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EKO PRO ENGINEERS PVT. LTD.

Environmental Consultants and Analytical Laboratory

(An ISO 9001:2015 Certified Company)

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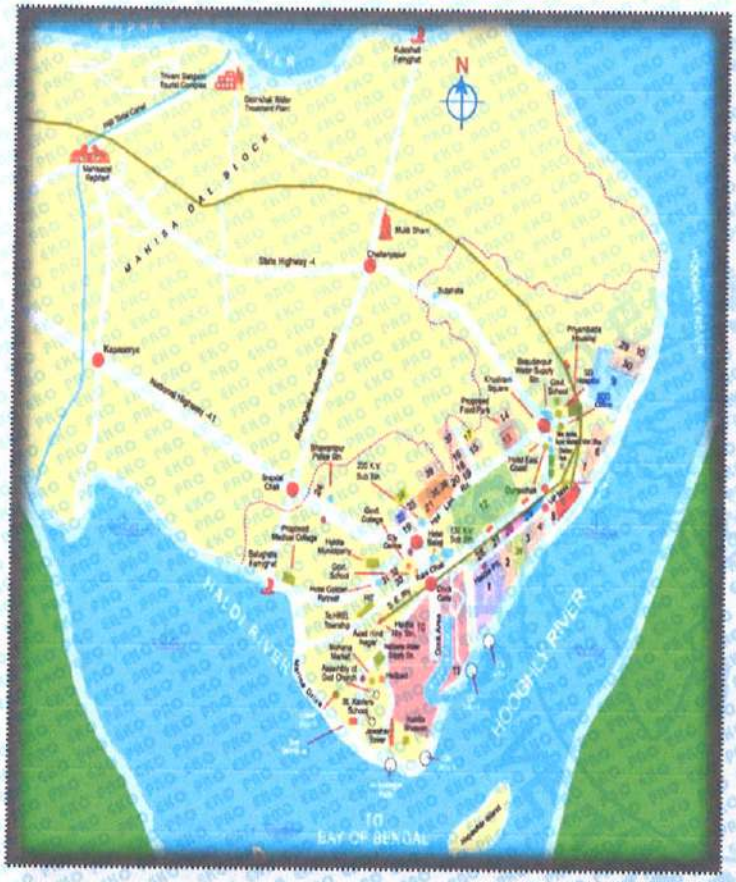
ENVIRONMENTAL MONITORING

Monsoon Season(July 2020 - Sep 2020)

*at*KOLKATAPORT TRUST

HALDIA DOCK COMPLEX



Submitted To:

KOLKATA PORT TRUST

Haldia Dock Complex
Haldia Townahip, Haldia
Distt: PurbaMedinpur (West Bengal)

Prepared by:

EKO PRO ENGINEERS PVT LTD
32/41, South Side of GT Road
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EKO PRO ENGINEERS PVT. LTD. GHAZIABAD SAVE THE ENVIRONMENT

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CONTENT

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1. Summary

Kolkata Port Trust, Haldia Dock Complexhasawardedtheprojecttitled"POST PROJECT MONITORING OF DIFFERENT ENVIRONMENTAL PARAMETERS UNDER HALDIA DOCK COMPLEX, HALDIA" to M/s. Eko Pro Engineers Private Limited, Ghaziabad vide work order No. I&CF/IZ&R/T/296/702 dated 10.10.2019.

The main objective of environmental Monitoring is to take the environmental observations, inside and outside the Dock complex.

A comprehensive environmental monitoring program has been planned to monitor data for the period of 4th Quarter i.e. **July 2020 – Sep 2020**. The monitored data of Ambient Noise Quality, Marine Water Quality, Sediment Quality and green belt study in an around Haldia Dock complex.

Ambient Noise monitoring is carried out once in a month i.e. from July 2020 to September 2020. The observations of total twelve locations were taken.

Marine Water quality samples for Physico-Chemical Analysis and Biological Analysis are carried out once in season.

Marine Sediment Quality samples for physico-chemical analysis and biological analysis also being carried out once as the frequency for the same is once in a season.

Green Belt Survey also been conducted in the Dock premises once in season.

Eko Pro Engineers Private Limited mobilized sampling team for conducting the Water, Noiseand Sediment in Haldia Dock Complex.

All the work was carried out by team and submitted the samples in lab.

We are very thankful to the official staff of Dock complex to support us and make this successfully happen. A big support of official staff we had at site to get the study and sample collection job done and gave us such type of opportunity.
The results and interpretation of study and monitoring is follows.

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2. Ambient Noise Quality

2.1 Selection of Monitoring Station

Ambient Noise Quality Monitoring stations were set up at twelve locations for the period once in month fromJuly to Sep 2020. The monitoring station were setup by filed visit, identify the source noise, sensitive location of the site and official discussion with the Haldia Dock Complex officials. The monitoring locations are given in **Table 2.1**

Table 2.1: Monitoring Station of Ambient Noise Quality

S.NO	STATION CODE	LOCATION	LATITUDE	LONGITUDE
1	NQ-1	Chrinjibpur OB Gate	22°03'08.89"N	88°05'47.98"E
2	NQ-2	GC Berth Main Gate	22°02'45.86"N	88°05'12.08"E
3	NQ-3	Jawahar Tower Main Gate	22°01'05.98"N	88°04'02.71"E
4	NQ-4	MBC Jetty / Floating Jetty	22°01'11.83"N	88°04'34.53"E
5	NQ-5	CJB Gate	22°03'01.71"N	88°05'53.14"E
6	NQ-6	Lock Gate	22°01'29.11"N	88°05'06.40"E
7	NQ-7	Marine House	22°01'31.80"N	88°05'17.26"E
8	NQ-8	Master Control	22°02'02.16"N	88°05'25.13"E
9	NQ-9	Port Hospital (Township)	22°01'25.96"N	88°03'44.03"E
10	NQ-10	Cluster 4/61 (Township)	22°01'06.30"N	88°03'38.53"E
11	NQ-11	DAV School (Township)	22°01'25.33"N	88°03'34.30"E
12	NQ-12	Gate No.4 (Township)	22°01'35.06"N	88°03'54.55"E

