

GROUNDWATER QUALITY REPORT ASSESSMENT

FOR

MM PORT FZE ESIA

Executive Summary

The proposed project is located at the Federal Ocean Terminal (FOT) in Onne, Eleme Local government Area in Rivers State and the neighborhood of Bonny River. The ground water samples collected during wet season condition indicates slight acidity nature of water. The high electrical conductivity and TDS of the groundwater within the project site is attributed to increased ions and salinity concentrations due to intrusion from seawater. Ammonia, urea, total nitrogen and cyanide concentrations were not detected in ground water samples attributable to the absence of nitrogen yielding processes in the project environment. Dissolved oxygen is within permissible limit with BOD and COD having low concentrations indicates reduction in oxidizable matter. Heavy metals were also below regulatory limits except for Iron and Zinc. The level of the analyzed physicochemical properties shows that the ground water is portable.

Introduction

This work captures the Environmental and Social Impact Assessment (ESIA) study for the proposed MM Port FZE Project to be located at Federal Ocean Terminal (FOT), Onne Port Complex, Oil & Gas Free Zone, Onne in Eleme Government Area, Rivers State. The project is located on the bank of the Bonny River which opens into the Atlantic Ocean to the south. The Bonny River is the ocean line for the companies operating within the Onne Port. Groundwater is the water found under the sub surface, through soil, sand, and rock formations, moving slowly through all the geologic formations into the aquifer which is the ultimate reservoir of the water cycle. Heavy rains may cause the water table to rise, or heavy pumping of groundwater for domestic, irrigation and industrial supplies may cause the water table to fall. Groundwater is increasingly becoming a sensitive subject because its shared resource warranted the inclusion in the ESIA study of the project. The proposed project site is in an area with no particular environmental designation (not near a site with an international, national or local designation, such as a Special Area of Conservation, a Special Protection Area, a Ramsar site, or a Site of Special Scientific Interest).

Scope of study

The scope of work includes:

- Delineation of five (5) sampling stations and one (1) control stations.
- Sample collection and laboratory analysis.

Field Approach

The existing three borewells samples were collected on 5th- 6th July 2023, whereas the three groundwater samples were collected on the 22nd from newly drilled borewells at the project site.

- Groundwater samples were collected from borewells (two existing and three newly drilled) and one other borewell from Owo-ogono community which serves as control for the determination of groundwater quality.
- Prior to collecting the groundwater samples, each container was first rinsed with the water from the borehole. To avoid possible sources contamination each tap was sterilized using 70% alcohol (spirit).
- After sterilization the tap was allowed to flow for at least 5 minutes before sampling.
- Samples for physico-chemical parameters were collected into 1-liter polyethylene bottles. The bottles were previously washed and rinsed with distilled water and with some portion of the samples water prior to sampling. For heavy metal analysis, samples were collected into 1-liter pre-cleaned glass bottles and preserved by the addition of 2 ml AR grade concentrated nitric acid to pH <2.0. For Oil & grease and THC analysis, samples were collected into 1-liter pre-cleaned glass bottles and preserved by the addition of 2 ml concentrated Sulfuric acid. Microbiology- Samples were collected into 25 ml sterilized glass bottles. BOD - Samples were collected into 300 ml amber-colored BOD bottles.
- The grab sampling methodology was adopted to collect the samples.
- Collected samples were labelled and stored at 4°C ice chest on the field before transportation to the laboratory for further storage at 4°C.
- A field laboratory samples handling chain of custody was maintained for all groundwater samples.

In-situ measurements were carried out for pH, Temperature, Dissolved Oxygen (DO), Total Dissolved Solids (TDS), Electrical conductivity (EC) and Turbidity by using calibrated

instruments, (Jenway Model 430 for pH and Temperature, Hanna HI 98703 Portable Turbidity meter for Turbidity, Hanna HI 9835 for EC, TDS and Salinity, and Hanna HI 98186 for DO). The samples were preserved in ice-chest during transportation to the laboratory. Laboratory analysis was performed by M/s Anal Concept Limited, Port Harcourt, a FMEnv accredited laboratory. The laboratory analysis was witnessed by FMEnv representative. Chain of custody procedures including sample handling, transportation, logging and crosschecking in the laboratory were also performed.

