

FINAL ESIA REPORT

FOR

THE PROPOSED 20''x76KM NATURAL GAS PIPELINE PROJECT

FROM

**AGPC FACILITY IN OHAJI/EGBEMA LGA, IMO STATE TO
INDORAMA COMPLEX IN ELEME LGA, RIVERS STATE**

BY

**INDORAMA ELEME FERTILIZER & CHEMICALS LIMITED
INDORAMA COMPLEX, ELEME LGA,
RIVERS STATE, NIGERIA**

SUBMITTED TO

**FEDERAL MINISTRY OF ENVIRONMENT
FEDERAL SECRETARIAT
ABUJA, NIGERIA**

**VOLUME II
ANNEXURES**

MARCH 2025



FEDERAL MINISTRY OF ENVIRONMENT

Environment House

Independence Way South, Central Business District, Abuja - FCT.

Email: info@ead.gov.ng. www.ead.gov.ng, www.eia@ead.gov.ng

ENVIRONMENTAL ASSESSMENT DEPARTMENT

FMEEnv/EA/EIA/7236/Vol. 1/170

27th October 2023.

The Managing Director,
Indorama Eleme Fertilizer and Chemical Limited,
Indorama Complex,
East-West Expressway, Eleme,
Port Harcourt, Rivers State.

RE: SUBMISSION OF REVISED TERMS OF REFERENCE/SCOPE OF WORK FOR ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT (ESIA) OF THE PROPOSED 76KM NATURAL GAS PIPELINE PROJECT FROM ANOH GAS MANIFOLD IN ASSA NORTH LGA, IMO STATE TO INDORAMA COMPLEX, ELEME LGA, RIVERS STATE.

Please refer to your letter with Ref. No. NGLine/ENV/FMEEnv/2023/03 dated 23rd October, 2023 on the above proposed project.

2. Following the conclusion of the evaluation of the documents submitted, I am directed to inform you that the documents are adjudged good. Accordingly, you can proceed to the next stage of the EIA process, which is Data gathering exercise. Please, you are to notify the Ministry in good time to enable adequate participation in the exercise.
3. You may wish to contact the under signed on 08037869670 or Ladula H. D (08020910889) to confirm the receipt of this letter and for any clarification please.
4. Thank you for your cooperation.


Engr. Gomwalk, Celestine W. G
For: Honourable Minister



FEDERAL MINISTRY OF ENVIRONMENT

Environment House

Independence Way South, Central Business District, Abuja - FCT.

Email: info@ead.gov.ng. www.ead.gov.ng, www.eia@ead.gov.ng

ENVIRONMENTAL ASSESSMENT DEPARTMENT

FMEEnv/EA/EIA/7236/Vol. 1/68

12th October, 2023.

The Managing Director,
Indorama Eleme Fertilizer and Chemical Limited,
Indorama Complex,
East-West Expressway, Eleme,
Port Harcourt, Rivers State.

RE: ENVIRONMENTAL IMPACT ASSESSMENT (EIA) OF THE PROPOSED 76KM GAS PIPELINE FROM ANOH GAS MANIFOLD IN ASSA NORTH LGA, IMO STATE TO INDORAMA COMPLEX, ELEME LGA, RIVERS STATE.

Please refer to your letter with Reference Number: NGLine/ENV/FMEEnv/2023/01 dated 25th August, 2023 on the above proposed project.

2. Following the conclusion of the Site Verification exercise, I am directed to inform you that the Ministry has placed the project in Category One(1) with One (1) season baseline data gathering exercise in line with Best Practices.
3. You are required to conduct a scoping workshop exercise involving relevant stakeholder. Regulators from the Federal Ministry of Environment, Rivers and Imo States Ministry of Environment shall participate in the exercise. Furthermore, you are requested to submit to the Ministry the report of the exercise incorporating significant issues raised during the scoping exercise.
4. Please note that the baseline data gathering and laboratory analysis exercises shall be witnessed by officials of the Ministry. Furthermore, the laboratory analysis of the samples collected should be carried out in FMEEnv accredited Laboratory. Accordingly, you are to ensure full Quality Assurance/Quality Control (QA/QC) measures in line with standard practices and notify the Ministry in good time to enable adequate participation in these exercises.
5. The following should be forwarded to the Federal Ministry of Environment before the submission of the draft EIA report;
 - i. Evidence of laboratory accreditation with the Federal Ministry of Environment where the sample analysis shall be carried out.
 - ii. Chain of custody for the samples collected
 - iii. Certificate of sample analysis duly stamped and signed by the laboratory manager.
 - iv. Evidence of laboratory analysis witnessing by the Federal Ministry of Environment.
6. Upon completion of the EIA study, you are required to submit to the Ministry Five (5) hard and Two (2) electronic copies of the draft EIA report and also email a copy to eia@ead.gov.ng. And copyinfo@ead.gov.ng.
7. Thank you for your co-operation.

Dr. Musa gashau

For: Honourable Minister

ANNEXURE 4.1

AIR QUALITY & NOISE MONITORING RESULTS

10minutes Average Values - (ppm)															
AQ1															
Time (Mins)	SO2	NO2	CO	O3	CXHY	VOC	NH3	SPM	PM10	PM2.5	NOISE (dB) Day	WIND SPD (m/s)	WIND DIR	TEMP (Oc)	REL HM (%)
10mins	0.002	0.012	0.004	0.002	<0.001	<0.001	<0.001	0.096	0.063	0.020	61.2	1.3	NNE	27.4	74.5
10mins	0.000	0.013	0.002	0.003	<0.001	<0.001	<0.001	0.103	0.066	0.030	65.6	1.8	SE	29.3	75.4
10mins	0.002	0.014	0.002	0.012	<0.001	<0.001	<0.001	0.098	0.061	0.025	62.6	1.8	SE	29.3	69.8
10mins	0.000	0.012	0.004	0.002	<0.001	<0.001	<0.001	0.104	0.064	0.031	64.1	1.4	SSE	33.8	66.5
10mins	0.004	0.010	0.006	0.005	<0.001	<0.001	<0.001	0.094	0.062	0.025	61.2	1.3	SE	27.4	74.5
10mins	0.000	0.011	0.002	0.003	<0.001	<0.001	<0.001	0.097	0.061	0.032	62.6	1.8	SE	29.3	75.4
Avg (ppm)	0.001	0.012	0.003	0.005	<0.001	<0.001	<0.001	0.099	0.063	0.027	62.9	1.6		29.4	72.7
µg/M3	3.49	22.57	3.82	8.83	<0.001	<0.001	<0.001	98.67	62.83	27.17	62.9	1.6		29.4	72.7

AQ2															
Time (Mins)	SO2	NO2	CO	O3	CXHY	VOC	NH3	SPM	PM10	PM2.5	NOISE (dB) Day	WIND SPD (m/s)	WIND DIR	TEMP (Oc)	REL HM (%)
10mins	0.000	0.014	0.004	0.002	<0.001	<0.001	<0.001	0.097	0.060	0.027	63.2	1.7	SE	28.4	76.8
10mins	0.004	0.011	0.002	0.002	<0.001	<0.001	<0.001	0.099	0.062	0.026	64.2	1.9	ENE	27.4	75.8
10mins	0.000	0.019	0.000	0.022	<0.001	<0.001	<0.001	0.098	0.058	0.035	63.8	1.7	SSE	28.4	76.4
10mins	0.002	0.012	0.002	0.000	<0.001	<0.001	<0.001	0.105	0.063	0.031	62.5	1.3	SSW	29.6	76.7
10mins	0.000	0.011	0.004	0.002	<0.001	<0.001	<0.001	0.093	0.061	0.032	63.2	1.7	SSE	27.4	76.4
10mins	0.003	0.012	0.006	0.000	<0.001	<0.001	<0.001	0.102	0.061	0.031	62.5	1.2	SSE	31.8	67.8
Avg (ppm)	0.002	0.013	0.003	0.005	<0.001	<0.001	<0.001	0.099	0.061	0.030	63.2	1.6		28.8	75.0
µg/M3	3.93	24.77	3.44	9.16	<0.001	<0.001	<0.001	99.00	60.83	30.33	63.2	1.6		28.8	75.0

AQ3															
Time (Mins)	SO2	NO2	CO	O3	CXHY	VOC	NH3	SPM	PM10	PM2.5	NOISE (dB) Day	WIND SPD (m/s)	WIND DIR	TEMP (Oc)	REL HM (%)
10mins	0.002	0.013	0.004	0.002	BDL	BDL	BDL	0.082	0.053	0.029	52.1	1.8	ENE	30.7	70.4
10mins	0.000	0.016	0.006	0.003	BDL	BDL	BDL	0.089	0.056	0.033	50.9	1.4	SW	31.8	70.5
10mins	0.002	0.012	0.000	0.012	BDL	BDL	BDL	0.090	0.051	0.039	50.1	1.6	NNE	33.7	67.9
10mins	0.000	0.017	0.004	0.003	BDL	BDL	BDL	0.104	0.055	0.032	50.1	1.6	ENE	33.7	66.8
10mins	0.004	0.013	0.004	0.022	BDL	BDL	BDL	0.099	0.048	0.030	50.1	1.6	ENE	33.7	67.9
10mins	0.000	0.012	0.000	0.003	BDL	BDL	BDL	0.088	0.056	0.032	51.9	1.4	SW	30.8	70.5
Avg (ppm)	0.001	0.014	0.003	0.008	BDL	BDL	BDL	0.092	0.053	0.033	50.9	1.6		32.4	69.0
µg/M3	3.49	26.02	3.44	14.72	BDL	BDL	BDL	92.00	53.17	32.50	50.9	1.57		32.4	69.0

AQ4															
Time (Mins)	SO2	NO2	CO	O3	CXHY	VOC	NH3	SPM	PM10	PM2.5	NOISE (dB) Day	WIND SPD (m/s)	WIND DIR	TEMP (Oc)	REL HM (%)
10mins	0.002	0.011	0.000	0.004	<0.001	<0.001	<0.001	0.089	0.048	0.028	48.9	0.7	ENE	27.4	76.4
10mins	0.000	0.019	0.004	0.021	<0.001	<0.001	<0.001	0.086	0.049	0.031	53.3	2.6	SE	29.5	70.5
10mins	0.000	0.017	0.008	0.011	<0.001	<0.001	<0.001	0.099	0.053	0.033	48.3	1.4	SW	31.8	70.5
10mins	0.002	0.016	0.000	0.022	<0.001	<0.001	<0.001	0.105	0.053	0.032	54.3	1.6	NNW	30.6	73.6
10mins	0.000	0.012	0.005	0.000	<0.001	<0.001	<0.001	0.083	0.049	0.034	50.9	1.4	SW	31.3	70.5
10mins	0.004	0.017	0.004	0.000	<0.001	<0.001	<0.001	0.112	0.052	0.031	50.9	1.4	SW	31.8	70.5
Avg (ppm)	0.001	0.015	0.004	0.010	<0.001	<0.001	<0.001	0.096	0.051	0.032	51.1	1.5	0.0	30.4	72.0
µg/M3	3.49	28.84	4.01	18.98	<0.001	<0.001	<0.001	95.67	50.67	31.50	51.1	1.52		30.4	72.0

AQ5															
Time (Mins)	SO2	NO2	CO	O3	CXHY	VOC	NH3	SPM	PM10	PM2.5	NOISE (dB) Day	WIND SPD (m/s)	WIND DIR	TEMP (Oc)	REL HM (%)
10mins	0.000	0.018	0.002	0.004	<0.001	<0.001	<0.001	0.089	0.058	0.027	53.2	3.5	SE	28.4	72.6
10mins	0.004	0.012	0.005	0.006	<0.001	<0.001	<0.001	0.094	0.061	0.033	53.3	1.6	SSE	31.9	67.3
10mins	0.002	0.011	0.002	0.004	<0.001	<0.001	<0.001	0.104	0.066	0.036	48.3	3.5	SW	28.4	70.8
10mins	0.000	0.017	0.008	0.025	<0.001	<0.001	<0.001	0.103	0.071	0.032	51.3	2.6	NE	29.4	71.6
10mins	0.003	0.010	0.000	0.005	<0.001	<0.001	<0.001	0.099	0.068	0.031	50.9	2.6	N	29.4	70.1
10mins	0.000	0.016	0.005	0.005	<0.001	<0.001	<0.001	0.101	0.069	0.032	50.9	2.6	NNE	29.4	71.6
Avg (ppm)	0.002	0.014	0.004	0.008	<0.001	<0.001	<0.001	0.098	0.066	0.032	51.3	2.7		29.5	70.7
µg/M3	3.93	26.33	4.20	16.03	<0.001	<0.001	<0.001	98.33	65.50	31.83	51.3	2.7		29.5	70.7

AQ6															
Time (Mins)	SO2	NO2	CO	O3	CXHY	VOC	NH3	SPM	PM10	PM2.5	NOISE (dB) Day	WIND SPD (m/s)	WIND DIR	TEMP (Oc)	REL HM (%)
10mins	0.000	0.014	0.000	0.005	<0.001	<0.001	<0.001	0.092	0.063	0.032	53.8	1.8	NE	31.1	67.8
10mins	0.002	0.013	0.004	0.007	<0.001	<0.001	<0.001	0.100	0.064	0.030	50.2	1.6	ENE	28.6	69.6
10mins	0.002	0.017	0.006	0.000	<0.001	<0.001	<0.001	0.110	0.062	0.032	54.7	1.6	ENE	28.6	72.6
10mins	0.003	0.012	0.004	0.025	<0.001	<0.001	<0.001	0.090	0.061	0.034	50.7	1.6	ENE	30.1	69.8
10mins	0.000	0.013	0.002	0.005	<0.001	<0.001	<0.001	0.094	0.063	0.031	54.7	1.6	ENE	30.5	70.2
10mins	0.003	0.014	0.003	0.000	<0.001	<0.001	<0.001	0.108	0.062	0.032	50.2	2.5	SSE	31.2	69.4
Avg (ppm)	0.002	0.014	0.003	0.007	<0.001	<0.001	<0.001	0.099	0.063	0.032	52.4	1.8		30.0	69.9
µg/M3	4.36	26.02	3.63	13.74	<0.001	<0.001	<0.001	99.00	62.50	31.83	52.4	1.8		30.0	69.9

AQ7															
Time (Mins)	SO2	NO2	CO	O3	CXHY	VOC	NH3	SPM	PM10	PM2.5	NOISE (dB) Day	WIND SPD (m/s)	WIND DIR	TEMP (Oc)	REL HM (%)
10mins	0.002	0.016	0.002	0.002	<0.001	<0.001	<0.001	0.089	0.060	0.032	51.2	1.8	SSE	29.8	69.3
10mins	0.000	0.017	0.006	0.012	<0.001	<0.001	<0.001	0.102	0.066	0.034	51.2	1.8	SSE	30.6	69.3
10mins	0.000	0.016	0.000	0.001	<0.001	<0.001	<0.001	0.106	0.069	0.032	51.4	1.5	ENE	30.1	70.6
10mins	0.000	0.017	0.002	0.025	<0.001	<0.001	<0.001	0.100	0.062	0.033	50.2	1.8	SE	30.6	70.2
10mins	0.000	0.015	0.004	0.005	<0.001	<0.001	<0.001	0.094	0.063	0.031	50.4	1.8	SSE	30.6	69.9
10mins	0.003	0.012	0.002	0.004	<0.001	<0.001	<0.001	0.102	0.061	0.032	57.2	1.8	SSE	29.8	70.3
Avg (ppm)	0.001	0.016	0.003	0.008	<0.001	<0.001	<0.001	0.099	0.064	0.032	51.9	1.8		30.3	69.9
µg/M3	2.18	29.16	3.05	16.03	<0.001	<0.001	<0.001	98.83	63.50	32.33	51.9	1.8		30.3	69.9

AQ8															
Time (Mins)	SO2	NO2	CO	O3	CXHY	VOC	NH3	SPM	PM10	PM2.5	NOISE (dB) Day	WIND SPD (m/s)	WIND DIR	TEMP (Oc)	REL HM (%)
10mins	0.000	0.013	0.004	0.002	<0.001	<0.001	<0.001	0.090	0.061	0.032	53.6	1.8	S	29.8	70.3
10mins	0.002	0.018	0.000	0.001	<0.001	<0.001	<0.001	0.102	0.060	0.033	56.8	1.4	NNE	28.6	70.6
10mins	0.002	0.015	0.016	0.001	<0.001	<0.001	<0.001	0.110	0.061	0.032	51.2	1.2	NNE	28.6	72.2
10mins	0.002	0.011	0.000	0.025	<0.001	<0.001	<0.001	0.092	0.061	0.031	51.4	0.8	SE	30.4	67.3
10mins	0.000	0.014	0.000	0.006	<0.001	<0.001	<0.001	0.096	0.064	0.033	50.2	0.8	SE	29.8	71.2
10mins	0.003	0.016	0.012	0.002	<0.001	<0.001	<0.001	0.102	0.062	0.032	50.4	1.8	S	30.9	69.2
Avg (ppm)	0.002	0.015	0.005	0.006	<0.001	<0.001	<0.001	0.099	0.062	0.032	52.3	1.3		29.7	70.1
µg/M3	3.93	27.27	6.11	12.11	<0.001	<0.001	<0.001	98.67	61.50	32.17	52.3	1.30		29.7	70.1

AQ9															
Time (Mins)	SO2	NO2	CO	O3	CXHY	VOC	NH3	SPM	PM10	PM2.5	NOISE (dB) Day	WIND SPD (m/s)	WIND DIR	TEMP (Oc)	REL HM (%)
10mins	0.000	0.016	0.000	0.002	<0.001	<0.001	<0.001	0.084	0.053	0.030	54.5	1.3	SE	29.8	70.3
10mins	0.002	0.012	0.005	0.022	<0.001	<0.001	<0.001	0.089	0.051	0.035	54.9	1.4	SSE	30.4	70.4
10mins	0.000	0.016	0.008	0.004	<0.001	<0.001	<0.001	0.087	0.030	0.036	52.5	1.6	SE	29.8	71.3
10mins	0.004	0.012	0.005	0.012	<0.001	<0.001	<0.001	0.071	0.032	0.032	51.9	1.4	SSE	30.4	69.4
10mins	0.000	0.012	0.000	0.000	<0.001	<0.001	<0.001	0.069	0.033	0.032	52.5	1.2	SE	29.8	70.3
10mins	0.002	0.016	0.002	0.000	<0.001	<0.001	<0.001	0.072	0.031	0.031	56.9	1.9	NNE	31.9	69.6
Avg (ppm)	0.001	0.014	0.003	0.007	<0.001	<0.001	<0.001	0.079	0.038	0.033	53.9	1.5		30.4	70.2
µg/M3	3.49	26.33	3.82	13.09	<0.001	<0.001	<0.001	78.67	38.33	32.67	53.9	1.5		30.4	70.2

AQ10															
Time (Mins)	SO2	NO2	CO	O3	CXHY	VOC	NH3	SPM	PM10	PM2.5	NOISE (dB) Day	WIND SPD (m/s)	WIND DIR	TEMP (Oc)	REL HM (%)
10mins	0.000	0.009	0.005	0.004	<0.001	<0.001	<0.001	0.096	0.063	0.032	49.8	1.7	NE	30.7	69.8
10mins	0.002	0.011	0.005	0.000	<0.001	<0.001	<0.001	0.098	0.063	0.031	49.8	1.3	NNE	30.9	70.5
10mins	0.000	0.013	0.006	0.014	<0.001	<0.001	<0.001	0.089	0.064	0.031	49.8	1.3	NNE	30.9	70.5
10mins	0.003	0.016	0.000	0.004	<0.001	<0.001	<0.001	0.094	0.062	0.031	51.6	1.4	ENE	31.2	71.2
10mins	0.000	0.011	0.000	0.014	<0.001	<0.001	<0.001	0.097	0.063	0.033	49.8	1.3	NNE	30.9	70.5
10mins	0.002	0.016	0.003	0.000	<0.001	<0.001	<0.001	0.093	0.061	0.032	51.6	1.4	ENE	31.2	71.2
Avg (ppm)	0.001	0.013	0.003	0.006	<0.001	<0.001	<0.001	0.095	0.063	0.032	50.4	1.4	0.0	31.0	70.6
µg/M3	3.05	23.83	3.63	11.78	<0.001	<0.001	<0.001	94.50	62.67	31.67	50.4	1.4		31.0	70.6

AQ11															
Time (Mins)	SO2	NO2	CO	O3	CXHY	VOC	NH3	SPM	PM10	PM2.5	NOISE (dB) Day	WIND SPD (m/s)	WIND DIR	TEMP (Oc)	REL HM (%)
10mins	0.002	0.013	0.000	0.002	<0.001	<0.001	<0.001	0.119	0.061	0.037	49.8	1.8	SE	29.3	75.4
10mins	0.000	0.012	0.007	0.002	<0.001	<0.001	<0.001	0.121	0.063	0.035	51.6	1.3	NNE	27.4	74.5
10mins	0.002	0.011	0.012	0.006	<0.001	<0.001	<0.001	0.109	0.064	0.033	54.9	1.3	SE	27.4	70.6
10mins	0.004	0.012	0.000	0.022	<0.001	<0.001	<0.001	0.115	0.067	0.032	52.5	1.3	SE	27.4	74.5
10mins	0.002	0.016	0.008	0.012	<0.001	<0.001	<0.001	0.118	0.061	0.033	51.9	1.8	NE	29.3	75.4
10mins	0.000	0.017	0.000	0.002	<0.001	<0.001	<0.001	0.123	0.068	0.039	52.5	1.3	SE	27.4	74.5
Avg (ppm)	0.002	0.014	0.005	0.008	<0.001	<0.001	<0.001	0.118	0.064	0.035	52.2	1.5		28.0	74.2
µg/M3	4.36	25.39	5.15	15.05	<0.001	<0.001	<0.001	117.50	64.00	34.83	52.2	1.47		28.0	74.2

AQ12															
Time (Mins)	SO2	NO2	CO	O3	CXHY	VOC	NH3	SPM	PM10	PM2.5	NOISE (dB) Day	WIND SPD (m/s)	WIND DIR	TEMP (Oc)	REL HM (%)
10mins	0.002	0.022	0.002	0.001	<0.001	<0.001	<0.001	0.124	0.061	0.030	50.9	1.8	ENE	27.8	76.8
10mins	0.000	0.019	0.000	0.002	<0.001	<0.001	<0.001	0.119	0.066	0.031	52.5	1.7	SSE	28.4	76.4
10mins	0.002	0.015	0.002	0.004	<0.001	<0.001	<0.001	0.133	0.068	0.033	51.9	1.2	SSE	30.4	71.4
10mins	0.000	0.021	0.002	0.012	<0.001	<0.001	<0.001	0.122	0.071	0.037	52.7	1.7	SSE	27.4	76.4
10mins	0.004	0.017	0.028	0.022	<0.001	<0.001	<0.001	0.127	0.068	0.030	50.2	1.2	SSE	30.4	71.4
10mins	0.000	0.016	0.000	0.002	<0.001	<0.001	<0.001	0.117	0.066	0.037	49.2	1.7	ENE	29.4	73.4
Avg (ppm)	0.001	0.018	0.006	0.007	<0.001	<0.001	<0.001	0.124	0.067	0.033	51.2	1.6		29.0	74.3
µg/M3	3.49	34.49	6.49	14.07	<0.001	<0.001	<0.001	123.67	66.67	33.00	51.2	1.55		29.0	74.3

AQ13															
Time (Mins)	SO2	NO2	CO	O3	CXHY	VOC	NH3	SPM	PM10	PM2.5	NOISE (dB) Day	WIND SPD (m/s)	WIND DIR	TEMP (Oc)	REL HM (%)
10mins	0.002	0.018	0.000	0.001	<0.001	<0.001	<0.001	0.134	0.071	0.033	50.1	1.6	NNE	31.7	67.9
10mins	0.002	0.012	0.002	0.002	<0.001	<0.001	<0.001	0.139	0.073	0.034	52.1	1.8	ENE	30.7	70.4
10mins	0.000	0.017	0.000	0.002	<0.001	<0.001	<0.001	0.139	0.070	0.034	50.7	1.5	ENE	30.4	69.9
10mins	0.004	0.011	0.002	0.022	<0.001	<0.001	<0.001	0.140	0.073	0.037	52.1	1.8	ENE	30.7	70.4
10mins	0.000	0.012	0.002	0.003	<0.001	<0.001	<0.001	0.149	0.076	0.038	50.9	1.4	SW	31.8	70.5
10mins	0.000	0.017	0.028	0.021	<0.001	<0.001	<0.001	0.141	0.075	0.039	50.1	1.6	ENE	33.7	67.9
Avg (ppm)	0.001	0.015	0.006	0.009	<0.001	<0.001	<0.001	0.140	0.073	0.036	51.0	1.6		31.5	69.5
µg/M3	3.49	27.27	6.49	16.69	<0.001	<0.001	<0.001	140.33	73.00	35.83	51.0	1.62		31.5	69.5

AQ14															
Time (Mins)	SO2	NO2	CO	O3	CXHY	VOC	NH3	SPM	PM10	PM2.5	NOISE (dB) Day	WIND SPD (m/s)	WIND DIR	TEMP (Oc)	REL HM (%)
10mins	0.000	0.015	0.000	0.001	<0.001	<0.001	<0.001	0.144	0.071	0.033	53.2	2.7	NNW	29.4	72.5
10mins	0.002	0.017	0.002	0.002	<0.001	<0.001	<0.001	0.141	0.077	0.034	53.3	2.6	SE	29.5	72.5
10mins	0.002	0.011	0.012	0.024	<0.001	<0.001	<0.001	0.146	0.073	0.033	48.9	0.7	ENE	27.4	76.4
10mins	0.000	0.016	0.002	0.002	<0.001	<0.001	<0.001	0.145	0.073	0.032	50.3	1.6	NNW	31.6	73.6
10mins	0.000	0.016	0.022	0.012	<0.001	<0.001	<0.001	0.145	0.073	0.032	50.3	1.6	NNW	27.4	73.4
10mins	0.005	0.017	0.000	0.004	<0.001	<0.001	<0.001	0.146	0.073	0.033	52.3	0.7	ENE	27.4	76.4
Avg (ppm)	0.002	0.015	0.006	0.008	<0.001	<0.001	<0.001	0.145	0.073	0.033	51.4	1.7		28.8	74.1
µg/M3	3.93	28.84	7.25	14.72	<0.001	<0.001	<0.001	144.50	73.33	32.83	51.4	1.65		28.8	74.1

AQ15															
Time (Mins)	SO2	NO2	CO	O3	CXHY	VOC	NH3	SPM	PM10	PM2.5	NOISE (dB) Day	WIND SPD (m/s)	WIND DIR	TEMP (Oc)	REL HM (%)
10mins	0.000	0.019	0.000	0.002	<0.001	<0.001	<0.001	0.122	0.066	0.036	52.3	1.6	NE	27.8	70.6
10mins	0.000	0.018	0.002	0.004	<0.001	<0.001	<0.001	0.114	0.060	0.034	48.9	3.5	SSE	28.4	72.6
10mins	0.003	0.010	0.000	0.025	<0.001	<0.001	<0.001	0.126	0.061	0.037	50.3	2.6	NNE	29.4	69.8
10mins	0.006	0.012	0.015	0.012	<0.001	<0.001	<0.001	0.117	0.067	0.038	50.3	2.6	NE	30.7	68.1
10mins	0.000	0.016	0.005	0.004	<0.001	<0.001	<0.001	0.128	0.063	0.039	52.3	3.5	SSE	28.4	69.6
10mins	0.000	0.019	0.002	0.005	<0.001	<0.001	<0.001	0.121	0.066	0.033	52.9	1.2	SSE	30.4	68.6
Avg (ppm)	0.002	0.016	0.004	0.009	<0.001	<0.001	<0.001	0.121	0.064	0.036	51.2	2.5		29.2	69.9
µg/M3	3.93	29.47	4.58	17.01	<0.001	<0.001	<0.001	121.33	63.83	36.17	51.2	2.50		29.2	69.9

AQ16															
Time (Mins)	SO2	NO2	CO	O3	CXHY	VOC	NH3	SPM	PM10	PM2.5	NOISE (dB) Day	WIND SPD (m/s)	WIND DIR	TEMP (Oc)	REL HM (%)
10mins	0.002	0.015	0.004	0.004	<0.001	<0.001	<0.001	0.122	0.065	0.027	51.8	1.8	NE	30.1	67.8
10mins	0.000	0.014	0.000	0.002	<0.001	<0.001	<0.001	0.125	0.069	0.026	50.8	1.2	ENE	26.9	75.4
10mins	0.002	0.013	0.004	0.001	<0.001	<0.001	<0.001	0.131	0.067	0.028	54.7	1.6	ENE	30.1	69.8
10mins	0.002	0.017	0.004	0.023	<0.001	<0.001	<0.001	0.128	0.066	0.032	49.7	1.6	ENE	28.6	68.6
10mins	0.000	0.019	0.000	0.004	<0.001	<0.001	<0.001	0.123	0.063	0.027	51.8	1.8	NE	31.1	67.8
10mins	0.003	0.013	0.014	0.008	<0.001	<0.001	<0.001	0.125	0.069	0.029	50.7	1.6	ENE	30.8	68.7
Avg (ppm)	0.002	0.015	0.004	0.007	<0.001	<0.001	<0.001	0.126	0.067	0.028	51.6	1.6		29.6	69.7
µg/M3	3.93	28.53	4.96	13.74	<0.001	<0.001	<0.001	125.7	66.50	28.17	51.6	1.60		29.6	69.7

AQ17															
Time (Mins)	SO2	NO2	CO	O3	CXHY	VOC	NH3	SPM	PM10	PM2.5	NOISE (dB) Day	WIND SPD (m/s)	WIND DIR	TEMP (Oc)	REL HM (%)
10mins	0.000	0.017	0.000	0.001	<0.001	<0.001	<0.001	0.116	0.063	0.033	53.4	1.5	ENE	30.1	71.3
10mins	0.002	0.016	0.002	0.002	<0.001	<0.001	<0.001	0.119	0.060	0.032	49.2	1.8	SSE	29.8	69.3
10mins	0.003	0.015	0.002	0.012	<0.001	<0.001	<0.001	0.128	0.061	0.034	50.2	1.8	SSE	30.6	69.9
10mins	0.000	0.013	0.000	0.004	<0.001	<0.001	<0.001	0.134	0.063	0.039	53.4	1.5	NE	30.1	67.8
10mins	0.000	0.014	0.000	0.021	<0.001	<0.001	<0.001	0.138	0.065	0.038	51.4	1.5	NE	30.1	70.6
10mins	0.003	0.017	0.022	0.002	<0.001	<0.001	<0.001	0.136	0.067	0.034	54.2	1.8	SSE	30.6	69.9
Avg (ppm)	0.001	0.015	0.004	0.007	<0.001	<0.001	<0.001	0.129	0.063	0.035	52.0	1.7		30.2	69.8
µg/M3	3.49	28.84	4.96	13.74	<0.001	<0.001	<0.001	128.50	63.17	35.00	52.0	1.65		30.2	69.8

AQ18															
Time (Mins)	SO2	NO2	CO	O3	CXHY	VOC	NH3	SPM	PM10	PM2.5	NOISE (dB) Day	WIND SPD (m/s)	WIND DIR	TEMP (Oc)	REL HM (%)
10mins	0.000	0.012	0.000	0.001	<0.001	<0.001	<0.001	0.119	0.066	0.033	52.2	1.5	SSE	29.8	70.5
10mins	0.000	0.014	0.004	0.002	<0.001	<0.001	<0.001	0.116	0.061	0.035	53.6	1.8	S	30.9	68.9
10mins	0.002	0.014	0.014	0.012	<0.001	<0.001	<0.001	0.127	0.066	0.033	50.2	1.5	SE	30.2	68.4
10mins	0.002	0.015	0.000	0.021	<0.001	<0.001	<0.001	0.129	0.061	0.032	51.8	1.2	NNE	28.6	72.2
10mins	0.000	0.011	0.000	0.004	<0.001	<0.001	<0.001	0.121	0.063	0.038	53.7	0.9	SSE	29.5	70.2
10mins	0.002	0.019	0.014	0.011	<0.001	<0.001	<0.001	0.118	0.061	0.037	54.8	1.4	NNE	31.6	70.6
Avg (ppm)	0.001	0.014	0.005	0.009	<0.001	<0.001	<0.001	0.122	0.063	0.035	52.7	1.4		30.1	70.1
µg/M3	2.62	26.65	6.11	16.69	<0.001	<0.001	<0.001	121.67	63.00	34.67	52.7	1.38		30.1	70.1

AQ19															
Time (Mins)	SO2	NO2	CO	O3	CXHY	VOC	NH3	SPM	PM10	PM2.5	NOISE (dB) Day	WIND SPD (m/s)	WIND DIR	TEMP (Oc)	REL HM (%)
10mins	0.000	0.012	0.000	0.001	<0.001	<0.001	<0.001	0.124	0.070	0.033	47.6	1.8	SSE	29.5	73.5
10mins	0.000	0.011	0.012	0.002	<0.001	<0.001	<0.001	0.126	0.070	0.032	52.5	1.7	S	29.8	74.6
10mins	0.000	0.016	0.016	0.022	<0.001	<0.001	<0.001	0.129	0.073	0.033	52.5	1.3	SE	29.8	70.3
10mins	0.006	0.012	0.005	0.012	<0.001	<0.001	<0.001	0.121	0.071	0.033	51.9	1.4	SSE	30.4	70.4
10mins	0.000	0.016	0.000	0.003	<0.001	<0.001	<0.001	0.128	0.073	0.032	52.5	2.4	SE	29.8	71.3
10mins	0.002	0.026	0.002	0.011	<0.001	<0.001	<0.001	0.123	0.071	0.034	51.9	1.9	NNE	31.9	69.6
Avg (ppm)	0.001	0.016	0.006	0.009	<0.001	<0.001	<0.001	0.125	0.071	0.033	51.5	1.8		30.2	71.6
µg/M3	3.49	29.16	6.68	16.69	<0.001	<0.001	<0.001	125.17	71.33	32.83	51.5	1.75		30.2	71.6

AQ20															
Time (Mins)	SO2	NO2	CO	O3	CXHY	VOC	NH3	SPM	PM10	PM2.5	NOISE (dB) Day	WIND SPD (m/s)	WIND DIR	TEMP (Oc)	REL HM (%)
10mins	0.002	0.017	0.000	0.004	<0.001	<0.001	<0.001	0.121	0.063	0.032	49.8	1.3	NNE	30.9	70.5
10mins	0.000	0.013	0.016	0.001	<0.001	<0.001	<0.001	0.124	0.069	0.033	49.8	1.3	NNE	30.9	70.5
10mins	0.010	0.019	0.005	0.002	<0.001	<0.001	<0.001	0.131	0.068	0.030	51.6	1.4	ENE	31.2	69.2
10mins	0.000	0.012	0.005	0.014	<0.001	<0.001	<0.001	0.125	0.073	0.034	49.8	1.3	NNE	32.7	67.8
10mins	0.004	0.011	0.000	0.003	<0.001	<0.001	<0.001	0.134	0.065	0.039	51.6	1.4	ENE	31.2	71.2
10mins	0.000	0.019	0.000	0.021	<0.001	<0.001	<0.001	0.137	0.067	0.033	55.6	1.4	ENE	31.2	70.2
Avg (ppm)	0.003	0.015	0.004	0.008	<0.001	<0.001	<0.001	0.129	0.068	0.034	51.4	1.4		31.4	69.9
µg/M3	6.98	28.53	4.96	14.72	<0.001	<0.001	<0.001	128.67	67.50	33.50	51.4	1.4		31.4	69.9

AQ21															
Time (Mins)	SO2	NO2	CO	O3	CXHY	VOC	NH3	SPM	PM10	PM2.5	NOISE (dB) Day	WIND SPD (m/s)	WIND DIR	TEMP (Oc)	REL HM (%)
10mins	0.000	0.012	0.000	0.012	<0.001	<0.001	<0.001	0.093	0.043	0.038	52.6	1.6	SE	29.3	75.4
10mins	0.006	0.010	0.002	0.000	<0.001	<0.001	<0.001	0.075	0.028	0.035	51.4	1.8	SSE	29.3	75.4
10mins	0.000	0.012	0.016	0.002	<0.001	<0.001	<0.001	0.079	0.031	0.036	59.8	1.3	SSE	29.4	68.7
10mins	0.000	0.011	0.005	0.022	<0.001	<0.001	<0.001	0.072	0.028	0.032	51.2	1.3	SE	30.4	74.5
10mins	0.008	0.012	0.000	0.002	<0.001	<0.001	<0.001	0.068	0.022	0.034	52.3	1.3	SE	30.5	71.4
10mins	0.000	0.010	0.002	0.000	<0.001	<0.001	<0.001	0.067	0.023	0.032	50.8	1.3	SSE	30.4	70.5
Avg (ppm)	0.002	0.011	0.004	0.006	<0.001	<0.001	<0.001	0.076	0.029	0.035	53.0	1.4		29.9	72.7
µg/M3	6.11	21.00	4.77	12.43	<0.001	<0.001	<0.001	75.67	29.17	34.50	53.0	1.4		29.9	72.7