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Figure 2.1 Ambient Noise Quality Location

2.2 Sampling Methodology and Parameter Selection

Noise monitoring has been carried out with using sound level meter ((HTC SL 1352) at monthly basis, in monsoon season. (July–Sep., 2020). Noise level monitoring was carried out for 24 hours. Noise levels measured over a given period of time of interval, enable to describe scenario of noise using statistical techniques.

a) **Leq (d)**
b) **Leq(n)**
c) **L10**
d) **L50**
e) **L90**
f) **Lmax**
g) **Lmin**
h) **Ldn**

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- Lday : Average noise levels between 6.00 hrs to 22.00hrs.
- Lnight : Average noise levels between 22.00 hrs to 6.00hrs.

2.3. Sampling Techniques with Standards

The HTC make sound level meter was used to record the sound data and the model number of used device is SL 1352 i.e. designed on the basis of "Type 2" professional requirements. The instrument has a frequency weighting of "A" type and allows the user to select Slow or Fast mode of measurement. A built-in Data Logger can record all the important Sound Level parameters in Non-Volatile Flash memory for 24 hours making detailed field data collection very simple. Each record contains the observation of each second, with the detailed data, L_{EQ}, L_{MIN} and L_{MAX} and many others calculations also can be drawn. Sound Pressure Level and Sound Exposure Level (SEL) observed during the recording interval. A built-in Real Time Clock maintains a Date and Time stamp in the recorded data.

Noise survey is conducted in areas where noise exposure is likely to be maximum. Noise level refers to the level of sound. A noise survey involves measuring noise level at selected locations throughout an entire plant or sections to identify noisy areas. This is usually done with a sound level meter (SLM). A reasonably accurate sketch showing the locations of workers and noisy machines is drawn. Noise level measurements are taken at a suitable number of locations around the area. National Ambient Noise Quality Standards as per CPCB is given in Table 3.2 to compression with the observed results.

Table 2.1: Ambient Noise Quality Standards as per CPCB

Type of Area	Limits in dB(A) Leq*	
	Day Time	Night Time
Industrial Area	75	70
Commercial Area	65	55
Residential Area	55	45
Silence Zone	50	40

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*-dB (A) Leq denotes the time weighted average of the level sound in decibels on scale A which is relatable to human hearing

Source: Pollution Control Act, Rule and Notifications issued there under, by Pollution Control Law Series: PCLS/02/2006(Fifth Edition) of Central Pollution Control Board, January 2006, pp 926. Day and Night time shall mean from 6:00 a.m. to 10:00 p.m. and 10:00 p.m. to 6:00 a.m. respectively.

2.4 Analytical Result

Table 2.3: Location wise Noise Quality Results

S. No	Parameters	NQ-1 Chrinjib Pur Main Gate	NQ-2 GC Berth Main Gate	NQ-3 awahar Tower Main Gate	NQ-4 MBC Jetty / Floating Jetty	NQ-5 CJB Gate	NQ-6 Gate No. 4	NQ-7 Port House	NQ-8 Master Control	NQ-9 Port Hospital Township	NQ-10 DAV School	NQ-11 DAV School (Township)	NQ-12 Gate no.4 (Township)
1	Leq (d)	62.0	67.8	62.3	68.0	68.4	63.4	61.6	67.7	61.4	65.8	69.5	68.3
2	Leq(n)	52.3	53.6	52.4	56.0	53.3	50.8	51.8	52.6	51.8	54.3	51.7	53.8
3	L10	61.4	66.5	62.1	67.2	67.1	62.8	60.5	65.9	60.5	64.8	68.1	67.2
4	L50	59.4	58.7	58.1	63.7	59.2	60.4	58.8	63.4	57.2	59.4	64.0	63.5
5	L90	53.4	54.8	52.8	57.1	54.2	51.7	52.8	53.1	52.4	55.6	52.7	54.7
6	Lmax	70.8	76.8	80.2	81.6	77.3	70.5	74.6	75.3	71.8	76.1	79.8	77.8
7	Lmin	41.2	42.8	43.8	44.7	42.8	44.8	43.1	42.8	43.8	44.5	42.8	43.7
8	Ldn	57.2	57.5	57.4	62.0	58.3	58.2	57.3	62.4	56.6	58.7	63.0	62.7

2.5 Interpretation

In the study area, noise source was observed only by vehicular movement & construction activities. High wind velocity in the river front area is another major source for high sound level in the study area. Noise levels were observed below the CPCB standards for Ambient Noise Quality in day time &night time.