Sampling Locations

Sampling design protocol was applied judgementally in the selection of study stations, taking into account ecological features, geographical location of communities and control points apparently of the project environs. Ground Water samples collected from five (5) sampling locations and one (1) control locations as shown on Table 1 and the sampling map is shown on Figure 1.

Table 1: Proposed sampling station

Station Code	Environmental Sphere	COORDINATES	
		LATITUDE	LONGITUDE
GW1	Ground water	4°40'12.24"N	7° 8'55.48"E
GW2	Ground water	4°40'52.65"N	7° 9'11.81"E
GW3	Ground water	4°40'20.97"N	7° 8'25.68"E
GW4	Ground water	4°40'03.15"N	7° 8'36.06"E
GW5	Ground water	4°40'14.84"N	7° 8'42.40"E
GWC1	Ground water	4°39'41.01"N	7° 9'21.21"E

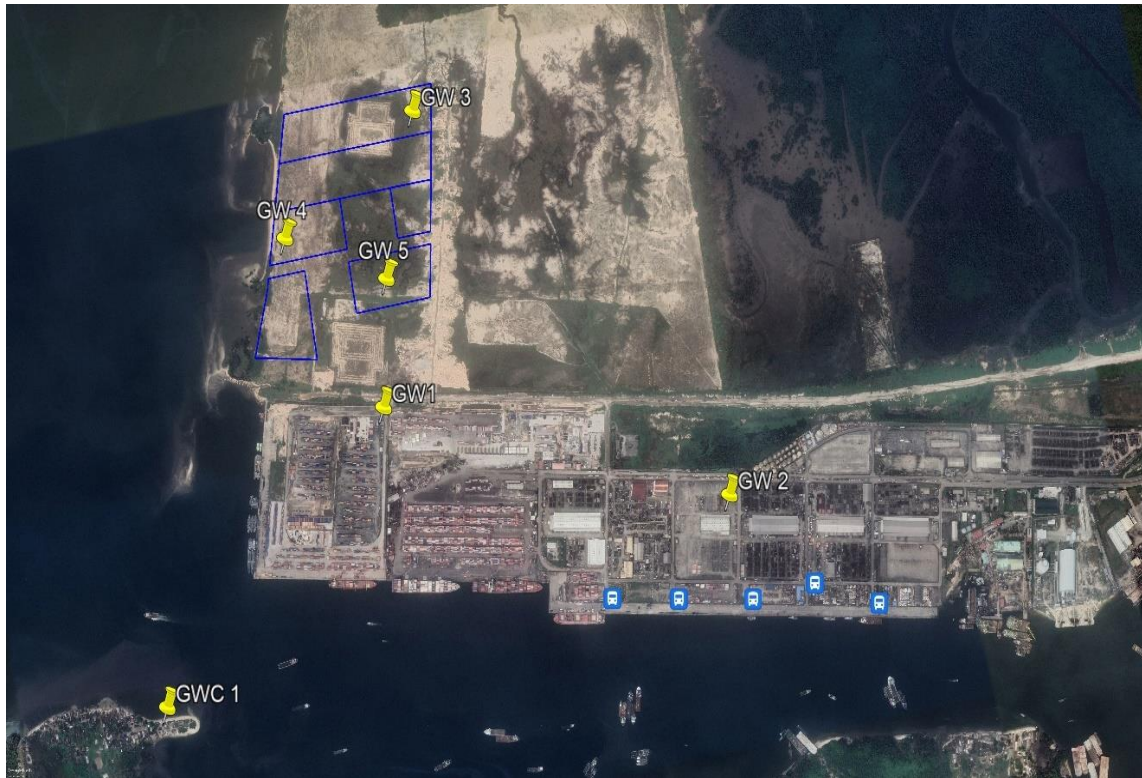


Figure 1: Groundwater sampling map

The assessment of the groundwater quality within the project area was conducted by sampling three existing boreholes (GW1-2) and three drilled boreholes on the project site (GW3-6), while the control is from the neighborhood community (GWC1). Groundwater chemistry is controlled by the chemistry of the infiltrating water, the chemistry of the porous media including the interstitial cement or matrix of the aquifer, the rate of groundwater flow and the permeability of the aquifer (Offodile, 2002).