AQ22															
Time (Mins)	SO2	NO2	CO	O3	CXHY	VOC	NH3	SPM	PM10	PM2.5	NOISE (dB) Day	WIND SPD (m/s)	WIND DIR	TEMP (Oc)	REL HM (%)
10mins	0.000	0.012	0.000	0.002	<0.001	<0.001	<0.001	0.103	0.062	0.036	51.5	1.0	SSE	28.4	70.5
10mins	0.000	0.010	0.002	0.002	<0.001	<0.001	<0.001	0.092	0.058	0.033	53.2	1.7	SSE	28.4	76.4
10mins	0.003	0.012	0.016	0.002	<0.001	<0.001	<0.001	0.102	0.062	0.039	50.1	1.7	NE	28.4	70.3
10mins	0.000	0.021	0.005	0.012	<0.001	<0.001	<0.001	0.091	0.057	0.033	53.2	1.9	SS	27.4	76.4
10mins	0.006	0.013	0.000	0.000	<0.001	<0.001	<0.001	0.098	0.063	0.034	50.2	1.2	SE	30.4	71.4
10mins	0.000	0.015	0.002	0.022	<0.001	<0.001	<0.001	0.091	0.058	0.032	51.8	1.7	SSE	28.4	76.4
Avg (ppm)	0.002	0.014	0.004	0.007	<0.001	<0.001	<0.001	0.096	0.060	0.035	51.7	1.5		28.6	73.6
µg/M3	3.93	26.02	4.77	13.09	<0.001	<0.001	<0.001	96.17	60.00	34.50	51.7	1.53		28.6	73.6

AQ23															
Time (Mins)	SO2	NO2	CO	O3	CXHY	VOC	NH3	SPM	PM10	PM2.5	NOISE (dB) Day	WIND SPD (m/s)	WIND DIR	TEMP (Oc)	REL HM (%)
10mins	0.000	0.012	0.002	0.000	<0.001	<0.001	<0.001	0.095	0.059	0.032	50.1	1.6	NNE	30.4	70.2
10mins	0.000	0.012	0.000	0.022	<0.001	<0.001	<0.001	0.098	0.061	0.033	49.8	1.2	NNE	30.7	70.8
10mins	0.006	0.010	0.000	0.000	<0.001	<0.001	<0.001	0.091	0.066	0.031	48.9	1.6	NNE	31.6	67.9
10mins	0.002	0.016	0.015	0.022	<0.001	<0.001	<0.001	0.096	0.068	0.034	52.1	1.8	ENE	30.7	70.4
10mins	0.000	0.014	0.005	0.002	<0.001	<0.001	<0.001	0.092	0.063	0.033	50.7	1.5	ENE	30.4	69.9
10mins	0.005	0.011	0.000	0.002	<0.001	<0.001	<0.001	0.102	0.064	0.034	50.3	1.4	NE	30.4	71.6
Avg (ppm)	0.002	0.013	0.004	0.008	<0.001	<0.001	<0.001	0.096	0.064	0.033	50.3	1.5		30.7	70.1
µg/M3	5.67	23.51	4.20	15.70	<0.001	<0.001	<0.001	95.67	63.50	32.83	50.3	1.5		30.7	70.1

AQ24															
Time (Mins)	SO2	NO2	CO	O3	CXHY	VOC	NH3	SPM	PM10	PM2.5	NOISE (dB) Day	WIND SPD (m/s)	WIND DIR	TEMP (Oc)	REL HM (%)
10mins	0.000	0.013	0.000	0.004	<0.001	<0.001	<0.001	0.090	0.059	0.028	52.3	1.3	ENE	27.4	76.4
10mins	0.000	0.012	0.002	0.000	<0.001	<0.001	<0.001	0.091	0.063	0.025	53.3	2.6	SE	29.5	72.5
10mins	0.002	0.010	0.000	0.004	<0.001	<0.001	<0.001	0.095	0.064	0.028	50.9	1.4	SW	31.8	70.5
10mins	0.000	0.017	0.018	0.022	<0.001	<0.001	<0.001	0.104	0.067	0.034	50.9	1.4	SW	31.8	70.5
10mins	0.004	0.014	0.005	0.000	<0.001	<0.001	<0.001	0.103	0.065	0.035	50.9	1.4	SW	31.8	70.5
10mins	0.000	0.016	0.000	0.012	<0.001	<0.001	<0.001	0.097	0.065	0.029	49.8	1.6	NE	31.6	69.8
Avg (ppm)	0.001	0.014	0.004	0.007	<0.001	<0.001	<0.001	0.097	0.064	0.030	51.4	1.6		30.7	71.7
µg/M3	2.62	25.71	4.77	13.74	<0.001	<0.001	<0.001	96.67	63.83	29.83	51.4	1.6		30.7	71.7

AQ25															
Time (Mins)	SO2	NO2	CO	O3	CXHY	VOC	NH3	SPM	PM10	PM2.5	NOISE (dB) Day	WIND SPD (m/s)	WIND DIR	TEMP (Oc)	REL HM (%)
10mins	0.000	0.012	0.000	0.004	<0.001	<0.001	<0.001	0.090	0.064	0.033	48.9	2.6	NNE	29.4	71.6
10mins	0.000	0.013	0.003	0.005	<0.001	<0.001	<0.001	0.089	0.065	0.035	52.1	2.6	NNE	29.4	71.6
10mins	0.000	0.015	0.022	0.004	<0.001	<0.001	<0.001	0.099	0.064	0.032	50.7	3.5	SSE	28.4	76.6
10mins	0.006	0.010	0.000	0.025	<0.001	<0.001	<0.001	0.090	0.062	0.033	48.9	2.6	NNE	29.4	71.2
10mins	0.008	0.010	0.000	0.000	<0.001	<0.001	<0.001	0.096	0.067	0.032	52.1	2.6	NE	30.3	71.6
10mins	0.000	0.012	0.003	0.005	<0.001	<0.001	<0.001	0.090	0.068	0.034	50.7	1.3	NE	29.4	71.3
Avg (ppm)	0.002	0.012	0.005	0.007	<0.001	<0.001	<0.001	0.092	0.065	0.033	50.6	2.5		29.4	72.3
µg/M3	6.11	22.57	5.34	14.07	<0.001	<0.001	<0.001	92.33	65.00	33.17	50.6	2.5		29.4	72.3

AQ26															
Time (Mins)	SO2	NO2	CO	O3	CXHY	VOC	NH3	SPM	PM10	PM2.5	NOISE (dB) Day	WIND SPD (m/s)	WIND DIR	TEMP (Oc)	REL HM (%)
10mins	0.000	0.010	0.000	0.000	<0.001	<0.001	<0.001	0.096	0.063	0.032	50.8	1.2	ENE	30.7	68.1
10mins	0.002	0.012	0.004	0.002	<0.001	<0.001	<0.001	0.098	0.063	0.031	54.7	1.6	NE	29.4	71.6
10mins	0.004	0.017	0.002	0.000	<0.001	<0.001	<0.001	0.089	0.064	0.031	48.9	1.6	ENE	28.6	72.6
10mins	0.002	0.013	0.014	0.022	<0.001	<0.001	<0.001	0.097	0.063	0.034	52.1	1.6	ENE	28.6	72.6
10mins	0.000	0.016	0.004	0.012	<0.001	<0.001	<0.001	0.098	0.065	0.033	50.7	1.6	ENE	28.6	72.6
10mins	0.002	0.014	0.004	0.000	<0.001	<0.001	<0.001	0.094	0.062	0.031	54.7	1.6	ENE	28.6	72.6
Avg (ppm)	0.002	0.014	0.005	0.006	<0.001	<0.001	<0.001	0.095	0.063	0.032	52.0	1.5		29.1	71.7
µg/M3	4.36	25.71	5.34	11.78	<0.001	<0.001	<0.001	95.33	63.33	32.00	52.0	1.5		29.1	71.7

AQ27															
Time (Mins)	SO2	NO2	CO	O3	CXHY	VOC	NH3	SPM	PM10	PM2.5	NOISE (dB) Day	WIND SPD (m/s)	WIND DIR	TEMP (Oc)	REL HM (%)
10mins	0.000	0.014	0.002	0.000	<0.001	<0.001	<0.001	0.097	0.067	0.036	54.2	2.3	NE	29.6	69.2
10mins	0.004	0.012	0.000	0.012	<0.001	<0.001	<0.001	0.093	0.062	0.039	50.7	1.5	NE	30.1	68.3
10mins	0.000	0.011	0.000	0.000	<0.001	<0.001	<0.001	0.095	0.063	0.036	53.4	1.8	ENE	30.1	70.6
10mins	0.003	0.015	0.022	0.021	<0.001	<0.001	<0.001	0.097	0.062	0.031	50.4	1.8	SSE	30.6	69.9
10mins	0.000	0.017	0.002	0.014	<0.001	<0.001	<0.001	0.099	0.063	0.032	54.2	2.0	SE	30.6	70.2
10mins	0.003	0.015	0.000	0.002	<0.001	<0.001	<0.001	0.099	0.064	0.031	55.3	1.8	SE	30.6	69.9
Avg (ppm)	0.002	0.014	0.004	0.008	<0.001	<0.001	<0.001	0.097	0.064	0.034	53.0	1.9		30.3	69.7
µg/M3	4.36	26.33	4.96	16.03	<0.001	<0.001	<0.001	96.67	63.50	34.17	53.0	1.9		30.3	69.7

AQ28															
Time (Mins)	SO2	NO2	CO	O3	CXHY	VOC	NH3	SPM	PM10	PM2.5	NOISE (dB) Day	WIND SPD (m/s)	WIND DIR	TEMP (Oc)	REL HM (%)
10mins	0.000	0.014	0.000	0.002	<0.001	<0.001	<0.001	0.090	0.061	0.032	56.2	0.8	SE	31.2	71.2
10mins	0.002	0.013	0.000	0.014	<0.001	<0.001	<0.001	0.102	0.060	0.033	58.6	1.8	NNE	27.4	76.4
10mins	0.002	0.013	0.004	0.012	<0.001	<0.001	<0.001	0.110	0.061	0.032	58.6	1.8	S	29.8	70.3
10mins	0.000	0.015	0.000	0.022	<0.001	<0.001	<0.001	0.094	0.063	0.031	53.6	1.8	S	30.9	71.3
10mins	0.004	0.011	0.024	0.000	<0.001	<0.001	<0.001	0.099	0.062	0.032	52.8	1.4	NE	28.6	70.6
10mins	0.006	0.013	0.000	0.000	<0.001	<0.001	<0.001	0.092	0.061	0.031	51.8	1.4	NE	28.6	72.2
Avg (ppm)	0.002	0.013	0.005	0.008	<0.001	<0.001	<0.001	0.098	0.061	0.032	55.3	1.5		29.4	72.0
µg/M3	6.11	24.77	5.34	16.36	<0.001	<0.001	<0.001	97.83	61.33	31.83	55.3	1.5		29.4	72.0

AQ29															
Time (Mins)	SO2	NO2	CO	O3	CXHY	VOC	NH3	SPM	PM10	PM2.5	NOISE (dB) Day	WIND SPD (m/s)	WIND DIR	TEMP (Oc)	REL HM (%)
10mins	0.002	0.012	0.005	0.002	<0.001	<0.001	<0.001	0.102	0.066	0.034	51.9	1.4	SSE	30.4	70.4
10mins	0.000	0.016	0.000	0.000	<0.001	<0.001	<0.001	0.106	0.069	0.032	52.5	1.2	SE	29.8	71.3
10mins	0.002	0.014	0.000	0.012	<0.001	<0.001	<0.001	0.101	0.063	0.033	50.6	1.2	SE	29.8	70.3
10mins	0.000	0.013	0.015	0.000	<0.001	<0.001	<0.001	0.096	0.065	0.031	48.6	1.2	SE	29.8	70.3
10mins	0.004	0.015	0.000	0.022	<0.001	<0.001	<0.001	0.100	0.062	0.033	51.2	1.2	SE	30.2	69.8
10mins	0.002	0.012	0.005	0.002	<0.001	<0.001	<0.001	0.094	0.063	0.031	49.4	1.4	SSE	30.4	70.4
Avg (ppm)	0.002	0.014	0.004	0.006	<0.001	<0.001	<0.001	0.100	0.065	0.032	50.7	1.3		30.1	70.4
µg/M3	4.36	25.71	4.77	12.43	<0.001	<0.001	<0.001	99.83	64.67	32.33	50.7	1.3		30.1	70.4

AQ30															
Time (Mins)	SO2	NO2	CO	O3	CXHY	VOC	NH3	SPM	PM10	PM2.5	NOISE (dB) Day	WIND SPD (m/s)	WIND DIR	TEMP (Oc)	REL HM (%)
10mins	0.000	0.010	0.003	0.000	<0.001	<0.001	<0.001	0.100	0.064	0.030	50.6	1.3	NE	30.9	69.8
10mins	0.004	0.012	0.005	0.000	<0.001	<0.001	<0.001	0.098	0.066	0.032	48.3	1.3	NNE	29.4	70.5
10mins	0.002	0.010	0.002	0.024	<0.001	<0.001	<0.001	0.097	0.061	0.031	49.8	1.3	NNE	30.9	70.5
10mins	0.000	0.012	0.000	0.000	<0.001	<0.001	<0.001	0.110	0.062	0.032	51.6	1.4	ENE	31.2	71.2
10mins	0.000	0.010	0.015	0.000	<0.001	<0.001	<0.001	0.090	0.061	0.034	49.8	1.3	NNE	30.9	70.5
10mins	0.003	0.014	0.000	0.013	<0.001	<0.001	<0.001	0.094	0.063	0.031	51.6	1.4	ENE	31.2	71.2
Avg (ppm)	0.002	0.011	0.004	0.006	<0.001	<0.001	<0.001	0.098	0.063	0.032	50.3	1.3		30.8	70.6
µg/M3	3.93	21.32	4.77	12.11	<0.001	<0.001	<0.001	98.17	62.83	31.67	50.3	1.3		30.8	70.6

AQ31															
Time (Mins)	SO2	NO2	CO	O3	CXHY	VOC	NH3	SPM	PM10	PM2.5	NOISE (dB) Day	WIND SPD (m/s)	WIND DIR	TEMP (Oc)	REL HM (%)
10mins	0.000	0.018	0.002	0.000	<0.001	<0.001	<0.001	0.094	0.061	0.033	49.8	1.9	ENE	27.7	75.2
10mins	0.002	0.019	0.002	0.000	<0.001	<0.001	<0.001	0.104	0.066	0.036	51.6	1.8	SE	29.3	75.4
10mins	0.003	0.016	0.000	0.021	<0.001	<0.001	<0.001	0.095	0.063	0.032	49.8	0.8	NNE	28.2	74.2
10mins	0.004	0.014	0.012	0.000	<0.001	<0.001	<0.001	0.102	0.066	0.031	51.6	1.8	NE	29.3	75.4
10mins	0.000	0.012	0.000	0.022	<0.001	<0.001	<0.001	0.103	0.071	0.032	51.2	1.3	SE	27.4	74.5
10mins	0.002	0.013	0.002	0.000	<0.001	<0.001	<0.001	0.099	0.068	0.031	52.6	1.8	SE	29.3	75.4
Avg (ppm)	0.002	0.015	0.003	0.007	<0.001	<0.001	<0.001	0.100	0.066	0.033	51.1	1.57		28.5	75.0
µg/M3	4.80	28.84	3.44	14.07	<0.001	<0.001	<0.001	99.50	65.83	32.50	51.1	1.57		28.5	75.0

AQ32															
Time (Mins)	SO2	NO2	CO	O3	CXHY	VOC	NH3	SPM	PM10	PM2.5	NOISE (dB) Day	WIND SPD (m/s)	WIND DIR	TEMP (Oc)	REL HM (%)
10mins	0.000	0.016	0.000	0.000	<0.001	<0.001	<0.001	0.090	0.053	0.033	53.4	1.5	ENE	28.6	74.8
10mins	0.002	0.017	0.012	0.000	<0.001	<0.001	<0.001	0.090	0.051	0.035	49.8	1.3	SSW	29.6	76.7
10mins	0.000	0.014	0.000	0.026	<0.001	<0.001	<0.001	0.089	0.053	0.032	51.6	1.7	SSE	27.4	76.4
10mins	0.004	0.013	0.002	0.002	<0.001	<0.001	<0.001	0.089	0.053	0.032	51.2	1.2	SSE	30.4	71.4
10mins	0.000	0.016	0.012	0.012	<0.001	<0.001	<0.001	0.087	0.049	0.034	53.2	1.7	ENE	29.4	73.4
10mins	0.002	0.011	0.000	0.000	<0.001	<0.001	<0.001	0.087	0.052	0.031	54.2	1.2	SSE	30.6	70.2
Avg (ppm)	0.001	0.015	0.004	0.007	<0.001	<0.001	<0.001	0.089	0.052	0.033	52.2	1.43		29.3	73.8
µg/M3	3.49	27.27	4.96	13.09	<0.001	<0.001	<0.001	88.67	51.83	32.83	52.2	1.43		29.3	73.8

AQ33															
Time (Mins)	SO2	NO2	CO	O3	CXHY	VOC	NH3	SPM	PM10	PM2.5	NOISE (dB) Day	WIND SPD (m/s)	WIND DIR	TEMP (Oc)	REL HM (%)
10mins	0.000	0.016	0.003	0.000	<0.001	<0.001	<0.001	0.102	0.062	0.036	53.3	2.6	SE	29.5	72.5
10mins	0.002	0.014	0.000	0.002	<0.001	<0.001	<0.001	0.097	0.058	0.035	52.1	1.8	ENE	30.7	70.4
10mins	0.002	0.020	0.000	0.003	<0.001	<0.001	<0.001	0.098	0.063	0.031	50.9	1.4	SW	31.8	70.5
10mins	0.000	0.016	0.012	0.033	<0.001	<0.001	<0.001	0.097	0.061	0.032	50.9	1.4	SW	31.8	70.5
10mins	0.002	0.012	0.000	0.012	<0.001	<0.001	<0.001	0.098	0.062	0.032	50.7	1.5	ENE	30.4	76.9
10mins	0.004	0.011	0.012	0.003	<0.001	<0.001	<0.001	0.096	0.061	0.031	51.9	1.4	SW	30.8	70.5
Avg (ppm)	0.002	0.015	0.005	0.009	<0.001	<0.001	<0.001	0.098	0.061	0.033	51.6	1.68		30.8	71.9
µg/M3	4.36	27.90	5.15	17.34	<0.001	<0.001	<0.001	98.00	61.17	32.83	51.6	1.68		30.8	71.9

AQ34															
Time (Mins)	SO2	NO2	CO	O3	CXHY	VOC	NH3	SPM	PM10	PM2.5	NOISE (dB) Day	WIND SPD (m/s)	WIND DIR	TEMP (Oc)	REL HM (%)
10mins	0.002	0.018	0.000	0.004	<0.001	<0.001	<0.001	0.100	0.066	0.030	52.3	1.6	ENE	27.4	76.4
10mins	0.002	0.016	0.005	0.004	<0.001	<0.001	<0.001	0.098	0.061	0.033	54.7	1.4	NE	28.6	72.2
10mins	0.002	0.015	0.005	0.000	<0.001	<0.001	<0.001	0.099	0.064	0.031	53.3	2.6	SE	32.4	72.5
10mins	0.000	0.016	0.022	0.022	<0.001	<0.001	<0.001	0.098	0.062	0.032	54.3	1.6	NNW	27.4	73.4
10mins	0.002	0.014	0.000	0.014	<0.001	<0.001	<0.001	0.097	0.061	0.032	52.3	0.7	ENE	27.4	76.4
10mins	0.000	0.016	0.000	0.002	<0.001	<0.001	<0.001	0.095	0.058	0.033	45.9	1.6	NNW	31.6	73.6
Avg (ppm)	0.001	0.016	0.005	0.008	<0.001	<0.001	<0.001	0.098	0.062	0.032	52.1	1.58		29.1	74.1
µg/M3	3.49	29.78	6.11	15.05	<0.001	<0.001	<0.001	97.83	62.00	31.83	52.1	1.58		29.1	74.1

AQ35															
Time (Mins)	SO2	NO2	CO	O3	CXHY	VOC	NH3	SPM	PM10	PM2.5	NOISE (dB) Day	WIND SPD (m/s)	WIND DIR	TEMP (Oc)	REL HM (%)
10mins	0.000	0.017	0.003	0.004	<0.001	<0.001	<0.001	0.102	0.068	0.030	51.2	3.5	SSE	28.4	68.6
10mins	0.002	0.016	0.005	0.002	<0.001	<0.001	<0.001	0.099	0.063	0.032	68.8	2.6	NNE	29.4	71.6
10mins	0.003	0.012	0.005	0.012	<0.001	<0.001	<0.001	0.108	0.071	0.033	54.7	2.6	NE	30.7	68.1
10mins	0.000	0.016	0.002	0.024	<0.001	<0.001	<0.001	0.111	0.073	0.034	53.3	3.5	SSE	28.4	68.6
10mins	0.004	0.014	0.005	0.000	<0.001	<0.001	<0.001	0.108	0.065	0.039	54.3	2.6	SE	32.7	68.1
10mins	0.000	0.016	0.015	0.014	<0.001	<0.001	<0.001	0.104	0.067	0.033	56.2	3.5	SSE	30.4	68.6
Avg (ppm)	0.002	0.015	0.006	0.009	<0.001	<0.001	<0.001	0.105	0.068	0.034	56.4	3.05		30.0	68.9
µg/M3	3.93	28.53	6.68	18.32	<0.001	<0.001	<0.001	105.33	67.83	33.50	56.4	3.05		30.0	68.9

AQ36															
Time (Mins)	SO2	NO2	CO	O3	CXHY	VOC	NH3	SPM	PM10	PM2.5	NOISE (dB) Day	WIND SPD (m/s)	WIND DIR	TEMP (Oc)	REL HM (%)
10mins	0.000	0.016	0.000	0.004	<0.001	<0.001	<0.001	0.110	0.070	0.036	57.8	1.8	NE	30.1	67.8
10mins	0.002	0.017	0.013	0.000	<0.001	<0.001	<0.001	0.110	0.073	0.033	52.7	1.6	ENE	28.6	72.6
10mins	0.000	0.014	0.000	0.014	<0.001	<0.001	<0.001	0.110	0.071	0.035	49.8	1.8	NE	30.1	67.8
10mins	0.004	0.015	0.000	0.016	<0.001	<0.001	<0.001	0.113	0.073	0.036	50.8	1.8	NE	30.1	67.8
10mins	0.002	0.013	0.024	0.003	<0.001	<0.001	<0.001	0.113	0.073	0.036	50.7	1.6	ENE	30.8	68.7
10mins	0.002	0.015	0.004	0.004	<0.001	<0.001	<0.001	0.112	0.073	0.035	54.7	1.6	ENE	30.4	70.6
Avg (ppm)	0.002	0.015	0.007	0.007	<0.001	<0.001	<0.001	0.111	0.072	0.035	52.8	1.70		30.0	69.2
µg/M3	4.36	28.22	7.82	13.41	<0.001	<0.001	<0.001	111.33	72.17	35.17	52.8	1.70		30.0	69.2

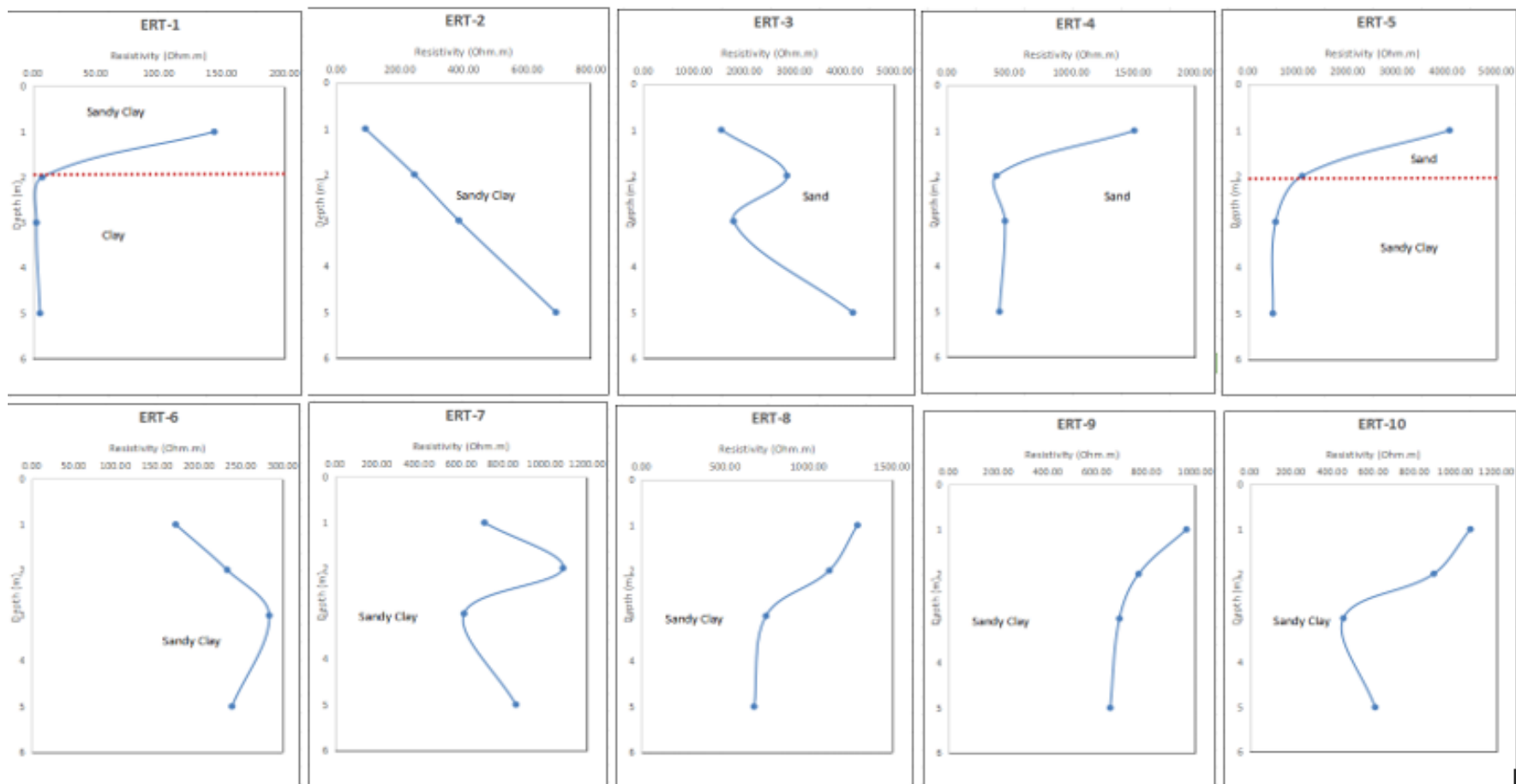
AQ37															
Time (Mins)	SO2	NO2	CO	O3	CXHY	VOC	NH3	SPM	PM10	PM2.5	NOISE (dB) Day	WIND SPD (m/s)	WIND DIR	TEMP (Oc)	REL HM (%)
10mins	0.000	0.012	0.002	0.000	<0.001	<0.001	<0.001	0.100	0.061	0.035	56.2	1.5	ENE	28.7	70.6
10mins	0.000	0.010	0.000	0.002	<0.001	<0.001	<0.001	0.103	0.066	0.033	53.4	1.5	NE	29.8	67.8
10mins	0.000	0.014	0.000	0.012	<0.001	<0.001	<0.001	0.097	0.061	0.032	49.5	1.5	NE	30.1	67.8
10mins	0.003	0.015	0.022	0.023	<0.001	<0.001	<0.001	0.097	0.060	0.033	54.2	1.8	SSE	30.6	69.9
10mins	0.003	0.012	0.002	0.002	<0.001	<0.001	<0.001	0.097	0.061	0.032	49.9	1.8	SSE	29.8	70.3
10mins	0.002	0.011	0.004	0.012	<0.001	<0.001	<0.001	0.105	0.063	0.038	53.6	1.2	SE	30.2	69.3
Avg (ppm)	0.001	0.012	0.005	0.009	<0.001	<0.001	<0.001	0.100	0.062	0.034	52.8	1.55		29.9	69.3
µg/M3	3.49	23.20	5.73	16.69	<0.001	<0.001	<0.001	99.83	62.00	33.83	52.8	1.55		29.9	69.3

AQ38															
Time (Mins)	SO2	NO2	CO	O3	CXHY	VOC	NH3	SPM	PM10	PM2.5	NOISE (dB) Day	WIND SPD (m/s)	WIND DIR	TEMP (Oc)	REL HM (%)
10mins	0.004	0.011	0.000	0.000	<0.001	<0.001	<0.001	0.096	0.060	0.032	51.2	0.8	SE	31.6	70.2
10mins	0.003	0.014	0.024	0.012	<0.001	<0.001	<0.001	0.104	0.066	0.034	49.2	0.8	SE	31.2	71.2
10mins	0.000	0.012	0.000	0.024	<0.001	<0.001	<0.001	0.105	0.069	0.032	50.8	1.8	NE	30.1	67.8
10mins	0.000	0.014	0.000	0.002	<0.001	<0.001	<0.001	0.099	0.061	0.034	53.6	1.8	S	30.9	71.3
10mins	0.000	0.012	0.000	0.014	<0.001	<0.001	<0.001	0.106	0.063	0.039	53.7	0.9	SSE	29.5	70.2
10mins	0.002	0.012	0.004	0.000	<0.001	<0.001	<0.001	0.107	0.065	0.038	56.8	1.4	NNE	31.6	70.6
Avg (ppm)	0.002	0.013	0.005	0.009	<0.001	<0.001	<0.001	0.103	0.064	0.035	52.6	1.25		30.8	70.2
µg/M3	3.93	23.51	5.34	17.01	<0.001	<0.001	<0.001	102.83	64.00	34.83	52.6	1.25		30.8	70.2

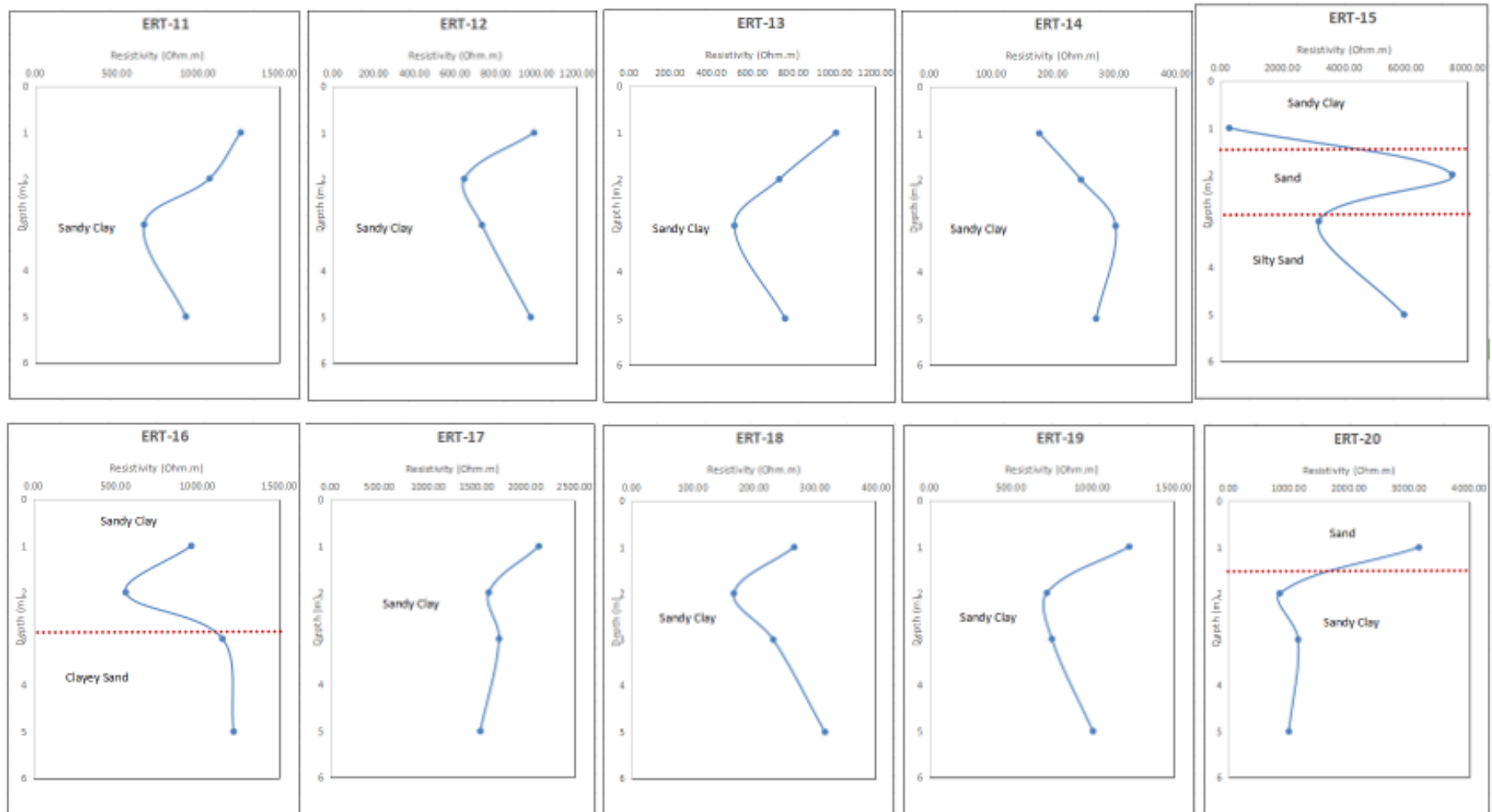
AQC1															
Time (Mins)	SO2	NO2	CO	O3	CXHY	VOC	NH3	SPM	PM10	PM2.5	NOISE (dB) Day	WIND SPD (m/s)	WIND DIR	TEMP (Oc)	REL HM (%)
10mins	0.000	0.011	0.000	0.000	<0.001	<0.001	<0.001	0.109	0.067	0.038	52.5	1.2	S	29.8	74.6
10mins	0.002	0.011	0.005	0.024	<0.001	<0.001	<0.001	0.102	0.063	0.035	52.9	1.9	NNE	31.9	71.3
10mins	0.002	0.012	0.005	0.002	<0.001	<0.001	<0.001	0.098	0.064	0.030	51.9	1.4	SSE	30.4	70.4
10mins	0.003	0.012	0.014	0.012	<0.001	<0.001	<0.001	0.102	0.066	0.032	53.9	1.4	SSE	30.4	69.4
10mins	0.003	0.026	0.002	0.002	<0.001	<0.001	<0.001	0.104	0.063	0.037	53.7	1.9	NNE	31.9	69.6
10mins	0.000	0.012	0.000	0.002	<0.001	<0.001	<0.001	0.112	0.069	0.039	56.8	2.1	NW	30.2	70.1
Avg (ppm)	0.002	0.014	0.004	0.007	<0.001	<0.001	<0.001	0.105	0.065	0.035	53.6	1.65		30.8	70.9
µg/M3	4.36	26.33	4.96	13.74	<0.001	<0.001	<0.001	104.50	65.33	35.17	53.6	1.65		30.8	70.9

AQC2															
Time (Mins)	SO2	NO2	CO	O3	CXHY	VOC	NH3	SPM	PM10	PM2.5	NOISE (dB) Day	WIND SPD (m/s)	WIND DIR	TEMP (Oc)	REL HM (%)
10mins	0.003	0.016	0.000	0.002	<0.001	<0.001	<0.001	0.098	0.060	0.034	51.6	1.4	ENE	31.2	71.2
10mins	0.002	0.016	0.005	0.012	<0.001	<0.001	<0.001	0.098	0.061	0.033	53.7	1.4	ENE	31.2	71.2
10mins	0.004	0.016	0.014	0.002	<0.001	<0.001	<0.001	0.100	0.060	0.036	56.8	1.4	ENE	31.2	71.2
10mins	0.003	0.012	0.000	0.000	<0.001	<0.001	<0.001	0.102	0.061	0.037	55.6	1.4	ENE	31.2	70.2
10mins	0.000	0.011	0.014	0.024	<0.001	<0.001	<0.001	0.109	0.067	0.038	49.8	1.3	NE	30.9	68.5
10mins	0.000	0.011	0.002	0.002	<0.001	<0.001	<0.001	0.106	0.063	0.039	49.8	1.3	NNE	30.9	70.5
Avg (ppm)	0.002	0.014	0.006	0.007	<0.001	<0.001	<0.001	0.102	0.062	0.036	52.9	1.37		31.1	70.5
µg/M3	5.24	25.71	6.68	13.74	<0.001	<0.001	<0.001	102.17	62.00	36.17	52.9	1.37		31.1	70.5