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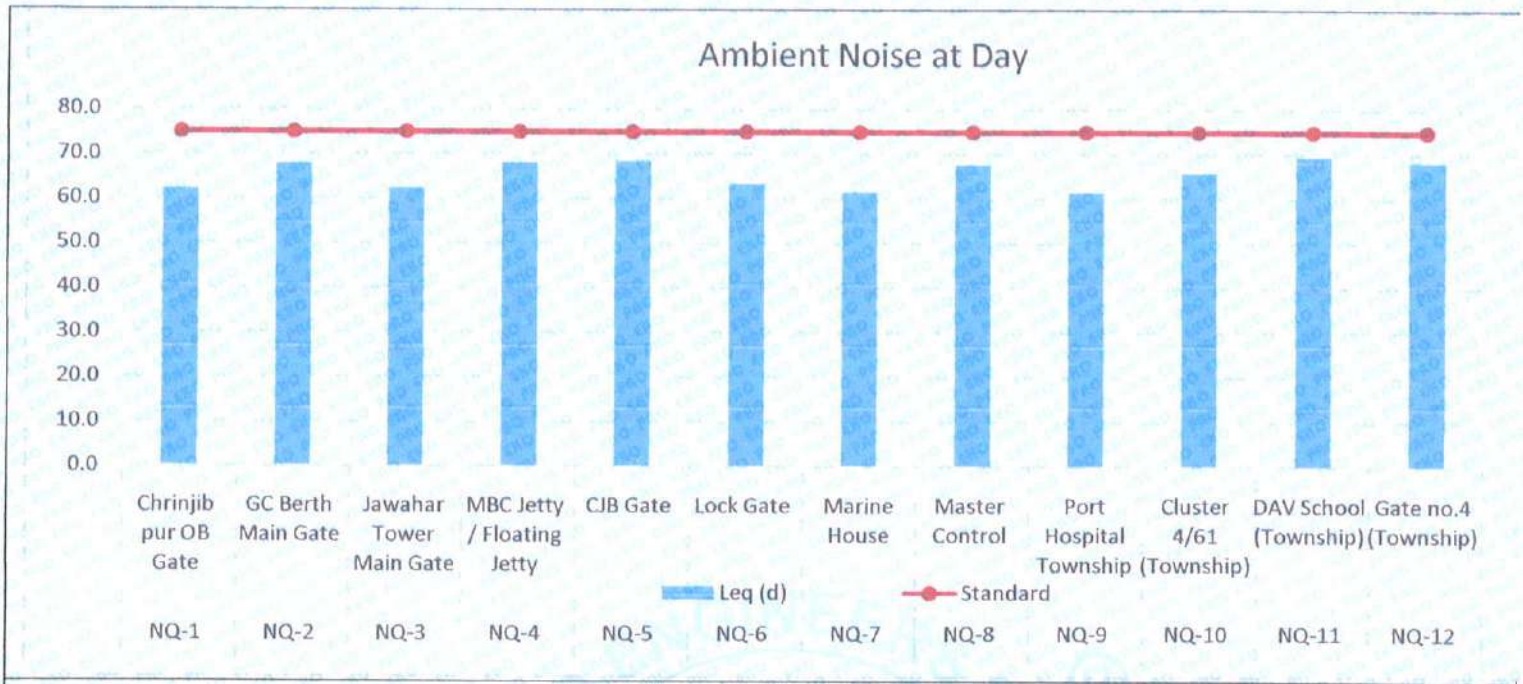

Fig: 2.2 Noise Quality in Day Time

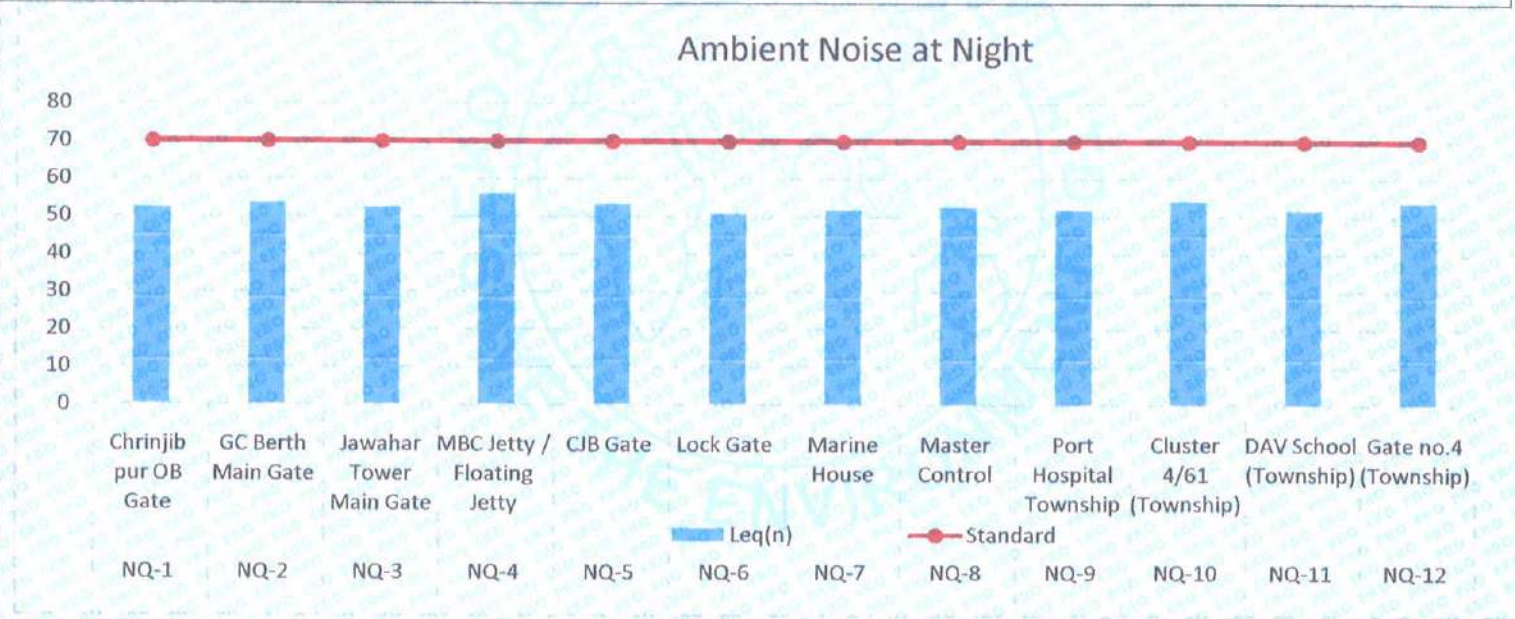

Fig:2.3 Noise Quality in Night Time

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2.6 Noise Quality Monitoring Site Photograph