Groundwater Physico-chemistry

The result of physicochemical characteristics ground water is presented in table 2 whereas the statistical summary is shown on Table 3. The groundwater quality comparison between regional and project site is shown in table 4.

Table 2: Groundwater analysis results

S/N	Parameter(s)	GW 1	GW 2	GW 3	GW 4	GW 5	GW C
1	pH	6.70	6.20	7.70	7.20	6.90	6.30
2	Temperature (°C)	27.6	27.6	27.7	27.8	27.6	26.8
3	Appearance	Clear	Clear	Clear	Clear	Clear	Clear
4	Elec. Conductivity (µs/cm)	663	89	2580	6320	1420	63
5	TDS (mg/l)	404	54	1420	3480	780	38
6	Turbidity (NTU)	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
7	TSS (mg/l)	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
8	Salinity (ppm)	38x10 ⁻⁸	4x10 ⁻⁸	1,897	10,062	1,482	3x10 ⁻⁸
9	Total Hardness (mg/l)	30.0	16.0	208.0	380.0	130.0	12.0
10	Alkalinity (mg/l)	12.0	6.0	20.0	24.0	16.0	8.0
11	Chloride, Cl ⁻ (mg/l)	58.0	18.0	380.0	702.0	230.0	14.0
12	Sulphate, SO ₄ ²⁻ (mg/l)	10.0	4.0	25.0	100.0	20.0	2.0
13	Nitrate, NO ₃ ⁻ (mg/l)	0.82	0.45	1.28	1.67	1.13	0.29
14	Phosphate, PO ₄ ³⁻ (mg/l)	0.15	0.16	1.20	1.45	0.75	0.13
15	Cyanide (mg/l)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
16	Ammonia (mg/l)	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
17	Urea	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
18	Total Nitrogen (mg/l)	0.23	<0.20	0.37	0.48	0.32	<0.20
19	Oil & Grease (mg/l)	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
20	DO (mg/l)	5.30	5.80	5.20	4.90	5.10	5.60
21	BOD ₅ (mg/l)	<1.00	<1.00	2.00	1.60	1.40	<1.00
22	COD (mg/l)	2.20	2.10	3.40	2.50	2.40	2.00
23	Sodium, Na (mg/l)	24.39	7.84	145.00	278.00	89.80	6.31
24	Potassium, K (mg/l)	16.81	2.73	52.80	109.70	31.80	2.56
25	Calcium, Ca (mg/l)	8.72	3.90	56.80	108.20	34.60	3.50
26	Magnesium, Mg (mg/l)	1.51	0.78	13.70	24.60	9.20	0.58
27	Silver, Ag (mg/l)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
28	Cobalt, Co (mg/l)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
29	Manganese, Mn (mg/l)	0.127	0.086	0.182	0.243	0.157	0.101
30	Vanadium, V (mg/l)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
31	Nickel, Ni (mg/l)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
32	Chromium, Cr (mg/l)	<0.001	0.012	0.025	0.038	0.017	0.016
33	Iron, Fe (mg/l)	0.125	0.108	0.246	0.295	0.119	0.137
34	Lead, Pb (mg/l)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
35	Copper, Cu (mg/l)	0.073	<0.001	0.084	0.097	0.065	0.092
36	Zinc, Zn (mg/l)	0.016	0.011	0.078	0.085	0.054	0.017
37	Mercury, Hg (mg/l)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
38	Cadmium, Cd (mg/l)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
39	Arsenic, As (mg/l)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
40	HUB (CFU/ml) x 10 ²	NIL	0.2	0.2	0.4	0.1	NIL
41	HUF (CFU/ml) x 10 ²	NIL	NIL	NIL	NIL	NIL	NIL