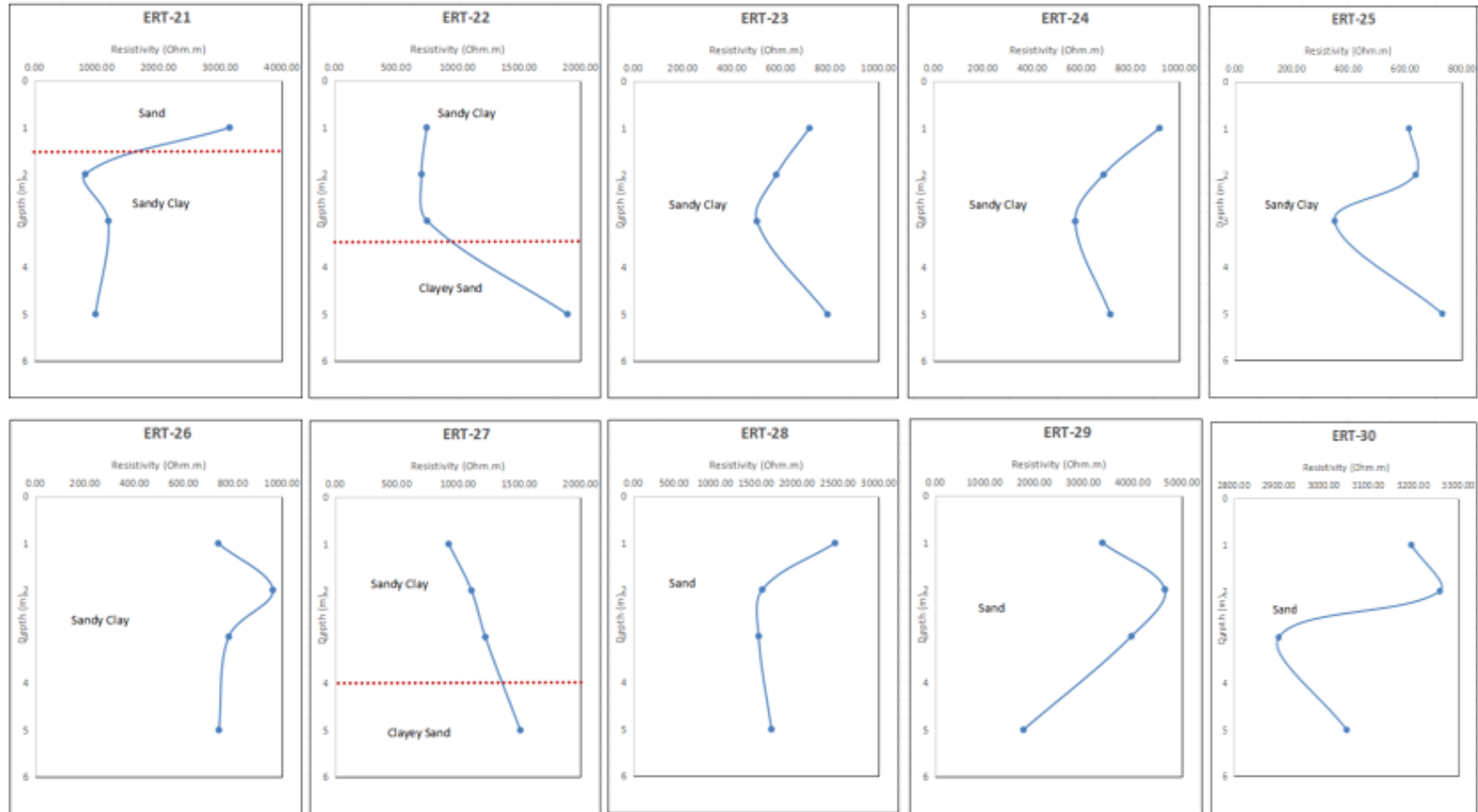
ANNEXURE 4.2: GEOLOGY RESULTS (RESISTIVITY DEPTH PROFILE DIAGRAMS)



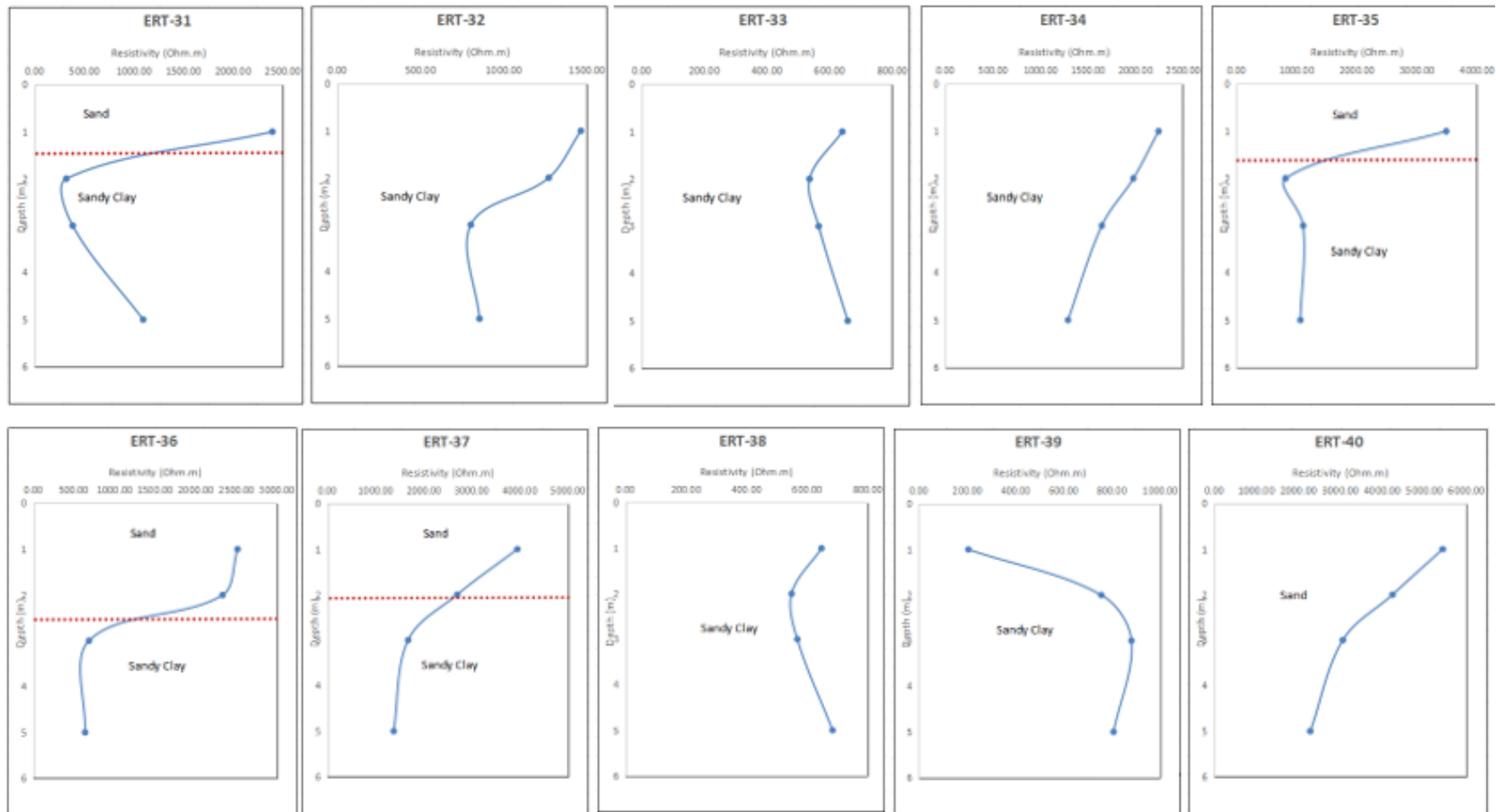
Resistivity depth profiles for surveys conducted within the survey area using Wenner array (ERT1 to ERT10)



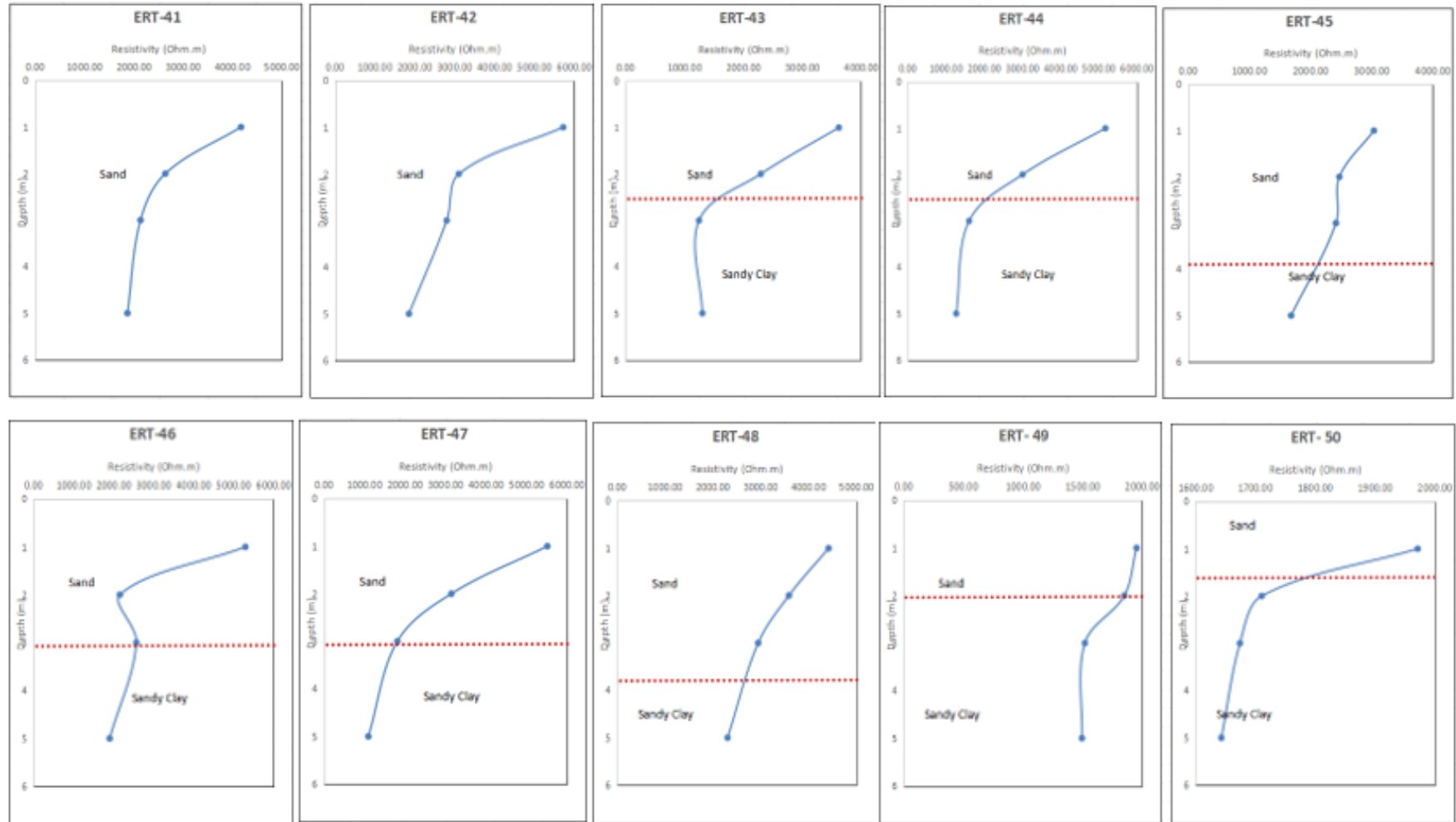
Resistivity depth profiles for surveys conducted within the survey area using Wenner array (ERT11 to ERT20)



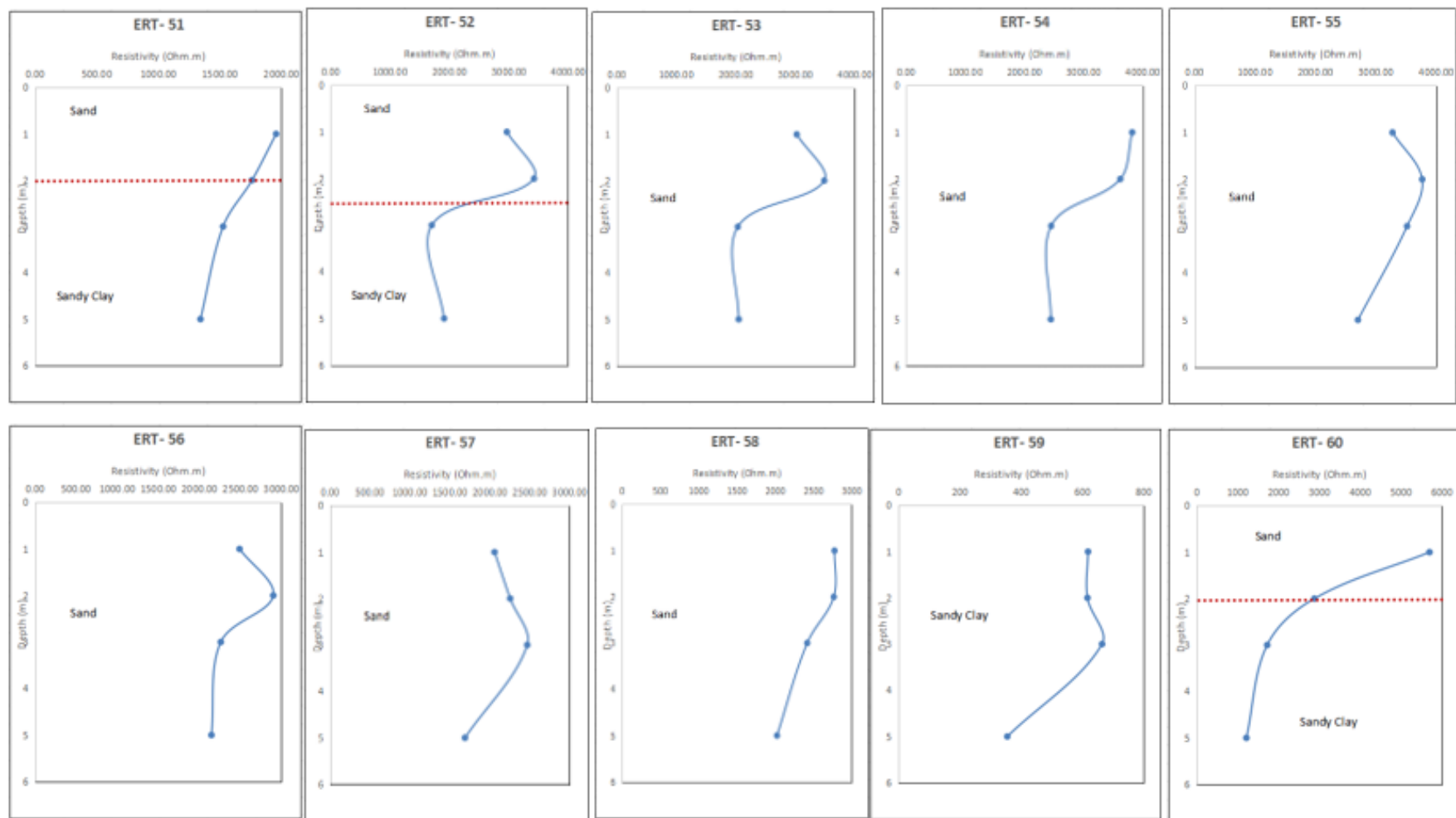
Resistivity depth profiles for surveys conducted within the survey area using Wenner array (ERT21 to ERT30)



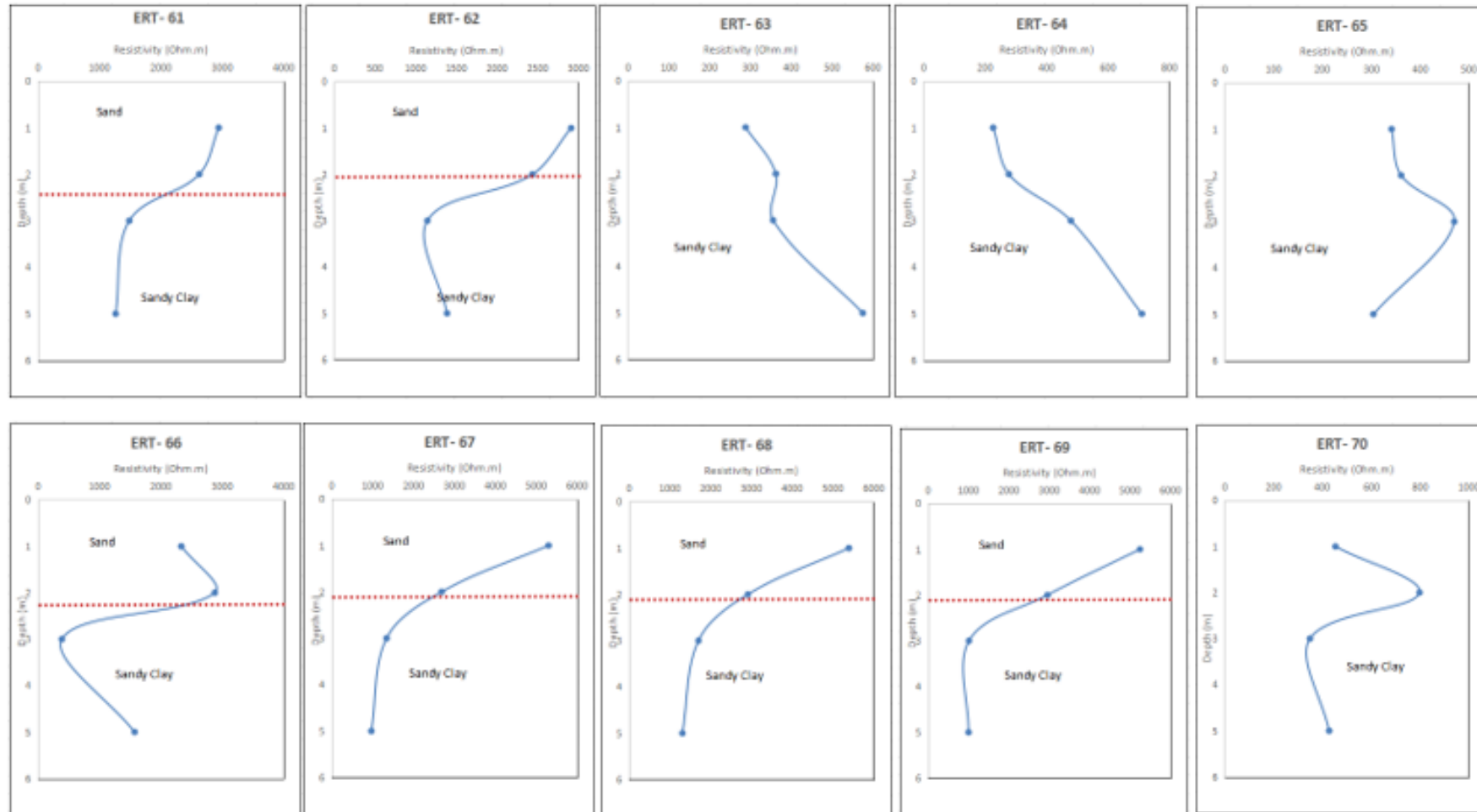
Resistivity depth profiles for surveys conducted within the survey area using Wenner array (ERT31 to ERT40)



Resistivity depth profiles for surveys conducted within the survey area using Wenner array (ERT41 to ERT50)



Resistivity depth profiles for surveys conducted within the survey area using Wenner array (ERT51 to ERT60)



Resistivity depth profiles for surveys conducted within the survey area using Wenner array (ERT61 to ERT70)

ANNEXURE 4.3: SOIL QUALITY RESULTS

Topsoil (0-15cm) Results

S/N	Parameter(s)	SS 1T	SS 2T	SS 3T	SS 4T	SS 5T	SS 6T	SS 7T	SS 8T	SS 9T	SS 10T
1	pH	4.5	4.1	4.4	6.7	5.8	4.9	4.7	4.5	4.7	4.9
2	Moisture Content (%)	5.56	4.53	3.08	4.85	8.25	7.30	10.31	7.31	5.16	7.51
3	Sulphide, S ₂ (mg/kg)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
4	Sulphate, SO ₄ ²⁻ (mg/kg)	7	10	3	14	10	4	4	3	16	5
5	Nitrate, NO ₃ ⁻ (mg/kg)	1.0	2.0	0.5	2.4	2.0	0.7	0.8	0.6	2.6	1.2
6	Total Nitrogen (%)	0.162	0.155	0.131	0.098	0.132	0.091	0.081	0.155	0.121	0.105
7	Phosphate, PO ₄ ³⁻ (mg/kg)	0.68	1.68	0.5	1.79	1.68	0.52	0.65	0.42	2.45	0.52
8	THC (mg/kg)	1.61	1.15	1.09	1.12	1.24	1.14	1.13	1.71	1.2	1.11
9	TPH (mg/kg)	2.00	2.42	1.60	2.25	1.34	1.26	1.54	1.87	1.04	1.39
10	PAH (mg/kg)	0.003	0.002	0.003	0.003	0.003	0.002	0.003	0.003	0.002	<0.001
11	BETEX (mg/kg)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
12	Phenol (mg/kg)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
13	Ammonia (mg/kg)	0.21	0.17	0.20	0.38	0.30	0.16	0.14	0.20	0.32	0.24
14	TOC (%)	1.872	1.794	1.521	1.131	1.521	1.053	0.936	1.794	1.404	1.209
15	TOM (%)	3.237	3.102	2.630	1.955	2.630	1.821	1.618	3.102	2.428	2.090
16	Electric Conductivity (µs/cm)	82	118	43	191	125	45	36	37	245	44
17	Sand (%)	85.79	81.10	86.97	84.47	83.09	87.05	82.76	82.45	85.43	84.57
18	Silt (%)	5.25	5.65	4.85	3.96	4.26	4.26	3.12	3.25	5.72	5.80
19	Clay (%)	8.96	13.25	8.18	11.57	12.65	8.69	14.12	14.30	8.85	9.63
20	Particle Size Distribution	SS	LS	SS	LS	LS	SS	LS	LS	SS	SS
21	Porosity	0.40	0.37	0.42	0.39	0.38	0.42	0.38	0.38	0.40	0.39
22	Colour	Brown	Brown	Dark Brown	Brown	Dark Brown	Brown	Light Brown	Dark Brown	Dark Brown	Dark Brown
23	Permeability (cm/sec)×10	0.13	0.12	0.12	0.16	0.17	0.17	0.15	0.15	0.13	0.12
24	Bulk Density (g/cm ³)	1.17	1.05	1.15	1.18	1.13	1.30	1.14	1.14	1.10	1.26

S/N	Parameter(s)	SS 1T	SS 2T	SS 3T	SS 4T	SS 5T	SS 6T	SS 7T	SS 8T	SS 9T	SS 10T
25	Sodium, Na (mg/kg)	43.55	30.94	32.07	37.28	24.21	28.68	25.55	38.41	23.04	34.91
26	Magnesium, Mg (mg/kg)	3.21	2.45	3.75	10.25	6.39	5.80	4.80	2.33	6.54	2.14
27	Calcium, Ca (mg/kg)	<0.001	<0.001	<0.001	682.8	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
28	Potassium, K (mg/kg)	4.58	4.72	5.45	11.61	3.91	7.93	6.36	4.31	8.26	4.04
29	Manganese, Mn (mg/kg)	12.63	31.60	9.28	21.46	12.06	12.41	4.57	28.40	40.50	20.97
30	Vanadium, V (mg/kg)	<0.001	<0.001	0.72	1.18	0.53	0.66	0.19	0.42	0.14	0.05
31	Nickel, Ni (mg/kg)	<0.001	<0.001	15.16	24.78	11.15	13.95	3.99	8.74	2.88	1.15
32	Chromium, Cr (mg/kg)	<0.001	<0.001	6.04	2.00	<0.001	<0.001	<0.001	1.60	5.26	<0.001
33	Iron, Fe (mg/kg)	256.4	156.7	200.8	331.0	379.9	599.7	229.8	215.8	189.7	291.6
34	Lead, Pb (mg/kg)	0.92	1.18	1.74	2.78	1.59	2.11	2.43	2.18	2.38	2.86
35	Copper, Cu (mg/kg)	12.54	10.74	15.16	13.02	15.73	22.70	13.46	7.97	17.31	16.13
36	Zinc, Zn (mg/kg)	7.36	8.18	6.73	14.01	49.24	12.20	6.63	8.35	8.43	8.91
37	Mercury, Hg (mg/kg)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
38	Arsenic, As (mg/kg)	0.12	0.1	0.14	0.12	0.14	0.21	0.12	0.07	0.16	0.15
39	HUB (CFU/g) x 10 ³	1.0	0.9	1.5	0.9	1.3	0.8	0.9	1.1	0.6	1.7
40	HUF (CFU/g) x 10 ³	0.6	0.7	1.0	0.4	0.8	0.3	0.4	0.7	0.4	1.1
41	THB (CFU/g) x 10 ⁶	3.3	3	4.1	3.2	2.4	1.8	2.4	3.2	2.6	3.2
42	THF (CFU/g) x 10 ⁶	2.6	1.8	2.7	1.9	1.1	0.7	1.8	2.4	1	2

Topsoil (0-15cm) Results

S/N	Parameter(s)	SS 11T	SS 12T	SS 13T	SS 14T	SS 15T	SS 16T	SS 17T	SS 18T	SS 19T	SS 20T
1	pH	4.8	4.6	4.3	4.5	4.7	4.5	4.5	4.4	4.5	4.3
2	Moisture Content (%)	5.10	8.30	5.03	7.33	4.30	10.73	11.23	8.75	9.83	7.06
3	Sulphide, S ₂ (mg/kg)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
4	Sulphate, SO ₄ ²⁻ (mg/kg)	3	15	8	4	2	3	2	4	4	8
5	Nitrate, NO ₃ ⁻ (mg/kg)	0.7	2.8	1.3	0.7	0.8	0.9	0.8	0.8	0.8	1.0
6	Total Nitrogen (%)	0.172	0.150	0.155	0.154	0.158	0.162	0.148	0.145	0.142	0.135
7	Phosphate, PO ₄ ³⁻ (mg/kg)	0.52	1.73	1.21	0.65	0.43	0.38	0.3	0.38	0.65	1.25
8	THC (mg/kg)	1.1	1.22	1.26	1.18	1.11	1.13	1.31	1.13	1.32	0.84
9	TPH (mg/kg)	1.39	1.63	1.51	1.21	1.13	1.99	2.00	2.42	2.52	2.44
10	PAH (mg/kg)	0.002	<0.001	0.002	0.002	0.003	<0.001	0.002	0.002	0.003	0.002
11	BETEX (mg/kg)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
12	Phenol (mg/kg)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
13	Ammonia (mg/kg)	0.25	0.25	0.25	0.20	0.33	0.29	0.18	0.21	0.75	0.15
14	TOC (%)	1.981	1.98	1.794	1.794	1.833	1.872	1.716	1.677	1.638	1.56
15	TOM (%)	3.439	3.000	3.102	3.100	3.169	3.237	2.967	2.900	2.832	2.679
16	Electric Conductivity (µs/cm)	38	143	73	39	28	49	28	49	56	73
17	Sand (%)	82.13	84.16	84.25	85.47	80.15	82.06	86.49	86.35	84.33	81.60
18	Silt (%)	6.12	6.88	6.89	5.65	5.75	6.25	4.30	3.12	4.10	4.65
19	Clay (%)	11.75	8.96	8.86	7.88	14.10	11.69	9.21	8.53	11.57	13.75
20	Particle Size Distribution	LS	SS	SS	SS	LS	LS	SS	SS	LS	LS
21	Porosity	0.37	0.39	0.40	0.41	0.37	0.39	0.44	0.43	0.41	0.38
22	Colour	Dark Brown	Brown	Brown	Dark Brown	Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Reddish
23	Permeability (cm/sec)×10	0.13	0.11	0.15	0.13	0.12	0.15	0.18	0.13	0.11	0.13
24	Bulk Density (g/cm ³)	1.30	1.15	1.10	1.13	1.30	1.16	1.10	1.25	1.30	1.42
25	Sodium, Na (mg/kg)	24.59	25.03	25.48	22.23	25.09	18.39	26.21	24.54	29.42	41.12
26	Magnesium, Mg (mg/kg)	2.45	1.72	2.07	2.10	1.17	1.23	1.15	4.15	3.96	3.1

S/N	Parameter(s)	SS 11T	SS 12T	SS 13T	SS 14T	SS 15T	SS 16T	SS 17T	SS 18T	SS 19T	SS 20T
27	Calcium, Ca (mg/kg)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
28	Potassium, K (mg/kg)	4.60	3.75	4.92	4.85	2.55	3.11	2.42	6.14	7.79	5.44
29	Manganese, Mn (mg/kg)	12.81	7.62	10.52	14.67	11.83	7.07	4.69	2.27	3.42	4.19
30	Vanadium, V (mg/kg)	0.19	0.41	0.49	0.63	<0.001	0.74	0.03	0.35	<0.001	<0.001
31	Nickel, Ni (mg/kg)	3.95	8.61	10.19	13.21	<0.001	15.58	10.65	7.28	<0.001	<0.001
32	Chromium, Cr (mg/kg)	<0.001	<0.001	0.29	<0.001	<0.001	<0.001	<0.001	0.80	<0.001	<0.001
33	Iron, Fe (mg/kg)	397.1	299.0	314.5	396.6	348.1	253.8	250.1	272.2	161.20	365.80
34	Lead, Pb (mg/kg)	3.08	3.07	2.43	2.57	2.97	4.02	3.63	4.18	3.20	3.17
35	Copper, Cu (mg/kg)	16.15	12.50	8.78	26.30	23.88	23.40	18.19	10.50	16.31	17.78
36	Zinc, Zn (mg/kg)	9.32	7.07	6.24	7.76	8.47	6.30	7.58	5.94	6.8	6.49
37	Mercury, Hg (mg/kg)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
38	Arsenic, As (mg/kg)	0.15	0.12	0.08	0.24	0.22	0.22	0.17	0.1	0.2	0.2
39	HUB (CFU/g) x 10 ³	1.0	1.6	1.2	0.6	0.8	1.1	1.3	0.6	1.1	1.0
40	HUF (CFU/g) x 10 ³	0.6	0.8	0.8	0.3	0.7	0.5	0.6	0.2	0.5	0.4
41	THB (CFU/g) x 10 ⁶	3.7	4.2	2.8	2	2.5	4	3.6	2.1	3	3.6
42	THF (CFU/g) x 10 ⁶	2.7	2.3	1.7	1.1	1.3	2.3	2.1	1.8	2.4	2

Topsoil (0-15cm) Results

S/N	Parameter(s)	SS 21T	SS 22T	SS 23T	SS 24T	SS 25T	SS 26T	SS 27T	SS 28T	SS 29T	SS 30T
1	pH	4.5	4.6	5	5.3	4.6	5.1	4.9	5.4	4.9	4.7
2	Moisture Content (%)	8.33	5.56	8.85	7.25	5.80	6.70	10.33	8.26	7.76	8.26
3	Sulphide, S ₂ (mg/kg)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
4	Sulphate, SO ₄ ²⁻ (mg/kg)	3	8	3	12	3	5	5	2	3	4
5	Nitrate, NO ₃ ⁻ (mg/kg)	0.8	1.3	1.0	2.5	0.8	0.9	1.0	0.2	0.8	1.2
6	Total Nitrogen (%)	0.134	0.091	0.140	0.185	0.196	0.138	0.147	0.190	0.152	0.187
7	Phosphate, PO ₄ ³⁻ (mg/kg)	0.75	0.69	1.1	2.1	0.48	0.48	0.46	0.65	0.4	1.7
8	THC (mg/kg)	1.1	1.92	1.03	1.41	1.12	1.03	0.73	1.06	1.21	1.16
9	TPH (mg/kg)	1.12	1.10	1.15	1.54	1.12	1.57	1.21	1.12	1.87	1.35
10	PAH (mg/kg)	0.002	0.004	0.002	0.003	0.002	0.003	0.002	0.004	0.002	0.002
11	BETEX (mg/kg)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
12	Phenol (mg/kg)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
13	Ammonia (mg/kg)	0.23	0.31	0.27	0.40	0.31	0.32	0.28	0.25	0.40	0.20
14	TOC (%)	1.56	1.053	1.638	2.145	2.262	1.599	1.706	2.193	1.758	2.16
15	TOM (%)	2.696	1.821	2.832	3.709	3.911	2.765	2.950	3.792	3.040	3.735
16	Electric Conductivity (µs/cm)	38	63	33	227	59	62	81	40	50	79
17	Sand (%)	85.61	85.43	86.59	86.95	84.36	85.14	85.26	87.25	85.70	86.43
18	Silt (%)	5.72	5.12	5.25	4.10	3.06	2.90	2.49	2.49	2.23	5.32
19	Clay (%)	8.67	9.45	8.16	8.95	12.58	11.96	12.25	10.26	12.07	8.25
20	Particle Size Distribution	SS	SS	SS	SS	LS	LS	LS	LS	LS	SS
21	Porosity	0.42	0.41	0.45	0.46	0.40	0.41	0.41	0.42	0.42	0.42
22	Colour	Dark Brown	Dark Brown	Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Brown	Dark Brown
23	Permeability (cm/sec)×10	0.13	0.12	0.13	0.14	0.12	0.13	0.16	0.14	0.15	0.13
24	Bulk Density (g/cm ³)	1.10	1.18	1.30	1.17	1.25	1.23	1.15	1.17	1.23	1.20
25	Sodium, Na (mg/kg)	36.83	38.27	26.33	17.30	40.06	35.88	71.01	28.13	38.55	21.38

S/N	Parameter(s)	SS 21T	SS 22T	SS 23T	SS 24T	SS 25T	SS 26T	SS 27T	SS 28T	SS 29T	SS 30T
26	Magnesium, Mg (mg/kg)	5.1	2.46	2.70	21.07	<0.001	<0.001	2.15	21.30	5.80	<0.001
27	Calcium, Ca (mg/kg)	<0.001	<0.001	<0.001	617	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
28	Potassium, K (mg/kg)	5.00	3.93	3.53	38.43	5.02	20.87	8.02	4.34	3.47	3.56
29	Manganese, Mn (mg/kg)	25.10	38.30	11.34	27.70	5.57	29.10	58.30	43.60	36.20	16.09
30	Vanadium, V (mg/kg)	0.05	0.53	0.25	<0.001	0.01	<0.001	<0.001	<0.001	0.24	0.42
31	Nickel, Ni (mg/kg)	1.15	11.04	5.25	<0.001	0.19	<0.001	<0.001	<0.001	5.05	8.76
32	Chromium, Cr (mg/kg)	0.0	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
33	Iron, Fe (mg/kg)	264.10	115.2	406.4	540.6	205.7	147.0	386.6	273.6	288.8	85.5
34	Lead, Pb (mg/kg)	3.74	3.70	4.24	4.06	3.82	3.61	4.51	3.76	3.95	3.90
35	Copper, Cu (mg/kg)	15.27	15.15	15.81	24.28	17.74	13.82	13.22	13.81	21.90	11.72
36	Zinc, Zn (mg/kg)	7.9	6.55	8.91	29.97	7.68	9.37	12.06	7.96	6.70	6.32
37	Mercury, Hg (mg/kg)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
38	Arsenic, As (mg/kg)	0.1	0.14	0.15	0.22	0.16	0.13	0.12	0.13	0.21	0.11
39	HUB (CFU/g) x 10 ³	1.0	1.4	0.8	0.6	0.7	1.0	0.9	1.6	1.9	0.6
40	HUF (CFU/g) x 10 ³	0.8	1.2	0.3	0.4	0.5	0.6	0.6	1.0	1.2	0.5
41	THB (CFU/g) x 10 ⁶	2.9	3.5	2.7	2.8	3.6	2	2.8	3.3	4.2	3.1
42	THF (CFU/g) x 10 ⁶	1.7	2.6	1.5	2	2.1	1.3	1.6	2.1	2.8	2.2

Topsoil (0-15cm) Results

S/N	Parameter(s)	SS 31T	SS 32T	SS 33T	SS 34T	SS 35T	SS 36T	SS 37T	SS 38T	SSC 1T	SSC 2T
1	pH	4.7	4.8	4.6	4.4	4.8	4.6	4.8	4.7	5.6	5.7
2	Moisture Content (%)	7.25	10.10	9.26	7.25	5.30	5.33	5.76	8.12	10.13	8.63
3	Sulphide, S ₂ (mg/kg)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
4	Sulphate, SO ₄ ²⁻ (mg/kg)	2	5	3	3	0	3	3	10	3	10
5	Nitrate, NO ₃ ⁻ (mg/kg)	0.5	1.1	0.8	0.7	0.2	0.7	0.4	0.8	0.3	0.8
6	Total Nitrogen (%)	0.166	0.183	0.164	0.194	0.169	0.092	0.110	0.161	0.098	0.122
7	Phosphate, PO ₄ ³⁻ (mg/kg)	1.27	1.75	0.34	1.2	0.12	0.25	1.85	2.01	2.7	0.75
8	THC (mg/kg)	1.14	1.12	1.18	1.27	1.27	1.11	1.38	2.28	0.51	0.68
9	TPH (mg/kg)	1.50	1.10	1.11	1.14	1.92	2.22	1.89	1.69	1.00	1.69
10	PAH (mg/kg)	0.004	<0.001	0.005	<0.001	0.002	0.004	0.003	0.002	0.002	0.003
11	BETEX (mg/kg)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
12	Phenol (mg/kg)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
13	Ammonia (mg/kg)	0.26	0.42	0.25	0.33	0.25	0.33	0.18	0.25	0.28	0.21
14	TOC (%)	1.925	2.116	1.896	2.245	1.956	1.068	1.275	1.867	1.131	1.416
15	TOM (%)	3.328	3.659	3.278	3.882	3.382	1.847	2.204	3.228	1.955	2.448
16	Electric Conductivity (µs/cm)	38	103	52	57	9	48	28	54	22	52
17	Sand (%)	80.85	85.10	86.10	85.26	87.23	84.30	86.33	87.33	89.25	86.16
18	Silt (%)	2.94	3.32	4.50	4.28	5.22	4.24	5.02	3.39	2.00	3.02
19	Clay (%)	16.21	11.58	9.40	10.46	7.55	11.46	8.65	9.28	8.75	10.82
20	Particle Size Distribution	SL	LS	SS	LS	SS	LS	SS	SS	SS	LS
21	Porosity	0.37	0.40	0.42	0.40	0.42	0.40	0.42	0.43	0.43	0.42
22	Colour	Brown	Dark Brown	Brown	Brown	Dark Brown	Brown	Brown	Dark Brown	Brown	Brown
23	Permeability (cm/sec)×10	0.15	0.13	0.13	0.14	0.15	0.16	0.13	0.15	0.17	0.13
24	Bulk Density (g/cm ³)	1.26	1.26	1.17	1.33	1.20	1.53	1.17	1.18	1.16	1.21
25	Sodium, Na (mg/kg)	30.86	25.72	32.60	39.03	27.85	25.80	33.23	33.53	21.73	22.17
26	Magnesium, Mg (mg/kg)	21.03	5.53	11.53	11.30	4.53	3.16	7.80	2.40	10.45	7.48

