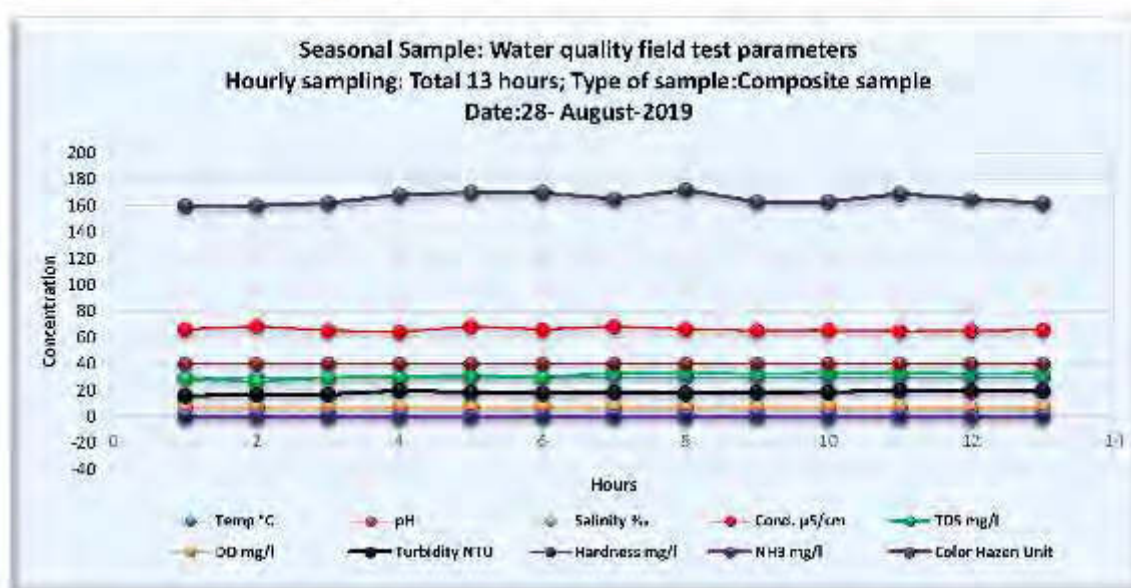


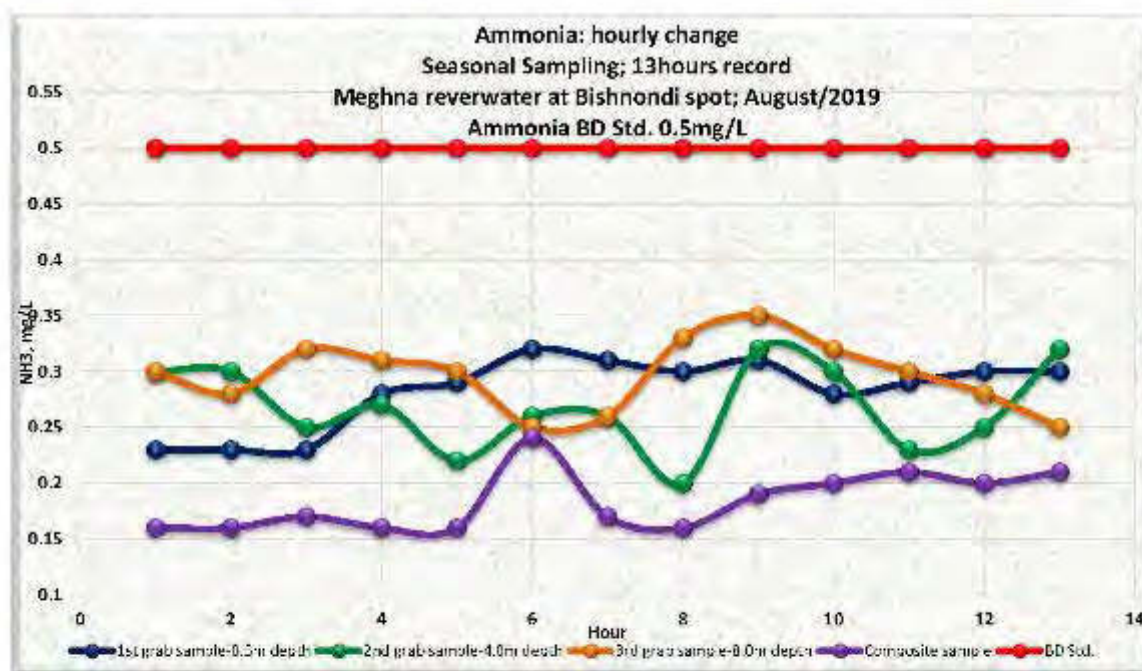
Figure 4:8 Concentration variation with respect to time(13hours)- Composite sample



4.4 Observation on Seasonal Sampling-Hourly sampling –Field test parameter

Test parameter- Ammonia (NH₃); Unit=mg/L; BD Std.=0.50mg/L; 13hours sample

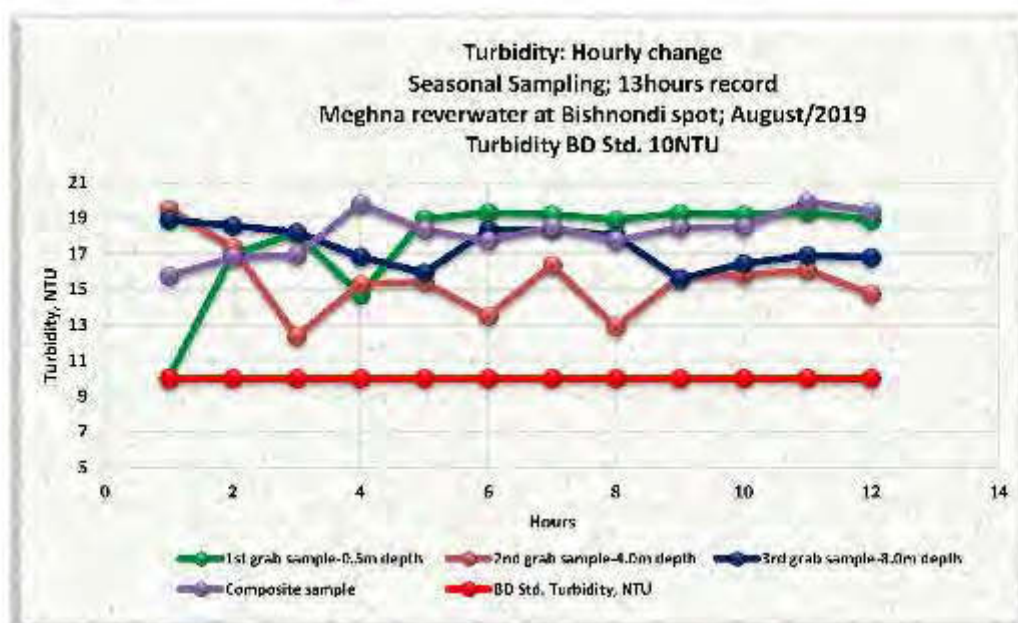
Time	1st grab sample- 0.5m depth	2nd grab sample- 4.0m depth	3rd grab sample- 8.0m depth	Composite sample	BD Std. NH ₃ ; mg/L
6AM	0.23	0.3	0.3	0.16	0.5
7AM	0.23	0.3	0.28	0.16	
8AM	0.23	0.25	0.32	0.17	
9AM	0.28	0.27	0.31	0.16	
10AM	0.29	0.22	0.3	0.16	
11AM	0.32	0.26	0.25	0.24	
12PM	0.31	0.26	0.26	0.17	
1PM	0.3	0.2	0.33	0.16	
2PM	0.31	0.32	0.35	0.19	
3PM	0.28	0.3	0.32	0.2	
4PM	0.29	0.23	0.3	0.21	
5PM	0.3	0.25	0.28	0.2	
6PM	0.3	0.32	0.25	0.21	
Max	0.32	0.32	0.35	0.24	
Min	0.23	0.2	0.25	0.16	
Avg.	0.28	0.27	0.30	0.19	





**Hourly sampling: Test Parameter: Turbidity, Unit- NTU; BD Std.-10NTU
13hours record**

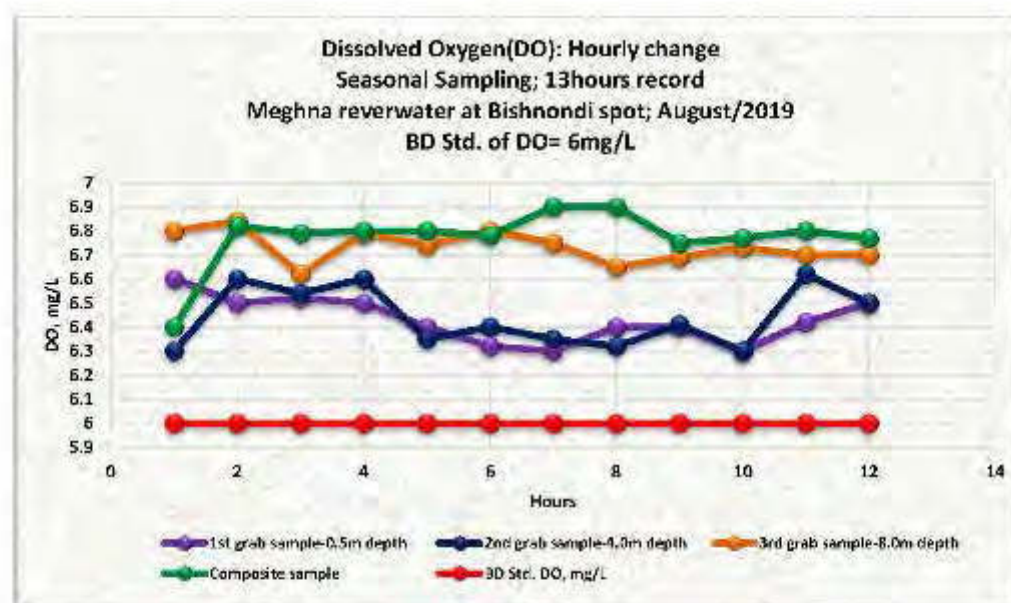
Time	1st grab sample- 0.5m depth	2nd grab sample- 4.0m depth	3rd grab sample- 8.0m depth	Composite sample	BD Std. Turbidity, NTU
6AM	10.05	19.49	18.89	15.76	10
7AM	16.96	17.35	18.57	16.78	
8AM	18.18	12.36	18.2	16.92	
9AM	14.71	15.29	16.82	19.78	
10AM	18.95	15.4	15.92	18.34	
11AM	19.31	13.5	18.34	17.73	
12PM	19.2	16.35	18.4	18.5	
1PM	18.9	12.9	18	17.74	
2PM	19.27	15.67	15.57	18.45	
3PM	19.2	15.79	16.45	18.49	
4PM	19.32	16.07	16.9	19.9	
5PM	18.9	14.74	16.8	19.4	
6PM	18.95	14.07	16.8	19.7	
Max	19.32	19.49	18.89	19.9	
Min	10.05	12.36	15.57	15.76	
Avg	17.42	15.39	17.34	18.21	





Hourly sampling: Test Parameter: DO: Unit- mg/L; BD Std. = 6.0 mg/L;
 13hours record

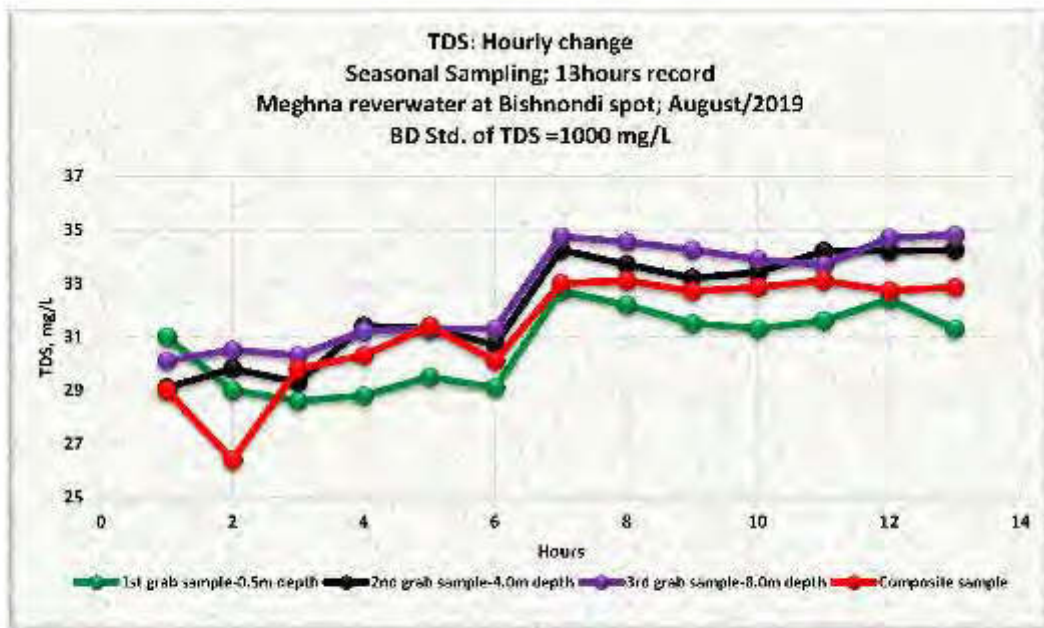
Time	1st grab sample- 0.5m depth	2nd grab sample- 4.0m depth	3rd grab sample- 8.0m depth	Composite sample	BD Std. DO, mg/L
6AM	6.6	6.3	6.8	6.4	6.0
7AM	6.5	6.6	6.84	6.82	
8AM	6.52	6.54	6.62	6.79	
9AM	6.5	6.6	6.79	6.8	
10AM	6.4	6.35	6.74	6.8	
11AM	6.32	6.4	6.8	6.78	
12PM	6.3	6.35	6.75	6.9	
1PM	6.4	6.32	6.65	6.9	
2PM	6.4	6.41	6.69	6.75	
3PM	6.3	6.3	6.73	6.77	
4PM	6.42	6.62	6.7	6.8	
5PM	6.5	6.5	6.7	6.77	
6PM	6.5	6.63	6.74	6.79	
Max	6.6	6.63	6.84	6.9	
Min	6.3	6.3	6.62	6.4	
Avg.	6.44	6.46	6.73	6.76	