N1: ChrinjibPur Main Gate

N2: GC Berth Main Gate Noise

N3: Jawahar Tower

N4: MBC Jetty

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N5: CJB gate	N6: Lock Gate
	
N7: Marine House	N8: Master Control

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N9: Port Hospital (Township)	N10: Cluster 4/61 (Township)
	
N11: DAV School (Township)	N12: Gate No. 4 (Township)

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3. Water Quality

3.1 Selection of Monitoring Station

Water Quality Monitoring stations were set up at four locations. The monitoring stations were setup by filed visit, sensitive location of the site and official discussion with the Haldia Dock Complex officials. The monitoring locations are given in **Table 3.1**

Table 3.1: Monitoring Station of Water Quality

S.No.	STATION CODE	LOCATION	LATITUDE	LONGITUDE
1	WQ-1	Near 1st Oil Jetty	22°01'55.32"N	88°06'03.16"E
2	WQ-2	Near 2nd Oil Jetty	22°01'43.42"N	88°05'50.88"E
3	WQ-3	Near 3rd Oil Jetty	22°01'02.13"N	88°04'32.26"E
4	WQ-4	Near Lock Gate	22°01'19.59"N	88°05'11.12"E

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Figure 3.1 Water Quality Location

3.2 Sampling Methodology and Parameter Selection

The parameter selections for the marine sediment quality are described below.

A. Physio-Chemical Parameters

- Colour
- Turbidity
- pH
- Electrical Conductivity (EC)
- Total Dissolve Solids (TDS)
- Total Suspended Solid (TSS)
- Floating matters
- Oil & Grease
- Petroleum Hydrocarbons
- Salinity

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- Alkalinity as $CaCO_3$
- Total Hardness as $CaCO_3$
- Calcium as Ca
- Magnesium as Mg
- Sodium as Na
- Potassium as K
- Chloride as Cl
- Sulphate as SO_4
- Nitrate as NO_3
- Flouride as F
- Phenolic compound as C_6H_5OH
- Cyanide
- Aluminium
- Arsenic
- Cadmium
- Chromium as Cr^{+6}
- Iron
- Copper
- Lead
- Manganese
- Mercury
- Zinc
- Dissolve Oxygen
- BOD, 27°C 3 days
- COD
- Total coliform

B. Biological Parameters

- Phytoplankton
- Zooplankton
- Shell Fishes
- Fin Fishes
- Chlorophyll Content
- Gross Primary Productivity
- Net Primary Productivity
- Community Respiration

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Marine water samples shall be collected at the rate of 2 samples per location (one sample at surface i.e. 0.3 meter depth and another sample form bottom (6 meter to 16 meter depth). Sampling for Marine water quality shall be conducted inside the protected water i.e., within break waters. The analysis of marine water for physico-chemical parameters as per the procedures specified in Standard Methods for the Examination of Water and Wastewater published by American Public Health Association (APHA) and Lab SOP-W/66. Samples for physico-chemical analysis were collected in polyethylene and glass bottle and preserved as per standard procedure. Samples collected for metal content were acidified with 1ml HNO_3.

Table 3.2: Sample Collection Procedure

S.No.	Parameter	Sample collection	Sample Size	Storage/ Preservation
1	pH, EC, TDS	Grab sampling Plastic container	50 ml	On site analysis
2	Other Physico-Chemical Parameters	Grab sampling Plastic glass container	2000 ml	As per SOP
3	Oil & Grease	Wide mouth glass container	500 ml	Add HCl to pH>2, refrigeration, 28 days
5	Cyanide	Grab sampling glass container	500 ml	As per SOP
6	BOD	Grab sampling glass container	1000 ml	Cooling between 2 to 5 degree
7	COD	Grab sampling plastic container	100 ml	Add HNO_3 to pH <2
8	Heavy Metals	Glass rinsed with 1+1 HNO_3	500 ml	HNO_3 to pH>2; Grab sample; 6 months
9	Biological Sample	Sterilized plastic container	500 ml	As per SOP

Plankton

Plankton samples were collected from the surface waters of the study areas by towing a plankton net (mouth diameter 0.35 m) made of bolting silk (No.25 mesh size 48 µm) for half an hour. These samples were preserved in 5% neutralized formalin and used for qualitative analysis. For the quantitative analysis

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of phytoplankton, the settling method described by Sukhanovo (1978) was adopted. Numerical plankton analysis was carried out using Utermohl's inverted plankton microscope

3.3 Analysis Technique

The analysis techniques were followed by Standard Methods for the Examination of Water and Wastewater published by American Public Health Association (APHA) and Lab SOP-W/66. After the analysis the results were compared as per the SW Class IV (CPCB). The instrument used for the above mention parameters are given below.

Table 3.3: Instrument Used

S. No.	Parameters	Instrument Used
1	pH	pH meter
2	Turbidity	Nephelo Meter
3	Conductivity (at 25^{0}C)	Conductivity meter
4	Total Dissolve Solids	Gravimetric
5	Alkalinity as $CaCO_3$	Titrimetric Method
6	Total Hardness as $CaCO_3$	TitrimetricMethod
7	Calcium as Ca	Titrimetric Method
8	Magnesium as Mg	Calculation
9	Sodium	Flame Photometric
10	Potassium	Flame Photometric
11	Chloride as Cl	Argentometric
12	Sulphate as SO_4	Turbidimetric
13	Nitrate as NO_3	Spectro photometric
14	Phosphate	Spectrophotometric
15	Fluoride as F	Spectrophotometric
16	Phenolic compound as C_6H_5OH	Spectrophotometric
17	Cyanide	Spectrophotometric/Spot test
18	Dissolve Oxygen	Winkler Method
19	Oil & Grease	Gravimetric
20	Heavy Metal	Induced Couple Plasma- Mass Spectro Meter (ICP-MS)
21	Total Coliform	MPN Method
22	Plankton Study	Microscope

Onsite Parameter Analyses

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pH, temperature and conductivity were analyzed at the time of sample collection. For dissolved oxygen, samples were collected in standard BOD bottle and fixed the oxygen by manganese oxide and alkaline iodide immediately after collection of the sample.