S/N	Parameter(s)	SS 31T	SS 32T	SS 33T	SS 34T	SS 35T	SS 36T	SS 37T	SS 38T	SSC 1T	SSC 2T
27	Calcium, Ca (mg/kg)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
28	Potassium, K (mg/kg)	3.61	6.16	4.74	3.82	4.24	3.62	4.79	3.67	2.11	3.44
29	Manganese, Mn (mg/kg)	45.10	45.70	47.40	16.43	4.78	1.84	3.18	1.97	2.84	1.84
30	Vanadium, V (mg/kg)	<0.001	0.58	<0.001	<0.001	<0.001	<0.001	0.14	0.36	0.23	0.14
31	Nickel, Ni (mg/kg)	<0.001	12.08	<0.001	<0.001	3.87	<0.001	2.94	7.51	4.84	3.01
32	Chromium, Cr (mg/kg)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
33	Iron, Fe (mg/kg)	168.5	306.0	193.1	318.2	423.1	176.7	124.1	287.7	148.7	210.4
34	Lead, Pb (mg/kg)	3.51	3.61	3.39	3.06	3.64	3.63	3.06	3.61	3.65	3.08
35	Copper, Cu (mg/kg)	8.86	25.52	10.28	24.30	25.67	8.31	21.20	14.12	13.38	20.60
36	Zinc, Zn (mg/kg)	5.27	9.40	8.33	7.97	7.14	5.28	7.66	5.88	2.97	4.76
37	Mercury, Hg (mg/kg)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
38	Arsenic, As (mg/kg)	0.08	0.24	0.1	0.22	0.24	0.08	0.2	0.13	0.12	0.19
39	HUB (CFU/g) x 10 ³	1.4	0.2	1.1	0.6	0.6	1.3	1.1	0.9	1.2	1.8
40	HUF (CFU/g) x 10 ³	0.6	0.9	0.8	0.3	0.2	0.6	0.8	0.6	0.7	0.5
41	THB (CFU/g) x 10 ⁶	2.3	3.5	2.7	2.8	2.2	3.6	2.6	1.7	2.9	3.7
42	THF (CFU/g) x 10 ⁶	1.3	2.7	1.9	1	1	2.1	2.3	0.8	1.3	2.5

Subsoil (15-30cm) Results

S/N	Parameter(s)	SS 1B	SS 2B	SS 3B	SS 4B	SS 5B	SS 6B	SS 7B	SS 8B	SS 9B	SS 10B
1	pH	4.5	4.5	4.3	6.3	6.1	4.6	4.9	4.7	4.6	4.8
2	Moisture Content (%)	7.10	6.27	5.70	8.87	10.31	8.12	10.45	8.70	7.20	8.25
3	Sulphide, S ₂ (mg/kg)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
4	Sulphate, SO ₄ ²⁻ (mg/kg)	2	3	3	10	3	3	3	6	14	3
5	Nitrate, NO ₃ ⁻ (mg/kg)	0.8	0.7	0.8	2.3	0.8	0.8	0.8	0.9	2.0	1.0
6	Total Nitrogen (%)	0.149	0.140	0.149	0.089	0.122	0.109	0.066	0.132	0.109	0.102
7	Phosphate, PO ₄ ³⁻ (mg/kg)	0.42	0.52	0.5	1.76	0.38	0.62	0.37	0.46	1.69	0.39
8	THC (mg/kg)	1.16	1.24	1.14	1.12	1.21	1.12	1.11	1.32	1.24	1.12
9	TPH (mg/kg)	1.65	2.25	1.40	2.65	1.21	1.20	1.10	1.67	0.75	1.21
10	PAH (mg/kg)	0.002	0.002	0.002	0.004	0.003	0.003	0.002	0.002	0.002	<0.001
11	BETEX (mg/kg)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
12	Phenol (mg/kg)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
13	Ammonia (mg/kg)	0.16	0.15	0.21	0.32	0.25	0.15	0.23	0.18	0.32	0.20
14	TOC (%)	1.723	1.612	1.723	1.026	1.412	1.258	0.758	1.524	1.265	1.176
15	TOM (%)	2.980	2.787	2.979	1.774	2.441	2.175	1.311	2.635	2.187	2.033
16	Electric Conductivity (µs/cm)	31	49	40	161	29	35	25	58	121	32
17	Sand (%)	82.10	80.74	85.92	82.55	82.39	85.87	82.14	79.88	82.55	83.31
18	Silt (%)	4.95	6.10	5.12	4.12	3.96	5.38	3.10	6.17	4.30	4.36
19	Clay (%)	12.95	13.16	8.96	13.33	13.65	8.75	14.76	13.95	13.15	12.33
20	Particle Size Distribution	LS	SS	SS	LS	LS	SS	LS	LS	LS	LS
21	Porosity	0.37	0.37	0.47	0.38	0.37	0.40	0.37	0.37	0.38	0.39
22	Colour	Brown	Brown	Dark Brown	Brown	Brown	Brown	Light Brown	Dark Brown	Brown	Dark Brown
23	Permeability (cm/sec)×10	0.14	0.11	0.15	0.15	0.16	0.16	0.16	0.13	0.14	0.13
24	Bulk Density (g/cm ³)	1.25	1.20	1.17	1.20	1.15	1.25	1.16	1.25	1.25	1.15
25	Sodium, Na (mg/kg)	27.73	28.59	22.52	28.56	32.59	30.08	24.56	20.85	27.95	25.56

S/N	Parameter(s)	SS 1B	SS 2B	SS 3B	SS 4B	SS 5B	SS 6B	SS 7B	SS 8B	SS 9B	SS 10B
26	Magnesium, Mg (mg/kg)	0.98	2.63	1.90	16.12	5.21	5.25	1.58	0.90	2.37	1.63
27	Calcium, Ca (mg/kg)	<0.001	<0.001	<0.001	579.3	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
28	Potassium, K (mg/kg)	2.98	4.30	3.88	20.05	7.77	7.59	3.79	1.41	5.77	3.09
29	Manganese, Mn (mg/kg)	9.10	14.66	10.55	21.17	21.87	13.43	3.30	14.07	38.10	17.77
30	Vanadium, V (mg/kg)	0.26	0.14	<0.001	0.43	0.59	<0.001	<0.001	0.20	0.27	0.21
31	Nickel, Ni (mg/kg)	5.56	3.01	<0.001	8.96	12.49	<0.001	<0.001	4.19	5.62	4.35
32	Chromium, Cr (mg/kg)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	1.00	1.99	<0.001	<0.001
33	Iron, Fe (mg/kg)	266.7	220.3	275.7	269.0	354.4	292.9	269.4	249.9	277.3	35.5
34	Lead, Pb (mg/kg)	0.82	2.48	1.29	2.10	2.14	1.33	1.77	2.00	2.07	2.91
35	Copper, Cu (mg/kg)	19.16	2.55	9.16	15.87	17.71	11.45	15.32	24.03	26.62	9.24
36	Zinc, Zn (mg/kg)	3.90	6.97	5.01	9.57	58.65	7.69	6.12	6.29	10.99	5.66
37	Mercury, Hg (mg/kg)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
38	Arsenic, As (mg/kg)	0.18	0.02	0.08	0.15	0.16	0.11	0.14	0.22	0.25	0.09
39	HUB (CFU/g) x 10 ³	0.5	0.6	0.8	0.5	0.8	0.3	0.5	0.8	0.3	1.2
40	HUF (CFU/g) x 10 ³	0.2	0.4	0.6	0.2	0.5	0.1	0.1	0.4	0.2	0.6
41	THB (CFU/g) x 10 ⁶	2.6	2.1	3	1.5	1.5	1	1	1.9	1.7	2.1
42	THF (CFU/g) x 10 ⁶	1.4	1	1.6	0.6	0.8	0.3	0.6	1	0.4	1.3

Subsoil (15-30cm) Results

S/N	Parameter(s)	SS 11B	SS 12B	SS 13B	SS 14B	SS 15B	SS 16B	SS 17B	SS 18B	SS 19B	SS 20B
1	pH	4.6	4.4	4.3	4.6	4.5	4.5	4.3	4.4	4.5	4.6
2	Moisture Content (%)	6.53	8.65	4.86	9.10	6.36	11.53	11.57	8.83	8.27	9.25
3	Sulphide, S ₂ (mg/kg)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
4	Sulphate, SO ₄ ²⁻ (mg/kg)	3	3	5	2	2	0	2	2	4	4
5	Nitrate, NO ₃ ⁻ (mg/kg)	0.8	0.7	1.0	0.6	0.6	0.5	0.7	0.7	0.9	1.0
6	Total Nitrogen (%)	0.150	0.147	0.123	0.132	0.144	0.148	0.138	0.127	0.116	0.114
7	Phosphate, PO ₄ ³⁻ (mg/kg)	0.39	0.55	0.3	0.28	0.35	0.29	0.32	0.31	0.4	0.53
8	THC (mg/kg)	1.41	1.18	1.21	1.14	1.12	1.24	1.12	1.04	1.14	0.71
9	TPH (mg/kg)	1.26	1.52	1.28	1.08	0.98	1.45	1.63	2.12	2.33	2.26
10	PAH (mg/kg)	0.003	<0.001	0.002	0.002	0.003	<0.001	0.002	0.003	0.002	0.002
11	BETEX (mg/kg)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
12	Phenol (mg/kg)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
13	Ammonia (mg/kg)	0.27	0.30	0.33	0.25	0.28	0.20	0.28	0.33	0.20	0.14
14	TOC (%)	1.736	1.696	1.425	1.526	1.668	1.712	1.6	1.465	1.338	1.318
15	TOM (%)	3.002	2.932	2.464	2.638	2.884	2.960	2.766	2.533	2.313	2.279
16	Electric Conductivity (µs/cm)	36	43	46	23	26	21	23	29	43	40
17	Sand (%)	79.15	82.63	83.57	81.57	80.77	80.24	86.40	82.23	82.55	80.95
18	Silt (%)	7.15	8.12	4.30	6.12	4.88	7.33	5.25	6.52	5.10	4.80
19	Clay (%)	13.70	9.25	12.13	12.31	14.35	12.43	8.35	11.16	12.35	14.25
20	Particle Size Distribution	LS	SS	LS	LS	LS	LS	SS	LS	LS	LS
21	Porosity	0.36	0.38	0.40	0.38	0.38	0.37	0.44	0.39	0.39	0.38
22	Colour	Dark Brown	Brown	Dark Brown	Dark Brown	Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Reddish Brown
23	Permeability (cm/sec)×10	0.12	0.13	0.14	0.13	0.13	0.15	0.17	0.13	0.12	0.14
24	Bulk Density (g/cm ³)	1.20	1.18	1.25	1.33	1.28	1.25	1.13	1.33	1.53	1.14
25	Sodium, Na (mg/kg)	25.27	25.43	24.79	34.67	27.50	28.23	25.42	46.24	39.84	33.44
26	Magnesium, Mg (mg/kg)	2.50	1.40	3.30	1.65	1.85	1.50	2.86	2.58	2.3	2.75

S/N	Parameter(s)	SS 11B	SS 12B	SS 13B	SS 14B	SS 15B	SS 16B	SS 17B	SS 18B	SS 19B	SS 20B
27	Calcium, Ca (mg/kg)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
28	Potassium, K (mg/kg)	4.84	3.65	5.89	3.04	3.55	3.27	3.95	4.92	4.71	4.53
29	Manganese, Mn (mg/kg)	4.31	7.65	8.86	11.40	13.08	7.92	3.98	4.60	5.16	6.66
30	Vanadium, V (mg/kg)	0.17	<0.001	<0.001	0.63	0.25	<0.001	0.26	0.15	0.71	0.49
31	Nickel, Ni (mg/kg)	3.56	<0.001	<0.001	3.3	5.23	<0.001	5.37	3.08	14.57	10.33
32	Chromium, Cr (mg/kg)	<0.001	2.06	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
33	Iron, Fe (mg/kg)	560.3	490.7	537.9	607.7	387.9	270.2	380.9	468.60	150.50	391.60
34	Lead, Pb (mg/kg)	2.98	1.57	2.55	2.90	3.45	3.02	3.75	3.67	3.72	4.17
35	Copper, Cu (mg/kg)	4.08	14.05	22.30	18.87	13.64	19.02	19.34	14.82	12.97	26.41
36	Zinc, Zn (mg/kg)	8.78	6.76	6.81	8.52	9.35	7.32	6.57	5.85	5.37	6.67
37	Mercury, Hg (mg/kg)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
38	Arsenic, As (mg/kg)	0.04	0.13	0.21	0.17	0.13	0.18	0.18	0.1	0.1	0.2
39	HUB (CFU/g) x 10 ³	0.7	1.1	0.7	0.3	0.5	0.7	0.8	0.2	0.7	0.8
40	HUF (CFU/g) x 10 ³	0.4	0.5	0.6	0.1	0.2	0.2	0.3	0.1	0.2	0.3
41	THB (CFU/g) x 10 ⁶	2.4	2.9	1.9	0.9	1.6	2.5	2.3	1.6	2.1	2.7
42	THF (CFU/g) x 10 ⁶	1.3	1.7	1	0.5	0.6	1.7	1	0.6	1.8	1.3

Subsoil (15-30cm) Results

S/N	Parameter(s)	SS 21B	SS 22B	SS 23B	SS 24B	SS 25B	SS 26B	SS 27B	SS 28B	SS 29B	SS 30B
1	pH	4.6	4.5	5.6	5.7	4.6	5	5.1	5	4.7	4.7
2	Moisture Content (%)	8.76	6.20	8.98	7.63	7.33	7.34	10.48	8.23	7.85	8.55
3	Sulphide, S ₂ (mg/kg)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
4	Sulphate, SO ₄ ²⁻ (mg/kg)	2	3	8	10	2	8	3	2	3	3
5	Nitrate, NO ₃ ⁻ (mg/kg)	0.7	1.2	1.0	2.0	0.3	1.5	0.8	0.2	0.7	0.8
6	Total Nitrogen (%)	0.112	0.077	0.113	0.156	0.182	0.121	0.132	0.169	0.127	0.164
7	Phosphate, PO ₄ ³⁻ (mg/kg)	0.3	0.45	1.3	1.67	0.4	1.67	0.38	0.45	0.38	1.33
8	THC (mg/kg)	1.11	1.21	0.73	1.13	0.52	1.16	0.74	0.54	1.31	1.23
9	TPH (mg/kg)	1.03	0.86	1.06	1.32	0.69	1.28	1.09	0.86	1.65	1.23
10	PAH (mg/kg)	0.002	0.003	0.002	0.003	0.003	0.003	0.003	0.002	0.003	10.002
11	BETEX (mg/kg)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
12	Phenol (mg/kg)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
13	Ammonia (mg/kg)	0.20	0.32	0.20	0.32	0.21	0.49	0.16	0.15	0.25	0.15
14	TOC (%)	1.296	0.896	1.31	1.805	2.107	1.41	1.53	1.95	1.469	1.895
15	TOM (%)	2.241	1.549	2.265	3.121	3.643	2.438	2.645	3.372	2.540	3.276
16	Electric Conductivity (µs/cm)	29	34	64	130	28	125	50	26	40	50
17	Sand (%)	82.17	85.55	84.05	82.40	82.65	82.95	83.16	85.56	81.75	84.66
18	Silt (%)	6.20	4.80	4.70	5.25	4.89	4.59	2.47	1.99	3.00	2.89
19	Clay (%)	11.63	9.65	11.25	12.35	12.46	12.46	14.37	12.45	15.25	12.45
20	Particle Size Distribution	LS	SS	LS	LS	LS	LS	LS	LS	SL	LS
21	Porosity	0.39	0.42	0.40	0.39	0.38	0.39	0.39	0.41	0.38	0.40
22	Colour	Dark Brown	Dark Brown	Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Brown	Dark Brown
23	Permeability (cm/sec)×10	0.13	0.12	0.13	0.13	0.15	0.13	0.15	0.13	0.13	0.14
24	Bulk Density (g/cm ³)	1.17	1.23	1.24	1.20	1.30	1.34	1.16	1.43	1.17	1.13
25	Sodium, Na (mg/kg)	52.08	37.97	32.43	49.28	34.11	37.10	36.59	36.63	22.81	25.91
26	Magnesium, Mg (mg/kg)	1.03	2.30	1.75	7.82	0.73	11.83	3.03	11.25	2.17	4.53

S/N	Parameter(s)	SS 21B	SS 22B	SS 23B	SS 24B	SS 25B	SS 26B	SS 27B	SS 28B	SS 29B	SS 30B
27	Calcium, Ca (mg/kg)	<0.001	<0.001	<0.001	113.2	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
28	Potassium, K (mg/kg)	2.68	3.72	2.41	13.17	4.96	13.11	5.09	2.98	3.01	2.87
29	Manganese, Mn (mg/kg)	21.18	35.20	5.51	67.40	0.27	29.20	52.20	33.10	15.44	24.00
30	Vanadium, V (mg/kg)	<0.001	0.18	<0.001	0.71	<0.001	<0.001	0.13	0.30	0.55	0.08
31	Nickel, Ni (mg/kg)	<0.001	3.69	<0.001	14.96	<0.001	<0.001	2.79	6.14	11.5	1.73
32	Chromium, Cr (mg/kg)	<0.001	<0.001	0.85	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
33	Iron, Fe (mg/kg)	478.20	301.7	369.5	349.9	387.1	60.7	305.2	200.0	375.3	294.9
34	Lead, Pb (mg/kg)	4.94	3.47	4.14	4.38	3.78	4.48	4.13	4.02	4.54	3.85
35	Copper, Cu (mg/kg)	30.43	11.69	21.22	19.75	7.95	20.91	19.74	23.54	16.39	11.91
36	Zinc, Zn (mg/kg)	7.39	6.67	8.48	12.55	9.59	10.12	8.09	5.03	7.66	8.31
37	Mercury, Hg (mg/kg)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
38	Arsenic, As (mg/kg)	0.3	0.11	0.2	0.18	0.07	0.19	0.18	0.22	0.15	0.11
39	HUB (CFU/g) x 10 ³	0.6	0.8	0.5	0.2	0.4	0.8	0.5	1.2	1.1	0.4
40	HUF (CFU/g) x 10 ³	0.4	0.5	0.2	0.1	0.1	0.2	0.4	0.6	0.7	0.3
41	THB (CFU/g) x 10 ⁶	1.8	2.2	1	1.6	2.4	1.2	2.1	2.2	2.7	1.6
42	THF (CFU/g) x 10 ⁶	1.2	1.1	0.6	0.5	1.6	0.8	1	1.4	1.9	0.6

Subsoil (15-30cm) Results

S/N	Parameter(s)	SS 31B	SS 32B	SS 33B	SS 34B	SS 35B	SS 36B	SS 37B	SS 38B	SSC 1B	SSC 2B
1	pH	4.6	4.5	4.6	4.5	4.7	4.6	4.8	4.9	4.6	5.1
2	Moisture Content (%)	8.34	11.24	10.10	7.10	4.83	5.47	7.82	6.10	7.23	7.12
3	Sulphide, S ₂ (mg/kg)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
4	Sulphate, SO ₄ ²⁻ (mg/kg)	0	3	3	0	0	0	0	8	5	2
5	Nitrate, NO ₃ ⁻ (mg/kg)	0.3	1.0	0.8	0.3	0.2	0.2	0.3	0.7	0.8	0.8
6	Total Nitrogen (%)	0.143	0.164	0.133	0.182	0.149	0.083	0.106	0.143	0.088	0.109
7	Phosphate, PO ₄ ³⁻ (mg/kg)	0.28	1.25	0.38	0.48	0.13	0.16	2.5	1.38	1.3	0.46
8	THC (mg/kg)	1.07	1.01	1.28	1.28	1.02	1.12	2.27	1.17	0.12	0.67
9	TPH (mg/kg)	1.36	0.95	0.98	0.86	1.53	2.10	1.52	1.40	<0.001	1.58
10	PAH (mg/kg)	0.003	0.004	0.002	<0.001	0.002	0.005	0.002	0.005	0.003	0.002
11	BETEX (mg/kg)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
12	Phenol (mg/kg)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
13	Ammonia (mg/kg)	0.33	0.33	0.20	0.32	0.26	0.20	0.28	0.10	0.25	0.18
14	TOC (%)	1.65	1.896	1.538	2.108	1.725	0.955	1.23	1.658	1.016	1.256
15	TOM (%)	2.853	3.278	2.659	3.645	2.983	1.651	2.127	2.867	1.756	2.172
16	Electric Conductivity (µs/cm)	18	54	44	29	10	17	15	52	27	20
17	Sand (%)	82.16	82.75	83.76	85.60	85.52	86.25	82.65	54.16	86.13	84.31
18	Silt (%)	2.46	2.15	2.99	4.15	5.13	4.10	4.93	2.24	4.61	2.00
19	Clay (%)	15.38	15.10	12.25	10.25	9.35	9.65	12.42	13.60	9.26	13.69
20	Particle Size Distribution	SL	SL	LS	LS	SS	SS	LS	LS	SS	LS
21	Porosity	0.38	0.38	0.40	0.40	0.41	0.42	0.42	0.42	0.42	0.42
22	Colour	Brown	Dark Brown	Brown	Brown	Dark Brown	Brown	Brown	Dark Brown	Brown	Brown
23	Permeability (cm/sec)×10	0.13	0.14	0.13	0.13	0.15	0.13	0.18	0.16	0.18	0.12
24	Bulk Density (g/cm ³)	1.17	1.18	1.25	1.32	1.25	1.32	1.20	1.18	1.17	1.20
25	Sodium, Na (mg/kg)	57.55	45.75	32.58	38.66	31.69	34.09	24.46	27.71	21.45	21.71
26	Magnesium, Mg (mg/kg)	<0.001	8.10	<0.001	7.30	2.75	4.30	<0.001	12.30	2.86	9.53

S/N	Parameter(s)	SS 31B	SS 32B	SS 33B	SS 34B	SS 35B	SS 36B	SS 37B	SS 38B	SSC 1B	SSC 2B
27	Calcium, Ca (mg/kg)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
28	Potassium, K (mg/kg)	2.67	4.49	5.82	3.71	5.27	5.08	2.77	4.46	2.19	2.78
29	Manganese, Mn (mg/kg)	55.10	38.10	34.90	21.21	6.12	2.72	3.19	2.69	1.81	1.68
30	Vanadium, V (mg/kg)	0.22	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.30	0.24	0.08
31	Nickel, Ni (mg/kg)	4.69	<0.001	<0.001	13.62	3.73	<0.001	<0.001	6.29	4.99	1.61
32	Chromium, Cr (mg/kg)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
33	Iron, Fe (mg/kg)	195.5	296.5	321.4	244.1	369.0	488.0	260.2	86.0	477.0	320.7
34	Lead, Pb (mg/kg)	3.43	4.50	3.39	3.71	3.93	5.54	4.12	3.88	3.45	3.46
35	Copper, Cu (mg/kg)	9.93	17.12	24.15	8.70	20.44	<0.001	13.17	0.70	11.39	16.59
36	Zinc, Zn (mg/kg)	6.46	7.17	8.20	5.20	7.11	7.24	4.68	5.42	4.90	6.55
37	Mercury, Hg (mg/kg)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
38	Arsenic, As (mg/kg)	0.09	0.16	0.22	0.08	0.19	<0.001	0.12	0.01	0.1	0.15
39	HUB (CFU/g) x 10 ³	1.0	0.8	0.5	0.3	0.3	0.9	0.6	0.5	0.8	1.0
40	HUF (CFU/g) x 10 ³	0.2	0.6	0.2	0.1	0.2	0.5	0.4	0.2	0.4	0.2
41	THB (CFU/g) x 10 ⁶	2	2	1.6	1.2	1.5	2.7	2.1	1	1.1	2.4
42	THF (CFU/g) x 10 ⁶	0.8	1.5	0.6	0.6	0.4	1.6	1.4	0.3	0.6	1.8

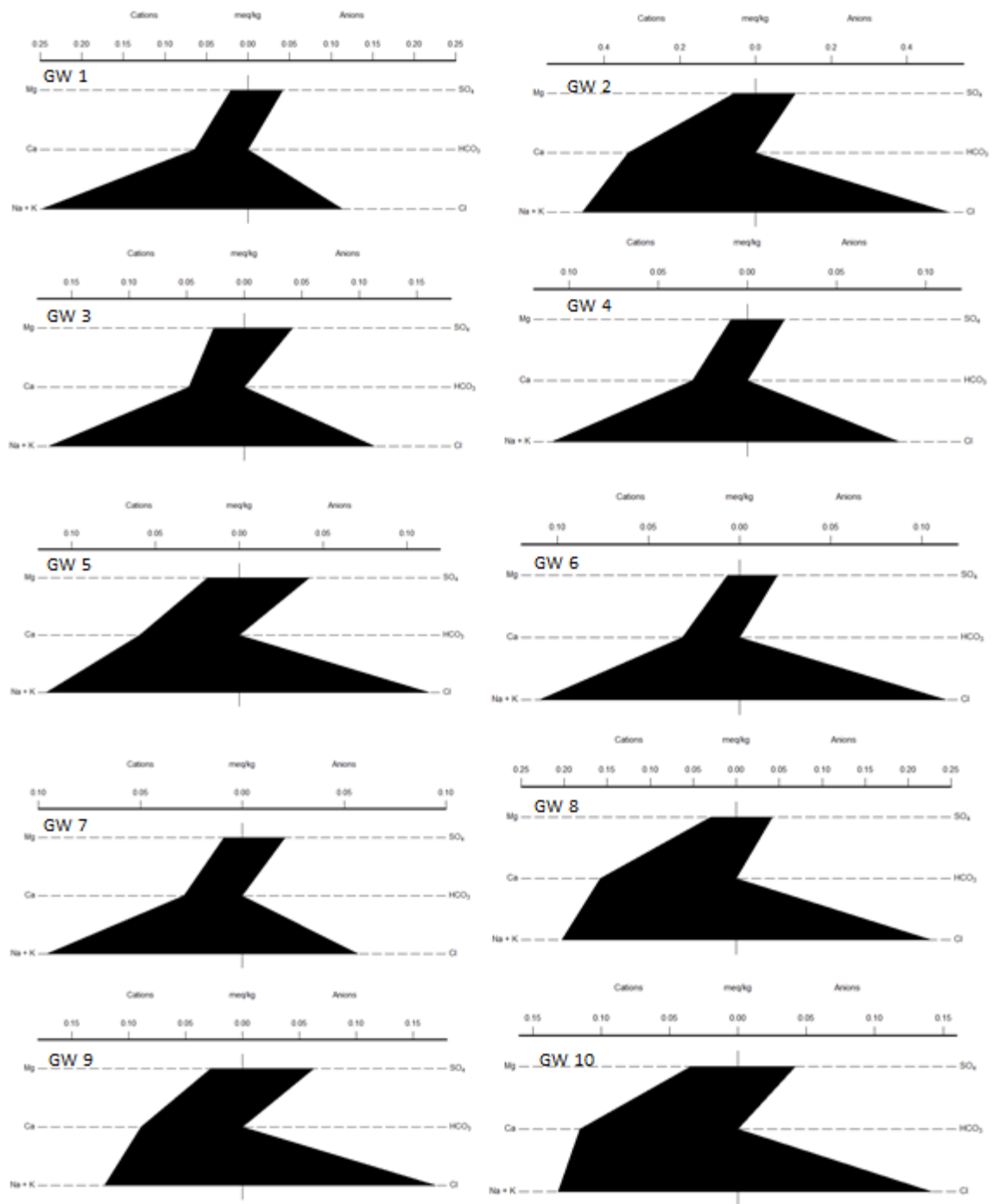
ANNEXURE 4.4

GROUNDWATER QUALITY RESULTS/STIFF DIAGRAMS

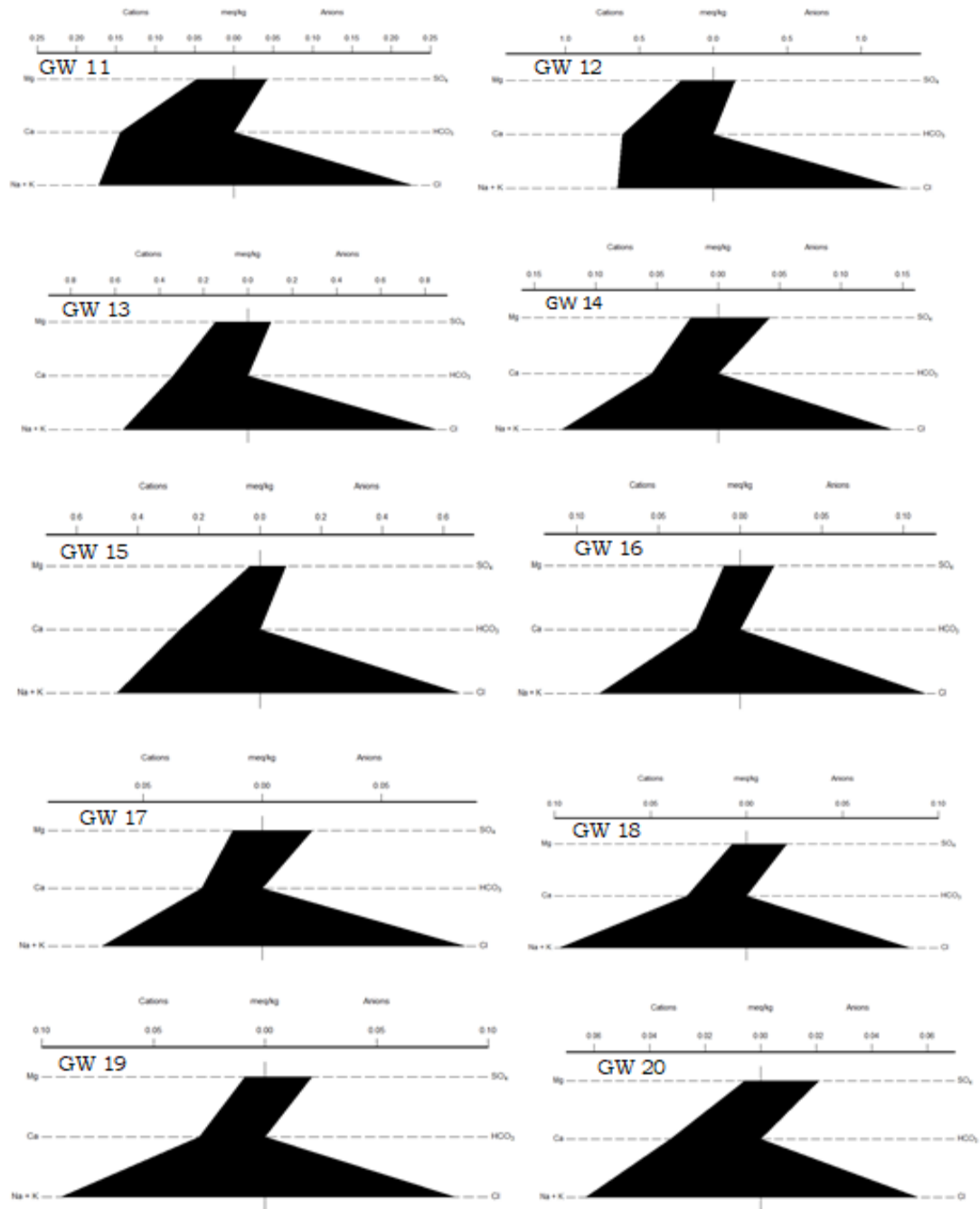
S/N	Parameter(s)	GW 1	GW 2	GW 3	GW 4	GW5	GW 6	GW 7	GW 8	GW 9	GW 10	GW 11	GW 12
1	pH	7.86	7.67	6.65	6.67	6.71	7.17	7.22	7.29	7.42	7.34	7.31	4.28
2	Temperature (°C)	35.4	34.2	29.0	29.0	29.2	34.2	33.4	35.4	36.5	35.3	34.2	29.2
3	Appearance	Clear	Clear	Clear	Clear	Clear	Clear	Clear	Clear	Clear	Clear	Clear	Clear
4	Elec. Conductivity (µs/cm)	23.0	101.0	22.0	15.0	17.0	15.0	12.0	41.0	24.0	26.0	39.0	169.5
5	TDS (mg/l)	13.0	56.0	12.0	9.0	10.0	9.0	7.0	23.0	11.0	13.0	21.0	84.9
6	Turbidity (NTU)	1.3	1.0	<1.0	1.6	1.0	<1.0	<1.0	<1.0	<1.0	1.0	1.4	<1.0
7	TSS (mg/l)	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
8	Total Hardness (mg/l)	5.0	20.0	4.0	2.0	4.0	2.0	2.0	10.0	6.0	8.0	10.0	42.0
9	Total Alkalinity (mg/l)	16.0	14.0	10.0	10.0	12.0	10.0	12.0	12.0	10.0	14.0	12.0	8.0
10	Chloride, Cl ⁻ (mg/l)	4.0	18.0	4.0	3.0	4.0	4.0	2.0	8.0	6.0	5.0	8.0	45.0
11	Sulphate, SO ₄ ²⁻ (mg/l)	2.0	5.0	2.0	1.0	2.0	1.0	1.0	2.0	3.0	2.0	2.0	7.0
12	Nitrate, NO ₃ ⁻ (mg/l)	0.40	1.30	0.40	0.30	0.30	0.30	0.20	0.70	0.80	0.40	0.50	1.80
13	Phosphate, PO ₄ ³⁻ (mg/l)	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
14	Cyanide (mg/l)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
15	Ammonia (mg/l)	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
16	Silica (mg/l)	7.6	3.2	4.3	2.0	3.9	6.2	4.9	7.2	5.9	8.3	5.8	8.0
17	Salinity (ppt)	0.01	0.05	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.08
18	Oil & Grease (mg/l)	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
19	DO (mg/l)	4.10	4.20	4.70	3.90	4.30	4.50	5.00	4.50	4.10	4.30	4.20	4.40
20	BOD (mg/l)	<1.00	2.70	2.30	2.50	<1.00	2.50	3.80	2.00	2.20	1.60	1.80	<1.00
21	COD (mg/l)	2.00	4.50	4.00	4.40	2.20	4.60	5.00	3.60	4.00	3.60	3.90	2.00
22	Sodium, Na (mg/l)	5.59	8.47	3.79	2.42	2.57	2.42	2.13	3.93	2.41	2.83	3.59	12.47
23	Potassium, K (mg/l)	0.15	3.43	0.18	0.16	0.12	0.17	0.11	1.23	0.63	0.31	0.59	3.96

S/N	Parameter(s)	GW 1	GW 2	GW 3	GW 4	GW5	GW 6	GW 7	GW 8	GW 9	GW 10	GW 11	GW 12
24	Calcium, Ca (mg/l)	1.28	6.71	0.96	0.62	1.19	0.63	0.57	3.16	1.78	2.31	2.88	12.27
25	Magnesium, Mg (mg/l)	0.25	0.69	0.32	0.11	0.23	0.08	0.11	0.36	0.34	0.42	0.57	2.65
26	Manganese, Mn (mg/l)	0.056	0.037	0.029	0.043	0.052	0.048	0.061	0.047	0.072	0.033	0.037	0.068
27	Iron, Fe (mg/l)	0.174	0.247	0.126	0.217	0.242	0.089	0.146	0.115	0.146	0.106	0.162	0.252
28	Copper, Cu (mg/l)	0.089	0.060	0.120	0.046	0.143	0.056	0.156	0.045	0.065	0.033	0.076	0.055
29	Zinc, Zn (mg/l)	0.012	0.025	0.010	0.015	0.018	0.012	0.013	0.014	0.040	0.017	0.073	0.022
30	Arsenic, As (mg/l)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
31	Chromium, Cr (mg/l)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
32	Lead, Pb (mg/l)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
33	Mercury, Hg (mg/l)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
34	Nickel, Ni (mg/l)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
35	Cadmium, Cd (mg/l)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
36	HUB (CFU/ml) x 10 ²	0.5	0.3	0.2	NIL	0.3	0.2	0.2	0.6	0.5	0.2	0.6	0.3
37	HUF (CFU/ml) x 10 ²	0.3	0.1	0.1	NIL	NIL	NIL	0.1	0.2	0.2	0.1	0.4	0.1
38	THB (CFU/ml) x 10 ²	2.1	1.8	1.6	1.5	1.4	1.6	1.5	2.0	1.6	1.8	2.6	2.3
39	THF (CFU/ml) x 10 ²	1.3	0.6	1.1	0.4	0.8	0.5	0.6	1.3	1.0	1.2	1.8	1.4
40	Total Coliform (MPN/100ml)	0	2.0	3.0	0	0	0	0	0	0	0	2.0	4.0
41	Faecal Coliform (MPN/100ml)	0	0	0	0	0	0	0	0	0	0	0	0