S/N	Parameter(s)	GW 1	GW 2	GW 3	GW 4	GW 5	GW C
42	THB (CFU/ml) x 10 ²	1.0	1.8	1.4	1.7	1.1	1.3
43	THF (CFU/ml) x 10 ²	NIL	NIL	NIL	NIL	NIL	NIL
44	SRB (MPN/100ml)	0	0	0	0	0	0
45	Fecal Coliform (MPN/100ml)	12	16	10	26	18	4
46	Total Coliform (MPN/100ml)	120	140	90	180	150	32

Table 3: Statistical analysis of Groundwater analysis result

Parameter	GW PROJECT AREA (GW1-GW10)		GW CONTROL (GW1)		DW Limit
	Range	Mean ± SD	Range	Mean ± SD	
<i>Colour (Pt-Co)</i>	Clear	-	Clear	-	
<i>pH</i>	6.20 – 7.70	6.984± 0.50	6.30	6.30 ± 0	6.5 – 8.5
<i>Temperature (°C)</i>	27.6 – 27.8	27.06 ± 0.08	26.8	26.8 ± 0	20-33
<i>Electrical Conductivity (µS/cm)</i>	89 – 6320	2214 ± 2215.6	63.0	63.0 ± 0	NS
<i>Total Dissolved Solids (mg/l)</i>	54 – 3480	1227 ± 1213.7	38.0	38.0± 0	NS
<i>Turbidity (NTU)</i>	<1.0	ND ± 0	<1.0	ND ± 0	NA
<i>Total Suspended Solids (mg/l)</i>	<1.0	ND ± 0	<1.0	ND ± 0	NS
<i>Salinity (ppt)</i>	0.04 – 0.38	0.21 ± 0.17	0.03	0.03 ± 0	NS
<i>Total Hardness (mg/l) (CaCO₃)</i>	16.0 – 380	152.0 ± 133.0	12.0	12.0 ± 0	NA
<i>Alkalinity (mg/l)</i>	6.0 – 24.0	15.60 ± 6.25	8.0	8.0 ± 0	NA
<i>Ammonia (mg/l)</i>	<0.10	ND ± 0	<0.10	ND ± 0	NS
<i>Urea (mg/l)</i>	<0.10	ND ± 0	<0.10	ND ± 0	NA
<i>Total Nitrogen (mg/l)</i>	<0.23 – 0.48	0.35 ± 0.16	<0.20	ND ± 0	NS
<i>Oil & Grease (mg/l)</i>	<1.00	ND ± 0	<1.00	ND ± 0	NA
<i>Dissolved Oxygen (mg/l)</i>	4.10 - 5.80	5.26 ± 0.34	5.60	5.60 ± 0	6.8
<i>Biological Oxygen Demand (mg/l)</i>	<1.00 – 2.00	1.67 ± 0.84	<1.00	ND ± 0	4.0
<i>Chemical Oxygen Demand (mg/l)</i>	2.10 – 3.40	2.52 ± 0.46	2.00	2.00 ± 0	4.0
<i>Chloride Ion (mg/l)</i>	18.0 – 702.0	277.6 ± 248.4	8.00	8.00 ± 0	NS
<i>Sulphate (mg/l)</i>	4.00 - 100	31.80 ± 34.9	14.0	14.0 ± 0	100
<i>Phosphate (mg/l)</i>	0.15 – 1.45	0.74 ± 0.53	0.13	0.13 ± 0	3.5