3.4Analytical Result and Interpretation

A. Physio-Chemical Parameters

S. No.	PARAMETERS	UOM	WQ-1 Near Ist Oil Jetty	WQ-2 Near 2nd Oil Jetty	WQ-3 Near 3rd Oil Jetty	WQ-4 Near Lock Gate	CPCB GUIDELINE (CLASS SW-IV)
			28.09.20	28.09.20	28.09.20	28.09.20	
(0.3 Meter Depth)							
1	Colour	Hazen	60	50	50	60	No Visible Colour
2	Turbidity	NTU	442	480	376	438	-
3	pH	-	7.64	7.88	7.7	7.92	6.5-9.0
4	Conductivity	µs/cm	5184	6418	7728	5244	-
5	Total Dissolved Solid	mg/l	3464	3744	4560	3470	-
6	Total Suspended Soilds	mg/l	588	738	638	384	-
7	Floating Matters	mg/l	0.24	0.28	0.20	0.20	10.0
8	Oil & Grease	mg/l	<4.0	<4.0	<4.0	<4.0	-
9	Petroleum Hydrocarbons	mg/l	<0.01	<0.01	<0.01	<0.01	-
10	Salinity	mg/l	4652	5126	5880	4868	-

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11	Alkalinity as CaCO3	mg/l	188	164	170	158	-
12	Total Hardness as CaCO3	mg/l	628	668	742	642	-
13	Calcium as Ca	mg/l	128	108	136	118.4	-
14	Magnesium as Mg	mg/l	75.0	96.9	97.9	84.3	-
15	Sodium as Na	mg/l	844	768	1048	924	-
16	Potassium as K	mg/l	48	34.4	62.4	48.2	-
17	Chloride as Cl	mg/l	1864	1722	2438	1960	-
18	Sulphate as SO4	mg/l	284.3	248.4	342.0	256.4	-
19	Nitrate as NO3	mg/l	5.44	8.41	7.18	7.66	-
20	Flouride as F	mg/l	1.08	1.34	1.84	1.44	-
21	Phenolic Compound as C6H5OH	mg/l	<0.001	<0.001	<0.001	<0.001	-
22	Cyanide	mg/l	<0.02	<0.02	<0.02	<0.02	-
23	Aluminium	mg/l	18.22	20.34	28.40	21.40	-
24	Arsenic	mg/l	0.013	0.019	0.048	0.061	-
25	Cadmium	mg/l	<0.005	<0.005	<0.005	<0.005	-
26	Chromium as Cr+6	mg/l	<0.05	<0.05	<0.05	<0.05	-
27	Iron	mg/l	28.66	36.40	30.18	11.64	-
28	Copper	mg/l	0.28	0.34	0.20	0.38	-
29	Lead	mg/l	0.08	0.18	0.11	0.16	-
30	Manganese	mg/l	1.42	1.30	1.48	1.04	-

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31	Mercury	mg/l	<0.005	<0.005	<0.005	<0.005	-
32	Zinc	mg/l	3.42	1.26	3.08	2.40	-
33	Dissolved Oxygen	mg/l	5.2	5.4	4.9	5.3	3.0
34	BOD, 27°C 3 Days	mg/l	6.6	5.4	5.2	4.4	5.0
35	COD	mg/l	38.0	19.2	38.0	19.2	-
36	Total Coliform	MPN/100ml	1700	1300	1600	1400	-

In the physico –chemical analysis of the marine water quality from 0.3 meter depth, the pH variation was found from 7.64 to 7.92, Conductivity is found from 5184 µs/cm to 7728µs/cm, Magnesium is found from 75.0 mg\l to 97.9 mg\l and Calcium is found from 108mg\l to 136 mg\l.

S. No.	PARAMETERS	UOM	WQ-1 Near Ist Oil Jetty	WQ-2 Near 2nd Oil Jetty	WQ-3 Near 3rd Oil Jetty	WQ-4 Near Lock Gate	CPCB GUIDELINES (CLASS IV)
			28.09.20	28.09.20	28.09.20	28.09.20	
(7 Meter Depth)							
1	Colour	Haze n	70	80	70	60	No visible colour
2	Turbidity	NTU	479	514	542	474	-
3	pH	-	7.77	7.68	7.99	7.82	6.5-9.0
4	Conductivity	µs/cm	6417	6396	8117	6520	-
5	Total Dissolved Solid	mg/l	3722	3774	4708	3864	-
6	Total Suspended Soilds	mg/l	592	722	688	256	-
7	Floating Matters	mg/l	0.35	0.46	0.32	0.48	10.0