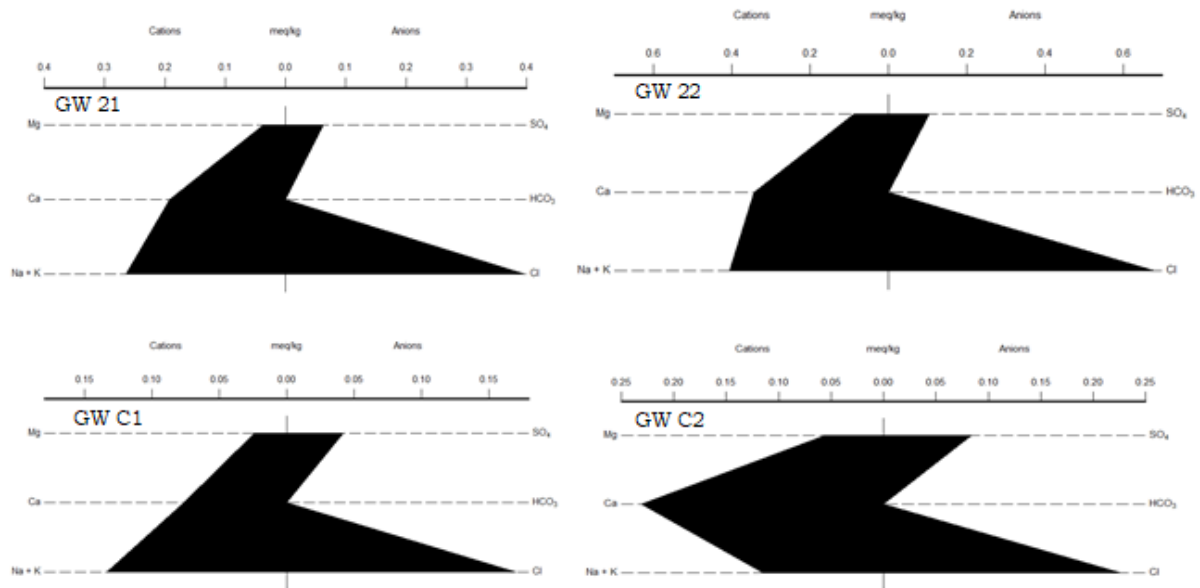
S/N	Parameter(s)	GW 13	GW 14	GW 15	GW 16	GW 17	GW 18	GW 19	GW 20	GW 21	GW 22	GW C1	GW C2
1	pH	4.27	6.72	4.91	4.33	4.65	7.63	5.87	5.55	5.38	4.94	5.16	4.68
2	Temperature (°C)	29.3	28.3	26.6	27.7	28.3	27.8	27.8	27.0	27.2	27.5	28.4	28.6
3	Appearance	Clear	Clear	Clear	Clear	Clear	Clear	Clear	Clear	Clear	Clear	Clear	Clear
4	Elec. Conductivity (µs/cm)	102.7	23.6	83.7	17.1	13.9	16.8	19.4	13.3	49.9	106.5	26.8	52.6
5	TDS (mg/l)	51.5	11.8	41.8	8.5	7.0	8.4	9.7	6.7	24.5	53.2	25.8	26.4
6	Turbidity (NTU)	1.2	<1.0	1.0	<1.0	1.0	<1.0	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	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
8	Total Hardness (mg/l)	25.0	4.0	15.0	2.0	2.0	2.0	2.0	2.0	12.0	22.0	5.0	15.0
9	Total Alkalinity (mg/l)	10.0	11.0	10.0	8.0	10.0	12.0	10.0	8.0	8.0	8.0	10.0	8.0
10	Chloride, Cl ⁻ (mg/l)	30.0	5.0	23.0	4.0	3.0	3.0	3.0	2.0	14.0	24.0	6.0	8.0
11	Sulphate, SO ₄ ²⁻ (mg/l)	5.0	2.0	4.0	1.0	1.0	1.0	1.0	1.0	3.0	5.0	2.0	4.0
12	Nitrate, NO ₃ ⁻ (mg/l)	1.40	0.40	1.00	0.20	0.20	0.10	0.10	0.20	0.70	1.40	0.60	1.00
13	Phosphate, PO ₄ ³⁻ (mg/l)	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
14	Cyanide (mg/l)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.01
15	Ammonia (mg/l)	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
16	Silica (mg/l)	5.0	6.3	6.0	7.2	4.4	5.1	4.7	7.2	4.0	5.3	9.6	3.8
17	Salinity (ppt)	0.05	0.02	0.04	0.02	0.02	0.01	0.01	0.02	0.03	0.06	0.01	0.01
18	Oil & Grease (mg/l)	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
19	DO (mg/l)	4.70	3.80	3.90	3.60	3.50	4.70	4.80	4.60	3.90	4.60	3.90	3.60
20	BOD (mg/l)	1.50	3.20	4.30	4.80	4.20	4.80	2.70	4.30	4.70	2.80	<1.00	1.90
21	COD (mg/l)	2.90	6.50	9.00	11.50	8.50	12.50	4.80	8.50	12.00	4.50	2.60	4.50
22	Sodium, Na (mg/l)	11.44	2.85	10.22	1.85	1.49	2.15	1.94	1.41	5.84	8.59	2.96	2.38
23	Potassium, K (mg/l)	2.52	0.12	0.89	0.22	0.09	0.14	0.26	0.06	0.38	1.21	0.18	0.43
24	Calcium, Ca (mg/l)	6.73	1.08	5.27	0.55	0.51	0.62	0.59	0.65	3.84	6.85	1.53	4.61
25	Magnesium, Mg (mg/l)	1.78	0.27	0.41	0.12	0.15	0.09	0.11	0.07	0.45	1.08	0.29	0.68
26	Manganese, Mn (mg/l)	0.083	0.056	0.102	0.087	0.093	0.164	0.134	0.098	0.133	0.042	0.068	0.127
27	Iron, Fe (mg/l)	0.185	0.241	0.157	0.161	0.121	0.172	0.049	0.086	0.167	0.072	0.173	0.243
28	Copper, Cu (mg/l)	0.016	0.021	0.027	0.065	0.135	0.196	0.065	0.039	0.179	0.087	0.065	0.116
29	Zinc, Zn (mg/l)	0.037	0.027	0.020	0.028	0.035	0.010	0.026	0.037	0.045	0.016	0.013	0.078
30	Arsenic, As (mg/l)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
31	Chromium, Cr (mg/l)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
32	Lead, Pb (mg/l)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
33	Mercury, Hg (mg/l)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
34	Nickel, Ni (mg/l)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
35	Cadmium, Cd (mg/l)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
36	HUB (CFU/ml) x 10 ²	0.6	NIL	0.3	0.1	0.4	0.3	0.5	0.6	0.4	0.2	0.4	0.4
37	HUF (CFU/ml) x 10 ²	0.2	NIL	0.2	0.1	0.1	0.2	0.1	0.3	0.3	0.1	0.3	0.1
38	THB (CFU/ml) x 10 ²	1.7	1.7	2.1	1.7	1.9	2.7	1.8	2.6	2.4	1.7	2.2	1.7
39	THF (CFU/ml) x 10 ²	1.0	0.6	1.4	0.8	1.2	1.5	1.1	1.4	1.0	0.6	1.2	0.8
40	Total Coliform (MPN/100ml)	0	0	0	0	0	2.0	0	0	3.0	0	2.0	3.0
41	Faecal Coliform (MPN/100ml)	0	0	0	0	0	0	0	0	0	0	0	0



Stiff diagram showing groundwater chemistry across the project site (GW1 - GW10)



Stiff diagram showing groundwater chemistry across the project site (GW11 - GW20)



Stiff diagram showing groundwater chemistry across the project site (GW21-GWC2)

ANNEXURE 4.5

SURFACE WATER QUALITY RESULTS

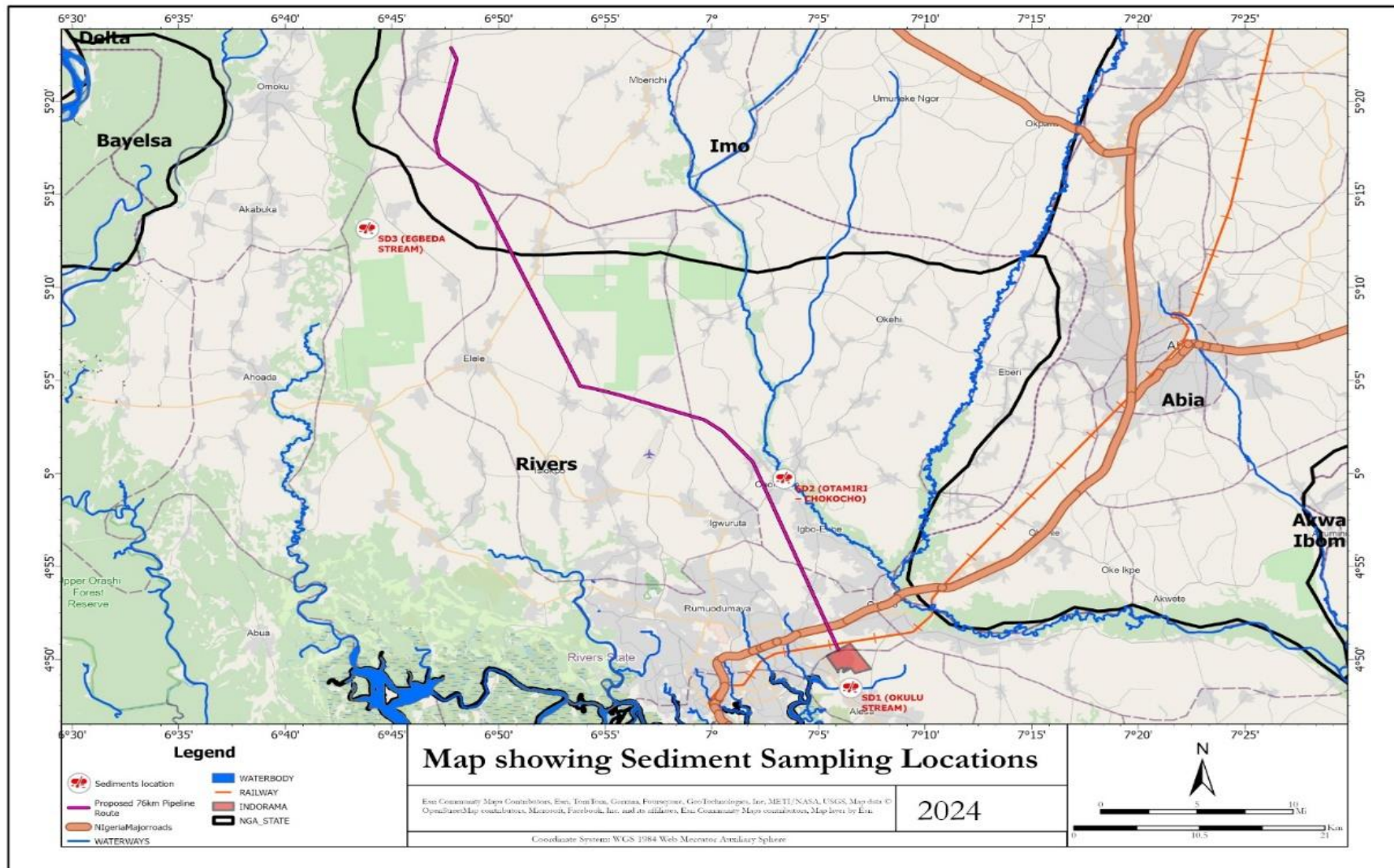
S/N	Parameter(s)	SW 1	SW 2	SW 3
0	Depth (meters)	5.7	3.8	4.1
1	pH	7.49	7.61	7.59
2	Appearance	Clear	Clear	Clear
3	Temperature (°C)	31.2	28.1	26.6
4	Elec. Conductivity (µs/cm)	7,720	37.0	18.0
5	TDS (mg/l)	3,890	19.0	11.0
6	Turbidity (NTU)	5.6	4.8	4.5
7	TSS (mg/l)	4.4	3.8	3.1
8	Salinity (ppt)	4.40	0.02	0.01
9	Total Hardness (mg/l)	940.0	14.0	10.0
10	Alkalinity (mg/l)	65.0	40.0	30.0
11	Chloride, Cl ⁻ (mg/l)	2,280	12.0	8.0
12	Sulphate, SO ₄ ²⁻ (mg/l)	345	4.0	2.0
13	Phosphate, PO ₄ ³⁻ (mg/l)	1.36	0.75	0.62
14	Nitrate, NO ₃ ⁻ (mg/l)	3.36	0.89	0.56
15	Cyanide (mg/l)	<0.001	<0.001	<0.001
16	Ammonia (mg/l)	0.68	0.30	0.20
17	Total Nitrogen (mg/l)	9.54	5.88	5.35
18	Oil & Grease (mg/l)	<1.00	<1.00	<1.00
19	DO (mg/l)	5.60	5.80	4.60
20	BOD ₅ (mg/l)	16.20	12.00	10.00
21	COD (mg/l)	54.40	38.80	32.40
22	Sodium, Na (mg/l)	1219.72	18.68	12.35
23	Potassium, K (mg/l)	28.68	1.78	1.23
24	Calcium, Ca (mg/l)	298.96	4.15	2.88
25	Magnesium, Mg (mg/l)	45.47	0.81	0.57
26	Silver, Ag (mg/l)	<0.001	<0.001	<0.001
27	Cobalt, Co (mg/l)	<0.001	<0.001	<0.001
28	Manganese, Mn (mg/l)	0.056	0.021	0.016
29	Vanadium, V (mg/l)	<0.001	<0.001	<0.001
30	Nickel, Ni (mg/l)	<0.001	<0.001	<0.001
31	Chromium, Cr (mg/l)	<0.001	<0.001	<0.001
32	Iron, Fe (mg/l)	0.271	0.081	0.032
33	Lead, Pb (mg/l)	<0.001	<0.001	<0.001
34	Copper, Cu (mg/l)	0.089	0.041	0.026
35	Zinc, Zn (mg/l)	0.075	0.032	0.034
36	Mercury, Hg (mg/l)	<0.001	<0.001	<0.001
37	Cadmium, Cd (mg/l)	<0.001	<0.001	<0.001
38	Arsenic, As (mg/l)	<0.001	<0.001	<0.001
39	HUB (CFU/ml) x 10 ²	0.3	0.4	0.6
40	HUF (CFU/ml) x 10 ²	0.1	0.2	0.4
41	THB (CFU/ml) x 10 ²	2.0	2.4	2.1
42	THF (CFU/ml) x 10 ²	1.2	1.1	1.6
43	Fecal Coliform (MPN/100ml)	23	0	15
44	Total Coliform (MPN/100ml)	60	8	20

ANNEXURE 4.6

SEDIMENT QUALITY RESULTS

S/N	Parameter(s)	SED 1	SED 2	SED 3
1.	pH	5.2	5.3	5.0
2.	Moisture Content (%)	28.35	27.23	28.12
3.	Sulphide, S ₂ (mg/kg)	<0.001	<0.001	<0.001
4.	Sulphate, SO ₄ ²⁻ (mg/kg)	25	10	13
5.	Nitrate, NO ₃ ⁻ (mg/kg)	2.5	2.0	2.4
6.	Total Nitrogen (%)	0.222	0.231	0.209
7.	Phosphate, PO ₄ ³⁻ (mg/kg)	1.75	1.21	1.43
8.	THC (mg/kg)	3.51	2.12	2.68
9.	TPH (mg/kg)	41.30	23.30	34.51
10.	PAH (mg/kg)	0.006	0.002	0.003
11.	BETEX (mg/kg)	<0.001	<0.001	<0.001
12.	Phenol (mg/kg)	<0.001	<0.001	<0.001
13.	Ammonia (mg/kg)	0.45	0.38	0.32
14.	TOC (%)	2.565	2.675	2.415
15.	TOM (%)	4.435	4.625	4.172
16.	Electric Conductivity (µs/cm)	858	141	273
17.	Sand (%)	78.25	76.78	78.16
18.	Silt (%)	3.45	3.52	3.38
19.	Clay (%)	18.30	19.70	18.46
20.	Particle Size Distribution	SL	SL	SL
21.	Porosity	0.365	0.360	0.362
22.	Colour	Black	Black	Black
23.	Permeability (cm/sec)×10	0.25	0.20	0.23
24.	Bulk Density (g/cm ³)	1.31	1.26	1.30
25.	Sodium, Na (mg/kg)	83.93	33.62	45.89
26.	Magnesium, Mg (mg/kg)	21.07	20.31	21.00
27.	Calcium, Ca (mg/kg)	<0.001	<0.001	<0.001
28.	Potassium, K (mg/kg)	22.21	5.02	29.68
29.	Manganese, Mn (mg/kg)	<0.001	4.65	4.03
30.	Vanadium, V (mg/kg)	<0.001	<0.001	0.49
31.	Nickel, Ni (mg/kg)	<0.001	<0.001	10.30
32.	Chromium, Cr (mg/kg)	<0.001	<0.001	<0.001
33.	Iron, Fe (mg/kg)	34.59	<0.01	63.72
34.	Lead, Pb (mg/kg)	3.44	3.86	3.74
35.	Copper, Cu (mg/kg)	15.60	7.14	4.65
36.	Zinc, Zn (mg/kg)	11.32	12.35	15.27
37.	Mercury, Hg (mg/kg)	<0.001	<0.001	<0.001
38.	Arsenic, As (mg/kg)	0.14	0.07	0.04
39.	HUB (CFU/g) x 10 ³	1.3	0.8	0.8
40.	HUF (CFU/g) x 10 ³	0.9	0.6	0.3
41.	THB (CFU/g)	3.2 × 10 ⁵	2.7 × 10 ⁵	2.3 × 10 ⁵
42.	THF (CFU/g)	2.4 × 10 ⁵	1.5 × 10 ⁵	1.2 × 10 ⁵

NOTE: LS – LOAMY SAND, SS – SANDY SOIL, SL – SANDY LOAMY.



Map showing sediment sampling location

ANNEXURE 4.7: VEGETATION RESULTS

(TREES, SHRUBS AND HERBACEOUS PLANTS)

TREE AND SHRUB IDENTIFIED IN THE STUDY AREA

S/N	Species Name	T1	T2	T3	T4	T5	T6	T7	T8	Species Freq.	Relative Abundance	Species Evenness	IUCN STATUS
1	<i>Acasia sp.</i>	0	0	3	0	0	0	0	0	12.5	0.42	0	NE
2	<i>Albizia sp.</i>	0	0	3	0	0	0	0	0	12.5	0.42	0	NE
3	<i>Alchornea cordifolia</i>	0	3	4	7	24	21	0	0	62.5	8.19	0.82	NE
4	<i>Alchornea laxiflora</i>	0	0	0	0	13	0	0	0	12.5	1.81	0	NE
5	<i>Alchornea oppositifolia</i>	5	0	3	0	0	0	0	0	25	1.11	0.95	NE
6	<i>Allophalus sp.</i>	0	0	0	4	0	0	0	0	12.5	0.56	0	NE
7	<i>Alstonia boonei</i>	2	0	1	0	2	0	0	0	37.5	0.69	0.96	NE
8	<i>Annona sp.</i>	0	0	0	1	0	0	0	0	12.5	0.14	0	NE
9	<i>Anthocliasta sp.</i>	0	0	0	0	3	2	0	0	25	0.69	0.97	NE
10	<i>Anthocliasta vogelli</i>	4	2	0	3	5	0	0	0	50	1.94	0.96	NE
11	<i>Anthonatha macrophylla</i>	16	0	0	8	14	0	0	0	37.5	5.28	0.96	NE
12	<i>Ceiba pentandra</i>	0	0	0	0	1	0	0	0	12.5	0.14	0	NE
13	<i>Cleistopholis pantens</i>	0	0	3	0	7	0	0	0	25	1.39	0.88	NE
14	<i>Dracinia sp.</i>	2	0	0	3	0	0	0	0	25	0.69	0.97	NE
15	<i>Dycrodes edulis</i>	0	0	4	0	0	0	0	0	12.5	0.56	0	LC
16	<i>Elieas guineensis</i>	12	4	7	4	21	14	0	0	75	8.61	0.9	LC
17	<i>Ficus exerparata</i>	4	0	0	0	0	0	0	0	12.5	0.56	0	LC
18	<i>Ficus muscosa</i>	5	0	0	0	0	0	0	0	12.5	0.69	0	LC
19	<i>Ficus sp</i>	0	5	5	7	0	12	0	0	50	4.03	0.95	LC
20	<i>Ficus sur</i>	3	0	0	0	0	0	0	0	12.5	0.42	0	LC
21	<i>Gracinia mannii</i>	0	0	0	2	3	4	0	0	37.5	1.25	0.97	LC
22	<i>Harungana madagascarensis</i>	4	0	7	13	24	2	0	0	62.5	6.94	0.81	LC
23	<i>Kola sp.</i>	0	0	0	0	3	8	0	0	25	1.53	0.85	LC

S/N	Species Name	T1	T2	T3	T4	T5	T6	T7	T8	Species Freq.	Relative Abundance	Species Evenness	IUCN STATUS
24	<i>Macaranga</i> sp.	0	0	12	0	7	0	0	0	25	2.64	0.95	NE
25	<i>Mallotus</i> sp.	2	0	0	7	0	0	0	0	25	1.25	0.76	NE
26	<i>Mangifera indica</i>	5	0	0	0	3	0	0	0	25	1.11	0.95	NE
27	<i>Maniphytom fulvum</i>	0	0	0	10	24	0	0	0	25	4.72	0.87	NE
28	<i>Meosobotrya</i> sp.	8	0	0	0	0	0	0	0	12.5	1.11	0	NE
29	<i>Milecia excelsa</i>	3	0	0	0	0	0	0	0	12.5	0.42	0	LC
30	<i>Millettia arboensis</i>	0	12	14	6	9	0	0	0	50	5.69	0.97	NE
31	<i>Millettia thonningii</i>	0	0	0	0	3	0	0	0	12.5	0.42	0	NE
32	<i>Musanga</i> sp.	0	0	7	0	6	5	0	0	37.5	2.5	0.99	NE
33	<i>Myristica</i> sp.	0	0	0	2	0	0	0	0	12.5	0.28	0	NE
34	<i>Napoleona</i> sp.	0	7	3	0	8	3	0	0	50	2.92	0.93	NE
35	<i>Nauclea pobeguinii</i>	0	0	0	0	5	0	0	0	12.5	0.69	0	LC
36	<i>Newbaldia leavis</i>	2	5	0	0	3	0	0	0	37.5	1.39	0.94	LC
37	<i>Pentacletra macrophylla</i>	0	9	0	7	5	0	0	0	37.5	2.92	0.97	LC
38	<i>Psidium guajava</i>	7	0	0	0	0	0	0	0	12.5	0.97	0	LC
39	<i>Pterocarpus santaloides</i>	0	0	0	4	0	7	0	0	25	1.53	0.95	LC
40	<i>Raphia</i> sp.	0	0	0	5	7	0	0	0	25	1.67	0.98	LC
41	<i>Raphia spp.,</i>	0	0	12	0	0	0	0	0	12.5	1.67	0	LC
42	<i>Senna alata</i>	0	0	27	0	0	0	0	0	12.5	3.75	0	LC
43	<i>Senna semea</i>	12	0	0	0	0	0	0	0	12.5	1.67	0	LC
44	<i>Spondias mombin</i>	0	0	6	0	4	9	0	0	37.5	2.64	0.95	LC
45	<i>Streculia tragacantha</i>	0	0	0	0	17	6	0	0	25	3.19	0.83	LC
46	<i>Symphonia globulifera</i>	0	0	0	0	3	0	0	0	12.5	0.42	0	LC
47	<i>Tectonia grandis</i>	0	0	0	0	3	0	0	0	12.5	0.42	0	LC
48	<i>Terminalia</i> sp.	0	0	0	0	1	0	0	0	12.5	0.14	0	LC
49	<i>Treculia</i> sp.	0	0	0	2	0	0	0	0	12.5	0.28	0	LC
50	<i>Dialium guineensis</i>	0	0	0	14	0	21	0	0	25	4.86	0.97	LC
51	<i>Vitex</i> sp.	0	0	3	2	0	0	0	0	25	0.69	0.97	LC

Note: NE = Not Evaluated, LC = Least Concern

HERBACEOUS PLANTS IDENTIFIED IN THE STUDY AREA

S/N	Species Name	T1	T2	T3	T4	T5	T6	T7	T8	Species Freq.	Relative Abundance	Species Evenness	IUCN Status
1	<i>Panicum maximum</i>	21	0	0	31	0	39	23	0	50	2.73	0.98	NE
2	<i>Manihot esculenta</i>	48	0	0	12	0	43	0	0	37.5	2.46	0.88	NE
3	<i>Andropogon gayanus</i>	0	0	0	15	24	23	31	0	50	2.23	0.98	NE
4	<i>Sida acuta</i>	12	0	0	23	0	55	0	0	37.5	2.15	0.84	NE
5	<i>Bambosa vulgaris</i>	0	20	3	20	3	31	0	0	62.5	1.84	0.82	NE
6	<i>Aspilia africana</i>	0	19	0	25	3	29	0	0	50	1.82	0.87	NE
7	<i>Phyllathus amarus</i>	23	0	0	0	39	13	0	0	37.5	1.79	0.92	NE
8	<i>Custus afer</i>	3	39	0	10	20	35	0	10	37.5	1.65	0.88	NE
9	<i>Sporobolus pyramidalis</i>	0	0	0	0	0	67	0	0	12.5	1.6	0	NE
10	<i>Urena lobata</i>	3	2	0	10	45	5	0	0	62.5	1.56	0.61	NE
11	<i>Pennisetum pedicellatum,</i>	22	0	0	0	0	0	43	0	25	1.56	0.92	NE
12	<i>Euphorbia heterophylla</i>	22	0	0	0	0	0	0	37	25	1.41	0.95	NE
13	<i>Chromolenea odorata</i>	0	8	6	29	13	0	0	0	50	1.34	0.86	NE
14	<i>Euphorbia hirta</i>	12	0	0	0	0	43	0	0	25	1.32	0.76	NE
15	<i>Asystasia gangetica</i>	29	0	0	24	0	0	0	0	25	1.27	0.99	NE
16	<i>Digitaria gayana</i>	0	0	0	0	0	0	53	0	12.5	1.27	0	NE
17	<i>Monechma ciliatum</i>	0	31	0	0	0	0	0	17	25	1.15	0.94	NE
18	<i>Cynodium sp.</i>	0	3	0	23	0	21	0	0	37.5	1.12	0.81	NE
19	<i>Calapogonium muconoides</i>	0	0	12	10	0	23	0	0	37.5	1.08	0.94	NE
20	<i>Dioscorea sp.</i>	0	0	10	4	31	0	0	0	37.5	1.08	0.73	NE
21	<i>Brachiaria spp</i>	0	0	0	0	0	0	45	0	12.5	1.08	0	NE
22	<i>Hackelochloa granularis</i>	0	0	0	0	0	0	45	0	12.5	1.08	0	NE
23	<i>Panicum laxum</i>	0	44	0	0	0	0	0	0	12.5	1.05	0	NE
24	<i>Saciolepsis africana</i>	0	43	0	0	0	0	0	0	12.5	1.03	0	NE
25	<i>Croton lobatus</i>	0	0	0	0	10	32	0	0	25	1.01	0.79	NE
26	<i>Leptochloa filiformis</i>	0	0	0	0	0	0	42	0	12.5	1.01	0	NE
27	<i>Desmodium salicifolium</i>	0	0	0	0	0	0	0	41	12.5	0.98	0	NE
28	<i>Rottboellia cochinchinensis</i>	0	0	0	0	0	0	39	0	12.5	0.93	0	NE

S/N	Species Name	T1	T2	T3	T4	T5	T6	T7	T8	Species Freq.	Relative Abundance	Species Evenness	IUCN Status
29	<i>Ludwigia</i> spp.	7	18	11	2	0	0	0	0	50	0.91	0.85	NE
30	<i>Chrysopogon aciculatus</i>	0	0	0	0	0	0	37	0	12.5	0.89	0	NE
31	<i>Cyperus</i> spp.	13	0	21	35	0	0	0	0	12.5	0.84	0	NE
32	<i>Ipomea</i> sp.	0	0	3	0	10	21	0	0	37.5	0.81	0.79	NE
33	<i>Salvinia nymhellula</i>	0	34	0	0	0	0	0	0	12.5	0.81	0	NE
34	<i>Sida linifolia</i>	0	0	0	0	0	0	0	34	12.5	0.81	0	NE
35	<i>Creponia</i> sp.	0	0	0	33	0	0	0	0	12.5	0.79	0	NE
36	<i>Brachiaria deflexa</i>	0	0	0	0	0	0	32	0	12.5	0.77	0	NE
37	<i>Imperata cylindrical</i>	0	0	0	0	0	0	32	0	12.5	0.77	0	NE
38	<i>Tomatococcus danieli</i>	32	0	0	0	0	0	0	0	12.5	0.77	0	NE
39	<i>Triumfetta rhomboidea</i>	0	0	0	0	0	0	0	32	12.5	0.77	0	NE
40	<i>Mimosa invosa</i>	0	0	0	31	0	0	0	0	12.5	0.74	0	NE
41	<i>Dactyloctenium aegyptium</i>	0	0	0	0	0	0	30	0	12.5	0.72	0	NE
42	<i>Cissus</i> sp.	3	0	2	0	10	14	0	0	50	0.69	0.82	NE
43	<i>Aframomum</i> spp.	0	0	0	0	29	0	0	0	12.5	0.69	0	NE
44	<i>Hypoestes forskalei</i>	0	29	0	0	0	0	0	0	12.5	0.69	0	NE
45	<i>Zea mays</i>	0	0	0	29	0	0	0	0	12.5	0.69	0	NE
46	<i>Fumtunia</i> sp.	6	0	0	8	13	0	0	0	37.5	0.65	0.95	NE
47	<i>Euphorbia</i> spp.	0	0	0	0	27	0	0	0	12.5	0.65	0	NE
48	<i>Malvastrum coromandelianum</i>	0	0	0	0	0	0	0	27	12.5	0.65	0	NE
49	<i>Vernonia cinerae</i>	0	27	0	0	0	0	0	0	12.5	0.65	0	NE
50	<i>Musa</i> spp.	0	2	0	0	0	24	0	0	25	0.62	0.39	NE
51	<i>Passiflora feotida</i>	13	12	0	0	0	0	0	0	25	0.6	1	NE
52	<i>Combertum racemosum</i>	0	0	0	0	25	0	0	0	12.5	0.6	0	NE
53	<i>Eragrostis atrovirens</i>	0	0	0	0	0	0	25	0	12.5	0.6	0	NE
54	<i>Hyparrhenia involucrate</i>	0	0	0	0	0	0	25	0	12.5	0.6	0	NE
55	<i>Amaramthus</i> sp.	3	2	0	0	18	0	0	0	37.5	0.55	0.61	NE
56	<i>Lageneria breviflora</i>	0	2	0	0	15	0	0	6	37.5	0.55	0.77	NE

S/N	Species Name	T1	T2	T3	T4	T5	T6	T7	T8	Species Freq.	Relative Abundance	Species Evenness	IUCN Status
57	<i>Cymbopogon giganteus</i>	0	0	0	0	0	0	23	0	12.5	0.55	0	NE
58	<i>Cynthula prostrata</i>	0	0	23	0	0	0	0	0	12.5	0.55	0	NE
59	<i>Evolvulus alsinoides</i>	0	0	0	0	0	0	0	23	12.5	0.55	0	NE
60	<i>Gomphrena</i> sp.	23	0	0	0	0	0	0	0	12.5	0.55	0	NE
61	<i>Pentodon pantandrus</i>	0	23	0	0	0	0	0	0	12.5	0.55	0	NE
62	<i>Perperomia</i> sp.	23	0	0	0	0	0	0	0	12.5	0.55	0	NE
63	<i>Physalis angulata</i>	0	23	0	0	0	0	0	0	12.5	0.55	0	NE
64	<i>Vernonia galamensis</i>	0	0	0	0	0	0	0	23	12.5	0.55	0	NE
65	<i>Cintrocima pubiscense</i>	10	0	0	12	0	0	0	0	25	0.53	0.99	NE
66	<i>Mimosa pidica</i>	0	19	0	3	0	0	0	0	25	0.53	0.57	NE
67	<i>Colocasis esculenta</i>	0	0	0	22	0	0	0	0	12.5	0.53	0	NE
68	<i>Diptazium samnatii</i>	22	0	0	0	0	0	0	0	12.5	0.53	0	NE
69	<i>Hiptis swavelencse</i>	0	0	0	22	0	0	0	0	12.5	0.53	0	NE
70	<i>Mormodica charantia</i>	22	0	0	0	0	0	0	0	12.5	0.53	0	NE
71	<i>Scleria naumanniana</i>	22	0	0	0	0	0	0	0	12.5	0.53	0	NE
72	<i>Combretum racemosum</i>	9	0	12	0	0	0	0	0	25	0.5	0.99	NE
73	<i>Andropogon tectorum</i>	0	0	0	0	0	0	21	0	12.5	0.5	0	NE
74	<i>Hyperthelia dissolute</i>	0	0	0	0	0	0	21	0	12.5	0.5	0	NE
75	<i>Sida cordifolia</i>	21	0	0	0	0	0	0	0	12.5	0.5	0	NE
76	<i>Desmodium scorpius</i>	0	20	0	0	0	0	0	0	12.5	0.48	0	NE
77	<i>Sesamum alatum</i>	0	0	0	0	0	0	0	20	12.5	0.48	0	NE
78	<i>Conyza Sumatrensis</i>	2	0	0	0	7	0	10	0	37.5	0.45	0.86	NE
79	<i>Amarathus hybridus</i>	0	4	0	15	0	0	0	0	25	0.45	0.74	NE
80	<i>Cissus gracilis</i>	0	0	0	19	0	0	0	0	12.5	0.45	0	NE
81	<i>Daniellia oliveri</i>	0	0	0	0	0	0	0	19	12.5	0.45	0	NE
82	<i>Oldenlandia herbacea</i>	0	0	0	0	0	0	0	19	12.5	0.45	0	NE
83	<i>Crotalaria macrocalyx</i>	0	0	3	0	0	15	0	0	25	0.43	0.65	NE
84	<i>Hibiscus haspan</i>	5	0	0	0	0	0	0	13	25	0.43	0.85	NE
85	<i>Combretum platypterum</i>	0	0	0	18	0	0	0	0	12.5	0.43	0	NE

S/N	Species Name	T1	T2	T3	T4	T5	T6	T7	T8	Species Freq.	Relative Abundance	Species Evenness	IUCN Status
86	<i>Eriosema psoraleoides</i>	0	0	0	0	0	0	0	18	12.5	0.43	0	NE
87	<i>Sida rhombifolia</i>	0	0	0	0	0	0	0	18	12.5	0.43	0	NE
88	<i>Adenia lobata</i>	6	0	3	6	2	0	0	0	50	0.41	0.93	NE
89	<i>Aspilia bussei</i>	0	0	0	7	0	10	0	0	25	0.41	0.98	NE
90	<i>Combretum spp.</i>	0	7	0	10	0	0	0	0	25	0.41	0.98	NE
91	<i>Clapertonia fibliformis</i>	0	0	0	17	0	0	0	0	12.5	0.41	0	NE
92	<i>Hypoestes cancellata</i>	0	0	0	0	0	0	0	17	12.5	0.41	0	NE
93	<i>Polycarpaea corymbosa</i>	0	0	0	0	0	0	0	17	12.5	0.41	0	NE
94	<i>Chrysanthellum indicum</i>	0	13	0	0	3	0	0	0	25	0.38	0.7	NE
95	<i>Combretum bracteatum</i>	0	0	0	0	0	16	0	0	12.5	0.38	0	NE
96	<i>Laggera aurita</i>	0	0	0	0		0	0	16	12.5	0.38	0	NE
97	<i>Loudetia annua</i>	0	0	0	0	0	0	16	0	12.5	0.38	0	NE
98	<i>Sclerocarpus africanus</i>	0	0	0	0	0	0	0	16	12.5	0.38	0	NE
99	<i>Vernonia perrottetii</i>	0	0	0	0	0	0	0	16	12.5	0.38	0	NE
100	<i>Landolphia sp.</i>	12	0	0	0	3	0	0	0	25	0.36	0.72	NE
101	<i>Hydrolea palustris</i>	15	0	0	0	0	0	0	0	12.5	0.36	0	NE
102	<i>Luffa cylindrica</i>	7	0	0	3	0	4	0	0	37.5	0.34	0.94	NE
103	<i>Clerodendrum splendens</i>	5	0	9	0	0	0	0	0	25	0.34	0.94	NE
104	<i>Lantana camara</i>	9	0	0	0	5	0	0	0	25	0.34	0.94	NE
105	<i>Loudetia arundinacea</i>	0	0	0	0	0	0	14	0	12.5	0.34	0	NE
106	<i>Tephrosia pedicellata</i>	0	0	0	0	0	0	0	14	12.5	0.34	0	NE
107	<i>Melastrutum sp.</i>	0	0	0	13	0	0	0	0	12.5	0.31	0	NE
108	<i>Vernonia amygdalina</i>	13	0	0	0	0	0	0	0	12.5	0.31	0	NE
109	<i>Cochlospermum planchoni</i>	0	7	0	0	3	0	2	0	37.5	0.29	0.87	NE
110	<i>Blepharis maderaspatensis</i>	0	0	3	0	9	0	0	0	25	0.29	0.81	NE
111	<i>Allanmanda sp.</i>	0	0	0	0	0	12	0	0	12.5	0.29	0	NE
112	<i>Cleome sp.</i>	0	0	0	0	0	12	0	0	12.5	0.29	0	NE
113	<i>Heteropogon connortus</i>	0	0	0	0	0	0	12	0	12.5	0.29	0	NE
114	<i>Ipacina trichanta</i>	12	0	0	0	0	0	0	0	12.5	0.29	0	NE