**Hourly sampling: Test Parameter: TDS; Unit-mg/L; BD Std. =1000mg/L
13hours record**

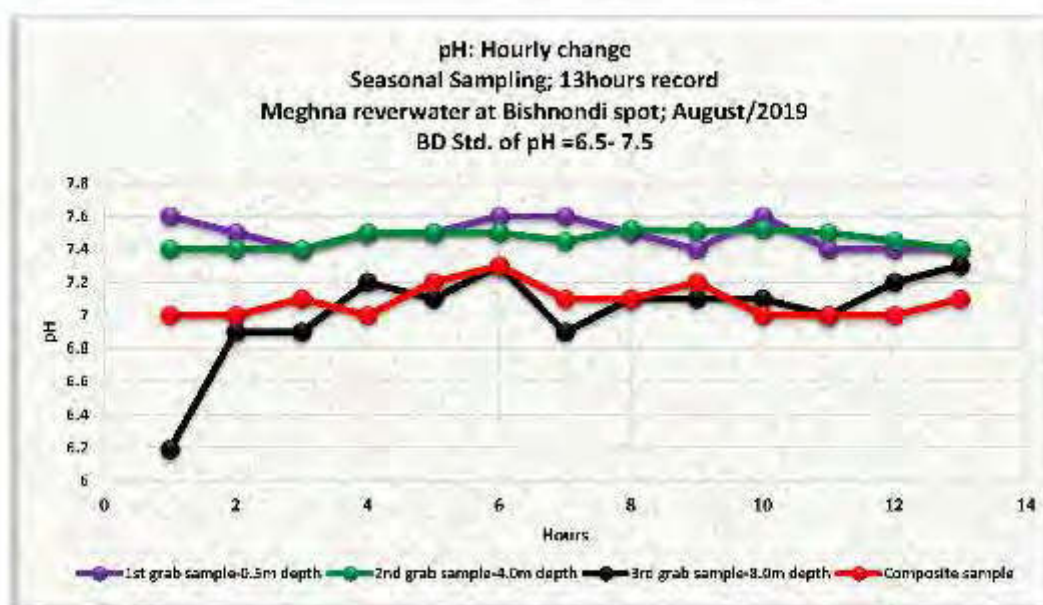
Time	1st grab sample-0.5m depth	2nd grab sample-4.0m depth	3rd grab sample-8.0m depth	Composite sample	BD Std. TDS; mg/L.
6AM	31	29.1	30.1	29	1000
7AM	29	29.8	30.5	26.4	
8AM	28.6	29.3	30.3	29.8	
9AM	28.8	31.4	31.2	30.3	
10AM	29.5	31.3	31.3	31.4	
11AM	29.1	30.7	31.3	30.1	
12PM	32.7	34.25	34.75	33	
1PM	32.2	33.7	34.55	33.1	
2PM	31.5	33.2	34.25	32.7	
3PM	31.3	33.4	33.9	32.85	
4PM	31.6	34.2	33.67	33.1	
5PM	32.4	34.2	34.7	32.72	
6PM	31.3	34.25	34.8	32.85	
Max	32.7	34.25	34.8	33.1	
Min	28.6	29.1	30.1	26.4	
Avg.	30.69	32.14	32.68	31.12	





Hourly sampling: Test Parameter: pH; BD Std. =6.5- 7.5
13hours record

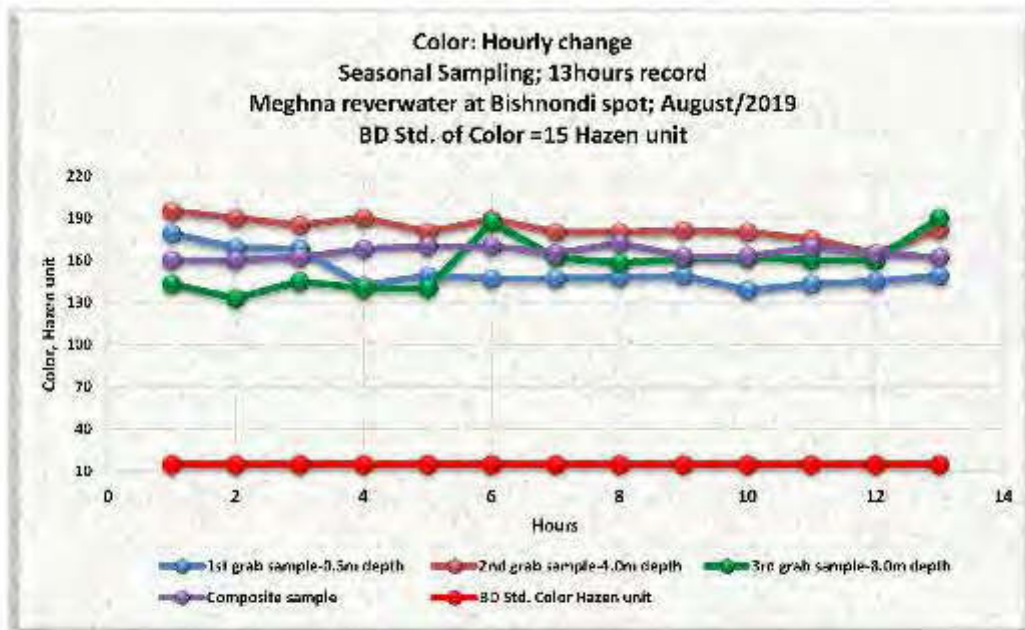
Time	1st grab sample- 0.5m depth	2nd grab sample- 4.0m depth	3rd grab sample- 8.0m depth	Composite sample	BD Std. pH
6AM	7.6	7.4	6.2	7	6.5 – 7.5
7AM	7.5	7.4	6.9	7	
8AM	7.4	7.4	6.9	7.1	
9AM	7.5	7.5	7.2	7	
10AM	7.5	7.5	7.1	7.2	
11AM	7.6	7.5	7.3	7.3	
12PM	7.6	7.5	6.9	7.1	
1PM	7.5	7.5	7.1	7.1	
2PM	7.4	7.5	7.1	7.2	
3PM	7.6	7.5	7.1	7	
4PM	7.4	7.5	7	7	
5PM	7.4	7.5	7.2	7	
6PM	7.4	7.4	7.3	7.1	
Max	7.6	7.5	7.3	7.3	
Min	7.4	7.4	6.2	7	
Avg.	7.5	7.5	7.0	7.1	





**Hourly sampling: Test Parameter: Color: Unit=Hazen unit; BD Std. =15 Hazen unit
 13hours record**

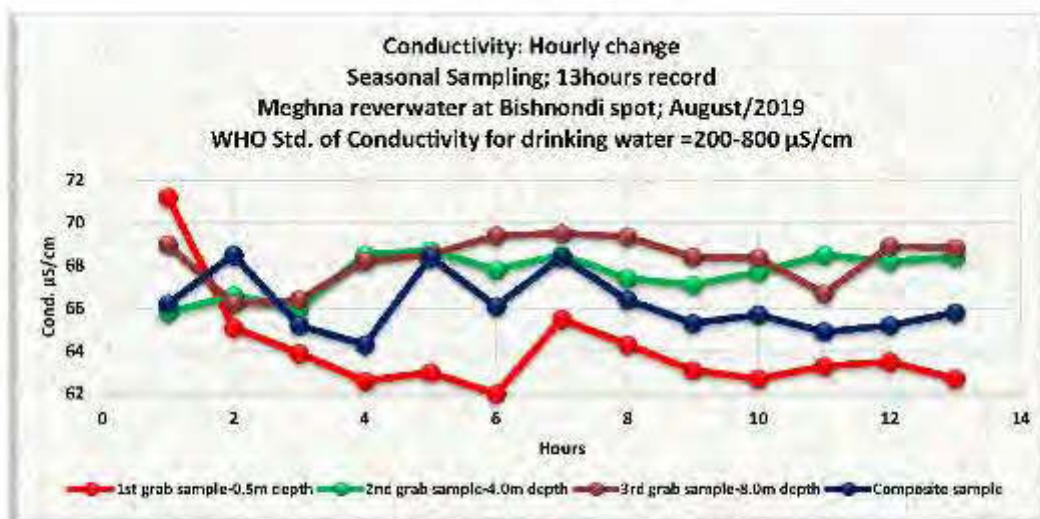
Time	1st grab sample- 0.5m depth	2nd grab sample- 4.0m depth	3rd grab sample- 8.0m depth	Composite sample	BD Std. Color Hazen unit
6AM	179	195	143	160	15
7AM	169	190	133	160	
8AM	168	185	145	162	
9AM	142	190	140	168	
10AM	149	180	140	170	
11AM	147	189	187	170	
12PM	147	180	162	165	
1PM	148	180	158	172	
2PM	149	181	161	163	
3PM	139	180	162	163	
4PM	143	175	160	169	
5PM	145	165	160	165	
6PM	149	182	190	162	
Max	179	195.0	190	172	
Min	139	165	133.0	160	
Avg.	152.8	182.1	157.6	165.4	





Hourly sampling Test Parameter: Conductivity; Unit- $\mu\text{S}/\text{cm}$; BD Std. = No; WHO-
200-800 $\mu\text{S}/\text{cm}$ for drinking water; 13hours record

Time	1st grab sample- 0.5m depth	2nd grab sample- 4.0m depth	3rd grab sample-8.0m depth	Composite sample	BD Std. Cond. $\mu\text{S}/\text{cm}$
6AM	71.2	65.8	69	66.2	No BD Std. As per WHO 200-800 $\mu\text{S}/\text{cm}$ for drinking water
7AM	65.1	66.6	66.2	68.5	
8AM	63.9	66	66.4	65.2	
9AM	62.6	68.5	68.2	64.3	
10AM	63	68.7	68.5	68.4	
11AM	62	67.8	69.4	66.1	
12PM	65.5	68.5	69.5	68.4	
1PM	64.3	67.4	69.34	66.4	
2PM	63.1	67.1	68.4	65.3	
3PM	62.7	67.7	68.35	65.7	
4PM	63.3	68.5	66.69	64.9	
5PM	63.5	68.2	68.9	65.2	
6PM	62.7	68.4	68.82	65.8	
Max	71.2	68.7	69.5	68.5	
Min	62	65.8	66.2	64.3	
Avg.	64.4	67.6	68.2	66.2	





OUR PACE WATER QUALITY MONITORING AT PROPOSED EAST
 BAPUR GATE POWER STATION, RAJSHAHI, DHAKA

4.5 Laboratory Test- Monthly sample and Seasonal Sample

Laboratory Test Results- Monthly Sample

Water quality Laboratory test result- Monthly sample; Composite sample					
Test conducted by: DPHE Central Laboratory, Mohakhali, Dhaka					
1st- Monthly sample: August/2019					
Date: 31-07-2019 Composite sample Depth=[Sample-1: 0.5m+Sample-2:4m+Sample-3: 8m]					
Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ
Alkalinity		38	mg/L	Titrimetric	
Aluminum	0.2	0.23	mg/l	AAS	0.002
Ammonia	0.5	0.63	mg/L	LVS	0.1
Arsenic (As)	0.05	0.001	mg/L	AAS	0.001
Biochemical Oxygen Demand (BOD)	0.2	18	mg/L	days incubation	0.1
Chemical Oxygen Demand (COD)	4	68	mg/L	CRM	
Hardness	200-500	110	mg/L	Titrimetric	
Iron (Fe)	0.3-1	0.49	mg/L	AAS	0.05
Manganese (Mn)	0.1	0.1	mg/L	AAS	0.03
Nitrogen (Nitrite)	10	2.5	mg/L	LVS	0.1
Nitrogen (Nitrite)	<1.0	0.03	mg/L	LVS	0.02
Phosphate	6	0.73	mg/L	LVS	0.1
Total Suspended Solid (TSS)	10	4.3	mg/L	Gravimetric Method	


Laboratory Test Results - Seasonal Sample

Water quality Laboratory test result- Seasonal sample: Composite sample					
Test conducted by: DPHE Central Laboratory, Mohakhali, Dhaka					
1st seasonal sample: August/2019					
Date: 31-07-2019		Composite sample Depth=[Sample-1: 0.5m+Sample-2:4m+Sample-3: 8m]			
Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ
Ammonia	0.5	0.6	mg/L	LVS	0.1
Arsenic (As)	0.05	0.001	mg/L	AAS	0.01
Barium (Ba)	0.01	0.09	mg/L	AAS	-
Biochemical Oxygen Demand (BOD)	0.2	8	mg/L	5 days Incubation	0.1
Cadmium (Cd)	0.005	0.00058	mg/L	AAS	0.00015
Chemical Oxygen Demand (COD)	4	36	mg/L	CRM	-
Chloride	150-600	10	mg/L	Titrimetric	-
Coliform (Fecal)	0	144	N/100ml	MFM	-
Copper (Cu)	1	0.26	mg/L	AAS	0.26
Chromium (Total)(Cr)	0.05	0.008	mg/L	AAS	0.0003
Fluoride	1	0.12	mg/L	LVS	0.12
Lead (Pb)	0.05	0.004	mg/L	AAS	0.001
Nickel (Ni)	0.1	0.03	mg/L	AAS	0.01
Nitrogen (Nitrate)	10	1.9	mg/L	LVS	0.1
Nitrogen (Nitrite)	<1.0	0.03	mg/L	LVS	0.02
Phosphate	6	0.84	mg/L	LVS	0.1
Selenium (Se)	0.01	0.001	mg/L	AAS	0.002
Sodium (Na)	200	10	mg/L	AAS	0.54
Sulphate	400	1	mg/L	LVS	1
Zinc (Zn)	5	0.08	mg/L	AAS	0.05