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8	Oil & Grease	mg/l	<4.0	<4.0	<4.0	<4.0	-
9	Petroleum Hydrocarbons	mg/l	<0.01	<0.01	<0.01	<0.01	-
10	Salinity	mg/l	4822	4964	6412	4810	-
11	Alkalinity as CaCO3	mg/l	188	146	162	172	-
12	Total Hardness as CaCO3	mg/l	568	714	766	792	-
13	Calcium as Ca	mg/l	138.6	122.4	128.2	130.6	-
14	Magnesium as Mg	mg/l	53.16	97.92	106.92	111.72	-
15	Sodium as Na	mg/l	862	918	1094	846	-
16	Potassium as K	mg/l	56.0	44.8	62.2	56.8	-
17	Chloride as Cl	mg/l	1864	1708	2248	1688	-
18	Sulphate as SO4	mg/l	292.8	280.4	474.2	288.4	-
19	Nitrate as NO3	mg/l	7.18	8.12	8.58	8.92	-
20	Flouride as F	mg/l	1.34	1.77	1.2	1.86	-
21	Phenolic Compound as C6H5OH	mg/l	<0.001	<0.001	<0.001	<0.001	-
22	Cyanide	mg/l	Absent	Absent	Absent	Absent	-
23	Aluminium	mg/l	22.88	26.42	36.20	24.80	-
24	Arsenic	mg/l	0.019	0.021	0.032	0.076	-
25	Cadmium	mg/l	<0.005	<0.005	<0.005	<0.005	-
26	Chromium as Cr+6	mg/l	<0.05	<0.05	<0.05	<0.05	-

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27	Iron	mg/l	18.62	30.18	28.60	10.28	–
28	Copper	mg/l	0.16	0.22	0.30	0.24	–
29	Lead	mg/l	0.09	0.14	0.20	0.14	–
30	Manganese	mg/l	1.02	0.88	1.68	1.10	–
31	Mercury	mg/l	<0.001	<0.001	<0.001	<0.001	–
32	Zinc	mg/l	2.24	0.88	2.96	2.08	–
33	Dissolve Oxygen	mg/l	4.8	4.6	5.2	5.1	3.0
34	BOD, 27°C 3 Days	mg/l	6.8	5.4	5.5	6.0	5.0
35	COD	mg/l	38.4	18.4	19.2	36.8	–
36	Total Coliform	MPN/100ml	1700	1600	1400	1300	–

In the physico-chemical analysis of the marine water quality from 7 meter depth, the pH variation was found from 7.68 to 7.99, Conductivity is found from 6396 µs/cm to8117µs/cm, Magnesium is found from 53.16 mg\l to111.72mg\l and Calcium is found from 122.4 mg\l to 138.6 mg\l.

4. Marine Biological Parameters

S.NO.	PARAMETERS	UOM	WQ-1 Near Ist Oil Jetty	WQ-2 Near 2nd Oil Jetty	WQ-3 Near 3rd Oil Jetty	WQ-4 Near Lock Gate

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				28.09.20	28.09.20	28.09.20	28.09.20
1	**Phytoplankton**						
	1.	Coscinodiscuscentralis	Cells/l	996	1120	1208	2794
	2.	Dinophysiscaudata	Cells/l	1200	1044	953	820
	3.	Odontellaaurita	Cells/l	245	688	518	560
	4.	Triceratiumbroeckii	Cells/l	756	1310	428	735
	5.	Cerataulinapelagica	Cells/l	1024	465	498	208
	6.	Hemiaulussinensis	Cells/l	166	156	185	265
	7.	Ceratiumsp	Cells/l	1028	845	1054	810
	8.	Guinardiastriata	Cells/l	1141	812	866	386
	9.	Coscinodiscuswailesii	Cells/l	820	822	920	812
	10.	Coscinodiscus marginatus	Cells/l	100	180	150	112
	11.	Rhizosolenia sp	Cells/l	240	310	210	310
	12.	Lauderia annulata	Cells/l	1218	560	680	810
	13.	Achnanthessp	Cells/l	840	520	448	564
	14.	Striatella unipunctata	Cells/l	655	700	438	520
2	**Zooplankton**						
	1	Parvocalanussp	Org./m^3	182	120	152	208
	2	Centropagesorsini	Org./m^3	178	152	175	216
	3	Oithona nana	Org./m^3	208	52	98	108

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	4	Oithonasp	Org./m³	132	148	241	-
	5	Mysis larvae	Org./m³	46	-	22	18
	6	Oikopleura larvae	Org./m³	105	118	86	201
	7	Oithonaplumifera	Org./m³	126	126	98	82
	8	Centropagessp	Org./m³	156	145	132	125
	9	Copepod nauplii	Org./m³	-	155	182	152
	10	Calanopiaeliptica	Org./m³	130	154	132	98
	11	Dikopleura larvae	Org./m³	172	150	90	120
	12	Temora sp.	Org./m³	150	188	133	108
	13	Tintinnopsissp	Org./m³	72	92	-	80
	14	Calanopia sp	Org./m³	132	-	206	100
	15	Temoraturbinata	Org./m³	186	198	154	170
	16	Pseudodiaptomussp	Org./m³	102	92	104	132
3	**Shell Fishes**		Nos .	10	5	8	8
	Penaeus vannamei		Nos .	-	-	1	1
	Penaeus monodon		Nos .	2	1	-	-
	Penaeus semisulcatus		Nos .	1	-	2	-
	Penaeus indicus		Nos .	2	1	1	-
	Macrobrachium malcolmsonii		Nos .	1	1	2	2
	Macrobrachium rosenbergii		Nos .	1	1	2	1

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	Schylla serrata	Nos .	1	1	2	2
	Schylla tranquebarica	Nos .	2	1	3	2
4	**Fin Fishes**	Nos.	25	32	40	65
5	**Chlorophyll Content**	µg/L	0.29	0.43	0.45	0.38

4.1 Interpretation

A total number of 14 Phytoplankton species were found, out of which the higher number of Phytoplankton is Coscinodiscuswailesii and the lowest number of Phytoplankton is Coscinodiscus marginatus.

On the other hand, total 16 species were found of Zooplankton, out of which the higher number of Zooplankton is Oithonaspand the lowest number of Zooplankton is Mysis larvae.

Shell fishes and fin fishes were recorded during the marine biological survey carried out in the study area.