S/N	Species Name	T1	T2	T3	T4	T5	T6	T7	T8	Species Freq.	Relative Abundance	Species Evenness	IUCN Status
115	<i>Ipomoea involucrata</i>	0	0	0	12	0	0	0	0	12.5	0.29	0	NE
116	<i>Leonotis nepetifolia</i>	0	0	0	0	0	0	0	12	12.5	0.29	0	NE
117	<i>Psychotria polanthera</i>	12	0	0	0	0	0	0	0	12.5	0.29	0	NE
118	<i>Sorghum arundinaceum</i>	0	0	0	0	0	0	12	0	12.5	0.29	0	NE
119	<i>Spermacoce octodon</i>	0	0	0	0	0	0	0	12	12.5	0.29	0	NE
120	<i>Acanthus montanus</i>	0	3	2	5	0	0	0	0	37.5	0.24	0.94	NE
121	<i>Carica papaya</i>	3	7	0	0	0	0	0	0	25	0.24	0.88	NE
122	<i>Xanthosoma sagitifolia</i>	0	7	0	3	0	0	0	0	25	0.24	0.88	NE
123	<i>Bidens pinnata</i>	0	10	0	0	0	0	0	0	12.5	0.24	0	NE
124	<i>Cenchrus biflorus</i>	0	0	0	0	0	0	10	0	12.5	0.24	0	NE
125	<i>Elusine indica</i>	10	0	0	0	0	0	0	0	12.5	0.24	0	NE
126	<i>Hyptis spicigera</i>	0	0	0	0	0	0	0	10	12.5	0.24	0	NE
127	<i>Ipomoea triloba</i>	0	10	0	0	0	0	0	0	12.5	0.24	0	NE
128	<i>Vernonia ambigua</i>	0	0	0	0	0	0	0	10	12.5	0.24	0	NE
129	<i>Stachythapheta cyanensis</i>	0	0	0	9	0	0	0	0	12.5	0.22	0	NE
130	<i>Smilax anceps</i>	3	0	2	3	0	0	0	0	37.5	0.19	0.99	NE
131	<i>Calamus sp.</i>	0	0	5	0	2	0	0	0	25	0.17	0.86	NE
132	<i>Chamaecrista mimosoides</i>	0	0	0	0	0	5	0	2	25	0.17	0.86	NE
133	<i>Croton hirsuta</i>	0	4	0	3	0	0	0	0	25	0.17	0.99	NE
134	<i>Abrus sp.</i>	0	0	0	7	0	0	0	0	12.5	0.17	0	NE
135	<i>Aerva javanica</i>	0	0	0	0	0	0	0	7	12.5	0.17	0	NE
136	<i>Ageratum houtonianum</i>	0	7	0	0	0	0	0	0	12.5	0.17	0	NE
137	<i>Canna indica</i>	0	7	0	0	0	0	0	0	12.5	0.17	0	NE
138	<i>Cloeme retrosperma</i>	7	0	0	0	0	0	0	0	12.5	0.17	0	NE
139	<i>Isoberlina doka</i>	0	0	0	0	0	0	0	7	12.5	0.17	0	NE
140	<i>Polygonum lanigerum</i>	0	7	0	0	0	0	0	0	12.5	0.17	0	NE
141	<i>Celosia leptostachya</i>	2	0	0	4		0	0	0	25	0.14	0.92	NE
142	<i>Combretum hispidum</i>	0	6	0	0	0	0	0	0	12.5	0.14	0	NE
143	<i>Justicia carnea</i>	0	6	0	0	0	0	0	0	12.5	0.14	0	NE

S/N	Species Name	T1	T2	T3	T4	T5	T6	T7	T8	Species Freq.	Relative Abundance	Species Evenness	IUCN Status
144	<i>Rhynchospora corymbosa</i>	6	0	0	0	0	0	0	0	12.5	0.14	0	NE
145	<i>Sphenoclea zzyllanica</i>	6	0	0	0	0	0	0	0	12.5	0.14	0	NE
146	<i>Combretum indicum</i>	0	5	0	0	0	0	0	0	12.5	0.12	0	NE
147	<i>Echhornea natans</i>	0	5	0	0	0	0	0	0	12.5	0.12	0	NE
148	<i>Nelsonia canescens</i>	0	5	0	0	0	0	0	0	12.5	0.12	0	NE
149	<i>Piliostigma thonningii</i>	0	0	0	0	0	0	0	5	12.5	0.12	0	NE
150	<i>Solanum torvum</i>	5	0	0	0	0	0	0	0	12.5	0.12	0	NE
151	<i>Syngonium pobophyllum</i>	0	0	5	0	0	0	0	0	12.5	0.12	0	NE
152	<i>Adenia cissampliodes</i>	4	0	0	0	0	0	0	0	12.5	0.1	0	NE
153	<i>Albemuscus esculenta</i>	4	0	0	0	0	0	0	0	12.5	0.1	0	NE
154	<i>Fuirena umbellata</i>	4	0	0	0	0	0	0	0	12.5	0.1	0	NE
155	<i>Solanum nigrum</i>	4	0	0	0	0	0	0	0	12.5	0.1	0	NE
156	<i>Acmeilla ugliedosa</i>	0	3	0	0	0	0	0	0	12.5	0.07	0	NE
157	<i>Brillantasia lamum</i>	0	0	0	0	3	0	0	0	12.5	0.07	0	NE
158	<i>Fimbristylis littoralis</i>	3	0	0	0	0	0	0	0	12.5	0.07	0	NE
159	<i>Heteranthera callifolia</i>	3	0	0	0	0	0	0	0	12.5	0.07	0	NE
160	<i>Paulinia sp.</i>	0	0	0	3	0	0	0	0	12.5	0.07	0	NE
161	<i>Synedrella sp.</i>	3	0	0	0	0	0	0	0	12.5	0.07	0	NE
162	<i>Triumffeta cordifolia</i>	3	0	0	0	0	0	0	0	12.5	0.07	0	NE
163	<i>Aeschynomene indica</i>	2	0	0	0	0	0	0	0	12.5	0.05	0	NE
164	<i>Cyperus haspan</i>	0	2	0	0	0	0	0	0	12.5	0.05	0	NE
165	<i>Melochia corchorifolia</i>	2	0	0	0	0	0	0	0	12.5	0.05	0	NE
166	<i>Citrus cinensis</i>	0	0	1	0	0	0	0	0	12.5	0.02	0	NE

Note: NE = Not Evaluated, LC = Least Concern

ANNEXURE 4.8

ECOSYSTEM SERVICES

Ethnobotanical Value/Uses of Plant in the Project Area

S/N	Species Composition	Common Name	Family	Ethnobotanical Value/Uses
1	<i>Gmelina arborea</i>	Gmelina	<i>Lamiaceae</i>	It is used for making furniture, boats, and musical instruments.
2	<i>Tectona grandis</i>	Teak	<i>Lamiaceae</i>	It is used for for poles, beams, trusses, columns, roofs, doors, window frames, flooring, planking, panelling, and staircases etc.
3	<i>Pentacletra macrophylla</i>	Africa oil bean	<i>Fabaceae</i>	Extracts of the leaf, bark, seed and fruit pulp have anti-inflammatory and anthelmintic activity, and are used to treat gonorrhoea and convulsions etc.
4	<i>Newbouldia laevis</i>	Boundary tree	<i>Bignoniaceae</i>	The bark of <i>Newbouldia laevis</i> tree can be used for treating stomachic, piles and constipation.
5	<i>Ficus exasperate</i>	Sandpaper tree	<i>Moraceae</i>	Sandpaper tree is widely used as a source of sandpaper and as a valuable medicinal plant.
6	<i>Mangifera indica</i>	Mango	<i>Anacardiaceae</i>	Various parts of plant are used as a dentrifice, antiseptic, astringent, diaphoretic, stomachic, vermifuge, tonic, laxative and diuretic and to treat diarrhoea, dysentery, anaemia etc.
7	<i>Cassia Sp</i>	Candle bush	<i>Fabaceae</i>	The leaf of the tree is used for erysipelas, malaria, rheumatism, and ulcers, the buds are used for biliousness, etc.
8	<i>Moringa oleifera</i>	Drumstick tree	<i>Moringaceae</i>	Protecting and nourishing skin and hair.
9	<i>Anthocleista vogelii</i>	Cabbage tree	<i>Gentianaceae</i>	It is used in West Africa as a strong purgative and diuretic.

S/N	Species Composition	Common Name	Family	Ethnobotanical Value/Uses
10	<i>Harungana madagascariensis</i>	Haronga	<i>Hypericaceae</i>	It is used for the treatment of chest pains and urogenital infections.
11	<i>Nauclea dendrichii</i>	Opepe	<i>Rubiaceae</i>	It is hard, dense and resistant to fungi and insects, and is used in joinery, flooring and marine construction.
12	<i>Spondias moubin</i>	Hog plum	<i>Anacardiaceae</i>	The fruit has been used as a diuretic and febrifuge.
13	<i>Rauvolfia vomitoria</i>	Poison devil pepper	<i>Apocynaceae</i>	The roots, leaves, and stem are used in medicine. People use <i>Rauvolfia vomitoria</i> for convulsions, fever, weakness, inability to sleep, mental disorders, etc.
14	<i>Coco nucifera</i>	Coconut tree	<i>Arecaceae</i>	Industry is using the husk fibre from the pith as raw material for carpets, car seat stuffing, and in agricultural as fertilizers.
15	<i>Psidium guajava</i>	Guava	<i>Myrtaceae</i>	It is used for inflammation, diabetes, hypertension, caries, wounds, pain relief, fever, diarrhoea, rheumatism, lung diseases, and ulcers.
16	<i>Persea americana</i>	Avocado	<i>Lauraceae</i>	It is used in the treatment of diarrhoea, dysentery caused by helminths and amoebas, toothache.
17	<i>Alstonia macrophylla</i>	Hard milkwood	<i>Apocynaceae</i>	It is used for making roof beams, frames, poles and toys.
18	<i>Alstonia boonei</i>	Stool wood	<i>Apocynaceae</i>	It is used with other preparations in the treatment of fractures or dislocation.
19	<i>Raphia hookeri</i>	Raphia palm	<i>Arecaceae</i>	It is used as tying material for horticulture and handicrafts.
20	<i>Albizia zygia</i>	Nongo	<i>Fabaceae</i>	It is used for carving, flooring and furniture.
21	<i>Garcinia cola</i>	Bitter kola	<i>Clusiaceae</i>	The seeds are used for liver disorders, bronchitis, throat infections, colic, head or chest colds, and cough.
22	<i>Entandrophragma cylindricum</i>	sapele or sapelli or	Meliaceae	It is used for for flooring, interior joinery, interior trim, panelling, stairs, furniture, cabinet work, musical instruments, carvings, ship building, veneer, and plywood.

S/N	Species Composition	Common Name	Family	Ethnobotanical Value/Uses
		sapele mahogany		
23	<i>Funtumia elastica</i>	Silk rubber	<i>Apocynaceae</i>	It is used for treatment of whooping cough, asthma, blennorrhoea, painful menstruation, fungal infections, and wounds.
24	<i>Ricinodendron heudelotii</i>	Corkwood	<i>Euphorbiaceae</i>	It is used in treating constipation, cough, dysentery, rheumatism, rickets in children, oedema etc.
25	<i>Ficus sur</i>	Sandpaper tree	<i>Moraceae</i>	The tree is used as an ornamental and shade tree.
26	<i>Sterculia tragacantha</i>	African tragacanth	<i>Sterculiaceae</i>	It is used as food and medicine.
27	<i>Hevea brasiliensis</i>	Pará rubber tree	<i>Euphorbiaceae</i>	It is used for the manufacture of a range of products, especially tyres.
28	<i>Mitragyna ciliate</i>	Heartwood	<i>Rubiaceae</i>	<i>Mitragyna ciliata</i> is widely used in traditional medicine for the treatment of inflammation, hypertension, headache, rheumatism, gonorrhoea, and broncho-pulmonary diseases.
29	<i>Terminalia catappa</i>	India almond	<i>Combretaceae</i>	Juice of young leaves are employed in preparation of ointment for leprosy, scabies and also used internally for colic and headache.
30	<i>Theobroma cocoa</i>	Cacao tree	<i>Malvaceae</i>	Food and pharmaceutical additives.
31	<i>Ficus glumosa</i>	Cedar bush fig	<i>Moraceae</i>	It is used as an ornamental.
32	<i>Xylopia aethiopica</i>	Cherry tree (Uda)	<i>Annonaceae</i>	It is used extensively in construction, African cuisine, and traditional medicine. The plant's bark is used to make doors and partitions.
33	<i>Ceiba pentandra</i>	Ukong	<i>Malvaceae</i>	<i>Ceiba pentandra</i> bark decoction has been used as a diuretic, as an aphrodisiac, and to treat headache, as well as type II diabetes.

S/N	Species Composition	Common Name	Family	Ethnobotanical Value/Uses
34	<i>Pterocarpus erinaceous</i>	Abura	<i>Fabaceae</i>	It is used for fuel wood, for medicinal purposes, as a woodworking material, and is useful as a nitrogen-fixing plant.
35	<i>Terminalia ivorensis</i>	Black afara	<i>Combretaceae</i>	The wood is used for fine carpentry, joinery, building, flooring, and plywood manufacture.
36	<i>Brachystegia eurycoma</i>	Achi	<i>Fabaceae</i>	It is used in cooking.
37	<i>Triplochiton scleroxylon</i>	Obeche	<i>Malvaceae</i>	The timber is used in the manufacture of veneer, furniture, picture frames and mouldings.
38	<i>Mansonia altissima</i>	African black walnut	<i>Malvaceae</i>	It is used in spear traps for large game.
39	<i>Bambusa vulgaris</i>	Bamboo	<i>Bambusae</i>	It is used as a building material.
40	<i>Phoenix Sp</i>	Indian date palm	<i>Arecaceae</i>	The fruit serves as a tonic and restorative and is also used as an analgesic to mitigate pain from backache and in the buttocks.
41	<i>Baphia nitida</i>	Camwood	<i>Fabaceae</i>	It is used for house posts, rafters, naves of wheels and utensils such as walking sticks, mortars, pestles, etc.
42	<i>Polyalthia longifolia</i>	Masquerade tree	<i>Annonaceae</i>	It is used in the treatment of fever, helminthiasis, diabetes, and various cardiac problems.
43	<i>Delonix regia</i>	Royal Poinciana	<i>Fabaceae</i>	It provides forage for livestock and the seed meal can be fed to farm animals.
44	<i>Hura crepitans</i>	Sandbox tree	<i>Euphorbiaceae</i>	It treats skin diseases, rheumatism, intestinal worms.
45	<i>Citrus sinensis</i>	sweet oranges	<i>Rutaceae</i>	It's main uses are for food and beverages, and cosmetics.
46	<i>Dracaena arborea</i>	African dragon tree	<i>Asparagaceae</i>	It is used against gonorrhoea, smallpox, malaria, and leishmaniosis.

S/N	Species Composition	Common Name	Family	Ethnobotanical Value/Uses
47	<i>Musanga cecropioides</i>	Umbrella tree	<i>Moraceae</i>	The sheath-like stipules are applied as emmenagogue and oxytotic, and to treat stomach complaints, hiccough, and wounds.
48	<i>Alchornea cordifolia</i>	Christmas bush	<i>Euphorbiaceae</i>	It supplies dye and wood and in other occasions it is widely used for food.
49	<i>Elaeis guineensis</i>	Palm tree	<i>Arecaceae</i>	Palm oil is extracted from the mesocarp of the fruit and is used traditionally for the treatment of headaches, pains, rheumatism, etc.
50	<i>Pycnanthus angolensis</i>	African nutmeg	<i>Myristicaceae</i>	The seeds are sometimes used as a spice.
51	<i>Syzygium maloe</i>	Brush cherries or satin ash	<i>Myrtaceae</i>	It is used as fruit.
52	<i>Raphia hookeri</i>	Raphia palm	<i>Arecaceae</i>	It is used as tying material for horticulture and handicrafts.
53	<i>Dacryodes edulis</i>	Bush pear	<i>Burseraceae</i>	It is used in treating various ailments such as wound, skin diseases, dysentery, and fever.
54	<i>Milicia excelsa</i>	African teak	<i>Moraceae</i>	The tree is nitrogen fixing and the leaves are used for mulching.
55	<i>Allanblackia floribunda</i>	Tallow tree	<i>Clusiaceae</i>	It has been long used in traditional African medicine to treat hypertension.
56	<i>Bombax ceiba</i>	Cotton tree	<i>Malvaceae</i>	
57	<i>Mansonia altissima</i>	African black walnut	<i>Sterculiaceae</i>	It is used for general and high-class joinery, cabinet work, furniture, turnery, decorative veneer, and handicrafts.
58	<i>Funtumia Africana</i>	Rubber tree	<i>Apocynaceae</i>	A latex exudes copiously from wounds in the bark.
59	<i>Picralima nitida</i>	The Akuamma	<i>Apocynaceae</i>	It is use in treating fever, hypertension, jaundice, dysmenorrhea, gastrointestinal disorders, and malaria.
60	<i>Artocarpus altilis</i>	Breadfruit	<i>Moraceae</i>	The fruit is nutritious and a valuable staple food in most Pacific Islands.

S/N	Species Composition	Common Name	Family	Ethnobotanical Value/Uses
61	<i>Annona muricata</i>	Soursop	<i>Annonaceae</i>	Muricata, the juicy flesh-fruit of the soursop is a remedy for rheumatism, arthritic pain, fever, neuralgia, heart, and liver diseases, etc.
62	<i>Kigelia Africana</i>	Sausage tree	<i>Bignoniaceae</i>	The powdered mature fruit is applied as a dressing in the treatment of wounds, abscesses, and ulcers.
61	<i>Ceiba buonopozense</i>	Cotton tree	<i>Malvaceae</i>	They are used in the treatment of cholera, tubercular fistula, coughs, urinary complaints etc.
63	<i>Terminalia superba</i>	Limba, or white afara	<i>Combretaceae</i>	It is used for making furniture, table tennis blades (as outer ply), and musical instruments etc.
64	<i>Quercus Sp</i>	Black oak	<i>Fagaceae</i>	It provides protective shading for houses and people, lowering energy needs for cooling homes.
65	<i>Tetrapleura tetraptera</i>	Aidan fruit	<i>Fabaceae</i>	It is used in the treatment of arthritis and other inflammatory conditions, asthma, diabetes mellitus, hypertension, epilepsy etc.
66	<i>Juglans regia</i>	Persia walnut	<i>Juglandaceae</i>	It is used in traditional medicine for a wide array of ailments that include helminthiasis, diarrhoea, sinusitis et.

ANNEXURE 4.9

QUESTIONNAIRE SIA/HIA

FOR INDORAMA 20" X 76KM NATURAL GAS PIPELINE PROJECT

SOCIAL SECTOR

HOUSEHOLD QUESTIONNAIRE

1. Study No: _____
2. Interviewer's No: _____
3. Interview No.: _____
4. Community: _____
5. Community Status: _____

READ

This questionnaire relates to community/socio-economic studies for the INDORAMA Natural Gas Pipeline Project. We shall ask you questions that relate to your household, dwelling unit and residential environment. We also wish to find out your feelings and opinions about the Pipe Line Route, i.e. how it will affect the overall socio-economic life of yourself, your household, and your area. We shall be grateful to receive complete and accurate answers. The answers you provide would certainly be useful in the overall execution of the project. Please be assured the answers you provide will not be used for unauthorized purposes.

6. Date of Interview: _____
7. Length of Edit: _____
8. Local Govt. Area: _____
9. Exact Time Now: _____

SECTION A

DWELLING UNIT ASPECTS

FOR ALL
RESPONDENTS

TICK BOXES AS APPROPRIATE

A.1 How many living rooms do you have in this dwelling unit?
_____ (rooms)

A.2 Do you own this dwelling unit, are you renting it or what?

1 ☐ Own 2 ☐ Renting 3 ☐ Other

A.2 (a) If "Other", please specify:

- i ☐ Doubling up with
parents/relatives
- ii ☐ Company quarters
- iii ☐ Government quarters

FOR RENTERS ONLY

TICK BOXES AS APPROPRIATE

A.3 How long have you lived in this community? _____ (Years)

A.4 Before you moved into this community, in which community were you residing
(if applicable)?

- (a) Community _____
- (b) Local Government Area _____
- (c) State _____

A.5 If you have moved, please state your primary reason for moving

A.6 How much rent do you pay per year for your present dwelling unit? ~~N~~_____

A.7 Who is your present landlord?

1 ☐ Individual 2 ☐ Community 3 ☐ Others, please specify

A.8 Do you think that the rent you are paying is too high, about right or too low for this type of accommodation?

1 ☐ Too high 2 ☐ About right 3 ☐ Too low

A.9 Are you considering making a permanent move from this dwelling unit to another one?

1 ☐ Yes 2 ☐ No

A.9 (a) If "Yes", will it be in the same community or to another community?

1 ☐ Same community 2 ☐ Different community

A.9 (b) If "Different community", please specify:

(a) Community _____

(b) Local Government Area _____

(c) State _____

FOR OWNER-OCCUPIERS
ONLY

A.10 How long have you lived in this Community? _____ (Years)

A.11 Did you buy (or are you buying) this dwelling unit or did you build it yourself?

1 ☐ Bought/buying 2 ☐ Built

A.11 (a) If you built it yourself, how did you acquire the land?

- | | | | | | |
|---|--------------------------|-----------------------|---|--------------------------|----------------------------|
| 1 | ☐ | Bought/buying | 2 | ☐ | Inherited |
| 3 | ☐ | Lease from government | 4 | ☐ | Other, please specify_____ |

A.11 (b) How did you raise the money to buy/build your house?

- | | | | | | |
|---|--------------------------|--------------------|---|--------------------------|-------------------------------|
| 1 | ☐ | Personal savings | 2 | ☐ | Mortgage Loan |
| 3 | ☐ | Thrift/osusu loans | 4 | ☐ | Grants from relatives/friends |
| 5 | ☐ | Inherited funds | 6 | ☐ | Other, please specify_____ |

A.11(c) What is the age of the dwelling unit?
_____ (Years)

A.12 Before you moved into this community, in which community were you residing (if applicable)?

- (a) Community _____
- (b) Local Government Area _____
- (c) State _____

A.13 If you have moved, please state your main reasons for moving

SECTION B

ENVIRONMENTAL CONDITIONS AND SERVICES

FOR ALL
RESPONDENTS

B.1 How do you store your household garbage before disposal? TICK ONE BOX

- | | | | | | | | | |
|---|--------------------------|----------------------------|---|--------------------------|------------------------------|---|--------------------------|------------------------|
| 1 | ☐ | Stored in polythene bags | 3 | ☐ | Stored in plastic waste bins | 5 | ☐ | Stored in cartons |
| 2 | ☐ | Stored in metal waste bins | 4 | ☐ | Stored in waste baskets | 6 | ☐ | Other, _____ (specify) |

B.2 State the major way you dispose of your household garbage.

B.3 What major type of toilet system do you use?

B.4 What is the main source of water for your household?

(a) For drinking

(b) For other household purposes

B.5 Is electricity available in your home?

1 ☐ Yes 2 ☐ No

B.6 What is the major energy source for cooking in your household?

- | | | | | | |
|---|--------------------------|----------------------|---|--------------------------|-------------|
| 1 | ☐ | Firewood | 2 | ☐ | Kerosene |
| 3 | ☐ | Gas | 4 | ☐ | Electricity |
| 5 | ☐ | Other, specify _____ | | ☐ | |

B.7 I shall now use some statements to describe your residential neighbourhood/community. Please tell me to what extent you agree or disagree with each of the statements.

Aspect	1 Agree Strongly	2 Agree Some- what	3 Uncertain	4 Disagree Somewhat	5 Disagree Strongly
(a) My neighbourhood is quiet					
(b) My neighbourhood is friendly					
(c) There is a lot of road traffic (vehicular)					
(d) The neighbourhood is crowded					
(e) There are too many strangers					
(f) The neighbourhood is safe (i.e. crime rate is low)					
(g) The neighbourhood is attractive					

B.8 Are there some services or facilities that you do not have now that you would like to have in this neighbourhood/community?

1 ☐ Yes 2 ☐ No

B.6(a) If "Yes", what are these (Mention 3 in order of importance)?

- i _____
- ii _____
- iii _____

B.9 On the whole, would you say that this community is a good community to live in?

1 ☐ Yes 2 ☐ No

B.10 (a) If “No”, please explain (Mention 3 reasons for your response)

- i _____
- ii _____
- iii _____

SECTION C

PERCEPTIONS OF THE PROPOSED INDORAMA GAS PIPELINE PROJECT

FOR ALL RESPONDENTS

C.1 With reference to the INDORAMA Pipe Line Route that will pass through your area, how do you think this will affect your community (a) positively and (b) negatively.

C.1 (a) Three key positive effects {in order of importance.}

1	
2	
3	

C.1 (b) Three key negative effects in order of importance.

1	
2	
3	

C.2 In the last five years, has your community benefited from any INDORAMA development projects?

1 ☐ Yes 2 ☐ No (If "No", Go to C.4)

C.2 (a) If "Yes", please name the three most important in order of importance:

i	_____
ii	_____
iii	_____

C.3 Everything considered, how pleased or displeased are you with the INDORAMA Pipeline project?

i	☐	Very displeased
ii	☐	Somewhat displeased
iii	☐	Neither pleased nor displeased
iv	☐	Somewhat pleased
v	☐	Very pleased

C.3 (a) If you are displeased, please tell us (in order of importance) three major reasons for your displeasure:

- i _____
- ii _____
- iii _____

C.3 (b) If you are pleased, state (in order of importance) the three major reasons for your pleasure:

- i _____
- ii _____
- iii _____

C.4 Do you expect anything from INDORAMA in connection with this project?

- 1 ☐ Yes 2 ☐ No
s

C.4 (a) If "Yes", state your three most urgent expectations (in order of urgency):

- i _____
- ii _____
- iii _____

C.5 How would you describe the relationship between your Community and INDORAMA?
(TICK APPROPRIATE BOX)

- i ☐ Very strained
- ii ☐ Somewhat strained
- iii ☐ Don't know/uncertain (DK/UC)
- iv ☐ Somewhat cordial
- v ☐ Very cordial

C.5 (a) Please give reasons for your answer:

C.6 Please comment freely on how you think the Pipeline project will affect aspects of life in your community/neighborhood.

SECTION D

PERSONAL CHARACTERISTICS

FOR ALL RESPONDENTS

TICK BOXES AS APPROPRIATE

Please provide us some information about yourself and your household

D.1 Sex of respondent: Male ☐
 Female ☐

D.2 What is your age as at your last birthday _____

D.3 What is your marital status?

- i ☐ Married
- ii ☐ Separated
- iii ☐ Widowed
- iv ☐ Divorced
- v ☐ Single/Never Married
- vi ☐ Any other, specify _____

D.4. What is your relationship to the head of this household?

- i ☐ Head
- ii ☐ Spouse(Husband or Wife)
- iii ☐ Daughter
- iv ☐ Somewhat pleased
- v ☐ Son
- vi ☐ Mother
- vii ☐ Father
- viii ☐ Friends
- ix ☐ Other relations

D.5 Please state the number of persons in your household (including yourself) who fall into the following age categories:

S/N o.	Age categories (years)	Gender		Total
		1. Male	2. Female	
(i)	00 - 04			
(ii)	05 - 09			

(iii)	10 - 14			
(iv)	15 - 19			
(v)	20 - 24			
(vi)	25 - 29			
(vii)	30 - 34			
(viii)	35 - 39			
(ix)	40 - 44			
(x)	45 - 49			
(xi)	50-54			
(xii)	55-59			
(xiii)	60-64			
(xiv)	65-69			
(xv)	70 and above			

D.6 What is your State of origin?

1. Rivers	15. Enugu	29. Ondo
2. Abia	16. Gombe	20. Osun
3. Adamawa	17. Imo	31. Oyo
4. Akwa-Ibom	18. Jigawa	32. Plateau
5. Anambra	19. Kaduna	33. Sokoto
6. Bayelsa	20. Kano	34. Taraba
7. Bauchi	21. Kastina	35. Yobe
8. Benue	22. Kebbi	36. Zamfara
9. Borno	23. Kogi	37. FCT
10. Cross rivers	24. Kwara	38. States outside Nigeria
11. Delta	25. Lagos	
12. Ebonyi	26. Nasarawa	
13. Edo	27. Niger	
14. Ekiti	28. Ogun	

D.7 What is your ethnic group?

1. Ibo	6. Ikwerre	11. Isoko	16. Hausa
2. Ogba	7. Etche	12. Andoni	17. Fulani
3. Yoruba	8. Urobo	13. Ogoni	18.
4. Ibibio	9. Itsekiri	14. Kalabari	19.
5. Efik	10. Edo	15. Ijaw	20.

D.8 What is the highest level of education that you have attained?

(i) No formal education	(vii) Tertiary (uncompleted)
(ii) Pre-primary	(viii) Tertiary (completed)
(iii) Primary (uncompleted)	(ix) Teachers Grade II Certificate
(iv) Primary (completed)	(x) Trade Test Certificate
(v) Secondary (uncompleted)	(xi) City and Guilds Certificate
(vi) Secondary (completed)	

D.9 What is the highest level of education that your wife/husband has attained?

(i) No formal education	(viii) Tertiary (uncompleted)
(ii) Pre-primary	(viii) Tertiary (completed)
(iii) Primary (uncompleted)	(ix) Teachers Grade II Certificate
(iv) Primary (completed)	(x) Trade Test Certificate
(v) Secondary (uncompleted)	(xi) City and Guilds Certificate
(vi) Secondary (completed)	

D.10 How many members of your household (including yourself) fall into the following educational categories?

Educational categories	Gender		Total
	1. Male	2. Female	
(i) No formal education			
(ii) Pre-primary			
(iii) Primary (uncompleted)			
(iv) Primary (completed)			
(v) Secondary (uncompleted)			
(vi) Secondary (completed)			
(ix) Tertiary (uncompleted)			
(viii) Tertiary (completed)			

(ix) Teachers Grade II Certificate			
(x) Trade Test Certificate			
(xi) City and Guilds Certificate			

D. 11 Please tell me the number of persons in your household (broken down by gender) that fall into the specified age categories and are attending the types of educational institutions indicated

Age categories	Number in Household		Educational institution	Number Attending		Percent	
	M	F		M	F	M	F
2-5			Pre-primary school				
6-12			Primary school				
13-19			Secondary school				
Total							

D.12 Are you employed (including self-employment), unemployed, retired, or a housewife? _____

D.12 (a) If unemployed, please state what type of skill you have

D.13 How many members of your household (including yourself) fall into the following employment categories?

Employment Status	Gender		Total
	1. Male	2. Female	
i) Employed			
ii) Retired			
iii) Unemployed			
iv) Housewife			

D. 13(a) For the unemployed members of your household Please state how many fall into the age categories

S/No.	Age Category	Male	Female
1	19-29		
2	30-39		
3	40-49		
4	50 and above		

Total		
-------	--	--

D.14 For the employed members of your household, how many fall into the primary occupational categories specified below:

S/No.	Occupational categories	Gender		Total
		1. Male	2. Female	
(i)	Farmers			
(ii)	Fishermen			
(iii)	Hunters			
(iv)	Craftsmen/ technicians (artisans)			
(v)	Traders			
(vi)	Businessmen/contractors			
(vii)	Senior workers, including professionals (engineers, doctors, lawyers, etc.) in government service.			
(viii)	Professionals (engineers, doctors, lawyers, etc.) in private practice.			
(ix)	Senior workers, including professionals (engineers, doctors, lawyers, etc.) in multinational corporations and other companies			
(x)	Junior workers (clerical and allied) working in government			
(xi)	Junior workers (clerical and allied) in multi-national corporations and other companies			
(xii)	Paramedical staff (nurses and midwives, public health officers, laboratory technicians), etc. in government			
(xiii)	Paramedical staff (nurses and midwives, public health officers, laboratory technicians), etc. in multi-nationals and other companies.			

D.15 What is your usual mode of transport to your place of employment?

1. Personal car	4. Official car	7. speed boat
2. Staff bus	5. Taxi	8. Walking
3. Commercial bus	6. Bicycle	9. Other, specify _____

D.16 Please estimate your monthly individual income N-_____

D.17 To which of the following monthly income categories does your household (i.e. housekeeping unit, or all those feeding from the same pot) belong?

(TICK APPROPRIATE BOX)

code	Amount	Midpoint	Code	Amount	Midpoint
1	Less than N8,000	4,000	8	68,000 – 77,999	73,000
2	8,000 - 17,999	13,000	9	78,000 – 87,999	83,000
3	18,000 - 27,999	23,000	10	88,000 – 97,999	93,000
4	28,000 – 37,999	33,000	11	98,000 – 107,999	103,000
5	38,000 - 47,999	43,000	12	108,000 – 117,999	113,000
6	48,000 – 57,999	53,000	13	118,000 – 127,999	123,000
7	58,000 – 67,999	63,000	14	128,000 and more	139,500

SECTION E

DIRECT OBSERVATION AND MEASUREMENT

FOR THE INTERVIEWER

(TICK APPROPRIATE BOX UNDER EACH NUMBER)

E.1 House Type:

1. Rooming house (courtyard)	4. Block of flats (multi-family)
2. Rooming house (wagon type)	5. Semi-detached
3. Single-family	6. Storied building (single family)

E.2 Building Materials

E.2 (a) Walling:

1. Corrugated iron sheets	4. Blocks
2. Wood	5. Burnt bricks
3. Mud	6. Cardboard/plywood sheets

E.2 (b) Roofing:

1. Corrugated Iron Sheets	5. Decking
2. Wood	6. Cardboard/Plywood Sheets
3. Slate	7. Asbestos
4. Thatch	8. Other, Specify: _____
9. Aluminum Roofing Sheets	

E.3 Foundation:

1. Strip	3. Pile
2. Raft	4. None

E. 4 Building Conditions

Condition	1. Yes	2. No
Foundation in good condition		
Foundation affected by erosion		
No foundation		
Cracked walls		
Ceiling in good condition		
No ceiling or cracked		
Fascia board in good condition		
Windows in good condition		
Doors in good condition		
Building needs painting		
Building needs plastering		

E.5 Overall House Condition Rating:

1. Good (Needs No Repair)	3. Bad (Needs Major Repair)
2. Fairly Good (Needs Minor Repair)	4. Very Bad (Beyond Repair)

E.6 Household Parking:

1. Private Garage	3. Curtilage (Within Premises)
2. Street Side	4. Communal

E.7 Open Spaces:

1. Available within compound
2. Not available

E.8 Distance to nearest dwelling house from respondent's:

1. Less than 5 metres	3. 10 – 14 metres
2. 5 – 9 metres	4. 15 metres or more

E.9 Distance from Respondent's Dwelling to Basic Facilities:

S/n o	Facility	1. More Than 2 Km	2. Between 1 and 2 Km	3. Less Than 1 Km

(i)	Primary School			
(ii)	Police Station			
(iii)	Hospital/Clinic/Maternity			
(iv)	Shopping Area/Local Market			
(v)	Recreational Playground			
(vii)	Church			
(vii)	Mosque			
(viii)	Secondary School			

SECTION F

PUBLIC HEALTH ASPECTS

FOR ALL RESPONDENTS

F.1 What is the distance of the following facilities to members of your household?

Type of Health Facility	< 1 Km	1-3 Km	>3 km
Hospital			
Clinic			
Dispensary			
Patent Medicine Store			
Traditional Healing Centre			

F.2 Describe the prevalence of the following types of disease in your household in the last 12 months (As diagnosed by a health professional).

Types of Disease	No. of Cases	Number of Deaths
Typhoid		
hepatitis		
Cholera		
Malaria		
Asthma		
Bronchitis		
Cataract		
Eye Problems		
Conjunctivitis		
Skin Diseases		
Respiratory Tract Infections		
High Blood Pressure		
stroke		
Burns		

F.3 How many people died in your household in the last 12 months?

F.4 How many people were born in the last 12 months?_____

F.5 How many children 1-year-old or less have died in the last 12 months? _____

F.6 How many children 5 years or less have died in the last 12 months?

F.7 Specify any strange ailments that have occurred in your household in the recent past that you can attribute to oil spills:

1. _____

2. _____

3. _____

F.8 Have you observed any contamination of your water (taste, colour, odour) in the recent past that you can attribute to oil spills in your community?

1. ☐ Yes
2. ☐ No

F.8 (a) If “Yes”, please explain:

F.9 Have you experienced fire outbreak from pipelines in your community?

1. ☐ Yes
2. ☐ No

F. 10 (a) If “Yes”, what was the cause of the fire outbreak?

F.11(a) If yes to F11(a), how many persons died?