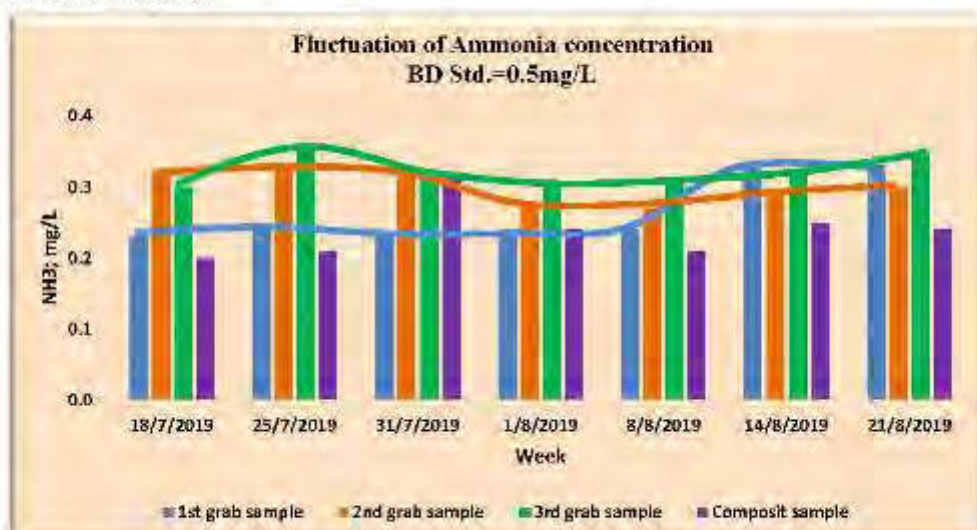


4.6 Observation of Water Quality Data

(A) Weekly sampling: Water quality field test data

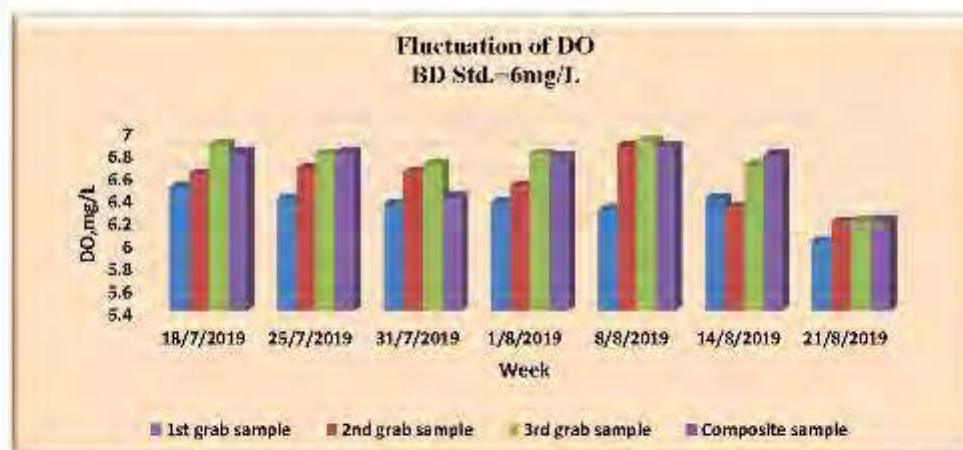
There are three grab samples (1st grab, 2nd grab & 3rd grab) where depth is 0.5 m, 4.0m and 8.0m simultaneously from the surface of the river collected every field visit and the measurement of physicochemical parameters are Temperature, pH, Salinity, Conductivity, Turbidity, Dissolved Oxygen (DO), Total Dissolved Solid (TDS), Ammonia (NH₃), Total Hardness and color at field.

Ammonia Test Result: In 1st grab sample where depth is 0.5m have low ammonia concentration. On the other hand, more ammonia concentration have been found in 2nd grab and 3rd grab sample where depth are 4m and 8m simultaneously. It is observed in the last two month that ammonia concentration is gradually increasing with respect to time. Composite sample is showing less ammonia due to aeration (contact with air) during mixing of three grab samples. Although ammonia concentration of all sample are in the safe limit as per BD Std. (NH₃ 0.5mg/L).

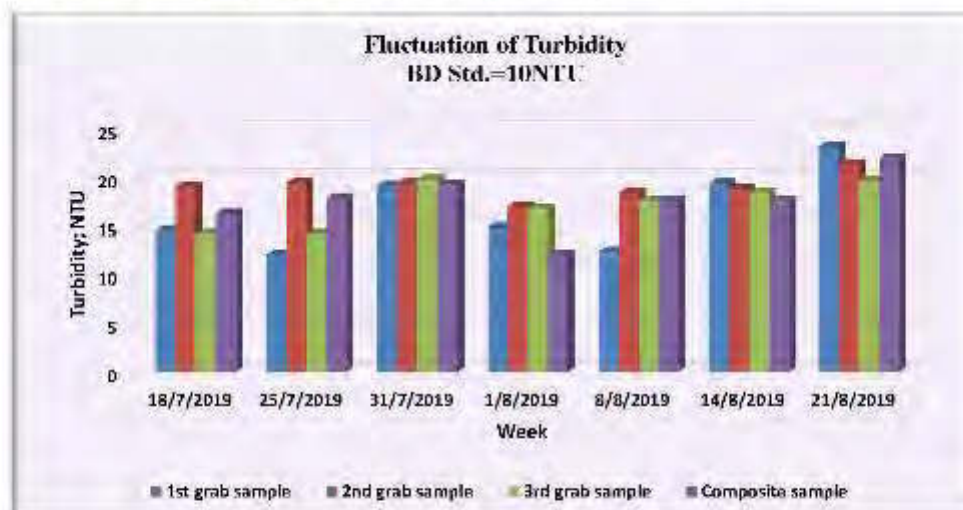




Dissolved Oxygen (DO) Test Result: All sample are containing high DO value more that BD Standard which is the indication of less pollution. However, it is observing that dissolved oxygen are gradually decreasing during seven weeks.



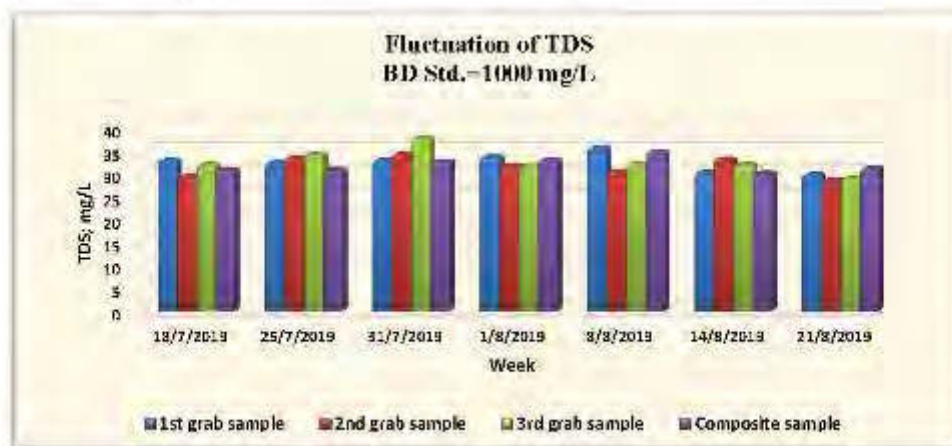
Turbidity Test Result: Genercally, surface water more turbide than ground water. Re-suspension of river sediments under high flow conditions or any disrupt can also contribute to higher turbidity levels in river water. More turbidity value was observed in all water sample and gradually increasing during last two months period have been found.



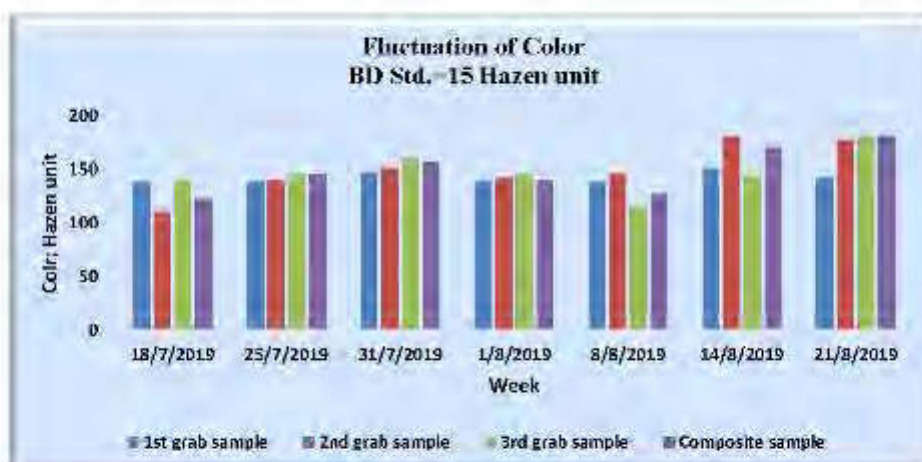


TDS Test Result: Total dissolved solids (TDS) is a measure of the dissolved combined content of all inorganic and organic substances present in a liquid in molecular, ionized, or micro-granular (colloidal sol) suspended form. Primary sources for TDS in receiving waters are agricultural runoff and residential (urban) runoff, clay-rich mountain waters, leaching of soil contamination, and point source water pollution discharge from industrial or sewage treatment plants.

No significant change have been found of TDS value in all sample water during last two months sampling time.



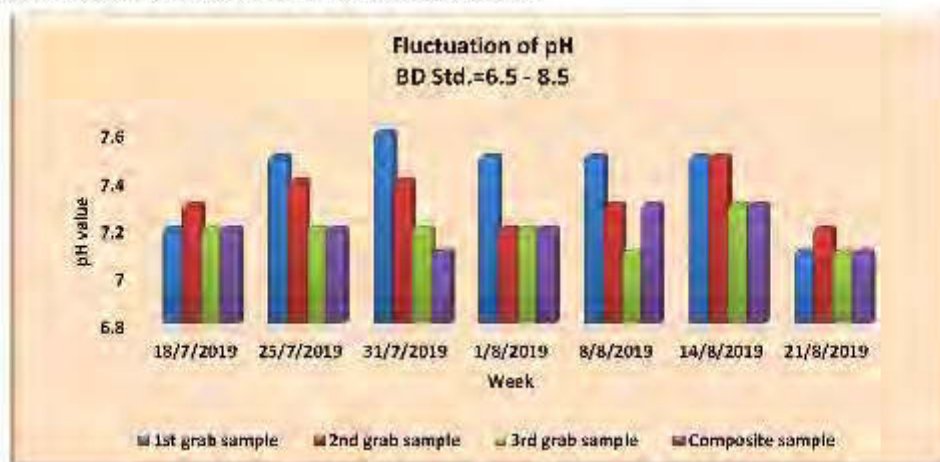
Color Test Result: In natural waters, color is due mainly to the presence of dissolved organic matter including humic and fulvic acids, which originate from soil and decaying vegetable matter. Surface water can also be coloured by waste discharges. The color in water is primarily of vegetable origin and is extracted from leaves and aquatic plants. It was observed that all samples contain high color value which indicate presence of dissolved organic matter and others.



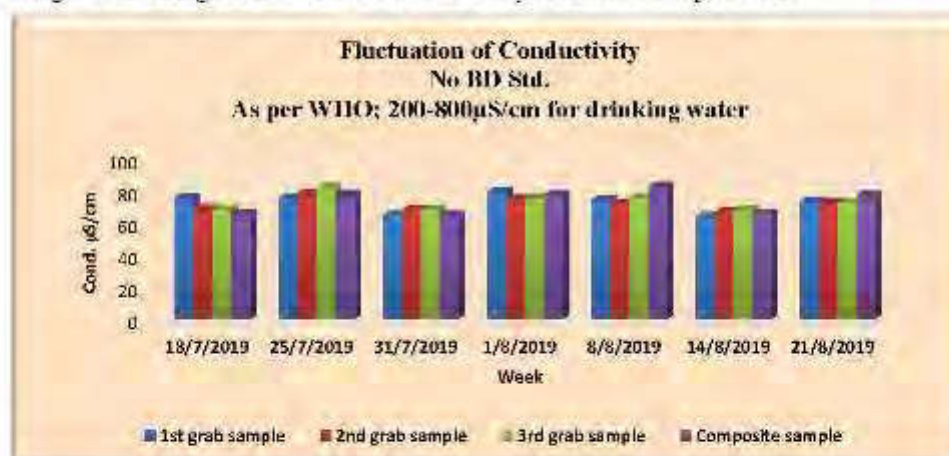


pH Test Result: Rivers are open systems, where frequent water exchange occurs. Water pH relationship to water quality problems. The pH of river water is the measure of how acidic or basic the water is on a scale of 0-14. It is a measure of hydrogen ion concentration. U.S. natural water falls between 6.5 and 8.5 on this scale with 7.0 being neutral. The optimum pH for river water is around 7.4 to 7.7.

All samples are showing good pH value from beginning of this study. In compare to depth, pH value is good enough in low depth (0.5m -1st grab sample) rather than more depth (4.0m-2nd grab sample and 8m-3rd grab sample). However, in course of time, pH value are going decrease, which was found end of the second month.



Conductivity Test Result: Conductivity is an indirect measure of the saltiness of the water. Climate change may increase the saltiness of freshwater lakes if warmer conditions increase evaporation. Pollution can also increase conductivity of lakes and rivers because industrial and human wastewaters often have high conductivity. Mid-range conductivity (200 to 1000 $\mu\text{S}/\text{cm}$) is the normal background for most major rivers. Conductivity is also affected by temperature: the warmer the water, the higher the conductivity. Conductivity is widely used as an indicator of pollution of water body, more conductivity value indicate more pollution. No significant change have been found conductivity value in all sample water.