Addition, along with the above, the gross primary productivity is found 0.465 to.559 gcm^3/h. The net primary value is found 0.403 to 0.523 gcm^3/h. and community respiration is found from 0.036 to 0.062 gcm^3/h.

Light penetration is found in the study area and which is found low to moderate.

5. Marine Sediment Quality

5.1 Selection of Monitoring Station

Sediment Quality Monitoring stations were set up at four locations. The monitoring stations were setup by field visit, sensitive location of the site and official discussion with the Haldia Dock Complex officials. The monitoring locations are given in **Table 5.1**

Table 5.1 Sediment Quality Monitoring stations Location

S. No.	Station Code	Location Name	Latitude	Longitude
1	S 1	Near 1st Oil Jetty	22° 01'55.63"N	8'° 05'"8.27"E

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2	S 2	Near 2nd Oil Jetty	22° 01'46.05"N	8'° 05'"3.49"E
2	S 3	Near 3rd Oil Jetty	22° 01'03.26"N	8'° 04'"5.38"E
2	S 4	Near Lock Gate	22° 01'20.72"N	8'° 05'"6.04"E

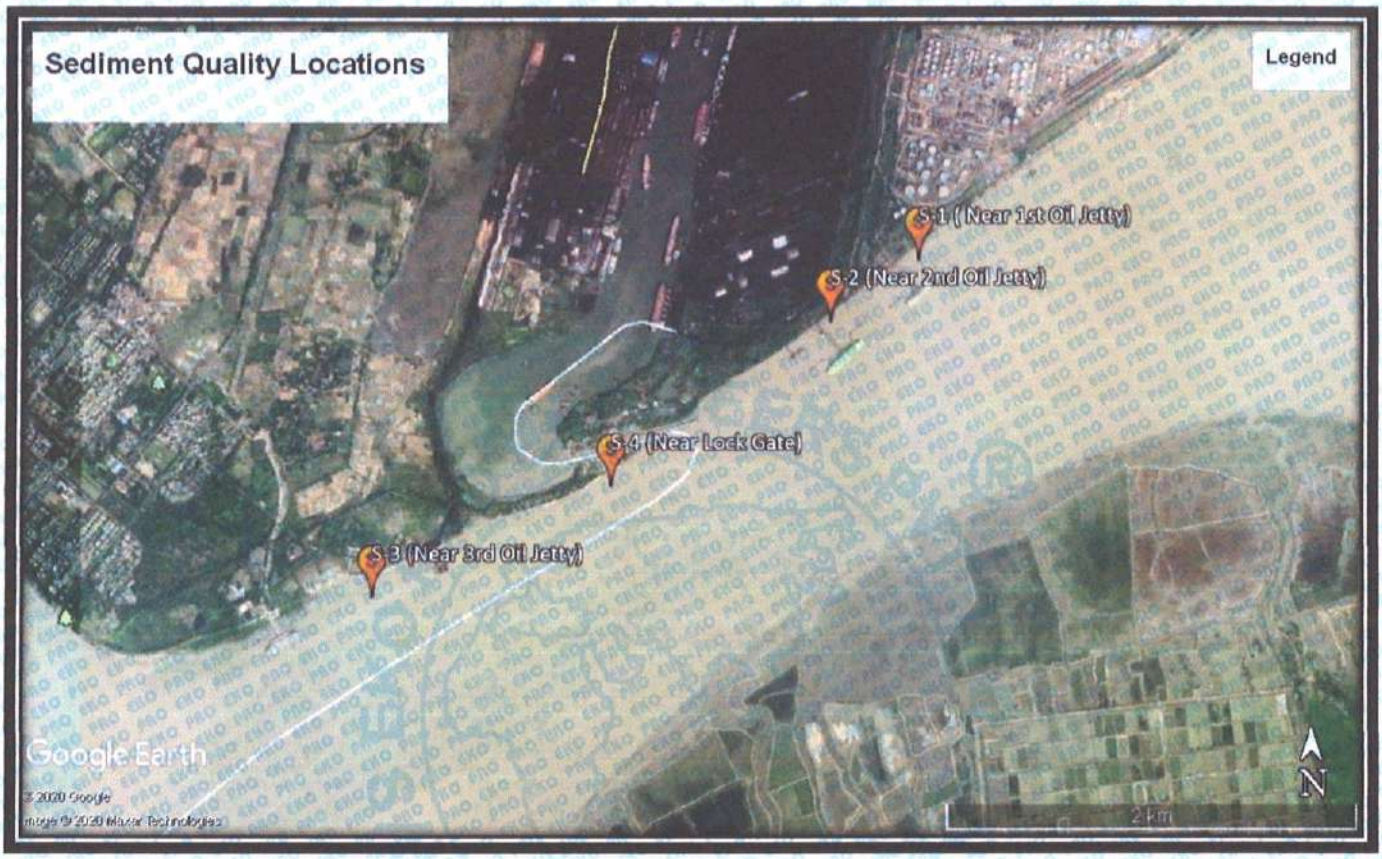

Figure 5.1 Sediment Quality Location

5.2 Sampling Methodology and Parameter Selection

The samples were collected and analyzed as per the procedures specified in Standard existing procedure. Sediment samples are collected as grab sampling procedure. The samples were collected using a Petersen grab sampler from bottom of the river. The collected samples were taken by a fresh plastic container and

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marked the lab code for physico-chemical analysis. The samples were taken into the laboratory and dry in normal temperature.

The biological analysis for microbenthic, meiobenthic and macrobenthic community structure, samples were also collected using a Petersen grab sampler and collected sample were taken in the sterilized plastic container.

The parameter selections for the marine sediment quality are described below.