Thank You

ANNEXURE 4.10

CULTURAL HERITAGE

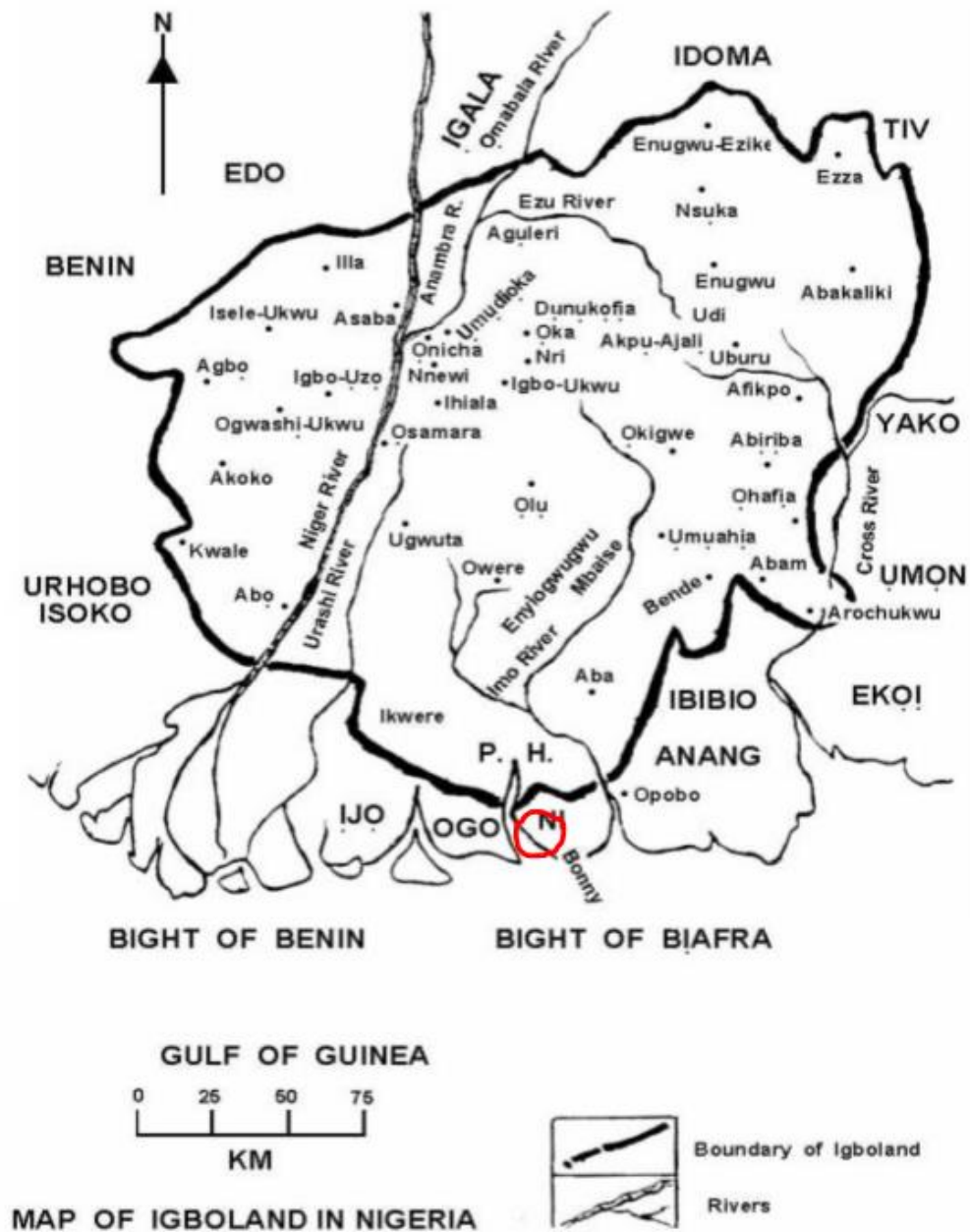
Literature review of Nigerian archaeology studies to date

Archaeological research began relatively late in south-eastern Nigeria, with the first excavation in the region taking place in 1960.¹ Prior to this more informal research took place in 1910, lead by European scholar Frobenius who focussed on recovering objects rather than documenting archaeological context. The discovery of terracotta, copper and bronze objects spurred further research, leading to a flurry of researchers interested in the collection of Nigerian artefacts through archaeological surveys.

In 1943 the Nigerian Department of Antiquities (NDA) was established in Nigeria to oversee archaeological works and in the late 1960s the first systematic surveys were carried out by the NDA in partnership with University of Cape Town, University of Ibadan, University of Ife and University of Nigeria. Excavations such as the Igboukwu excavations in Anambra State, southeastern Nigeria, yielded large quantities of glass beads, intricately produced bronze artefacts, potsherds, and various iron tools which revealed the intrinsic value and ingenuity of the surrounding Igbo kingdom. **Error! Reference source not found.** locates the Igbo region of Nigeria on a map in relation to the Project AoI.

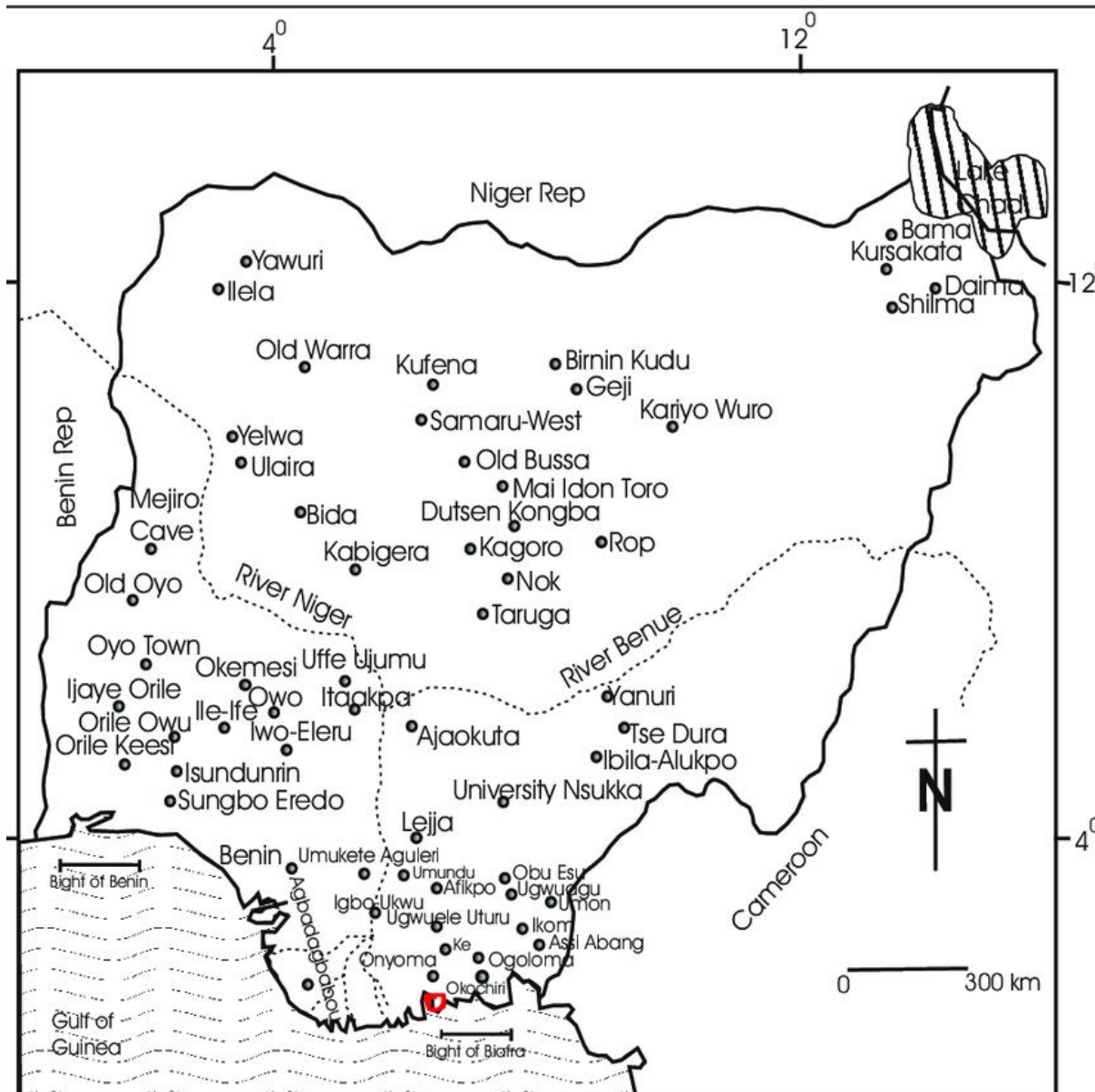
Archaeological studies in south-eastern Nigeria in more recent years have shed light on the technology used to extract raw materials in the past for the production of stone, metal tools and pottery. Traditional methods of raw material extraction continue into the 21st century within the Igbo region with evidence of iron smelting, pottery making and tin mining see figure below.

¹ Ngonadi, C. Archaeology of Igboland, Southeastern Nigeria. Oxford Research Encyclopedia of Anthropology. Retrieved 18 Feb. 2023, from <https://oxfordre.com/anthropology/view/10.1093/acrefore/9780190854584.001.0001/acrefore-9780190854584-e-556>.



The extent of Igboland, with approximate Project AoI circled in red.²

² Validating perceptual objective listening quality assessment methods on the tonal language Igbo - Scientific Figure on ResearchGate. Available from: https://www.researchgate.net/figure/Map-of-Igboland-in-Nigeria_fig2_27353122 [accessed 18 Feb, 2023]



Locations for studied archaeological sites in southeast Nigeria in relation to the Project AoI³

³ Babalola, Abidemi & AJEKIGBE, PHILIP. (2007). Poverty Alleviation in Nigeria: Need for the Development of Archaeo-Tourism. *Anatolia*. 18. 223-242. 10.1080/13032917.2007.9687203.

Archaeological and Historic Background

This *Section* provides a period-by-period overview of the archaeology and history of the region, wider study area and Project Area of Influence. Each period concludes with a preliminary assessment of the potential for cultural heritage resources to be present within the Project AoI.

Early Stone Age (c. 1.5 ma BCE – c. 130,000 BCE)

Very little is known about the Early Stone Age (ESA) in West Africa generally, partly due to historic research interests and partly due to geological inconsistencies, for example the lack of faulting to expose Early Quaternary sediments that we see across East Africa. The earliest reported ESA identified in West Africa remains controversial as pebble choppers similar to the Oldowan complex has been found in multi-period assemblages, and whilst an Oldowan presence in West Africa is possible there is no clear evidence yet to support this⁴.

The Acheulean in contrast to the Oldowan, has been identified in abundance throughout Nigeria, however there are currently very few direct age estimates from primary context. Mai Idon Toro, an archaeological site in Northern Nigeria yielded Acheulean stone artefacts for researchers from the 1920's through to the 1960's and have been studied further out of situ and without the knowledge of the dilapidated state of the archaeological site⁵.

Middle Stone Age (c. 130,000 BCE – c. 12,000 BCE)

The emergence of the chronological record for the Middle Stone Age (MSA) in Nigeria and West Africa in general indicates that core and flake technologies were present from the Middle Pleistocene at least until the Pleistocene Holocene boundary (c. 126,000 – 12,000 BCE)⁶. Evidence for MSA archaeological material in low-lying forested areas such as the Project AoI remains questionable however inter-regional styles and differences in technological style may vary based on raw material availability.

MSA assemblages in West Africa in general have been typologically identified based on links to other regions, for example the 'Sangoan' and 'Mousterian', though more recently local

⁴ Scerri, EM.L. 2019. Review of the book *The Middle Stone Age of Nigeria in its West African context* by Philip Allsworth-Jones. Oxford Archaeopress. Published in Azania doi.org/10.1080/0067270X.2019.1676052

⁵ Jock, Agai & Agai, Jock. (2021). A Report on the History of the Acheulean Industry of Mai Idon Toro in the Central-Region of Nigeria. IUP Journal of History and Culture. 1. 29-41. 10.30560/ch.v1n1p29.

⁶ Scerri, EM.L. 2019. Review of the book *The Middle Stone Age of Nigeria in its West African context* by Philip Allsworth-Jones. Oxford Archaeopress. Published in Azania doi.org/10.1080/0067270X.2019.1676052

terms have been used to describe MSA technologies throughout the region, such as 'Tiemassessanian'. In northern Nigeria there are two sites of considerable importance, Nok and Zenabi which yielded an abundance of disc-cores and blades with prepared platforms, in contrast to the 'Sangoan' industry which dominates the South with a Levallois technology⁷.

Based on the scarce evidence of MSA archaeological material in southern Nigeria, particularly in low-lying areas of high fluvial and estuarine activity, the potential for MSA cultural heritage to be present within the Project AoI is **low**.

Later Stone Age (c. 12,000 BCE – c. 1 BCE)

The Later Stone Age (LSA) sees significant innovation and technological diversification including micro and macro-lithic assemblages and a marked reduction on tool size, particularly geometric microliths seen across Nigeria dating to c. 12,000 BCE in basal stratigraphic lenses at the Iwo Eleru Rock Shelter, southwest Nigeria. The environment surrounding this well-known site is predominantly low-lying rainforest, indicating the **low to moderate** potential for buried LSA archaeological material to exist within the project AoI.

Pottery and agriculture is thought to have developed in c. 8000 BCE in the region, linked with the introduction of ground-stone axes,⁸ which signifies a change in ecological conditions. These axes were used for felling trees, allowing for agricultural expansion. Linguistic studies suggest that some of the earliest plants cultivated in southern Nigeria include oil palm, kolanuts, yams, and wine palm.⁹ The appearance of trapezoid tools from c.1500 BCE also suggest that grasses were exploited.¹⁰

Iron Age (c. 1 CE– c. 1600 CE)

The agricultural growth in the first millennium CE was likely helped by the early production of iron tools used for bush clearance and land tilling.¹¹ The rapid spread of iron production in this period suggests that there was either population movement, effective trade networks from iron production sites, or both.¹² Analysis of glass beads found at the Igbo-Ukwu burial site (140 km north of site) dated between the tenth and fifteenth centuries CE suggest

⁷ Scerri, EM.L. 2019. Review of the book *The Middle Stone Age of Nigeria in its West African context* by Philip Allsworth-Jones. Oxford Archaeopress. Published in Azania doi.org/10.1080/0067270X.2019.1676052

⁸ Emuobosa A. Orijemie, 'The Archaeobotany of the Later Stone Age (LSA) in Nigeria: A Review' in *Plants and People in the African Past*, ed. A. M. Mercuri (2018), p. 370

⁹ Emuobosa A. Orijemie, 'The Archaeobotany of the Later Stone Age (LSA) in Nigeria: A Review' in *Plants and People in the African Past*, ed. A. M. Mercuri (2018), p. 364.

¹⁰ Emuobosa A. Orijemie, 'The Archaeobotany of the Later Stone Age (LSA) in Nigeria: A Review' in *Plants and People in the African Past*, ed. A. M. Mercuri (2018), p. 364

¹¹ Joseph C. Chukwu, 'Traditional Igbo Building Architecture: An Historical Perspective', *Arts and Design Studies*, 34 (2015), p. 7

¹² Susan Keech McIntosh, 'Igbo-Ukwu at 50: A Symposium on Recent Archaeological Research and Analysis', *African Archaeological Review* (2022), p. 376

established trade connections up the River Niger to Gao, on to Mesopotamia, and perhaps even as far as India.¹³ The evidence for long-distance over-land trade indicates that Igboland was connected to global trade networks long before direct European contact from the sixteenth century. Moreover, the use of river systems as transport networks may mean that there is a **moderate potential** for archaeological evidence of this to be found at the Project AoI due to its proximity to an established river transport network.

Religion was an important facet of Igbo society, influencing other aspects of life such as law.¹⁴ As with the history, this theology is difficult to reconstruct as the concept of *Chukwu* (a supreme god) was already a complex formation of different (and varying) motifs and beliefs within the Igbo religious experience prior to its appropriation by Christian missionaries in the nineteenth century.¹⁵ Nevertheless, it is clear that reincarnation was (and still is) pivotal within the Igbo social system as they believe that their ancestors return to temporal life after death.¹⁶ This creates the sense that the living and the dead occupy the same universe, along with a pantheon of supernatural powers that control the heavens and earth.¹⁷

An important part of this belief is of living and dead ancestor worship, including feasting and daily invocations.¹⁸ This extended to burial where the dead are prepared for their journey into eternity, with every caution being observed to ensure that the dead person is in a state of contentment.¹⁹ Although few people now engage the rites of the ancestors, many of the practices have shifted in the present. Indeed, the *Alommo* (the annual feast of the ancestors) has transitioned into *emume iwaji ohuru* (new yam festival).²⁰ Therefore, it is important to view the present intangible culture of the communities surrounding the Project AoI with the **possibility of complex religious change with considerable time depth**.

European Contact and Colonial Era (c.1550 – 1960)

The volume of goods within the established global trade increased dramatically with the arrival of European traders in the later fifteenth century due to the size of the European ships.²¹ Initially, the main exports from the area were gold, ivory, gum, timber, pepper, and slaves (already an established facet of the local economy) in exchange for European manufactured

¹³ Susan Keech McIntosh, 'Igbo-Ukwu at 50: A Symposium on Recent Archaeological Research and Analysis', *African Archaeological Review* (2022), pp. 376-377.

¹⁴ Emmanuel C. Onyeozili and Obi N. I. Ebbe 'Social Control in Precolonial Igboland of Nigeria', *African Journal of Criminal Studies*, 6 (2012), p. 31.

¹⁵ Chukwuma Azyonye, 'Igbo Folktales and the Evolution of the Idea of *Chukwu* as the Supreme God of Igbo Religion', *Nsukka Journal of Linguistics and African Languages* (1987), p. 44.

¹⁶ Emmanuel C. Onyeozili and Obi N. I. Ebbe 'Social Control in Precolonial Igboland of Nigeria', *African Journal of Criminal Studies*, 6 (2012), p. 31.

¹⁷ Emmanuel C. Onyeozili and Obi N. I. Ebbe 'Social Control in Precolonial Igboland of Nigeria', *African Journal of Criminal Studies*, 6 (2012), p. 31.

¹⁸ Onukwube Alex Alfred Anedo, *Neglect of Ancestors (Ndiichie): The Bane of Modern Igbo Problems* (2008), pp. 6-10

¹⁹ Onukwube Alex Alfred Anedo, *Neglect of Ancestors (Ndiichie): The Bane of Modern Igbo Problems* (2008), p. 6

²⁰ Onukwube Alex Alfred Anedo, *Neglect of Ancestors (Ndiichie): The Bane of Modern Igbo Problems* (2008), pp. 10-11

²¹ P. A. Oguagha, "The Impact of European Trade on Igbo-Igala Commercial Relations in The Lower Niger C. 1650-1850 A.D.", *Journal of the Historical Society of Nigeria*, vol. 11, no. 3/4, (1982) p. 14. <<http://www.jstor.org/stable/41857115>> [Accessed 5 Oct. 2023].

goods such as textiles, firearms, and spirits.²² However, by the end of the seventeenth century the demand for slaves had greatly increased.²³ Igboland experienced the most intensive slave-trading activity in West Africa, with approximately 75% of total exports from the area between 1640 and 1800 being enslaved peoples.²⁴

The direct contact that Europeans had with members of Igboland at this point was minimal outside of the coastal hinterland.²⁵ However, the Project AoI sits within this hinterland, approx. 25km upstream from Bonny, one of the largest trading ports in western-central Africa during the height of the transatlantic slave trade.²⁶ Indeed, there is consensus amongst academics that by the mid-seventeenth century the waterways of the River Niger, including the Bonny River where the Project AoI is situated, were transformed into a major hub for commerce and exchange of goods.²⁷

Therefore, it is likely that there is **moderate potential** for encountering archaeological evidence of maritime trade, including marine archaeology. The economic migration towards the coast and the number of enslaved people passing through Igboland would have caused a major demographic shift throughout the region. It is possible this may also be seen in archaeological evidence from the Project AoI.

By mid-nineteenth century, the forced trafficking of enslaved peoples out of the Bights of Benin and Biafra had all but ceased.²⁸ Following the abolition of the slave trade in 1807 the British Royal Navy opened a trade route with the coastal towns driven by the palm oil industry. This became the economic basis for the region.²⁹ At the turn of the twentieth century the British Empire attempted to seize these resources, and their ultimate economic benefit, by military force throughout the whole of what is now Nigeria as part of the wider European 'Scramble for Africa'.

The military invasion of Igboland did not take place until 1901.³⁰ However, the arrival of the British prior to and during lead to increased encounters between Igbo and other communities

²² P. A. Oguagha, "The Impact of European Trade on Igbo-Igala Commercial Relations in The Lower Niger C. 1650-1850 A.D.", *Journal of the Historical Society of Nigeria*, vol. 11, no. 3/4, (1982) p. 14. <<http://www.jstor.org/stable/41857115>> [Accessed 5 Oct. 2023].

²³ P. A. Oguagha, "The Impact of European Trade on Igbo-Igala Commercial Relations in The Lower Niger C. 1650-1850 A.D.", *Journal of the Historical Society of Nigeria*, vol. 11, no. 3/4, (1982) p. 14. <<http://www.jstor.org/stable/41857115>> [Accessed 5 Oct. 2023].

²⁴ John N. Orij, 'Chapter 8: Igboland, Slavery, and the Drums of War and Heroism' in *Fighting the Slave Trade: West African Strategies*, ed. Sylviane A. Diouf (2017), p. 121.

²⁵ P. A. Oguagha, "The Impact of European Trade on Igbo-Igala Commercial Relations in The Lower Niger C. 1650-1850 A.D.", *Journal of the Historical Society of Nigeria*, vol. 11, no. 3/4, (1982) p. 14. <<http://www.jstor.org/stable/41857115>> [Accessed 5 Oct. 2023].

²⁶ Klas Rönnbäck, 'The Slave Trades out of Africa' in *The History of African Development*, ed. Ewoit Frankema, Ellen Hillboom, Ushehwedu Kufakuriani, and Felix Meier zu Salhausen (2020), p. 6.

²⁷ P. A. Oguagha, "The Impact of European Trade on Igbo-Igala Commercial Relations in The Lower Niger C. 1650-1850 A.D.", *Journal of the Historical Society of Nigeria*, vol. 11, no. 3/4, (1982) p. 14. <<http://www.jstor.org/stable/41857115>> [Accessed 5 Oct. 2023].

²⁸ Klas Rönnbäck, 'The Slave Trades out of Africa' in *The History of African Development*, ed. Ewoit Frankema, Ellen Hillboom, Ushehwedu Kufakuriani, and Felix Meier zu Salhausen (2020), p. 6.

²⁹ David Pratt, 'Currency & Conflict in Colonial Nigeria' in *The Political Economy of Everyday Life in Africa* (2017), p. 72.

³⁰ O. N. Njoku, 'Colonialism and the Decline of the Traditional Metal Industry of the Igbo, Nigeria', *Interario*, 15 (2), pp. 60-61.

around the Niger River and Delta. The colonialism of Igboland changed traditional cultural practices, as noted above. Christianity and individualism fundamentally shifted the focus of the social structure away from communalism and ancestor worship towards Western practices.³¹ This can be seen in the introduction of the Igbo rectangular house designs,³² as well as the construction of Christian churches. The changing design in these tangible buildings represent the shifting intangible cultural practices in Igboland during the colonial period. There is a **high potential** for some of these buildings to be still present in the villages surrounding the Project AoI.

Port Harcourt (20km Northeast of Project AoI, upriver) was established by the colonial administration in 1912 to export coal from the region.³³ The Port is situated thirty-three miles inland as it is the first area of solid land after the unbroken stretch of mangroves that extend down to the coast.³⁴ In the 1920s the Bonny River was dredged to increase its navigable depth.³⁵ This **may impact the marine archaeological potential of the Project AoI** as there is a chance that archaeology within the river bed has been disturbed or removed. In the 1950s oil was discovered in the Niger Delta, leading to the rapid growth and development of the Port as a centre for oil exploitation.³⁶

In summary, there is **moderate potential** for archaeological evidence of trade to be found within the study area, although marine archaeology may have been disturbed by the dredging of the River Bonny. There is **high potential** for buildings from the Colonial Era to be present in the villages surrounding the Project AoI.

Independence (1960 – present day)

Nigeria claimed independence from the United Kingdom in 1960, leaving Igboland confined mostly to the southeast region of Nigeria. From the mid-1960s there was increasing political turmoil, the beginning of which was marked by the January 1966 coup.³⁷ The intensifying political tensions and ethnically motivated violence led to the splintering of Nigeria into twelve states and the creation of the Republic of Biafra where the Project AoI is located.³⁸ The

³¹ Joseph C. Chukwu, 'Traditional Igbo Building Architecture: An Historical Perspective', *Arts and Design Studies*, 34 (2015), pp. 10-11

³² Joseph C. Chukwu, 'Traditional Igbo Building Architecture: An Historical Perspective', *Arts and Design Studies*, 34 (2015), p. 11

³³ Toyin Falola, Ann Genova, and Matthew M. Heaton, *Historical Dictionary of Nigeria* (2018), p. 305

³⁴ Ayodeji Olukoju, 'Playing Second Fiddle: The Development of Port Harcourt and Its Role in the Nigerian Economy', *International Journal of Maritime History* (1966), p. 107

³⁵ Ayodeji Olukoju, 'Playing Second Fiddle: The Development of Port Harcourt and Its Role in the Nigerian Economy', *International Journal of Maritime History* (1966), p. 110

³⁶ Akachi Odoemene, 'Agony in the Garden': Incongruity of Governance and the Travails of Port Harcourt City, Nigeria, 1912-2010', *Africana: The Niger Delta* (2011), p. 113

³⁷ Johnson Olaosebikan Aremu and Lateef Oluwafemi Buhari, 'Sense and Senselessness of War: Aggregating the Causes, Gains and Losses of the Nigerian Civil War, 1967-1970', *IAFOR Journal of Arts and Humanities* (2017), p. 63

³⁸ Johnson Olaosebikan Aremu and Lateef Oluwafemi Buhari, 'Sense and Senselessness of War: Aggregating the Causes, Gains and Losses of the Nigerian Civil War, 1967-1970', *IAFOR Journal of Arts and Humanities* (2017), p. 65.

Republic of Biafra was not recognised by the Nigerian Government as a sovereign state independent of Nigeria, which eventually led to a full-blown war on the 6th July 1966.³⁹

There is **moderate archaeological potential** for evidence of the civil war to be seen on the landscape surrounding the town of Aba (50km Northwest from Project AoI) and Port Harcourt (20km Northeast from Project AoI), both important strategic Biafran cities in the conflict.⁴⁰ Biafra became part of Nigeria once again in 1970 with military support from the United Kingdom however the tactics used to reunite Biafra and Nigeria remain controversial.⁴¹

In summary, there is **moderate potential** for archaeological evidence from post-Independence, including the Civil War, to be found within the study area due to its proximity with important strategic centres. Moreover, there is a **high potential** for oral knowledge about the recent history of Port Harcourt and the surrounding areas (including the Project AoI) to be present within the communities surrounding the Project AoI.

³⁹ Johnson Olaosebikan Aremu and Lateef Oluwafemi Buhari, 'Sense and Senselessness of War: Aggregating the Causes, Gains and Losses of the Nigerian Civil War, 1967-1970', *IAFOR Journal of Arts and Humanities* (2017), p. 66

⁴⁰ Mathews, Martin P. (2002). Nigeria: Current Issues and Historical Background. Nova Publishers. p. 38. ISBN 1-59033-316-0; Akachi Odoemene, 'Agony in the Garden': Incongruity of Governance and the Travails of Port Harcourt City, Nigeria, 1912-2010', *Africana: The Niger Delta* (2011), p. 115

⁴¹ Minogue, Martin; Judith Molloy (1974). African Aims & Attitudes: Selected Documents. General C. O. Ojukwu: CUP Archive. p. 393. ISBN 0-521-20426-7.

ANNEXURE 4.11

COMPREHENSIVE STAKEHOLDER ENGAGEMENTS REPORT

Introduction

Stakeholder engagement is a key aspect of the Environmental and Social Impact Assessment (ESIA) and also a requirement of the EIA Act CAP E12 LFN 2004. Stakeholder engagement during an EIA process is essential to ensure an inclusive, transparent, and robust assessment. As it leads to better decision-making, more sustainable outcomes, and helps to build trust and consensus among all parties involved. If well handled, it gives credibility and authenticity to the entire process and eventual report. The License to Operate (LTO) and Freedom to Operate (FTO) are products of fruitful stakeholder's engagements. This aspect of the ESIA for the 76KM pipeline project was handled by the consulting team of experts at different level.

Summary of Previous Engagements

Date	Stakeholder	Purpose	No. of attendees
21 September 2023	• Federal Ministry of Environment • Rivers State Ministry of Environment	Site verification required for Project categorization	8
19 October 2023	• FMEnv, ISMEnv, RSMEnv, LGAs • Council of Chiefs, • Paramount Rulers of respective Communities, • Elders, Women and women leaders, Youths, • NGOs, Civil societies, • Farmers, Traders, Fishers, students etc.	Scoping workshop for ESIA, Terms of Reference and Scope of Work A broader engagement to further educate participants on the proposed Pipeline project scope, environmental, social, economic and health aspects. Possible impacts of the project and community perspective (expectation, benefits, and perception etc.)	145
9 December 2023	Cluster Heads	Inform the Cluster of the proposed Pipeline Project scope; environmental, social, economic and health aspects. Clarify the roles and responsibilities of the Cluster Heads with regards to the Project.	4
15 December 2023	Cluster 1 communities' stakeholders: • The Paramount Ruler • Community Chairman • Youth President and Executives • Women group	Inform participants of the proposed Pipeline Project scope; environmental, social, economic and health aspects. Discuss possible impacts of the Project and obtain community	53

Date	Stakeholder	Purpose	No. of attendees
	- Youth Rep. of Youth Council - Community Members	perspectives (expectations, benefits, perceptions etc.).	
14 December 2023	Cluster 2 communities' stakeholders: - The Paramount Ruler - Community Chairman - Youth President and Executives - Women group - Youth Rep. of Youth Council - Community Members	Inform participants of the proposed Pipeline Project scope; environmental, social, economic and health aspects. Discuss possible impacts of the Project and obtain community perspectives (expectations, benefits, perceptions etc.).	87
20 December 2023	Cluster 3 communities' stakeholders: - The Paramount Ruler - Community Chairman - Youth President and Executives - Women group - Youth Rep. of Youth Council - Community Members	Inform participants of the proposed Pipeline Project scope; environmental, social, economic and health aspects. Discuss possible impacts of the project and obtain community perspectives (expectations, benefits, perceptions etc.).	135
19 December 2023	Cluster 4 communities' stakeholders: - The Paramount Ruler - Community Development Committee (CDC) Chairman - Youth President and Executives - Women group - Youth Rep. of Youth Council - Fishermen and Hunter - Community Members	Inform participants of the proposed Pipeline Project scope; environmental, social, economic and health aspects. Discuss possible impacts of the Project and obtain community perspectives (expectations, benefits, perceptions etc.).	91

FIRST ENGAGEMENT

SITE VERIFICATION BY ENVIRONMENT ASSESSMENT DEPARTMENT (EAD) AND RIVERS STATE MINISTRY OF ENVIRONMENT (RSMENV) OFFICERS

Proceedings

Date : 21 September 2023

Venue: Indorama Complex and Project Site

The site verification engagement session commenced at about 10:30am with introduction of participants which include Reps of FMEnv Abuja, FMEnv Zonal Office Port Harcourt, Rivers State Ministry of Environment (RSMEnv), and Proponent Reps. Total 10 attendees in the session.

The site verification activities were carried out by a multidisciplinary team consisting of environmental scientists, engineers, and other relevant experts from AGPC, Indorama, Consultant and Regulator. The team conducted extensive field visits to the proposed project site, observed the surrounding ecosystems, and interacted among stakeholders present as it relates to the proposed project. The verification process also involved reviewing project documents, including the proposed pipeline Right of Way (RoW), technical specifications of pipeline. The summary of engagement session is as below.

1. The Project Proponent Rep explained the proposed 20" x 76km natural pipeline project to the stakeholder present.
2. The FMEnv reps explained the purpose of the visit, which was supported by RSMEnv rep.
3. The FMEnv rep explained that EIA site verification visit is aimed to categories the project considering various environmental & social aspects.
4. The Ministry further instructed to submit Scoping Workshop report and revised Terms of Reference (TOR) incorporating significant issues raised at the Scoping Workshop and a detailed sampling frame for review and approval.
5. The Ministry was informed about the Scoping Workshop Program and the Ministry confirmed the participation.

The site verification ended successfully with the objectives of the engagement achieved, which includes that the project has actually not started, developmental projects around project environment. The Regulators further run through the EIA process to all stakeholder present confirm that the site verification is one the preliminary stages of EIA process. Below are photographs from site verification exercise.

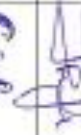
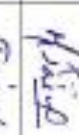
PHOTO GALLERY



INDORAMA ELEME FERTILIZER & CHEMICALS LIMITED, ELEME, RIVERS STATE, NIGERIA

ATTENDANCE SHEET

PROJECT	NG Pipeline – 76km
DATE & TIME	21 st September 2023: 10:00 PM
VENUE	Project Office Conference Room
TOPIC	NG Pipeline (76km) Project – Site Verification Visit

S/N	NAME	COMMUNITY / ORGANIZATION	PHONE NUMBER	Gender	Sign
1	IKOMAH, F. B.	FME NV, PTC	0825662496	M	
2	Alphonso Franklin	FME NV Abaya	08070983447	M	
3	Adegoke Joseph	FME NV Adeja	08032850037	M	
4	BARIEHES, GOVERNOR	FME NV, PTC	08077290705	F	
5	Dr. Ken. O. Oluaro	RS ME NV, PTC	08033894426	M	
6	Baruwa S. Dhamagbe	Indorama	08056116035	M	
7	Dr. Makindua Jain	Indorama	08070324523	M	
8	Toyin Olausabe	Indorama	08068264786	F	
9					
10					

SECOND ENGAGEMENT

**SCOPING WORKSHOP ORGANIZED FOR
76KM GAS PIPELINE PROJECT AT GOLDEN TULIP HOTEL, STADIUM
ROAD, PORT HARCOURT**

As advised by the Federal Ministry of Environment (FMEnv) vide letter reference number FMEnv/EA/EIA/7236/Vol.1/68 of 12th October 2023, the scoping workshop involving stakeholders was conducted on 19th October 2023.

The workshop commenced with an opening prayer by Mrs. Josephine Nwoye at about 9:35am, which was further complemented with second stanza of the Nigerian National Anthem followed introduction of stakeholders, by welcome remark by Indorama, safety briefing and opening remark by FMEnv representative.

The key stakeholders in attendance were:

1. Representative of the Federal Minister of Environment, Abuja
2. Zonal Controller of the Federal Ministry of Environment, Port Harcourt
3. Zonal Controller of the Federal Ministry of Environment, Owerri.
4. Representative of State Ministry of Environment, Rivers State
5. Representative of State Ministry of Environment, Imo State
6. Representative of Ohaji/Egbema LGA
7. Leadership of the 23 communities along the pipeline RoW
8. Youth Leaders
9. Women Leaders
10. Consultant team
11. The Indorama Team

A total of 145 attendees were present in the scoping workshop as shown in the attendance sheet.

IEFCL's MD OPENING REMARK

The representative of the Managing Director of Indorama Eleme Fertilizer & Chemicals Limited (IEFCL) Mr. Phool Singh in his opening remark thanked all stakeholders for finding time to honor their Invitation. Going further he explained to stakeholders that the engagement is for the proposed 76km Natural Gas Pipeline Project that will deliver gas from Asa in Ohaji/Egbema LGA of the Imo State to Indorama Complex in Eleme LGA of the Rivers State. Concluding he cited the objective of the engagement as per the ESIA statutory requirement and assured stakeholders of Indorama commitments to environmental protection.

FME_{env} REP OPENING REMARK

The Representative of the Honorable Minister – Mr. Omovoh Gift Ochonogor in his opening remark welcomed all participants to the scoping workshop, confirming that Indorama applied for ESIA approval of Proposed 76km Natural Gas Pipeline Project. Per EIA Act, the Honorable Minister advised Indorama to carryout scoping workshop to review the draft ESIA ToR/SoW submitted to the Ministry with the relevant stakeholders for their inputs. Furthermore, he stated the importance of the scoping workshop referring to it as a major component in the ESIA process, which brings all stakeholder together, give them the opportunity to be aware of developmental activities within their environment and more so afford them the opportunity to participate in the ESIA approval process. Going forward he confirms that this is not the first time Indorama has carried out such an engagement, as they are religiously complying to the ESIA process in any of their developmental projects. Concluding, he told the participants that Indorama will be making a presentation on the submitted draft ToR/SoW for the proposed project for their input, urging them to listen attentively to make valuable contributions that will help the Ministry take a sound decision to the benefit of our environment.

DRAFT ToR/SoW PRESENTATION BY THE ESIA CONSULTANT

The presentation of the draft ESIA ToR and scope of work submitted to the Federal Ministry of Environment was made by Mr. Solomon Nwachukwu. During his presentation he informed the participants about the Proponent and background of the Project before diligently reviewing the Scope of the ESIA study which covered description of the Project and the Physical, Biophysical, and socio-economic environmental components of the proposed ESIA study. He confirmed that the ESIA study would cover 23 communities for socio-economic studies. He emphasized that the socio-economic study would cover various Socio-economic variables including Cultural Heritage. He informed that the ESIA report will also cover assessment of possible associated and potential (positive and negative) impacts of the various phases of the proposed project, mitigation measures and management plans. He explained in clear terms that the ESIA study approach will be in line with the requirements of the FME_{env} ESIA process. He also explained about the ESIA report format, ESIA schedule and deliverables. Concluding He stated that the ESIA study will be carried out with reference to National Regulations and International Guidelines. The presentation made to stakeholders is appended as annexure 2.

QUESTIONS AND RESPONSES

Mrs. Josephine Woryi: During such meetings I will request presentation material be made available to participants ahead of time to enable them to study the material. Going

forward she asked, what are the safety and health hazards that will affect the communities hosting this pipeline project?

Response: Responding to the question, Dr. Jain of Indorama explained the ESIA process in detail. He explained the importance of the baseline data, process of impact assessment and mitigation measures including management plans. He explained that during ESIA process, the impact including safety & health impact will be assessed and mitigation measures will be proffered. The engineering design will follow the National/International codes ensuring the safety aspects of the project, that will eliminate the possibility of health impacts.

Mr. Okere Samuel: What are the measures to prevent contamination of surface & groundwater?