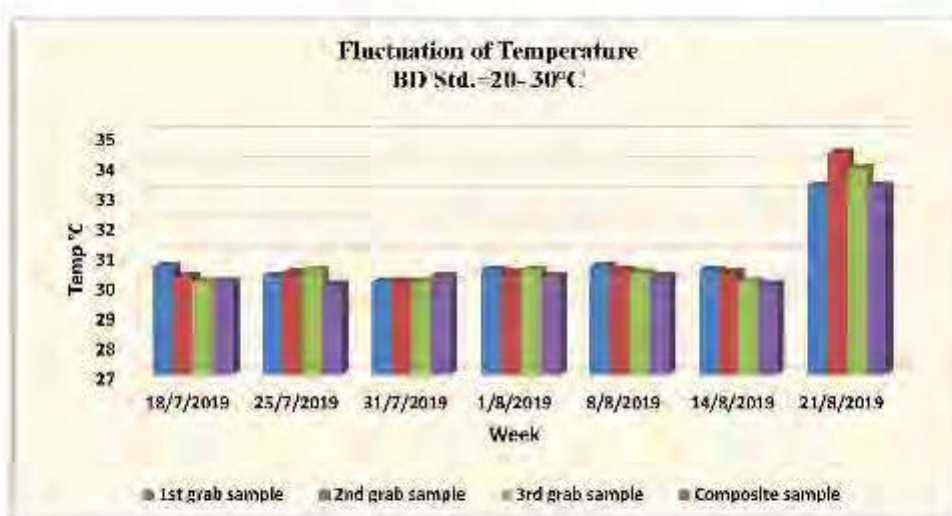




Conductivity Test Result: Water temperature can have an adverse effect on water quality. Temperature is also important because of its influence on water chemistry. The rate of chemical reactions generally increases at higher temperature, which in turn affects biological activity. An important example of the effects of temperature on water chemistry is its impact on oxygen.

Human activities affecting water temperature can include the discharge of cooling water or heated industrial effluents, agriculture and forest harvesting (due to effects on shading), urban development that alters the characteristics and path of storm water runoff, and climate change.

During two-month study, it was found that all sample water temperature increased significantly.



(B) Seasonal sampling /Hourly sampling:

During eighteen months study period, there are five times seasonal sample need to be collected which is hourly basis and sampling duration is 13 hours during daylight time. There are three grab samples (1st grab, 2nd grab & 3rd grab) where depth is 0.5 m, 4.0m and 8.0m simultaneously from the surface of the river collected every field visit and the measurement of physicochemical parameters are Temperature; pH, Salinity, Conductivity, Turbidity, Dissolved Oxygen (DO), Total Dissolved Solid (TDS), Ammonia (NH₃), Total Hardness and color at field. Concentration of these field parameters have not seen change during 13hours sampling time.

On the other hand, composite sample were send to DPHI Central laboratory and BCSIR Laboratory for the analysis of a wide range of water quality parameter and parameters are Arsenic; Algae; Barium; Cadmium; Chloride; Chromium(Hexavalent); Coliform(fecal); BOD; COD; Lead; Mercury; Ammonia; Nitrate; Nitrite; Phosphate; TOC; Pesticides (Organo-chlorine); Pesticides (Organo-phosphorus); Oil & Grease; Fluoride; Selenium; Zinc; Sulphate; Copper; Antimony; Boron; Nickel and Sodium.



(C) Monthly and Seasonal 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 and parameter are same as before using field kit and portable instrument. On the other hand, 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; BOD₅; Phosphate; Alkalinity; Ammonia; Total Hardness; Arsenic; Iron; Manganese and Aluminum.

(D) Observation of Laboratory test results for monthly and seasonal sample:

COD or Chemical Oxygen Demand is the total measurement of all chemicals (organics & in-organics) in the water / waste water. BOD is a measure of the amount of oxygen that require for the bacteria to degrade the organic components present in water / waste water. The most common application of COD is in quantifying the amount of oxidizable pollutants found in surface water (e.g., lakes and rivers) or wastewater. Typically, both BOD (Biochemical Oxygen Demand) and COD (Chemical Oxygen Demand) are the main parameters analyzed to indicate the degree of pollution in the river.

In widely, BOD is the measurement of the amount of oxygen required biologically to decompose organic matter under aerobic condition whereas COD is the measurement of total oxygen required to oxidize all biologically available and inert organic matter into carbon dioxide and water. BOD values thus are always smaller than COD values. Several studies on BOD and COD have been conducted to seek for reliable data as cross checking information for effective management water quality in river. Monitoring of biochemical parameter is a routine water quality assessment for river quality where pollution is of concern due to rapid urbanization and industrialization that can post threat to sustainability of river conservation. These two parameters, BOD and COD are widely used parameters for organic and inorganic pollution measurements for water body.

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

BOD and COD have been observed in higher trend in monthly and seasonal sample. Low BOD and COD value is an indicator of good quality water, while a high indicates polluted water. Bacteria consume dissolved oxygen (DO) when large amounts of organic matter from sewage or other discharges are present in the water.

0.58mg/l, and 0.6mg/l, of ammonia have been found and the value is higher than the Bangladesh drinking water quality standard.

Total ammonium concentration can increase because of discharges from wastewater treatment plants, industrial effluents, agricultural runoff, storm water runoff as well as leaching from septic systems. Ammonium exerts a demand on oxygen in water as it is transformed to oxidized forms of nitrogen. It is also an important nitrogenous fertilizer for aquatic plants, so it can cause eutrophication and indirectly reduce the dissolved oxygen due to increased BOD. Increasing of Eutrophication due to increasing of nutrient like phosphate,



nitrogen resulting enhances the growth of blue-green algae (cyanobacteria) and have directly health impact.

On the other hand, disinfection by-product formation potential (DBFP) from Blue-green Algae (*Microcystis aeruginosa*), diatom (*Cyclotella meneghiniana*) during chlorination and these are Trichloromethane (TCM), Trichloronitromethane (TCNM), Dichloroacetonitrile (DCAN), 1,1-dichloropropanone (1,1-DCP) and 1,1,1-trichloropropanone (1,1,1-TCP) etc which are also toxic agent for human health.

Algae and zooplanktons have been detected by BCSIR Laboratory during seasonal sample analysis.

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



CHAPTER 5

CONCLUSION

5 CONCLUSION

BOD and COD have been observed in higher trend in monthly and seasonal sample. Low BOD and COD value is an indicator of good quality water, while a high indicates polluted water. Bacteria consume dissolved oxygen (DO) when large amounts of organic matter from sewage or other discharges are present in the water.

BOD and COD test result during monthly sample analysis by laboratory have been found 18 mg/l and 68mg/l. On the other hand, BOD value have been found 8mg/l, and COD value have been found 36mg/L during seasonal sample analysis which indicate up trend of river contamination. Its need to more observation for other months to understand the trend of pollution.

Continuous water quality monitoring is essential for efficient management of urban rivers water in urban periphery area or urban (village residential area for the prompt control of pollution. Due to the rapid responses of urban rivers to intensive land use and/or diverse pollution sources, the deterioration of the water quality may be accelerated, immediately posing a direct or indirect threat to human health and aquatic ecosystems. The degree of organic pollution that occurs due to an excessive amount of organic matter has typically been monitored by measuring BOD and COD values in rivers. A high level of BOD deteriorates river water quality by rapid decomposition of biodegradable organic matter and the subsequent depletion of dissolved oxygen, while COD traditionally represents the total organic matter. However, both concentrations are quantified by the amount of oxygen consumed for a particular chemical oxidation of organic compounds in samples. Enrichment of total nitrogen in rivers may result in excessive growth of algae, need more chlorine during chlorination and finally different DBPs will be produced that toxic for human health.

Increasing of ammonia concentration, decreasing of dissolved oxygen (DO), reducing of pH value, increasing of turbidity, increasing of color unit need to be more critical review/observation over the study period.

Presence of algae and zooplankton during this period where river are full of bank, need to be more attention for further evaluation sensitively.

Absence of other water quality parameter like pesticides (Organo-chlorine); Pesticides (Organo-phosphorus); Oil & Grease; Fluoride; Selenium; Zinc; Sulphate; Copper; Antimony; Boron; Nickel and Sodium are the good indication of quality water at present.



SURFACE WATER QUALITY MONITORING AT PROPOSED EAST
BAY BRIDGE, TOWN OF BRISTOL, ALLEN COUNTY, MISSOURI

ANNEXURES



ANNEXURES

ANNEXURE-1: Field Survey Data Form

DWASA Surface Water Quality Monitoring Program

(1) **Sample location** : Bishnondi (Bank of Meghaa River), Aribazer

[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:

Time:

Sample	Depth (m)	Temp °C	pH	Salinity %	Cond. µS/cm	TD S mg/l	DO mg/l	Turbidity NTU	Hardness mg/l	NH ₃ mg/l	Color	Flow m ³ /s
1 st grab sample	0.5											
2 nd grab sample	1											
3 rd grab sample	2											
Composite Sample (1 st +2 nd +3 rd Grab sample)												

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; HCO₃; 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 ₄ mg/l	Color	Flow ft ³ /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-chlorine); 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-HNO₃ – Two liter
 (d) Preservative-H₂SO₄ – 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 ² /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 ² /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. °C	pH	Salinity ‰	Cond. µS/cm	TDS mg/l	DO mg/l	Turbidity NTU	Hardness mg/l	NH ₃ mg/l	Color	Flow l 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



সURFACE WATER QUALITY MONITORING AT PROPOSED EAST
WATER TREATMENT PLANT AT BRISKOLA, RAJSHahi PURMASHAN, RAJSHahi

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
	Trichloroethylene	..	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



OUR WASTE QUALITY CONTROLS AT PROPOSED EAST
BANK STAGE 1 AND 2 BARRIERS AND TREATMENT PLANT

SL	Parameter	Unit	Standard
34	Nitrate	mg/l	10
35	Nitrite	mg/l	<1.0
36	Odor	mg/l	Odorless
37	Oil and Grease	mg/l	0.01
38	pH	mg/l	6.5-8.5
39	Phenol compounds	mg/l	0.002
40	Phosphate	mg/l	6
41	Phosphorus	mg/l	0
42	Potassium	mg/l	12
43	Radioactive substances (Total-radiation)	Bq/l	0.01
44	Total B B-radiation	Bq/l	0.1
45	Selenium	mg/l	0.01
46	Silver	mg/l	0.02
47	Sodium	mg/l	200
48	S.S	mg/l	10
49	Sulfide	mg/l	0
50	Sulfate	mg/l	400
51	Total dissolved solids	mg/l	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)



STUDY ON WATER QUALITY MONITORING AT PROPOSED RAW
WATER INTAKE POINT AT BEGONOLI, BANK OF KRISHNA RIVER

**ANNEXURE-3: PHOTOGRAPH DURING FIELD SAMPLING IN DIFFERENT
DATE**



Figure: Weekly Sampling on 01/08/2019



Figure: Weekly Sampling on 08/08/2019



Figure: Weekly Sampling on 14/08/2019



Figure: Weekly Sampling on 21/08/2019



Figure: Seasonal/weekly Sampling on 28/08/2019



SURFACE WATER QUALITY MONITORING AT PROPOSED SWP
RAJIB BRIDGE POINT AT BISHNADI, BANK OF MEZHA RIVER

ANNEXURE-4: FIELD SURVEY DATA FORMS

Date: 1-8-2019



O.CREEDS

ONUSONDHANI CREEDS

Field Survey Data Form

DWASA Surface Water Quality Monitoring Program

- (1) Sample location : Bishnadi (Bank of Mezha River), Arlhazer
[Chaitankanda, Bishnadi, 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 below:

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 (H ₂ S) / 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: 01/08/2019

Time: 10 a.m - 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 l/s
1 st grab sample	0.3	30.5	7.5	0.03	79.5	39.7	6.36	14.9	40	0.23	130	
2 nd grab sample	1	30.4	7.2	0.03	75.2	31.8	6.51	17.04	40	0.27	142	
3 rd grab sample	0	30.5	7.2	0.03	75.8	31.9	6.79	16.86	40	0.30	145	
Composite Sample (1 st +2 nd +3 rd Grab sample)		30.3	7.2	0.03	78.0	33.0	6.77	12.13	40	0.24	140	

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; BOD₅; Phosphate; Alkalinity; Ammonia; Total Hardness; Arsenic; Iron; Manganese; Aluminum



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SURFACE WATER QUALITY MONITORING AT PROPOSED EAST
RAJSHI TAKE OFF AT BIRSHATI, BANK OF MEGHNA RIVER



O.CREEDS

ONUSONDHANI CREEDS

(4) Any other observations/comments:

Shahadat

Water Quality/ Environmental Specialist

Name: M D SHAHADAT HOSSAIN

Date: 01.08.2019

Mohimun Or Rahman

Water Quality Analyzer

Name: Mohimun Or Rahman

Date: 01/08/2019

DWASA PMU Representative

Name:

Designation:

Date:

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SURFACE WATER QUALITY MONITORING AT PROPOSED SMT
EARTH TAKE POINT AT BISHNADI BANK, GUMSONDHANI RIVER

Date: 8-8-2019



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Field Survey Data Form

DWASA Surface Water Quality Monitoring Program

(1) **Sample location:** Bishnadi (Bank of Meghna River), Arinazer
[Chattankanda, Bishnadi, 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 below:

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: 08/08/2019

Time: 10am - 12pm

Sample	Depth (m)	Temp °C	pH	Salinity ‰	Cond. µS/cm	TDS mg/l	DO mg/l	Turbidity NTU	Hardness mg/l	NH ₄ mg/l	Color	Flow l/s
1 st grab sample	0.5	30.6	7.5	0.03	84.5	35.6	6.30	12.40	40	0.24	139	
2 nd grab sample	4	30.5	7.3	0.03	72.3	30.5	6.86	18.43	40	0.27	146	
3 rd grab sample	8	30.4	7.1	0.03	76.3	32.2	6.91	17.64	60	0.31	116	
Composite Sample (1 st -2 nd -3 rd Grab sample)		30.3	7.3	0.03	83.0	34.8	6.86	17.67	40	0.21	127	

Note-1:

Field test parameters (Weekly & Monthly): Temp-Temperature; pH; Salinity; Cond-Conductivity; DO-Dissolved Oxygen; Turbidity; TDS-Total Dissolve Solid; Hardness; NH₄ - Ammonia; Color

Note-2:

Lab test parameters (Monthly sampling): Nitrate; Nitrite; COD; TSS; BOD₅; Phosphate; Alkalinity; Ammonia; Total Hardness; Arsenic; Iron; Manganese; Aluminium



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SURFACE WATER QUALITY MONITORING AT PROPOSED EAST
BAHAR INTAKE POINT AT BIRNOLA BANK, JUMSHILDA RIVER



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(4) Any other observations/comments:

Shahadat

Water Quality/ Environmental Specialist

Name: MD. SHAHADAT HOSSAIN

Date: 08.06.2019

Mohimun Ure Rahman

Water Quality Analyzer

Name: Mohimun Ure Rahman

Date: 08/08/2019

DWASA PMU Representative

Name:

Designation:

Date:

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Date: 14-8-2019

SURFACE WATER QUALITY MONITORING AT PROPOSED SAFF
BANK TAKE OFF AT BISHNADI BANK, CUMSONDHARI RIVER**O.CREEDS****ONUSONDHANI CREEDS****Field Survey Data Form****DWASA Surface Water Quality Monitoring Program**

- (1) **Sample location :** Bishnadi (Bank of Meghna River), Arihazer
(Chaitankanda, Bishnadi, Geo-Coordinates: N=23° 44' 47.107" N, E=50° 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 below:

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 / 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 algae / phytoplankton / others / none

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

Date: 14/08/2019

Time: 10am - 12pm

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 (R/s)
1 st grab sample	0.5	30.5	7.5	0.03	64.2	50.25	6.40	19.40	40	0.33	161	
2 nd grab sample	4	30.4	7.5	0.03	67.4	33.2	6.32	18.89	40	0.24	120	
3 rd grab sample	8	30.1	7.3	0.03	68.5	32	6.69	18.50	40	0.32	144	
Composite Sample (1 st + 2 nd + 3 rd Grab sample)	-	30.0	7.5	0.03	66.1	30.1	6.78	17.70	40	0.25	170	

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



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SURFACE WATER QUALITY MONITORING AT PROPOSED SAFF
BAKER INTAKE POINT AT BIRNIGOLA BANK, LUPATSONGA RIVER



O.CREEDS

ONUSONDHANI CREEDS

(4) Any other observations/comments:

[Empty box for observations/comments]

Shahadat

Water Quality/ Environmental Specialist

Name: MD. SHAHADAT HOSSAIN

Date: 29-08-2019

Mohimam Ure Rehman

Water Quality Analyzer

Name: Mohimam Ure Rehman

Date: 14/08/2019

DWASA PMU Representative

Name

Designation

Date



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Date: 21-8-2019

SURFACE WATER QUALITY MONITORING AT PROPOSED SAF
EATER TAKE POINT AT BISHNADI BANK, CHAITANKANDA**O.CREEDS**

ONUSONDHANI CREEDS

Field Survey Data Form**DWASA Surface Water Quality Monitoring Program**

- (1) **Sample location** : Bishnadi (Bank of Meghna River), Arihazer
 [Chaitankanda, Bishnadi, 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 below:

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 / 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 algae / phytoplankton / others..... / none

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

Date: 21/08/2019

Time: 10am - 12pm

Sample	Depth (m)	Temp (°C)	pH	Salinity (‰)	Cond. (µS/cm)	TDS (mg/l)	DO (mg/l)	Turbidity (NTU)	Hardness (mg/l)	NH ₄ (mg/l)	Color (PCU)	Flora (R/Y)
1 st grab sample	0.5	33.3	7.1	0.03	75.7	20.8	6.02	23.26	4.0	0.33	142	
2 nd grab sample	4	34.4	7.2	0.03	72.8	22.6	6.19	21.49	4.0	0.30	177	
3 rd grab sample	8	33.9	7.1	0.03	72.7	29.0	6.2	19.76	4.0	0.35	181	
Composite Sample (1 st -2 nd -3 rd Grab sample)		33.3	7.1	0.03	77.9	31.2	6.2	22.04	4.0	0.24	161	

Note-1:

Field test parameters: (Weekly & Monthly): Temp=Temperature; pH; Salinity; Cond=Conductivity; DO=Dissolved Oxygen; Turbidity; TDS=Total Dissolve Solid; Hardness; NH₄ = Ammonia; Color

Note-2:

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



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SURFACE WATER QUALITY MONITORING AT PROPOSED SAFF
 WATER TREATMENT PLANT AT SHIPINGLA, BANK OF PADMA RIVER



O.CREEDS

ONUSONDHANI CREEDS

(4) Any other observations/comments:

Shahadat

Water Quality/ Environmental Specialist

Name: MD. SHAHADAT HOSSAIN

Date: 21.08.2019

Mohimun Or. Rahman

Water Quality Analyzer

Name: Mohimun Or. Rahman

Date: 21/08/2019

DWASA PMU Representative

Name:

Designation:

Date:



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SURFACE WATER QUALITY MONITORING AT PROPOSED SAFF
BANK INTAKE POINT AT BISHNADI BANK OF MEGHNA RIVER

Date: 28-8-2019



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Field Survey Data Form

DWASA Surface Water Quality Monitoring Program

(1) **Sample location** : Bishnandi (Bank of Meghna River), Arahazar, Narayanganj
(Chaitankanda, Bishnandi, Geo-Coordinates: N=23° 44' 47.107" N, E=90° 43' 00.000" E)
(Distance: 100m from bank of river where SWTP structure piece 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 below:

Parameter	Observation
a. Water Colour	Greenish / reddish / yellowish / Muddy / Colourless
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 / musky odor / sewage odor / none
f. Biological Activity	Excessive growth of algal / Phytoplankton / others / none

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; BOD₅; Phosphate; Alkalinity; Ammonia; Total Hardness; Arsenic; Iron; Manganese; Aluminium



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SURFACE WATER QUALITY MONITORING AT PROPOSED SAFF
BARRAGE TAKE POINT AT BIRNATI, BANK OF MASHAI RIVER



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(3) Seasonal Sample:

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

Date: 31/08/2019

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 ft ³ /s
6AM	30.0	7.6	0.03	74.2	31.0	6.60	10.05	40	0.20	170	
7AM	30.1	7.5	0.03	65.1	27.0	6.50	16.36	40	0.00	160	
8AM	30.4	7.4	0.03	63.0	25.6	6.40	15.03	40	0.05	160	
9AM	30.3	7.5	0.03	62.0	23.5	6.30	14.71	40	0.20	140	
10AM	30.5	7.5	0.03	63.0	23.5	6.40	15.05	40	0.20	140	
11AM	30.5	7.6	0.03	62.0	19.1	6.40	19.00	40	0.00	147	
12	30.5	7.6	0.03	63.5	18.7	6.30	19.20	40	0.00	147	
1PM	30.4	7.5	0.03	61.5	12.3	6.20	20.35	40	0.00	140	
2PM	30.5	7.4	0.03	62.2	12.5	6.20	19.37	40	0.00	140	
3PM	30.4	7.6	0.03	62.0	12.0	6.20	19.00	40	0.00	140	
4PM	30.3	7.4	0.03	62.0	12.0	6.20	19.00	40	0.00	140	
5PM	30.3	7.4	0.03	62.0	12.0	6.20	19.00	40	0.00	140	
6PM	30.2	7.4	0.03	62.0	12.0	6.20	19.00	40	0.00	140	

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-chlorine); Pesticides (Organo-phosphorus); Oil & Grease; Fluoride; Selenium; Zinc; Sulphate; Copper; Antifreeze; Boron; Nickel and Sodium.

Note-4:

Hourly sample will be collected during seasonal sampling.

Note-5:

Sample volume and preservative:
(a) Non-preservative sample – 1000 liter
(b) Preservative-HCl – One liter
(c) Preservative-HNO₃ – Two liter
(d) Preservative-H₂SO₄ – One liter



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WATER QUALITY MONITORING AT PROCESSED WATER TREATMENT PLANT AT BANGSHE, AREA OF MOHAKHALI



O.CREEDS

ONUSONDHANI CREEDS

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

Date: 31/08/2019

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	30.3	7.4	0.03	65.8	23.1	6.2	11.49	40	0.24	126	
7AM	30.2	7.4	0.03	66.6	23.4	6.60	17.05	40	0.21	130	
8AM	30.2	7.4	0.03	66.0	23.3	6.54	12.03	40	0.25	128	
9AM	30.1	7.5	0.03	65.8	23.4	6.60	15.22	40	0.27	130	
10AM	30.1	7.5	0.03	68.7	24.9	6.35	15.40	40	0.22	130	
11AM	30.4	7.5	0.03	67.9	23.7	6.40	13.50	40	0.26	129	
12	30.9	7.45	0.03	63.5	21.2	6.05	16.35	40	0.26	120	
1PM	30.3	7.52	0.03	62.4	23.3	6.22	12.70	40	0.20	130	
2PM	30.9	7.52	0.03	62.1	23.2	6.49	11.67	40	0.22	121	
3PM	30.2	7.52	0.03	67.7	23.4	6.20	15.23	40	0.20	120	
4PM	30.2	7.50	0.03	61.5	23.2	6.12	16.57	40	0.23	126	
5PM	30.2	7.45	0.03	68.2	24.2	6.22	14.71	40	0.25	129	
6PM	30.2	7.40	0.03	68.4	24.1	6.19	14.17	40	0.22	128	

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

Date: 31/08/2019

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	30.1	6.9	0.03	69.0	23.1	6.2	18.20	40	0.20	143	
7AM	30.3	6.9	0.03	66.2	23.1	6.17	12.57	40	0.22	123	
8AM	30.2	6.9	0.03	66.4	23.0	6.68	12.20	40	0.22	145	
9AM	30.2	7.2	0.03	68.2	23.2	6.70	13.82	40	0.21	140	
10AM	30.1	7.1	0.03	68.7	23.3	6.74	12.32	40	0.20	140	
11AM	30.1	7.3	0.03	69.4	23.4	6.73	12.03	40	0.25	127	
12	30.1	6.9	0.03	69.5	23.7	6.78	12.40	40	0.26	162	
1PM	30.2	7.1	0.03	69.4	23.4	6.68	12.00	40	0.23	158	
2PM	30.0	7.1	0.03	66.40	23.2	6.69	15.17	40	0.25	121	
3PM	30.0	7.1	0.03	68.25	23.3	6.73	16.45	40	0.22	162	
4PM	30.1	7.0	0.03	66.60	23.4	6.70	16.30	40	0.20	160	
5PM	30.1	7.2	0.03	68.0	24.2	6.70	16.30	40	0.25	160	
6PM	30.1	7.3	0.03	68.32	24.3	6.74	16.30	40	0.25	130	



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SURFACE WATER QUALITY MONITORING AT PROPOSED EAST
RAJSHY GROUND WATER AT GROUNDWATER BANK, GUMSONDHANI, DHA



O.CREEDS

ONUSONDHANI CREEDS

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

Date: 31/08/2019 Depth: [Sample-1: 0.05m+ Sample-2: 4m+ Sample-3: 8m]

Time	Temp. °C	pH	Salinity	Cond. µS/cm	TDS mg/l	DO mg/l	Turbidity NTU	Hardness mg/l	Alk mg/l	Color	Total
8AM	30.1	7.0	0.03	66.2	22.0	6.2	15.76	40	0.16	160	
9AM	30.2	7.0	0.03	65.5	22.4	6.2	16.28	40	0.16	160	
10AM	30.4	7.1	0.03	65.2	22.3	6.7	16.02	40	0.17	162	
11AM	30.0	7.0	0.03	67.0	22.0	6.9	15.28	40	0.16	168	
12AM	30.0	7.0	0.03	65.4	21.4	6.5	15.54	40	0.16	170	
12	30.0	7.2	0.03	65.4	21.0	6.5	15.00	40	0.15	165	
1PM	30.1	7.1	0.03	66.2	22.0	6.7	15.72	40	0.16	172	
2PM	30.1	7.2	0.03	65.5	22.0	6.7	15.05	40	0.16	165	
3PM	30.3	7.0	0.03	67.7	22.0	6.7	15.42	40	0.20	160	
4PM	30.3	7.0	0.03	65.8	22.0	6.7	15.40	40	0.20	160	
5PM	30.2	7.0	0.03	65.1	22.0	6.7	15.70	40	0.20	165	
6PM	30.0	7.1	0.03	67.5	22.0	6.2	15.70	40	0.20	160	

(4) Any other observations/comments:

Shahadat

Water Quality/ Environmental Specialist

Name: MD. SHAHADAT HOSSAIN
Date: 31.08.2019

Latia Rahman

Water Quality Analyzer Assistant

Name: Mohimen Ora Rahman
Date: 31/08/2019

DWASA PMU Representative

Name:
Designation:
Date:





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SURFACE WATER QUALITY MONITORING AT PROPOSED SAFF
BAKAR BRIDGE POINT AT SHYAMOL AKAN CAMPUS, DHAKA

ANNEXURE-5: Lab test result scan copy

	Government of the People's Republic of Bangladesh Office of the Chief Chemist Department of Public Health Engineering Central Lab, 38-39, Mohakhali C/A, Dhaka-1212 <small>(Phone: 02-9611027 Fax: 02-9612003, Email: wprac_central_lab@yahoo.com)</small>	
Lab Memo: 202/CC, CP/16, C, Dhaka.		Date: 03-10-2019

Physical /Chemical/ Bacteriological Analysis of Water Sample



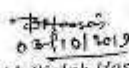
Sample ID: DEN2019100042	Sample Receiving date: 02-09-2019
Ref. Memo No: D.Creeds/2019/MI & Dated: 02-09-2019	Sample Source: River Water
Sent by: Engr. M. Shabbid Hossain, Chief Executive Officer, D. Creeds, Mohakhali DCWS, Dhaka-1205	Dist: Narayanganj, Upa: Malhaza
Case Taker: D. Creeds (Sample ID-02 D/WASA)	Union, Md. Meghas River
Sample Collection date:	Date of Testing: 02/09/2019-30/09/2019

LABORATORY TEST RESULTS:

Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ
1	Alkalinity	-	45	mg/L	Titrimetric	-
2	Aluminium (Al)	0.2	0.150	mg/L	AAS	0.02
3	Ammonia	0.5	0.58	mg/L	UVS	0.1
4	Arsenic (As)	0.05	0.031	mg/L	AAS	0.001
5	Biochemical Oxygen Demand (BOD)	0.2	18	mg/L	5 days Incubation	0.1
6	Chemical Oxygen Demand (COD)	4.0	88	mg/L	CRM	-
7	Hardness	200-500	117	mg/L	Titrimetric	-
8	Iron (Fe)	0.3-1	0.37	mg/L	AAS	0.05
9	Manganese (Mn)	0.1	0.13	mg/L	AAS	0.03
10	Nitrogen (Nitrate)	10.0	1.9	mg/L	UVS	0.10
11	Nitrogen (Nitrite)	<1.0	0.02	mg/L	UVS	0.02
12	Phosphate	6.0	0.01	mg/L	UVS	0.10
13	Total Suspended Solid (TSS)	10	1	mg/L	Gravimetric Method	-



Comments: Sample was collected & Supplied by client.