A. Physio-Chemical Parameters

- Texture
- pH
- Sodium as Na
- Potassium as K
- Cadmium as Cd
- Copper as Cu
- Lead as Pb
- Zinc as Zn
- Magnesium as Mg
- Arsenic as As
- Phosphate as PO4
- Chloride as Cl
- Sulphate as SO4

B. Biological Parameters

- Meiobenthos
- Microbenthos
- Macrobenthos

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5.3 Analysis Technique

The samples were analyses in laboratory with the procedures of APHA 22nd Edition and SOP (Standard Operating Procedure) of the Laboratory. For the biological analysis the collected wet sediment samples are sieved with varying mesh sizes for segregating the organisms. Macrobenthos are organisms which are retained in the sieve having mesh size between 0.5 and 1 mm. The term meiofauna loosely defines a group of organisms by their size, larger than microfauna but smaller than macrofauna, rather than a taxonomic grouping. In practice, that is organisms that can pass through a 1 mm mesh but will be retained by a 45 µm mesh. Organisms below size of 45 µm are regarded as microbenthos. The sieved organisms are then stained with Rose Bengal and sorted into different groups. The number of organisms in each grab sample is expressed in number per meter square.

5.4 Analytical Result

A. Physico-chemical Parameter

S.NO.	PARAMETERS	UOM	S-1 Near Ist Oil Jetty	S-2 Near 2nd Oil Jetty	S-3 Near 3rd Oil Jetty	S-4 Near Lock Gate
			28.09.20	28.09.20	28.09.20	28.09.20
1	Texture	-	Silty Clay	Silty Clay	Silty Clay	Silty Clay
2	pH	-	7.34	7.72	7.65	7.77
3	Sodium as Na	mg/kg	958.0	1164.0	1194.0	1204.0
4	Potassium as K	mg/kg	422.0	722.0	780.0	740.6
5	Cadmium as Cd	mg/kg	<1.0	<1.0	<1.0	<1.0
6	Copper as Cu	mg/kg	<1.0	<1.0	<1.0	<1.0
7	Lead as Pb	mg/kg	<1.0	<1.0	<1.0	<1.0
8	Zinc as Zn	Mg/kg	2.72	2.65	2.82	2.04
9	Magnesium as Mg	Mg/kg	908.6	946.2	922.8	892.0

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10	Arsenic as As	Mg/kg	<1.0	<1.0	<1.0	<1.0
11	Phosphate as PO4	Mg/kg	198.5	212.9	202.6	198.2
12	Chloride as Cl	Mg/kg	637.3	720.8	676.2	660.4
13	Sulphate as SO4	Mg/kg	332.4	342.6	312.3	288.2

6.0 Marine Sediment Quality- Biological Parameters

S.NO.	PARAMETERS	UOM	WQ-1 Near Ist Oil Jetty	WQ-2 Near 2nd Oil Jetty	WQ-3 Near 3rd Oil Jetty	WQ-4 Near Lock Gate
			28.09.20	28.09.20	28.09.20	28.09.20
3	**Benthos**					
3.1	Capitellacapitata	Org./10 m^2	185	80	40	60
3.2	Neantheschingrighattensis	Org./10 m^2	88	49	51	20
3.3	Ceratonereis sp.	Org./10 m^2	90	80	80	110
3.4	Nepthyspolybranchia	Org./10 m^2	72	50	85	120
3.5	Perinereis sp.	Org./10 m^2	85	54	40	95
3.6	Notocirrusaustralis	Org./10 m^2	-	136	48	-
3.7	Nereiscapensis	Org./10 m^2	12	20	45	120
3.8	*Neanthes chingrighattensis*	Org./10 m^2	32	36	15	26

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3.9	*Notocirrus australis*	Org./10 m^2	130	-	153	162
3.10	*Nerita articulata*	Org./10 m^2	50	66	80	-
3.11	*Neritina cornucopia*	Org./10 m^2	270	133	202	-
3.12	*Neripteron rubicundus*	Org./10 m^2	220	115	90	-
3.13	*Littoraria vespacea*	Org./10 m^2	95	80	-	-
3.14	*Littoraria strigata*	Org./10 m^2	65	45	-	32
3.15	*Littoraria melanostoma*	Org./10 m^2	45	-	-	32
3.16	*Littoraria scabra*	Org./10 m^2	10	-	15	-
3.17	*Littoraria undulata*	Org./10 m^2	36	40	-	36
3.18	*Cerithidea cingulata*	Org./10 m^2	38	--	28	76
3.19	*Cerithidea obtusa*	Org./10 m^2	40	-	55	42
3.20	*Nodilittorina vidua*	Org./10 m^2	-	91	56	98
3.21	*Telescopium telescopium*	Org./10 m^2	32	-	44	-
3.22	*Bellamya contracta*	Org./10 m^2	25	-	65	-
3.23	*Barbitonia sp.*	Org./10 m^2	-	36	-	40
3.24	*Amaea acuminate*	Org./10 m^2	20	-	20	56
3.25	*Anadara granosa*	Org./10 m^2	15	21	--	18
3.26	*Crassostrea cuttackensis*	Org./10 m^2	40	46	-	50
3.27	*Crassostrea gryphoides*	Org./10 m^2	45	40	-	30
3.28	*Saccostrea cucullata*	Org./10	40	-	20	-

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		m^2				
3.29	*Enigmonia aenigmatica*	Org./10 m^2	42	33	-	
3.30	*Macoma birmanica*	Org./10 m^2	15	20	-	13
3.31	*Brachiopod*	Org./10 m^2	2	-	-	8
3.32	*ciliophora*	Org./10 m^2	1	4	6	-

6.1 Interpretation

As per the analysis of Biological parameters of Sediment quality, Benthos community found. The number of species which includes Meiobenthos, Microbenthos and Macrobenthos.

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