Parameter	GW PROJECT AREA (GW1-GW10)		GW CONTROL (GW1)		DW Limit
	Range	Mean \pm SD	Range	Mean \pm SD	
Nitrate (mg/l)	0.45 – 1.67	1.07 \pm 0.41	0.29	0.29 \pm 0	50
Sodium (mg/l)	7.84 – 278.0	109.6 \pm 97.59	6.31	6.31 \pm 0	120
Potassium (mg/l)	2.73 – 109.7	42.8 \pm 37.36	2.56	2.56 \pm 0	50
Calcium (mg/l)	3.90 – 108.2	42.4 \pm 37.99	3.50	3.50 \pm 0	180
Magnesium (mg/l)	0.78 – 24.6	9.96 \pm 8.77	0.58	0.58 \pm 0	40
Silver (mg/l)	<0.001	ND \pm 0	<0.001	ND \pm 0	NS
Cobalt(mg/l)	<0.001	ND \pm 0	<0.001	ND \pm 0	NS
Manganese (mg/l)	0.086 – 0.243	0.160 \pm 0.05	0.101	0.101 \pm 0	NS
Vanadium (mg/l)	<0.001	ND \pm 0	<0.001	ND \pm 0	NS
Nickel (mg/l)	<0.001	ND \pm 0	<0.001	ND \pm 0	0.01
Chromium (mg/l)	<0.001- 0.038	0.02 \pm 0.01	0.016	0.016 \pm 0	0.001
Iron (mg/l)	0.109 – 0.246	0.18 \pm 0.08	0.137	0.137 \pm 0	0.05
Lead (mg/l)	<0.001	ND \pm 0	<0.001	ND \pm 0	0.01
Copper (mg/l)	<0.001-0.097	0.08 \pm 0.03	0.092	0.092 \pm 0	0.01
Zinc (mg/l)	0.011 – 0.084	0.05 \pm 0.03	0.017	0.017 \pm 0	0.01
Mercury (mg/l)	<0.001	ND \pm 0	<0.001	ND \pm 0	0.001
Cadmium (mg/l)	<0.001	ND \pm 0	<0.001	ND \pm 0	0.01
Arsenic (mg/l)	<0.001	ND \pm 0	<0.001	ND \pm 0	0.05

Results and Discussion

Groundwater sampled had pH values ranging from 6.20 to 7.70 with an average value of 6.94, while the control sample was 6.30 with an average of 6.30. These values indicate that the water from the project site and its environs and control stations are slightly acidic. The result also shows elevated electrical conductivity mean values 2214.4 μ S/cm and increased concentration of

total dissolved solids (TDS) mean of 1227.6 mg/l in groundwater indicated possible intrusion of seawater. DO concentration was within acceptable limit which indicated reduction of oxidizable matters in the project site. Heavy metal concentrations are below detection limits except iron and zinc content which characteristic of groundwater in the Niger Delta region.