N.B: AAS - Atomic Absorption Spectrophotometer, UVS - UV-Visible Spectrophotometer, CRM - Closed Reflex Methods, LOQ - Limit of Quantitation.

Test Performed by: 1.) Name: Md. Saiful Alam Khoru Designation: Sample Analyzer  03/10/19	Countersigned/Approved by: 1.) Name: Md. Zahidul Islam Mah Designation: Senior Chemist  03-10-19 2.) Name: Md. Biplob Hossain Designation: Chief Chemist  03-10-19 Md. Biplob Hossain Chief Chemist Department of Public Health Engineering Central Laboratory, Dhaka
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	Government of the People's Republic of Bangladesh Office of the Chief Chemist Department of Public Health Engineering Central Lab, 38-39, Mohakhali C/A, Dhaka-1212 Phone: 88-02-881927, Fax: 88-02-883203, Email: wpmc_central_lab@yahoo.com	
---	---	---

Lab Memo: 28/0 CC, DPHE, CL, Dhaka

Date: 03-10-2019

Physical/Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEV201910041	Sample Receiving date: 25-08-2019
Ref. Memo No. Q.Creds2019NH2 Dated: 28-05-2019	Sample Source: River Water
Sent by: Engr. Md. Shahadat Haqin, CEO & Founder, Q. Creeds, Monakhali DOHS, Dhaka-1206.	Dist: Narayanganj, Upz: Arainagar
Care Taken: Q. Creeds	Union: VII, Meghna River
Sample Collection date:	Date of Testing: 29/08/2019-30/08/2019

LABORATORY TEST RESULTS:

Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ
1	Ammonia	0.5	0.60	mg/L	UVS	0.1
2	Arsenic (As)	0.05	0.001	mg/L	AAS	0.001
3	Barium (Ba)	0.01	0.030	mg/L	AAS	-
4	Biochemical Oxygen Demand (BOD)	0.2	8	mg/L	5 days incubation	0.1
5	Cadmium (Cd)	0.005	0.0058	mg/L	AAS	0.00015
6	Chemical Oxygen Demand (COD)	4.0	35	mg/L	CRM	-
7	Chloride	150-300	10	mg/L	Titrimetric	-
8	Coliform (Faecal)	0	144	CFU/100ml	MFM	-
9	Copper (Cu)	1.0	0.26	mg/L	AAS	0.26
10	Cr (Total)	0.05	0.008	mg/L	AAS	0.0003
11	Fluoride	1.0	0.12	mg/L	UVS	0.12
12	Lead (Pb)	0.05	0.034	mg/L	AAS	0.001
13	Nickel (Ni)	0.1	0.03	mg/L	AAS	0.01
14	Nitrogen (Nitrate)	10.0	1.9	mg/L	UVS	0.10
15	Nitrogen (Nitrite)	<1.0	0.03	mg/L	UVS	0.02
16	Phosphate	6.0	0.84	mg/L	UVS	0.10
17	Selenium (Se)	0.01	0.003	mg/L	AAS	0.002
18	Sodium (Na)	200	10	mg/L	AAS	0.34
19	Sulphate	400	1	mg/L	UVS	1.0
20	Zinc (Zn)	5.0	0.08	mg/L	AAS	0.05

Comments: Sample was collected & Supplied by client.

N.B. AAS - Atomic Absorption Spectrophotometer, UVS - UV-VISIBLE Spectrophotometer, CRM - Closed Reflux Methods, MFM - Membrane Filtration Method, LOD - Limit of Quantitation.

Asad *Sherif* *Shahadat* *Haqin*

Page 1 of 2



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BANGLADESH COUNCIL OF SCIENTIFIC AND INDUSTRIAL RESEARCH (BCSIR)

জাতীয় গবেষণা পরিষদ

Institute Name: Institute of National Analytical Research & Service (INARS)

Analysis Report



Analytical Service Cell Ref No: Sep2019019402
 Lab ID: INS-1266
 Sample ID: A-1266

Unit (Lab/Inst.) Ref No: A-1266
 Sample Receiving Date: 03/09/2019
 Submission Date: 02 Sep 2019
 Report Delivery Date: 07/10/2019

Sample Description: Test of water
 Client's Details: Md. Shahadat Hossain
 ONUSONGHAM CREEDS
 House # House-133, road 05, 3rd floor, Mohakhali DO, Mohakhali DOHS, Dhaka-1206
 Number of Sample: 1

Report Details:

Lab ID	Particulars of supplied sample	Parameters	Concentration (mg/L)	Test Method (APHA)
--------	--------------------------------	------------	----------------------	--------------------

(Handwritten mark)



- Note:
- a. The results reported here pertained to the sample received in this laboratory only.
 - b. Complaint and/or query regarding delivered test report should be lodged within one month of report delivery date.
 - c. The laboratory is not responsible for the data quality affected due to sampling, transporting and storage conditions of the samples maintained before received in the laboratory.
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Page 2 of 3

7th of October 2019 02:14 PM



OUR POLICY ON WATER QUALITY MONITORING AT PROPOSED WATER INTAKE POINT AT BANGSHELA AREA, CUMMILLA DISTRICT

	বীজনের জন্য বিজ্ঞান প্রতি খেতানের পশুর গুণের জন্য উদ্ভিদ
বাংলাদেশ বিজ্ঞান ও শিল্প গবেষণা পরিষদ (বিসিএসআইআর) BANGLADESH COUNCIL OF SCIENTIFIC AND INDUSTRIAL RESEARCH (BCSIR)	

A-1266	Water	α-BHC	ND	6630.B
		γ-BHC	ND	6630.B
		β-BHC	ND	6630.B
		Heptachlor	ND	6630.B
		delta-BHC	ND	6630.B
		Aldrin	ND	6630.B
		Heptachlor Epoxide (Isome B)	ND	6630.B
		γ-Chlordane	ND	6630.B
		α-Chlordane	ND	6630.B
		Endosulfan I	ND	6630.B
		4,4'-DDE	ND	6630.B
		Dieldrin	ND	6630.B
		Endrin	ND	6630.B
		4,4'-DDD	ND	6630.B
		Endosulfan II	ND	6630.B
		4,4'-DDT	ND	6630.B
		Endrin aldehyde	ND	6630.B
		Endosulfan sulphate	ND	6630.B
		Methoxychlor	ND	6630.B
		Endrin ketone	ND	6630.B
A-1266	Water	TOC (Total Organic Carbon)	Less than 5.0 mg/l	5310.B
		Oil and Grease	Less than 2.0 mg/L	5520.B
		Mercury (Hg)	Less than 0.001 mg/L	3112.B

Analyst
 150, Ahsanul Kabir
 Senior Scientific Officer
 Institute of National Analytical
 Research & Service (INARS)
 BCSIR, Dhaka-1205

07.10.19
 Section/Division In-Charge
Shamsur Ahmed
 Senior Scientific Officer
 Institute of National Analytical
 Research & Service (INARS)
 BCSIR, Dhaka-1205

07.10.2019
 In-Charge/Director
Md. Aminul Ahsan
 Director (Add. Charge)
 Institute of National Analytical
 Research & Service (INARS)
 BCSIR, Dhaka-1205.



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Page 2 of 2

7th of October 2019 07:14 PM



OUR RANGE OF TESTS, QUALITY ACCORDING TO PROPOSED S.M.P.
EACH BY TAKING INTO ACCOUNT BIRTH DATE OF MICROBIAL LIFE

	দীর্ঘমেয়াদি গবেষণা বাংলাদেশ বিজ্ঞান ও শিল্প গবেষণা পরিষদ (বিসিএসআইআর) BANGLADESH COUNCIL OF SCIENTIFIC AND INDUSTRIAL RESEARCH (BCSIR)	(কম্পিউটার দ্বারা স্বাক্ষরিত প্রতিবেদন)
Institute Name: Institute of National Analytical Research & Service (INARS)		

Analysis Report

Analytical Service Cell Ref No: Sep2019019402 Unit (lab/inst.) Ref No: A-1266
 Lab ID: IMS-1266 Sample Receiving Date: 03/09/2019
 Sample ID: A-1266 Submission Date: 02 Sep 2019

Sample Description: Test of water
 Client's Details: Md. Shahadat Hossain
 OMI/SONDHANI CREEDS
 House#House-115, road-05,3rd floor Mohakhali DO, Mohakhali DCHS, Dhaka-1206
 Number of Sample: 1

Report Details:

Lab ID	Particulars of supplied Sample	Parameters	Concentration	Test Method (APHA)			
A-1266	Water	Boron (B) available	Less than 0.01 mg/L	4500.B			
<table style="width: 100%; border: none;"> <tr> <td style="width: 33%; text-align: center;"> Analyst Md. Akhmed Akbar Senior Scientific Officer Institute of National Analytical Research & Service (INARS) BCSIR, Dhaka </td> <td style="width: 33%; text-align: center;"> 07.10.19 Section/Division In-Charge Shamim Ahmed Senior Scientific Officer Institute of National Analytical Research & Service (INARS) BCSIR, Dhaka-1205 </td> <td style="width: 33%; text-align: center;"> 07.10.2019 In-Charge/Director Md. Aminul Ahsan Director (Addl. Charge) Institute of National Analytical Research & Service (INARS) BCSIR, Dhaka-1205 </td> </tr> </table>					 Analyst Md. Akhmed Akbar Senior Scientific Officer Institute of National Analytical Research & Service (INARS) BCSIR, Dhaka	 07.10.19 Section/Division In-Charge Shamim Ahmed Senior Scientific Officer Institute of National Analytical Research & Service (INARS) BCSIR, Dhaka-1205	 07.10.2019 In-Charge/Director Md. Aminul Ahsan Director (Addl. Charge) Institute of National Analytical Research & Service (INARS) BCSIR, Dhaka-1205
 Analyst Md. Akhmed Akbar Senior Scientific Officer Institute of National Analytical Research & Service (INARS) BCSIR, Dhaka	 07.10.19 Section/Division In-Charge Shamim Ahmed Senior Scientific Officer Institute of National Analytical Research & Service (INARS) BCSIR, Dhaka-1205	 07.10.2019 In-Charge/Director Md. Aminul Ahsan Director (Addl. Charge) Institute of National Analytical Research & Service (INARS) BCSIR, Dhaka-1205					



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Page 1 of 1

7th of October 2019 04:08 PM


ANNEXURE-6: Data –Month of July/2019
Table W1/2019: 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	0.05	75.8	32.9	6.5	14.66	40	0.23	138
2nd grab sample	4	30.3	7.3	0.05	69.2	29.4	6.61	19.08	60	0.32	110
3rd grab sample	8	30.1	7.2	0.05	68.8	32	6.87	14.28	60	0.3	140
Composite sample (1st-2nd-3rd grab sample)		30.1	7.2	0.05	66	30.9	6.8	16.32	40	0.2	122
Max		30.6	7.3	0.05	75.8	32.9	6.87	19.08	60	0.32	140
Min		30.1	7.2	0.05	66	29.4	6.5	14.28	40	0.2	110
Avg.		30.3	7.23	0.05	70.28	31.25	6.69	16.28	50	0.26	126.67

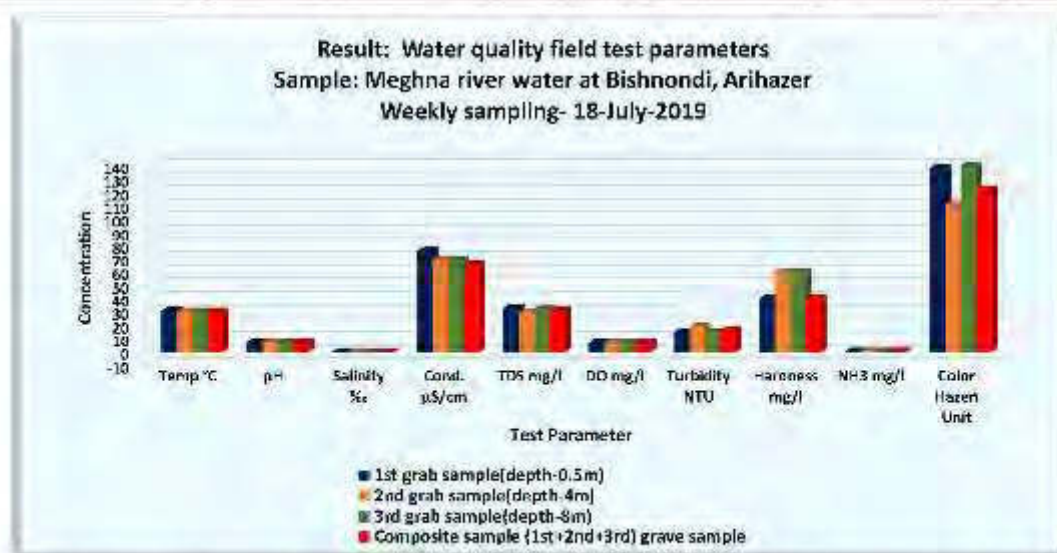

Figure W-1/2019 Water quality field test parameters Sample: Meghna river water at Bishnondi, Arihazer Weekly sampling- 18-July 2019