Table 4: Groundwater Quality comparison of Regional and Project Site

S/N	Parameter(s)	Range (GW1-2)	Mean	Std Dev	Range (GW3-5)	Mean	Std Dev
1	pH	6.20-6.70	6.45	0.35	6.90 - 7.70	7.27	0.4041
2	Temperature (°C)	27.6	27.60	0.00	27.6 - 27.8	27.70	0.10
3	EC (µS/cm)	89 -663	376.00	405.88	1420 - 6320	3440.00	2560.7
4	TDS (mg/l)	54 - 404	229.00	247.49	780 - 3480	1893.33	1410.9
5	Turbidity (NTU)	<1.0	<1.0	0.00	<1.0	<1.0	0.0
6	TSS (mg/l)	<1.0	<1.0	0.00	<1.0	<1.0	0.0
7	Total Hardness (mg/l)	16.0 - 30.0	23.00	9.90	130 - 380	239.33	127.91
8	Alkalinity (mg/l)	6.0 - 12.0	9.00	4.24	16.0 - 24.0	20.00	4.0
9	Chloride, Cl ⁻ (mg/l)	18.0 -58.0	38.00	28.28	230 - 702	437.33	241.17
10	Sulphate, SO ₄ ²⁻ (mg/l)	4.0 - 10.0	7.00	4.24	20.0 - 100	48.33	44.814
11	Nitrate, NO ₃ ⁻ (mg/l)	0.45 - 0.82	0.64	0.26	1.13 -1.67	1.36	0.2787
12	Phosphate, PO ₄ ³⁻ (mg/l)	0.15 -0.16	0.16	0.01	0.75 -1.45	1.13	0.3547
13	Cyanide (mg/l)	<0.001	<0.001	0.00	<0.001	<0.001	0.00
14	Ammonia (mg/l)	<0.001	<0.001	0.00	<0.001	<0.001	0.00
15	Urea	<0.001	<0.001	0.00	<0.001	<0.001	0.00
16	Total Nitrogen (mg/l)	<0.20 - 0.23	0.23	0.16	0.16 - 0.48	0.39	0.0819
17	Oil & Grease (mg/l)	<0.10	<0.10	0.00	<0.01	<0.10	0.00
18	DO (mg/l)	5.30 - 5.80	5.55	0.35	0.35 - 5.20	5.07	0.00
19	BOD ₅ (mg/l)	<1.0	<1.0	0.00	1.40 -2.00	1.67	0.00
20	COD (mg/l)	2.10 - 2.20	2.15	0.07	0.07 -3.40	2.77	0.5508
21	Sodium, Na (mg/l)	7.84 – 278.0	16.12	11.70	11.7 - 278.0	170.93	96.743
22	Potassium, K (mg/l)	2.73 -16.81	9.77	9.96	9.96 -109.7	64.77	40.305
23	Calcium, Ca (mg/l)	3.90 - 8.72	6.31	3.41	3.41 - 108.2	66.53	37.753
24	Magnesium, Mg (mg/l)	0.78	1.15	0.52	0.52 -24.60	15.83	7.9185
25	Silver, Ag (mg/l)	<0.001	<0.001	0.00	<0.001	<0.001	0.00
26	Cobalt, Co (mg/l)	<0.001	<0.001	0.00	<0.001	<0.001	0.00
27	Manganese, Mn (mg/l)	0.086 - 0.127	0.11	0.03	0.03 - 0.243	0.19	0.0442
28	Vanadium, V (mg/l)	<0.001	<0.001	0.00	<0.001	<0.001	0.00
29	Nickel, Ni (mg/l)	0.001	<0.001	0.00	0.001	<0.001	0.00
30	Chromium, Cr (mg/l)	<0.001-0.012	0.010	0.010	0.001	0.02	0.0106
31	Iron, Fe (mg/l)	0108-0.125	0.12	0.01	0.001-0.295	0.22	0.0908
32	Lead, Pb (mg/l)	<0.001	<0.001	0.00	<0.001	<0.001	0.00
33	Copper, Cu (mg/l)	<0.001-0.073	0.07	0.05	0.05 - 0.097	0.08	0.0161
34	Zinc, Zn (mg/l)	0.011-0.016	0.01	0.00	0.054 -0.085	0.07	0.0163
35	Mercury, Hg (mg/l)	<0.001	<0.001	0.00	<0.001	<0.001	0.00
36	Cadmium, Cd (mg/l)	<0.001	<0.001	0.00	<0.001	<0.001	0.00

A comparison of regional ground water (GW1-2) quality and the three (3) boreholes drilled (GW3-5) on site is shown on table 4 above. It revealed similar groundwater quality within the study area; however, minor differences were observed in total hardness, alkalinity and the ions having slightly higher concentrations in the newly drilled boreholes can be attributed to the depth of borehole and spread of the borehole locations around the coastal location.

Groundwater Availability

Groundwater is the water present beneath the earth surface in rocks and soil pore spaces and in the fractures of rocks formations. Global groundwater storage is roughly equal to the total amount of freshwater stored in snow and ice packs. The volume of groundwater can be estimated by measuring water levels in local wells and by examining geologic records from well drilling determinations.

Groundwater Uses

Groundwater in the study area is mainly used for domestic purposes such as drinking, cooking, bathing, and washing whereas a few industries operating in the area use the groundwater for industrial purposes. Groundwater use for irrigation in the study area is very limited because of fallow farming and prolonged raining season.

Impact Assessment

Possible impacts expected from the project will include:

- The possibility of groundwater contamination from accidental spills and improper disposal of excavated materials, wastewater and solid waste
- Infiltration of sanitary waste may also cause groundwater contamination.

Mitigation Measures

- The possible contamination of the ground by leakage of the pollutants should be dealt with by concreting to prevent infiltration.
- Groundwater monitoring well to be established.

APPENDIX

Calibration Certificates



152, Lagos Road
Ikoroju
Lagos
Tel: 07084594001, 07084594004
Email: aas@aasnig.com
Website:
<http://www.aasnig.com>

No: 2023/03/04/006

Certificate of Calibration Customer Information

Transparent Earth Nigeria Limited
13B/15A Road 2
Federal Housing Estate,
Off Agip Road, Rumueme,
Port Harcourt, Rivers

Instrument Identification

Description: Hanna Turbidity Meter Model: HI98703 Serial No: 00050671

Standards/Equipment Used

Description	Serial No.	Due Date	Traceable Reference
Formazine Standards	5119098	30/12/2024	Specific Primary Standard as per USEPA Method 180.1

Certificate Information

Engineer: Hakeem Owolabi Calibration Date: 04 March 2023 Calibration Due: 03 March 2024

Test Conditions

Temperature: 23.5°C
Relative Humidity: 64.5%

Calibration Data

Nominal Value	Measured Value	Tolerance	Error	Comments
20NTU	20.01	±0.5%	0.1	Passed
100NTU	100.3	2.0%	0.3	Passed
800NTU	800.6	2.0%	0.6	Passed

This instrument was calibrated using formazine primary turbidity standards as specified in USEPA Guidelines and methods 180.1 (1979). The calibration meets specification as outlined in ISO9001, ISO/IEC17025, ANSL/NCL 2540-1-1994 and applicable documents. The results contained herein relate to the item calibrated.

O.A. Adebola
QC Manager



152, Lagos Road
Ikoyi
Lagos
Tel: 07084594001, 07084594004
Email: aa@aaasia.com
Website: <http://www.aaasia.com>

Certificate of Calibration

No: 2023008012

Customer Information

Endpoint Laboratories and Equipments Ltd,
13B/15A, Road 2, Federal Housing Estate,
Off Agip Road, Rumueme,
Port Harcourt,
Rivers state.

Instrument Identification

Description: Portable pH Meter Model: PCS0 S/N: 761001001713100

Standards/Equipment Used

Description	Serial No	Due Date	Lot No
pH Buffer 4.00	19932601	06/2023	SO1004
pH Buffer 7.00	18258901	07/2024	SO1007
pH Buffer 10.00	SB116	11/2023	116555

Certificate Information

Engineer: Owolabi Hakeem Calibration Date: 27/02/2023 Calibration Due: 26/02/2024

Test Conditions:

Temperature: 23 °C
Relative Humidity: 58.0%

Calibration Data

Parameter	Nominal Value	Measured Value	Tolerance	Error	Comments
pH 4.0	4.00	4.01	±0.02	0.01	Passed
pH 7.0	7.00	7.02	±0.03	0.02	Passed
pH 10.0	10.00	10.2	±0.03	0.02	Passed

This instrument was calibrated using pH buffer solutions traceable to National Institute of Standards and Technology, NIST. The calibration meets specifications as outlined in ISO9001, ISO/IEC17025, ANSI/NCSL Z540-1-1994 and applicable documents. The results contained herein relate only to the item calibrated.

Owolabi Hakeem
Senior Technical Support Executive



152, Lagos Road
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Lagos
Tel: 07084594001, 07084594004
Email: aa@aastip.com
Website:
<http://www.aastip.com>

Certificate of Calibration

No: 2023/03/04/005

Customer Information

Transparent Earth Nigeria Limited
13B/15A Road 2
Federal Housing Estate,
Off Agip Road, Rumueme,
Port Harcourt, Rivers

Instrument Identification

Description: Hanna DO Meter Model: HI98193 S/N: 0031001101

Standards/Equipment Used

Description	Serial No.	Due Date	NIST Traceable Reference
Standard Zero Oxygen Solution	CZ00501052	09/11/2024	OEM Test Product

Certificate Information

Engineer: Hakeem Owolabi Calibration Date: 04 March 2023 Calibration Due: 03 March 2024

Test Conditions

Temperature: 24.0°C
Relative Humidity: 69.5%

Calibration Data

Nominal Value	Measured Value	Tolerance	Error	Comments
0.00	0.00	±0.01	0.00	Passed
100%	100%	±1.0%	0.00	Passed

This instrument was calibrated using the OEM's test method and materials. The calibration meets specifications as outlined in ISO9001, ISO/IEC17025, ANSI/NCSL Z540-1-1994 and applicable documents. The results contained herein relate only to the item calibrated.

O.A. Adebola
QC Manager