Table W2/2019: 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

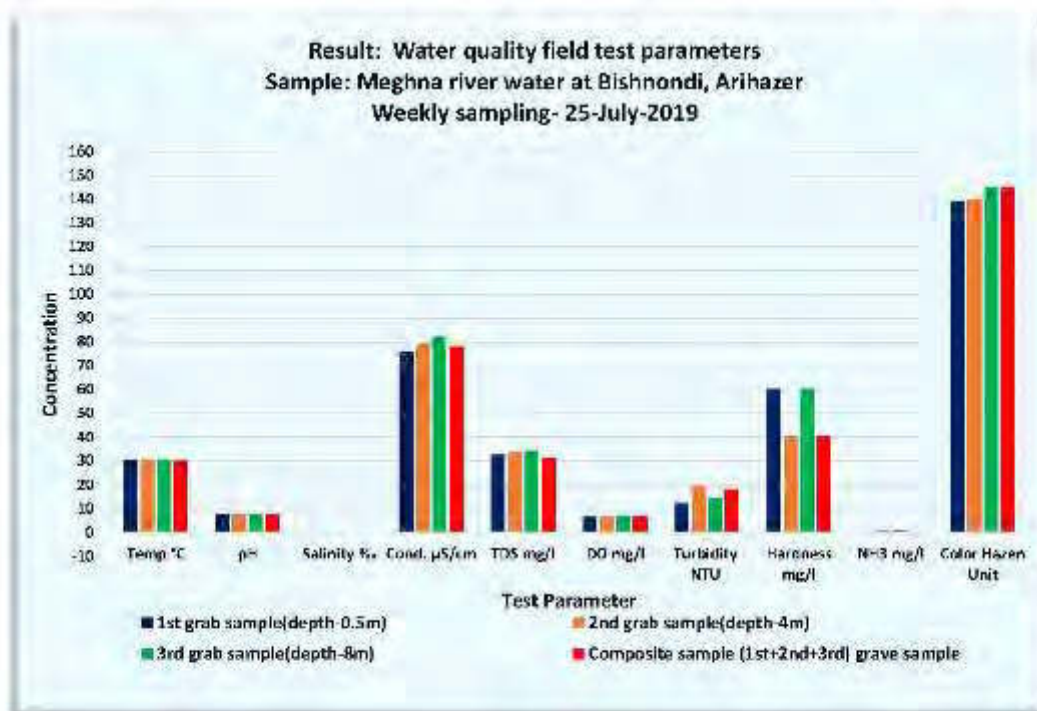


Figure W-2/2019 Water quality field test parameters Sample: Meghna river water at Bishnondi, Arihazer Weekly sampling- 25-July-2019



Table W3/2019: 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 grab 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

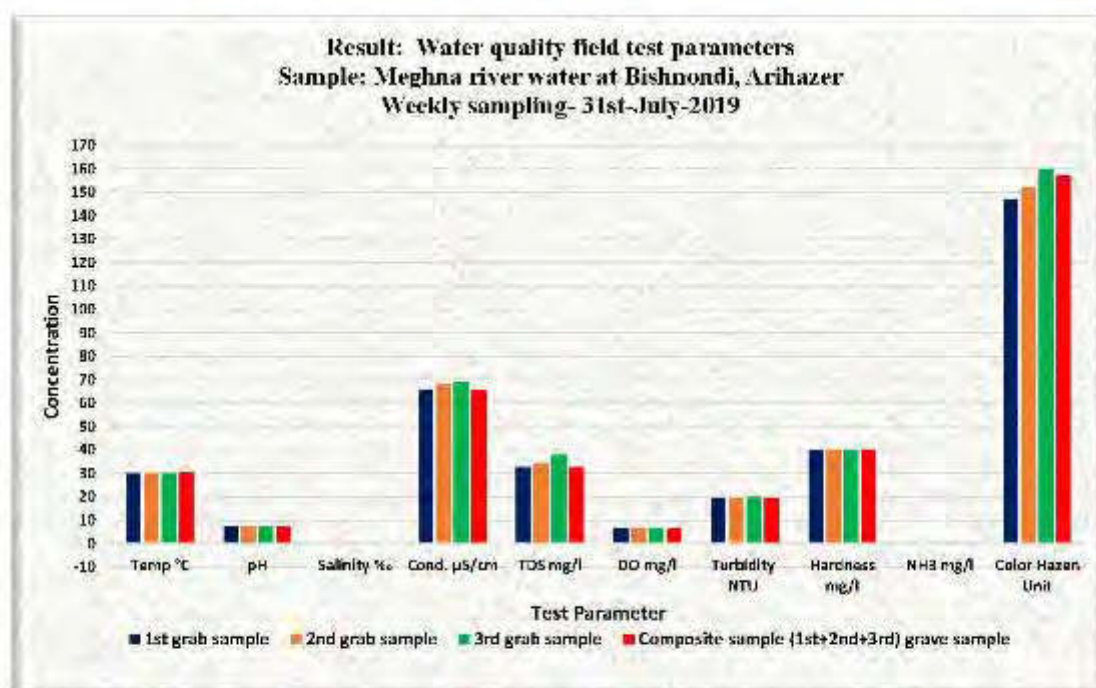


Figure 0-3/2019 Water quality field test parameters Sample: Meghna river water at Bishnondi, Arhazer Weekly sampling- 31st-July-2019



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 Bishnondi Araihaazar using Meghna river water for ensuring better quality water supply at mega-city Dhaka.

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

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

Measurement of physicochemical parameters are Temperature, pH, Salinity, Conductivity, Turbidity, Dissolved Oxygen (DO), Total Dissolved Solid (TDS), Ammonia (NH₃), Total Hardness and color at field during weekly sampling.

During monthly sampling, composite sample were sent to DPHE Central laboratory for the analysis of a wide range of water quality parameter and parameters are Nitrate; Nitrite; COD; TSS; BOD₅; Phosphate; Alkalinity; Ammonia; Total Hardness; Arsenic; Iron; Manganese and Aluminum and field parameter were tested as same as weekly sample parameters.

During the eighteen months study period, five times seasonal sample need to be collected which is hourly basis and 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 parameter and parameters are Arsenic; Algae; Barium; Cadmium; Chloride; Chromium(Hexavalent); Coliform(fecal); BOD; COD; Lead; Mercury; Ammonia; Nitrate; Nitrite; Phosphate; TOC; Pesticides (Organo-chlorine); Pesticides (Organo-phosphorus); Oil & Grease; Fluoride; Selenium; Zinc; Sulphate; Copper; Antimony; Boron; Nickel and Sodium. Field parameter were tested as same as weekly sample parameters.

BOD and COD values were found to be 3 mg/L and 8mg/L respectively during monthly sample analysis. To understand the pollution trend more data from different months are required.

Ammonia concentration of most sample are within the safe limit as per Bangladesh Drinking Water Quality Standard, (NH₃ 0.5mg/L). However, tendency of ammonia concentration to increase with respect to time has been found in the last three months. In conjunction, decreasing of dissolved oxygen (DO), reduction of pH value, increase of turbidity, increase of color unit were found.

The Water Quality Index (WQI) value was found to be 67.36 to 92.87 for weekly samples and 199 for monthly samples. The contributing pollutants were found to be mainly turbidity and color. The standard deviations were also calculated for further analysis. It was found that the deviation was maximum for color and minimum for pH (excluding salinity).



TABLE OF CONTENTS

EXECUTIVE SUMMARY	i
LIST OF FIGURES	iii
LIST OF TABLES	iv
ACRONYMS AND ABBREVIATIONS	v
1 INTRODUCTION	6
1.1 Background	6
1.2 Objectives	8
1.3 Scope of Works	8
1.4 Description of Sampling Area	8
1.5 Work Plan and Professional Staffing	10
2 METHODOLOGY	12
2.1 Sampling Approach and Methodology	12
2.2 Duration of the monitoring:	13
3 DESCRIPTION OF SAMPLING	14
3.1 Sampling Schedule:	14
3.2 Field Visits	16
3.3 Laboratory Tests	17
3.4 List of portable instrument/ Test kit and others use during field activities:	20
3.5 Field Survey data form:	20
3.6 Drinking Water Quality Standard:	20
4 RESULTS AND DISCUSSIONS	21
4.1 Weekly sampling- Field test results	21
4.2 Laboratory Test Results- Monthly Sample	25
5 CONCLUSION	26
ANNEXURES	29



LIST OF FIGURES

Figure 1:1 Schematic diagram- Different source for Surface water pollution.....	6
Figure 1:2 Schematic diagram-River pollution around Dhaka City.....	7
Figure 1:3 Study Area Map of Bishnondi, Arai hazar.....	8
Figure 1:4 Sample collections point of Bishnondi, Arai hazar.....	9
Figure 1:5 Work Plan of the Project.....	10
Figure 3:1 Central Laboratory, DPHE, Mohakhali, Dhaka.....	19
Figure 3:2 Bangladesh Council for Scientific and Industrial Research (BCSIR).....	19
Figure 4:1: Comparison of different water quality parameters at different depth; 1st week. .	21
Figure 4:2 Comparison of different water quality parameters at different depth; 2nd week. .	22
Figure 4:3 Comparison of different water quality parameters at different depth; 3 th week. .	23
Figure 4:4 Comparison of different water quality parameters at different depth; 4 th week. .	24
Figure A-1 Water quality field test parameters Sample: Meghna river water at Bishnondi, Arai hazar Weekly sampling- 18-July-2019.....	46
Figure A-2 Water quality field test parameters Sample: Meghna river water at Bishnondi, Arai hazar Weekly sampling- 25-July-2019.....	47
Figure A-3 Water quality field test parameters Sample: Meghna river water at Bishnondi, Arai hazar Weekly sampling- 31st-July-2019.....	48



LIST OF TABLES

Table 1-1: List of Professional staff involved in this study.....	11
Table 3-1: Field test parameters	14
Table 3-2: Hourly Sampling parameters	15
Table 3-3: Field Visit Schedule.....	16
Table 3-4: Laboratory test parameters for monthly sample	17
Table 3-5: Laboratory test parameters for hourly sample	17
Table 3-6: Laboratory test equipment used for test	18
Table 4-1: Weekly Sampling Field Test Results: Sampling date: 05/09/2019	21
Table 4-2: Weekly Sampling Field Test Results: Sampling date: 14/09/2019	22
Table 4-3: Weekly Sampling Field Test Results: Sampling date: 21/09/2019	23
Table W1: Weekly Sampling Results; 18/07/2019.....	46
Table W2: Weekly sampling results; 25/07/2019.....	47
Table W3: Weekly sampling results; 31/07/2019.....	48



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



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.

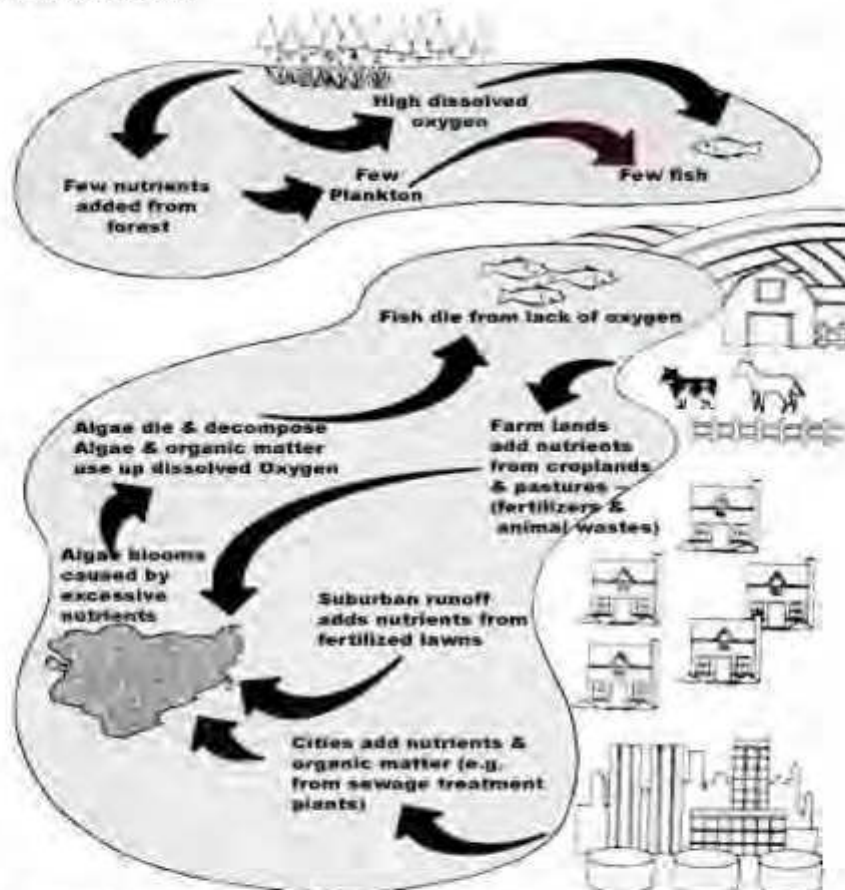


Figure 1:1 Schematic diagram- Different source for Surface water pollution



Water quality monitoring is an important aspect of overall water quality management and water resource 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 being maintained on a continuing basis. Monitoring involves the laboratory and /or spot testing of water samples collected from desirable locations both source and supply system.

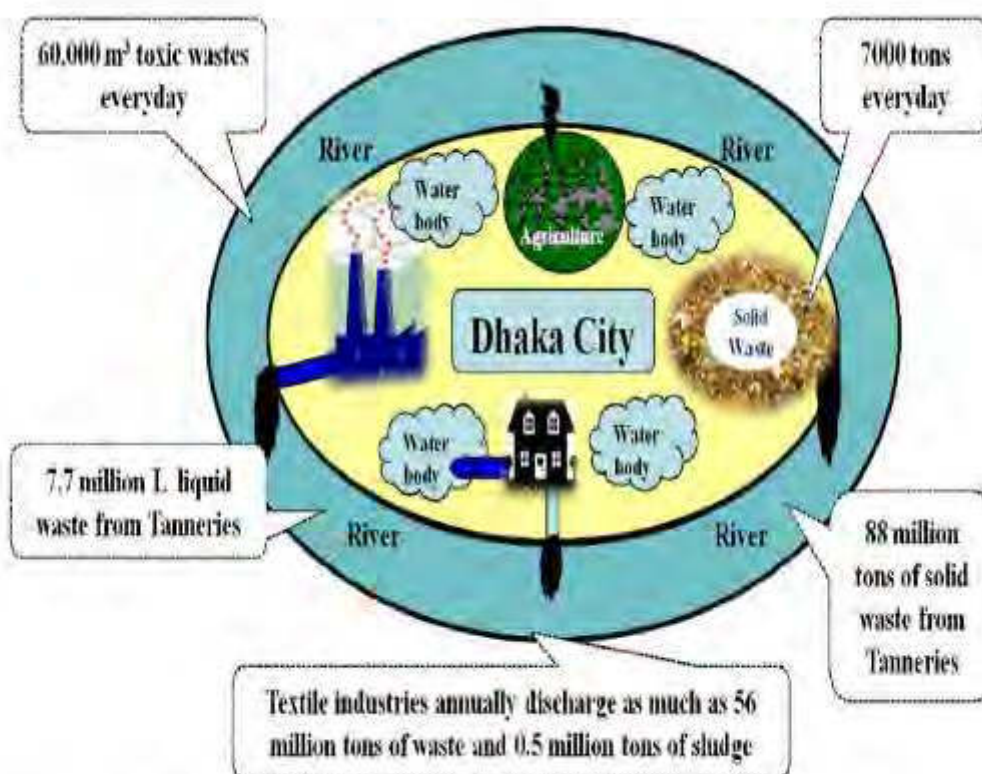


Figure 1:2 Schematic diagram-River pollution around Dhaka City

River pollution around Dhaka City from different sources is 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 where surface water does not meet drinking water quality standard due to presence of inferior substances or pollutants. This sort of water should not be introduced in water supply system before treatment. Rainfall (such as acid rain), storm water runoff, agriculture runoff, industrial wastes etc. can affect the color, odor, dissolved oxygen of water and also influences on major ion levels, bacteria level in surface water.

The target of this study is to know the change of surface water quality with respect to time by testing some fundamental parameters, which can represent or can give a synopsis of the given surface water quality before going for a wide scale parameter testing.

To assess the variation of surface water quality over the period of eighteen months for better understanding appropriate surface water treatment facilities for 500MLD capacity of DWASA surface treatment plant which is going to be installed at Bishnondi Araihaazar using Meghna river water to ensure better quality water supply at mega-city Dhaka. In order fulfill the above objective, Onushandhani CREDS Ltd has been assigned to conduct surface water quality monitoring at proposed intake point at Bishnondi, Bank of Meghna River, Araihaazar under DESWSP, DWASA [RFQ/W-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. Generation and submission of monthly report to DWASA.

1.4 Description of Sampling Area

Location of the sampling point:

Chaitankanda, Bishnondi
 Araihaazar

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 Bishnondi, Araihaazar



SURFACE WATER QUALITY MONITORING AT PROPOSED RAW
WATER INTAKE POINT AT BISHNODI, BANK OF MEGHNA RIVER

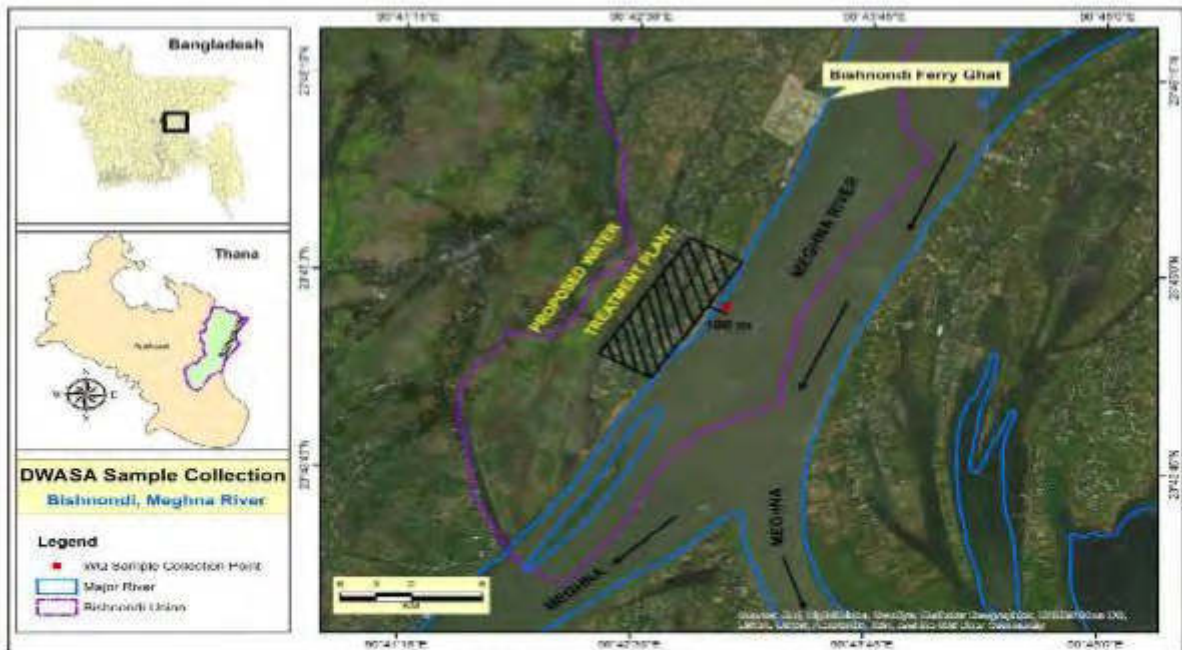


Figure 1:4 Sample collections point of Bishnodi, Araihaaz

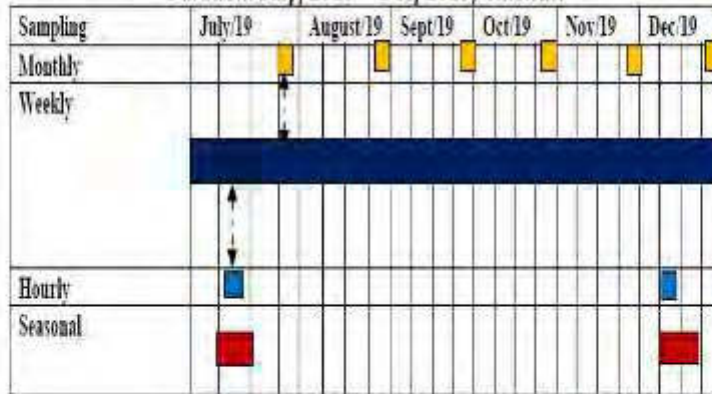


1.5 Work Plan and Professional Staffing

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

[Chaitankanda, 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

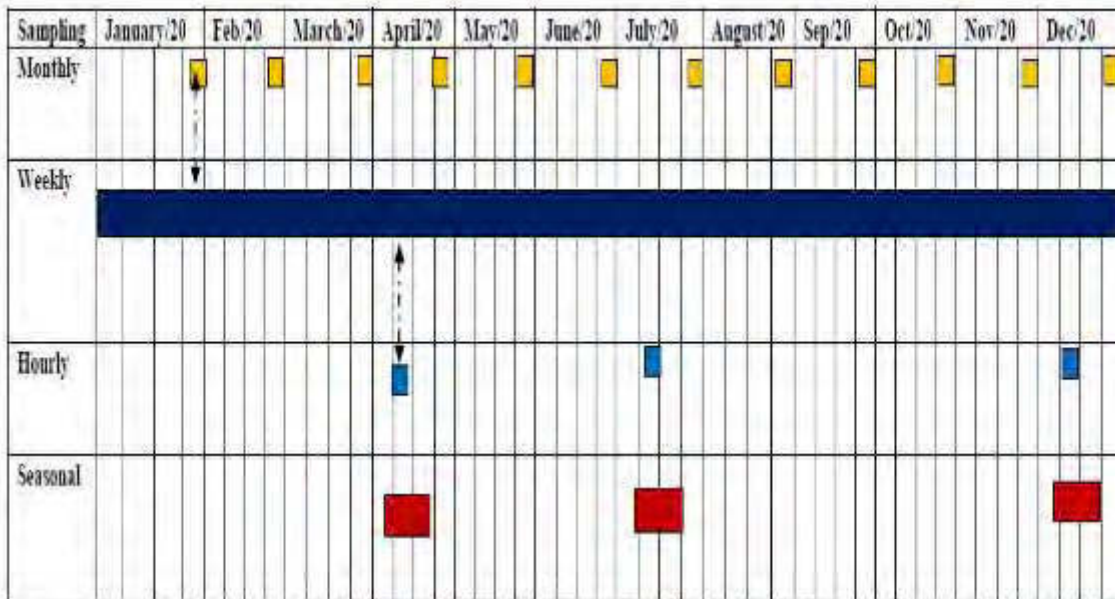


Figure 1:5 Work Plan of the Project


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

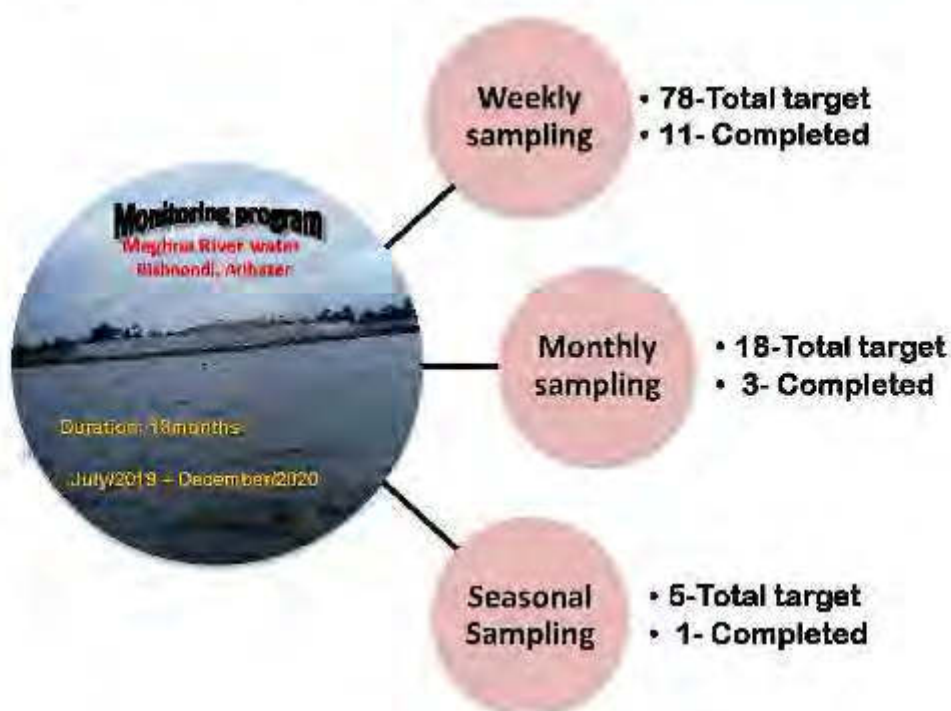
Name of The Expert	Position
Dr. Jubair Tariqul Alam Chowdhury	Water Quality /Environment Specialist and Adviser
Dr. Syed Zakir Hossain	River Morphological Specialist
Md. Shahadat Hossain	Water Supply Specialist
Rayaan Jubair Chowdhury	Environmental Engineer
Mohimen Ur Rahman	Water Quality Analyzer
Mansura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

Progress Index

Monitoring duration: July/2019 to December/2020

Reporting Month: September/2019

Progress month=Three month – July, August & September/2019





CHAPTER 2 METHODOLOGY

2 METHODOLOGY

The Methods and instruments for different parameter analysis and sample collections were selected by 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 every time. Measure some physicochemical parameters (Temperature, pH, Conductivity, Turbidity, Dissolved Oxygen, TDS and Ammonia) at field and record properly.
- (ii) Sample in different depths: Made up of two equal parts collected at predetermined intervals of depth 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 samples (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 the three grab samples (1st, 2nd & 3rd Grab sample), at field and record properly.
- (v) After the field physicochemical measurements have been recorded, collect water samples for laboratory analysis, both chemical and microbiological, at the same location and same depth in 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 Moghna 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 (Bishnondi) with three equal intervals.



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

Water Level: Water Level shall be measured weekly at Bishnondi sampling point. The level should be related to national datum. Other observations 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 should 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 during rainfall.
- The required instruments 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	1 st grab sample	2 nd grab sample	3 rd 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 DHPE central lab. Parameters are Nitrate; Nitrite; COD; TSS; BOD₅; Phosphate; Alkalinity; Ammonia; Total Hardness; Arsonic; 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	1 st grab sample	2 nd grab sample	3 rd 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:**

Arsonic; Algae; Antimony; Ammonia; Barium; Boron; Cadmium; Chloride; Chromium (Hexavalent); Coliform (fecal); Copper; BOD_{5days}; 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

Total of 04 (four) field visits were conducted during September/2019. The field visit schedule along with personnel involved is shown in table

Table 3-3: Field Visit Schedule

Date	Sampling Type	Personnel
05/09/2019	Weekly Sampling	Name: Md. Shahadat Hossain Designation: Water Quality Analysis Specialist
		Name: Mohimen Ur Rahman Designation: Water Quality Analysis Assistant
		Name: Ishraque Bin Khalil Designation: Water Quality Analysis Assistant
		Name: Fakhru Islam Designation: Survey Assistant
14/09/2019	Weekly Sampling	Name: Mohimen Ur Rahman Designation: Water Quality Analysis Specialist
		Name: Sourav Kanti Paul Designation: Water Quality Analysis Assistant
		Name: Ishraque Bin Khalil Designation: Water Quality Analysis Assistant
		Name: Fakhru Islam Designation: Survey Assistant
21/09/2019	Weekly Sampling	Name: Mohimen Ur Rahman Designation: Water Quality Expert and Adviser of the Study
		Name: Rayaan Jubair Chowdhury Designation: Environmental Engineer
		Name: Ishraque Bin Khalil Designation: Water Quality Analysis Assistant
		Name: Sourav Kanti Paul Designation: Survey Assistant
		Name: Fakhru Islam Designation: Survey Assistant
28/09/2019	Monthly Sampling	Name: Mohimen Ur Rahman Designation: Water Quality Analysis Assistant
		Name: Ishraque Bin Khalil Designation: Survey Assistant
		Name: Fakhru Islam Designation: Survey 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 samples, 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-chlorine)	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
Nickel	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



SURFACE WATER QUALITY MONITORING AT PROPOSED DUF
 WATER TAKE POINT AT BORDOIN, BANK OF MEGHNA RIVER



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



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