Response: Both the use of technology and strict adherence to standard operating procedures will all be employed to prevent the possibilities of contamination of both surface and groundwater resources from accidental release. Moreso, the ESIA study will cover the study of groundwater and surface water which will be used as reference in future.

Mr. Chima Ugo: Having listened to the presentation attentively, security of the pipeline is not mentioned during the presentation. What is the measure for pipeline security?

Response: The monitoring of the pipeline will employ the same technology and security surveillance procedure as currently practiced for the existing 83km pipeline i.e., the use of optical fiber cable to monitor remotely and the MoU and Security surveillance contract with host communities.

Mr. Kinsley Nweke: The existing pipeline right of way (RoW) is currently being encroached upon, any plan for settlement on the encroachment or new acquisitions process.

Response: The proposed 76km gas pipeline will be laid on the existing pipeline right of way, as no new land acquisition is envisaged.

Dr. Shammah Anyalebechi: A young girl died in our community in 2008 due to pipeline explosion. What are the mitigation measures to avert such an occurrence?

Response: Responding to the question, Mr. Kendrick Oluka informed stakeholders that Indorama only started operation of their first pipeline project in 2014. However, he confirmed that safety is key to every Indorama operation. Furthermore, he registered his dissatisfaction with the issue of sabotage on pipeline.

Chief Wgbara: Display of the ESIA report at the LGA council headquarters will be an invitation to Politicians to hijack the process to the disadvantage of the local community, he warned.

Response: Responding to the question, Indorama informed the stakeholders that the ESIA report display approach will be in line with the requirements of the Federal Ministry of Environment, as such has no political coloration.

Mr. Kingsley Akano: He began by confirming that Indorama fulfills whatever they promise, urging participants to foster peace in their various communities to enable actualization of the proposed project. Furthermore, he added that non-execution of CSR project is a problem of contractors, advising Indorama to appoint contractors by themselves for completion of projects awarded.

Response: Responding to the question Mr. Kendrick Oluka informed stakeholders that contracts are awarded to contractors nominated by the leadership of the community after verifying the capabilities.

Mr. Oliver KSC: What are the measures that the community will benefit from job opportunity that this project will provide during construction?

Response: This will be purely based on merit, knowledge, and skills. The community leadership will be informed to sublet the information in their communities, whenever opportunity arises. This is the process being used presently by Indorama.

Mr. Eze Vincent Nwosu: During the question-and-answer session Eze Vincent confirmed that Indorama is a company to work with, adding that they are committed to every promise they made to their host community. He further appeals to Indorama to come to their aid with respect to the community issues.

Engr. Nwgbu – Zonal Controller Imo State (FMEnv): The pipeline from Asa to Indorama, I want to ask are you drilling your own well?

Response: Responding to the question, Dr. Jain of Indorama confirmed that Indorama is not drilling well, rather they are laying pipeline that will transport gas from Anoh gas manifold to Indorama facility in Eleme.

CLOSING REMARKS

Dr. Kenneth Okoro – Rep of Commissioner, Rivers State Ministry of Environment

Commenting during the engagement, Dr. Kenneth Okoro confirmed that Indorama is doing well on all fronts, especially in the area of environmental protection, owing to the level of their compliance with environmental laws applicable to the operations. He further appeals

to the host communities to give Indorama the enabling environment to actualize this project.

Mr. Ikomah FB – Zonal Controller, FMEnv Port Harcourt Office, Rivers State

In his remark Mr. Ikomah expressed satisfaction on the Proponent attitude in observing the ESIA protocols. He urged the communities to encourage Indorama with their support to see that the project comes to fruition.

Mr. Omovoh Gift Ochonogor - FMEnv Minister's Rep

The Representative of the Honorable Minister confirmed that Indorama is a responsible corporate organization owing to their drive for environmental protection in all their operations. Furthermore, he confirmed that as a Ministry, they have listened to questions and answers provided, testimonial from the stakeholder about Indorama. Finally, he thanked all participants for their participation and valuable contributions.

Vote of thanks

Engr. Sylvester of Indorama gave the vote of thanks, appreciating all stakeholders for coming and being open with their contributions. He assured participants that Indorama will do their part to ensure that the proposed project is delivered in due consideration to the environment.

The meeting ended at about 11:30am with a closing prayer. After that, everyone present in the meeting was treated to refreshment.

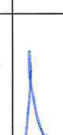
EVENT PHOTOGRAPHS





INDORAMA ELEME FERTILIZER & CHEMICALS LIMITED, ELEME, RIVERS STATE, NIGERIA

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TOPIC	76KM GAS PIPELINE PROJECT ESIA – Scoping Workshop				
S/N	NAME	COMMUNITY / ORGANIZATION	PHONE NUMBER	Gender	Sign
1	Dr. K.O. Okeke	RSMEN	08033094426	M	
2	Dr. Mrs. Adenike Edehina	Redevelopment	08034649910	F	
3	Ikemath, O.O.	FMEAN. PHE	0805662496	M	
4	Eng. Ubons Okeke	FMEAN. PHE	08030855787	M	
5	Okeke Okeke	STATE MIN. of Environment	08068021844	M	
6	Umovet Cuth Okeke	Fed. Min. of Environment	08076922255	M	
7	Phool Singh	Indorama	08052316666	M	
8	Dr. Mahendaa Jain	INDORAMA	08020324523	M	
9	Sylvester Okeke	Indorama	08035650244	M	
10	Andan Mai - Okeke	Indorama	08033384134	M	

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11	MORDECAI J.	OMADEME	0805 30 611 97	MALE	
12	Ego Meki	OMADEME	0815 104 522	FEMALE	
13	Tony Nwile	OMADEME	0906 37 8515 778	male	
14	Chief Patrick Nwaka	Omadaeme	09165 66 0763	MALE	
15	FELE BENEDICTO Nwaka	IAAHEH Umudiogo	0706 853 833 76	MALE	
16	Nwaka Chike Iwagbo	IMCH	0703 725 3984	MALE	
17	Augustine Onyegwara	Imch	09032 402 910	male	
18	Kwagbo Nwaka	Umudiogo	0808 865 6732	male	
19	Agnes Anugbo	Umudiogo	0813 458 8917	female	
20	Nwamguma Chris	Imch	0806 573 0909	Male	

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21	Mr. Kaka F.N. Onuoha	Ozuahia F. Ruler, ^{Ilumina}	07064859585	M	
22	Chief Victor Obisike	Osuahia Chief	08068091388	M	
23	Silkealine Mekiyeu	Ozuahia	08124945272	M	
24	Joy Sunday	Ipo I	08155881022	F	
25	OLIVER N. NWIDIA (KSC)	AKPAFO	08035518874	M	
26	ROSELINE D. OSAROLUFI	AKPAFO	08037761680	F	
27	EMMANUEL Oluca	AKPAFO	08037104607	M	
28	Osanduka Oluksin Ngeis	AKPAFO	08037070505	M	
29	Godsday Muluu OAKA	AKPAFO	08065832929	M	
30	ALI UCHIE ATTAH	AKPAFO Youth President	08062655828	M	

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31	GRAY SUNDAY BASIL	DUNHAM CDC	08063478195	MALE	
32	MUNIRU DIKOM EZEKIEL D	Orukwelu C.D.C Chama	08030670149	MALE	
33	CHUNNATH, UAD KUNDESA	Orukwelu CDC	08036636525	MALE	
34	IGWE, SUNDAY OHAHURU	Orukwelu CDC	08037351266	MALE	
35	OKPARANTA STEPHEN A.	160 SAKRAKOR	08038838335	MALE	
36	hon Waji Chamberlain	160 cluster leader	08037771535	male	
37	BARKAZ BARAKUNDU	Dunham CDC	09063558643	MUNE	
38	NYOZI Amaekwile	ATOKI TOWN	08036683484	Female	
39	TEMPLER, C. AGIBAPATA	ATOKI Town	080-66901666	MALE	
40	Chiforhon, G. N. I. AGIBAPATA	ATOKI Town	0803349382	MALE	

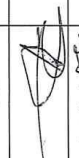
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41	HON NDURUISI ASD	ELITENBO	08033408774	MALE	
42	Udottukwu MTOLU	ELITENBO	08062270528	MALE	
43	Allen N. Nyechue	ELITENBO (CDC)	08035689919	MALE	
44	Ngozi Chinda	ELITENBO	08038260223	FEMALE	
45	Emmanuel Weli	ELITENBO	09136286177	MALE	
46	Ikechi Anubelen	Abara (Community)	08022865433	MALE	
47	Amadi Chionna	Abara Security	08104774853	FEMALE	
48	CHP Lucky Nwala	Abara	08068956470	MALE	
49	Chof TPI Day Nwuna	Abara	08063264254	MALE	
50	Emmanuel Okunna	AhARA CDC	08104227448	MALE	

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S/N	NAME	COMMUNITY / ORGANIZATION	PHONE NUMBER	Gender	Sign
51	Alexander John	Omehamra	08036224026	M	
52	Mr. F.I. Azikindia Jr	✓	0706173201	M	
53	WALELE CHARITY	✓	07065428511	F	
54	Edwain Wala	✓	08102889248	M	
55	Onuori, Samuel	Umuogah - Umuwedem	08067028196	M	
56	Gudness & Godwin	Umuwechem	08130734499	F	
57	AGBAM THAKGOD MGBECHI	Umuwechem	07063844728	M	
58	MURTEHUKU SILEMON	CONSULTING TEAM	08032906422	M	
59	OBINNA, Richard O.	✓	08632628237	M	
60	Godwin Abel	ImEh	08037719932	M	

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61	Chief Adolphus Nwankwo	Elemelem Chief Community	08034215548	M	
62	NKWO ELENUWA VICTOR	Elemelem SECRETARY	09026235849	MALE	
63	CHIDOLIE NICHOLAS	Elemelem CDC	08026050544	MALF	
64	Comv. Ebene Samuel O.	Elemelem Youth Press ID 44	08025416937	M	
65	CHIKUDIE MARY	Elemelem women's association	09061113061	FEMALE	
66	AKOZIE EMMI	Kumukomelu Akh	08030803258	Male	
67	Oxi Leonard	Awarra 2	080839714362	Male	
68	IZIE CHIKE	Awarra 1	08038253988	male	
69	OPAMAH Saturday	Awarra 2	09081957987	Male	
70	Paster Imeze Kenneth	Awarra 2	09084458416	male	

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S/N	NAME	COMMUNITY / ORGANIZATION	PHONE NUMBER	Gender	Sign
71	Chief Abubakar I. Oniye	Imuagodo	08025301486	Male	
72	Colund Mwafor	Imuagodo	08101733168	male	
73	Joe Jones	Imuagodo	08105734248	women	
74	Sylvester Dickie	Akamu	09039378409	M	
75	Amadi Chetue	Akamu	07062601395	M	
76	Eyikunaya Kikigley	Akamu	08022779064	M	
77	Ezechiel Oluochi L	Akamu	09137658975	F	
78	NRE Gideon Nwete Jr.	ASSA	08032756579	M.	
79	Hortensius Iruere	ASSA	08141720823	M	
80	Eng. Eric N. Nwanku	ASSA	08069016463	M	

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S/N	NAME	COMMUNITY / ORGANIZATION	PHONE NUMBER	Gender	Sign
81	Chief Clifford Nweli	Rumuokwuru 1	08337082034.	M.	
82	Off Godwin Allicia	✓	090 967 44894	✓	Alis
83	AGBOLU GBEKEE	✓	08037356603	M	
84	Chief Bennett C. Kpelere	✓	08101367669	✓	
85	Isaya to. Onanwa	✓	08037690191	F	
86	Utti Okueghalam	MAJOR RITA	08032686766	m	
87	Chief ^{Mr. N. J. Okeke} Okueghalam ^{Okueghalam}	Guwana	09015975764	F	
88	Pharm Eugene Chikozoie	✓	08147041296	m	
89	Mondy Okachukwu Nwelu	✓	09128663532	M	
90	Patience Ogbu	✓	07017970487	F	O-P



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S/N	NAME	COMMUNITY / ORGANIZATION	PHONE NUMBER	Gender	Sign
91	Enger Atfpan, Wlong Oko	Control/Interv. Ins State	08030855901	Male	Atfpan
92	Enger Atfpan, Wlong Oko	Rep. Hon. State Comm. of Environment	08034464490	Female	Atfpan
93	Okoroma Obinna. N	Rep. Hon. State Comm. of Environment	08068021844	Male	Okoroma
94	Omoveri Gift Dehonogor	Rep. Hon. State Comm. of Environment	08076577085	Male	Omoveri
95	Okoroma Jackson	Asst. Rep. Hon. State Comm. of Environment	07088325653	Male	Okoroma
96	Okoroma Jackson	Asst. Rep. Hon. State Comm. of Environment	08060120845	Male	Okoroma
97	Okoroma Jackson	Asst. Rep. Hon. State Comm. of Environment	08038670767	Male	Okoroma
98	Okoroma Jackson	Asst. Rep. Hon. State Comm. of Environment	08088695629	Male	Okoroma
99	Okoroma Jackson	Asst. Rep. Hon. State Comm. of Environment	081422877139	Male	Okoroma
100	Okoroma Jackson	Asst. Rep. Hon. State Comm. of Environment	08162600161	Female	Okoroma

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101	Akram Kingsley	Ochi'a community P.G	08064559887	Male	
102	Nwemerie Joseph	Yoruba Ochi'a community leader	08024382530	male	
103	Nathana Gnedoh Chigo	W/leader	09044581829	Female	
104	Heta Stanley N	PA ESSE	0703518156	Male	
105	Chief Ibekwa Idowuwa. C	Chief of staff Ochi'a padua	08064184794	Male	
106	ADEGUNWA-MOTUNRAYAN-O.	FED MUM. OF ENURUM (117)	08053813584	Female	
107	BARIEENEE, COVENANTS - B.	FED MUM OF ENURUM	08077290905	Female	
108	Agagye-Jack Boma favour	JO-MORGE INT-SEC. LTD	09033210161	Female	
109	Lucky MAGNUS	UNNOCITEM	08105822274	MAGE	
110	Eze Oor Shannah, Anyalekebeli	Unnuga- Unnuechan	08033918351	male	

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S/N	NAME	COMMUNITY / ORGANIZATION	PHONE NUMBER	Gender	Sign
111	Ongedikachi Nwogu	CDC chairman Chokocha community	08160257995	Male	
112	Em. Michael Nwazi	Chokocha Community	07047104193	Male	
113	Obbonna Bright E.	Youth Leader	07038830626	Male	
114	Eze Samuel Oshiam	Ngoragbida Chokocha	081659144796	Male	
115	Anaoli Irene	Chokocha Community Loman Local Govt.	070622947031	Female	
116	Chief Friday Chime	Rumokanali Afa	081104332022	Male	
117	FRED OGBONDA	Obunuwale	08030985812	M.	
118	Zonachukwu Anaoli		08064366410	Male	
119	Chief Okachukwu Odion		091228226065	Male	
120	Chief Ugoji Ireavus		08038889187	Male	

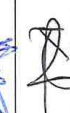
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121	PRINCE NNAMDI IKOSU	Uboing	08077976662	M	
122	PETER OYIKUN	Uboing	08064097356	M	
123	SIMEON I. DIKE	Chc Uboing	08062099213	M	
124	CHIEF INNOCENT ANADI	Patrice Chief Uboing Youth Leader	08082746642	M	
125	CHARLES OYIKUN	Uboing	070339925909	M	
126	Offa Anthony Umehiaku	Indorama Offa-in Council Uboing	09066804829	M	
127	ISA ALAMIN OKACHA	Seaeater Uboing	08184602777	M	
128	BESTRICE KAGOR	Indorama Center Uboing	07023603931	F	
129	IZELINNOCENT NIAOSU	Umuakuru	080391450252	M	
130	CHUKWUEMEKA PETER	Umuakuru	07010986328	M	

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131	High Chief I.O. Didi	Dmeveru	0710882744871	Male	
132	Mm Stanley Anusidi	Dmeveru	08060866152	Male	
133	Mrs Jennifer Okeme	Dmeveru	08064267432 07088744871	Female	
134	Mr Chif C.D. Chukwura	Dmeveru	08053262915	Male	
135	KOATE, Ezechium Beate	ECs	08106523807	Male	
136	Dr Obot Dominic Akpan	ECs	08032717955	M	
137	Sunday Lorka	ECs	07037993486	m	
138	Aie Chikali	Eleme	08086667357	M	
139	Ezekiuel Okereke	Eleme	09037542653	M	
140	Enunuo K Chibrikem	Eleme	08148400393	M	

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141	MR KENDRICK OLUKA	INDORAMA	0805586428	M	
142	MR KUZUE NGORU	INDORAMA	080633345885	M	
143	JAKA GODSPONER	INDORAMA	08134446692	M	
144	OKAKABARI OLOR	INDORAMA	07067576053	F	
145	JUMA BEBE-OPABE	INDORAMA	07027713286	M	

THIRD ENGAGEMENT

COMMUNITY LEVEL ENGAGEMENTS UNDER FOUR (4) CLUSTERS

Cluster 1 (Atali, Elemenwo, Rumuokwurusi and Akpajo)

Date of Engagement: 15 December 2023
Venue Village Town Hall/Palace
Facilitator Consulting Team

Stakeholder's Groups Present

- i. The Paramount Ruler of Community
- ii. Community Chairman
- iii. Fishermen and Hunters Association
- iv. Consulting Team (Safespace)
- v. Youth President and Executives
- vi. Women Leader and Executives
- vii. Cross section of Community

Attendance of participants by Gender

Total Attendance - **53**

Aim and Objective of the Engagement

The objective of this engagement was to establish a productive dialogue with Cluster 1 communities to be affected by the proposed Indorama 76km pipeline. The engagement sought to address community concerns, share project information, and build relationships to foster understanding and cooperation.

Key Activities:

1. Community Meetings:

- The Four communities were gathered a central place within Cluster 1.
- Meetings were held in local community halls, ensuring maximum accessibility.
- Presentations were made to disseminate project details, including its purpose, expected benefits, and potential impacts on communities.
- Opportunities for questions, comments, and concerns were provided, facilitating an open and transparent dialogue.

2. Stakeholder Consultation:

- Stakeholder consultations were conducted with local community leaders, opinion leaders, and representatives.
- These consultations aimed to gather insights into the project's potential social, economic, and environmental impacts, as well as suggestions for mitigation measures.
- Stakeholder feedback was documented and will be considered in future project planning and implementation.

3. Village Visits:

- The team visited various villages within Cluster 1 to gather firsthand information such as infrastructural development, sacred site and questionnaire administration within the communities
- This allowed for a more personal and detailed understanding of community concerns, needs, and aspirations.
- The team sought to build trust and rapport through these interactions.

Key Findings:

1. Community Concerns:

- Key concerns revolved around Youth employment/empowerment, land acquisition potential disruptions to farming activities, pollution, land ownership, and compensation for land use.
- There were also concerns about vandalism and possible fire outbreak
- Certain households expressed concerns about the potential impact on their livelihoods and income streams.

2. Information Gaps:

- Some community members expressed a lack of clear understanding of the project's objectives, timeline, and potential benefits.
- Limited awareness of sustainable construction practices and environmental mitigation measures was also observed.

3. Community Support:

- Despite concerns, there was a general willingness among community members to collaborate, provided their concerns were adequately addressed.
- Many expressed interest in potential job opportunities and sought guidance on ways to maximize the project's benefits to their communities.

Response

Based on the findings of this engagement, the following steps are proposed:

1. Addressing Concerns:

- Engage with relevant stakeholders to develop a comprehensive plan to address community concerns related to youth employment/empowerment farming disruptions, land ownership, compensation, and monitor potential impacts on water sources.
- Develop an information package in local languages to better communicate project objectives, benefits, and timeline.

2. Mitigation Measures:

- Collaborate with environmental experts to devise comprehensive mitigation measures to minimize the project's environmental impact, and also employ the use of technology for surveillance
- Engage local communities in environmental awareness and education programs, promoting sustainable practices.

3. Ongoing Engagement:

- Work with community liaison office to maintain regular communication and feedback channels with Cluster 1 communities throughout the project's lifecycle.
- Organize regular community meetings, informative sessions, and project updates to foster transparency and community involvement.

Conclusion:

The engagement with Cluster 1 communities was successful and was productive in establishing a dialogue and addressing initial concerns. It is important to implement the proposed next steps to ensure effective mitigation of community concerns and maximization of project benefits. Continuous engagement and transparency will be key to maintaining positive relationships with affected communities.

Photo gallery



ATA 1

INDORAMA ELEME FERTILIZER & CHEMICALS LIMITED, ELEME, RIVERS STATE, NIGERIA

INDORAMA

ATTENDANCE SHEET

PROJECT	76KM GAS PIPELINE FROM ANOH GAS MANIFOLD TO INDORAMA COMPLEX
DATE & TIME	15 th December, 2023 10:05am.
VENUE	Atala Community
TOPIC	76KM GAS PIPELINE PROJECT ESIA - FIELD DATA GATHERING EXERCISE

S/N	NAME	Postion Community / Organization	PHONE NUMBER	Gender	Sign
01	Chieftain Okeke	Chieftain	08033419362	M	[Signature]
2	George K. Ekwu - George	Yout leader	0803-0855-250	M	[Signature]
3.	Chief Friday Chime	Chief	08101452022	M	[Signature]
4	Elh Sony Ekezie	Elder	08032724735	M.	[Signature]
5	Eugene Okebona	Fourth	08030785817	M.	[Signature]
6	Chisom Sonia Ibigo	Woman group	0803041698	f.	[Signature]
7	Assumpta Okebona	Woman group	08031774114	f.	[Signature]
8	Florence Ekezie	Woman group	08152790409	f.	[Signature]
9	Ngazi Amareh	Woman leader	0803366834892	f.	[Signature]
10	Eden Anuolu	Elder	080333928498	M	[Signature]
11	Chief Okebona Ekezie	Chief	08046355007	M.	[Signature]

12 Lainta Finck's Chime

08162286977

76KM GAS PIPELINE FROM ANCH GAS MANIFOLD TO INDORAMA COMPLEX
INDORAMA ELEME FERTILIZER & CHEMICALS LIMITED, ELEME, RIVERS STATE, NIGERIA
ATTENDANCE SHEET

PROJECT	76KM GAS PIPELINE FROM ANCH GAS MANIFOLD TO INDORAMA COMPLEX				
DATE & TIME	15th December, 2023 12:46pm				
VENUE	Eleme Community				
TOPIC	76KM GAS PIPELINE PROJECT ESIA - FIELD DATA GATHERING EXERCISE				
S/N	NAME	Position Community / ORGANIZATION	PHONE NUMBER	Gender	Sign
1	Allen Njeke	CDC Chairman	0803519917	M	[Signature]
2	Ndubuisi Njelu	PRINC in the Community	0803340874	M	[Signature]
3	Sir Chief Simeon Wkiki	P.R.O: ELEME COUNCIL CHIEF	08036667300	M	[Signature]
4	Chudat Vanessa Churde	Youth Group leader	08032146147	F	[Signature]
5	Augustina (Audubus)	women leader	08034860793	F	[Signature]
6	Hon. Mabel Ejekiri	ELEME women leader	08055312086	F	[Signature]
7	Quinn Akado		07037581471	F	[Signature]
8	Hon. Hasso Chikura		08091942073	M	[Signature]
9	Atakor Chinab	ELCENVO	08033106074	M	[Signature]
10	MEL Njeki	Youth President	08036494141	F	[Signature]
11	Fade Njeki		0803552303	M	[Signature]

RU MUEKUR US 1
INDORAMA ELEME FERTILIZER & CHEMICALS LIMITED, ELEME, RIVERS STATE, NIGERIA

ATTENDANCE SHEET

PROJECT	76KM GAS PIPELINE FROM ANOH GAS MANIFOLD TO INDORAMA COMPLEX
DATE & TIME	15th December, 2023.
VENUE	Palace of H.H. Eze D.C. Ikemena (JP).
TOPIC	76KM GAS PIPELINE PROJECT ESIA - FIELD DATA GATHERING EXERCISE

S/N	NAME	Position / ORGANIZATION	PHONE NUMBER	Gender	Sign
1.	Chief Clifford Udui	Former R/C Ikemena Common Rep.	08637082034	M	
2.	Chief Godwin Anibiri	Community clt	09096744899		
3.	Chief Ben Uweke	Community chief	08101367662		
4.	Comon. Azubuike (Gue)	McBuron	08037356603		
5.	Agbodu GBEKEE	Rembrandt	08037356603		
6.	Solomon. I. Wokopu	Rembrandt	08122650005	M.	
7.	H.R.H. EZE D.C. Ikemena JP.	PARLIAMENT. RULER.	08039125576	M.	
8.	Mkedi Jey Cliff	Rumudun, Rumudun	08064399393	F	

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INDORAMA ELEME FERTILIZER & CHEMICALS LIMITED, ELEME, RIVERS STATE, NIGERIA

ATTENDANCE SHEET

PROJECT	76KM GAS PIPELINE FROM ANOH GAS MANIFOLD TO INDORAMA COMPLEX				
DATE & TIME	15/12/2023 2:00 PM				
VENUE	Akpa Eleme				
TOPIC	76KM GAS PIPELINE PROJECT ESIA - FIELD DATA GATHERING EXERCISE				
S/N	NAME	Position Community / Organization	PHONE NUMBER	Gender	Sign
1	Sir Oliver N. Nwida	CDC chairman	08033518874	male	
2	Osarefuka Godwin Ngosis	Seclary Akpa Council	08037070505	male	
3	Hen Emmanuel Oluke	Stakeholder youth LEADER	0803704607 07064693184	Male	
4	SAMSON PREMISE ARAE	Women LEADER	08037761680	FEMALE	
5	CHH MRS ROSELINE D. OSAREWUN	CDC SECRETARY	08065832929	MALZ	
6	Ben Godday Uwu Oluks	Women REP	08107227699	Female	
7	Goodness Wuu Oluks	member	08068500842	Female	
8	mercy Oluks	youth member	08063762412	male	
9	Nwodu Edwina		0806 08184550846	Female	
10	Imet Nwaka			F	
11	ESTHER ABEDNIEGO	youth	081146296340	F	

INDORAMA
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ATTENDANCE SHEET

PROJECT	76KM GAS PIPELINE FROM ANOH GAS MANIFOLD TO INDORAMA COMPLEX
DATE & TIME	15/12/2023 2:00pm
VENUE	Atkpa 50 - Elemo
TOPIC	76KM GAS PIPELINE PROJECT ESIA - FIELD DATA GATHERING EXERCISE

S/N	NAME	COMMUNITY / ORGANIZATION	PHONE NUMBER	Gender	Sign
12	Monday Chigot	Member Elder	08165245741	m	
13	ROBERT OWATE	MEMBER	08109208324	MALE	
14	Friday Okanje	Youth	08036470082	m	
15	Friday Okwida	Youth	08716259559	male	
16	Hezekiah Oku	Member	08032430726	m	
17	Daniel Oku	Youth	08170401780	m	
18	Johnson Oku	Youth	08034856480	m	
19	Mercy Ephraim Oku	Member	08068857838	f	
20	Alamy Ben	stakeholder	08137811844	f	
21	Remita Alale	stakeholder	08030536313	f	
22	Friday Nymene	stakeholder	08038851238	m	

Cluster 2 (Umuechem, Abara, Umuogodo, Imeh, Edegelem, Chokocho and Umuakuru)

Date of Engagement: 14 December 2023
Venue Village Town Hall/Palace
Facilitator Consulting Team

Stakeholder's Groups Present

- The Paramount Ruler of Community
- Community Chairman
- Fishermen and Hunters Association
- Consulting Team (Safespace)
- Security Guards
- Youth President and Executives
- Women Leader and Executives
- Community Members

Attendance of participants by Gender

Total - **87**

Aim and Objective of the Engagement

The objective of this engagement was to establish a productive dialogue with Cluster 2 communities to be affected by the proposed Indorama 76km pipeline. The engagement sought to address community concerns, share project information, and build relationships to foster understanding and cooperation.

Key Activities:

1. Community Meetings:

- The seven communities under this Cluster 2 were visited individual and reported under cluster 2.
- Meetings were held in village town halls/palace, ensuring maximum accessibility.
- Presentations were made to disseminate project details, including its purpose, expected benefits, and potential impacts on communities.
- Opportunities for questions, comments, and concerns were provided, facilitating an open and transparent dialogue.

2. Stakeholder Consultation:

- Stakeholder consultations were conducted with local community leaders, opinion leaders, and representatives.
- These consultations aimed to gather insights into the project's potential social, economic, and environmental impacts, as well as suggestions for mitigation measures.
- Stakeholder feedback was documented and will be considered in future project planning and implementation.

3. Village Visits:

- The team visited various villages within Cluster 2 to gather firsthand information such as infrastructural development, sacred site and questionnaire administration within the communities
- This allowed for a more personal and detailed understanding of community concerns, needs, and aspirations.
- The team sought to build trust and rapport through these interactions.

Key Findings:

1. Community Concerns:

- Key concerns revolved around Youth employment/empowerment, land acquisition potential disruptions to farming activities, pollution, land ownership, and compensation for land use.
- There were also concerns about vandalism and possible fire outbreak
- Certain households expressed concerns about the potential impact on their livelihoods and income streams.

2. Information Gaps:

- Some community members expressed a lack of clear understanding of the project's objectives, timeline, and potential benefits.
- Limited awareness of sustainable construction practices and environmental mitigation measures was also observed.

3. Community Support:

- Despite concerns, there was a general willingness among community members to collaborate, provided their concerns were adequately addressed.
- Many expressed interest in potential job opportunities and sought guidance on ways to maximize the project's benefits to their communities.

Response

Based on the findings of this engagement, the following steps are proposed:

1. Addressing Concerns:

- Engage with relevant stakeholders to develop a comprehensive plan to address community concerns related to youth employment/empowerment farming disruptions, land ownership, compensation, and monitor potential impacts on water sources.
- Develop an information package in local languages to better communicate project objectives, benefits, and timeline.

2. Mitigation Measures:

- Collaborate with environmental experts to devise comprehensive mitigation measures to minimize the project's environmental impact, and also employ the use of technology for surveillance
- Engage local communities in environmental awareness and education programs, promoting sustainable practices.

3. Ongoing Engagement:

- Work with community liaison office to maintain regular communication and feedback channels with Cluster 2 communities throughout the project's lifecycle.
- Organize regular community meetings, informative sessions, and project updates to foster transparency and community involvement.

Conclusion:

The engagement with Cluster 2 communities was successful and productive in establishing a dialogue and addressing initial concerns. It is crucial to implement the proposed next steps to ensure effective mitigation of community concerns and maximization of project benefits. Continuous engagement and transparency will be key to maintaining positive relationships with affected communities.

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INDORAMA

INDORAMA ELEME FERTILIZER & CHEMICALS LIMITED, ELEME, RIVERS STATE, NIGERIA

ATTENDANCE SHEET

PROJECT	76KM GAS PIPELINE FROM ANOH GAS MANIFOLD TO INDORAMA COMPLEX
DATE & TIME	14th Dec 2023 - 12:31 noon
VENUE	Practising Rivers Place Umuochem Community
TOPIC	76KM GAS PIPELINE PROJECT ESIA - FIELD DATA GATHERING EXERCISE

S/N	NAME	COMMUNITY / ORGANIZATION	PHONE NUMBER	Gender	Sign
1	Nwabialis J. Morgan	Unstet leader	08037426571	Male	
2	Eze Sampson Emey	Umuochem	08050941429	M	
3	Eze Gilbert Olanini, JP	✓	08069552804	M	
4	Eze Javos Olanini	✓	02036674998	M	
5	Eze Bartholomew Okhalu	✓	08059855123	M	
6	Akam Unkled M	✓	07063844728	M	
7	Eche Iweke	✓	08160817812	M	
8	Azuwusi Kenneth	✓	08100357266	M	
9	Eder Onyaso Amikosa	✓	08051946001	M	
10	Godwin Oluwale	✓	08077830229	M	
11	Lucky M. Olanini		08120264050		

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2020

ATTENDANCE SHEET

[illegible]

Abara Etche

B. 1st 2
INDORAMA

INDORAMA ELEME FERTILIZER & CHEMICALS LIMITED, ELEME, RIVERS STATE, NIGERIA

ATTENDANCE SHEET

PROJECT	76KM GAS PIPELINE FROM ANOH GAS MANIFOLD TO INDORAMA COMPLEX
DATE & TIME	14th Dec. 2023 - 11:29
VENUE	Chief Lucky's Place - Abara Community Etche.
TOPIC	76KM GAS PIPELINE PROJECT ESIA - FIELD DATA GATHERING EXERCISE

S/N	NAME	COMMUNITY / ORGANIZATION	PHONE NUMBER	Gender	Sign
1	Nwuebika T. Morgan	Abara Etche.	08039426571	Male	
2	CHF Lucky Nwala	Abara	07068956470	M	
3	CHF Friday Nwala	Abara	08063244254	M	
4	Sten Stanford Azuonwu	Abara	08072227089	M	
5	Jorge Alister Rube	))	09067804390	M	
6	Teddy Andrew Sime	))	08070655491	M	
7	Ikechi Ali	Abara	08038292964	M	
8	Shaggy Oyelewa	Abara	08064418295	M	
9	Goodson Oluo	Abara	08105824562	M	
10	Doris Lucky	Abara	0815212385	M	
11	Irene Chinedu	Abara	08088262451		

Abara Community
INDORAMA
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ATTENDANCE SHEET

Pg 2 of 2

PROJECT	76KM GAS PIPELINE FROM ANOH GAS MANIFOLD TO INDORAMA COMPLEX
DATE & TIME	14th Dec, 2023
VENUE	Palace of HRT - Abara Community
TOPIC	76KM GAS PIPELINE PROJECT ESIA - FIELD DATA GATHERING EXERCISE

S/N	NAME	COMMUNITY / ORGANIZATION	PHONE NUMBER	Gender	Sign
12	1st Cll Anuselen	Abara	08140447607	Male	<i>[Signature]</i>
	Anubelma Fediola	Abara	08140447607		<i>[Signature]</i>
	Azuwulu 1st Cll	Abara Eteke	070671192937	Male	<i>[Signature]</i>
	Adindly Amadi	Abara Eteke	08052546853	Male	<i>[Signature]</i>
	Simeon Anusufule		08024991233	Male	<i>[Signature]</i>
	Emmanuel C. Nwagwu		08102376324		<i>[Signature]</i>
	Ching Nwankwo		07032196542		
	Dimple Chinda		08164829288		
	Cyprian Chinda		0904168935		
	Jim Elebena				

Umuogodo Com

INDORAMA

INDORAMA ELEME FERTILIZER & CHEMICALS LIMITED, ELEME, RIVERS STATE, NIGERIA

ATTENDANCE SHEET

PROJECT	76KM GAS PIPELINE FROM ANOH GAS MANIFOLD TO INDORAMA COMPLEX			
DATE & TIME	14th December, 2023.			
VENUE	Umuogodo Community Hall			
TOPIC	76KM GAS PIPELINE PROJECT ESIA - FIELD DATA GATHERING EXERCISE			

S/N	NAME	CLUSTER / ORGANIZATION	PHONE NUMBER	Gender	Sign
1	Muhammad J. Morgan	Cluster leader	08057428571	male	
2	Kun Gburey Kureke	C. D' C chairman	08088656738	male	
3	Oze Benjamin Kureke	Traditional ruler	07065382376	male	
4	Emmanuel Kureke	10th leader	08068198877	male	
5	Muhammad Chale	Formal youth leader	08132771975	Male	
6	Sir Terry Ndagazi	Opinion leader	08026073452	male	
7	Mr John Amadi	Opinion leader	0802786524	male	
8	Amadi Blessing Kureke	Woman leader	07014928546	Female	

Meth Com.

INDORAMA
INDORAMA ELEME FERTILIZER & CHEMICALS LIMITED, ELEME, RIVERS STATE, NIGERIA

ATTENDANCE SHEET

PROJECT	76KM GAS PIPELINE FROM ANOH GAS MANIFOLD TO INDORAMA COMPLEX
DATE & TIME	14TH DECEMBER, 2023
VENUE	METH COMRAVUTE HOTEL
TOPIC	76KM GAS PIPELINE PROJECT ESIA - FIELD DATA GATHERING EXERCISE

S/N	NAME	IDENTITY/ ORGANIZATION	PHONE NUMBER	Gender	Sign
1	Morgbiker Jones Morgan	Cluster leader	08057426571	Male	
2	Elor Odun Alel	Inel CDC chairman	08037119932	Male	
3	Nwamguma Christian	Ineh Youth leader	08065730909	Male	
4	Aghaimi. Bandume	Ammasuku Day	08025801486	✓	
5	Ayaustrale Okeyegbala	Inel CDC chairman	07032401110	✓	
6	Njoku Ejike Ikingsey	C.D.C chairman	07037253984	Male	
7	Godson Nwanguwa	Umudiko Chief	08084479679	Male	
8	Ohaia Chidi	Umuru youth leader	0816635553	✓	
9	Calis Mwafor	Umuru youth leader	0816733168	Male	

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INDORAMA ELEME FERTILIZER & CHEMICALS LIMITED, ELEME, RIVERS STATE, NIGERIA

INDORAMA

ATTENDANCE SHEET

PROJECT	76KM GAS PIPELINE FROM ANOH GAS MANIFOLD TO INDORAMA COMPLEX
DATE & TIME	14th DECEMBER, 2023
VENUE	ELEME COMMUNITY HALL
TOPIC	76KM GAS PIPELINE PROJECT ESIA - FIELD DATA GATHERING EXERCISE

S/N	NAME	Community / ORGANIZATION	PHONE NUMBER	Gender	Sign
1	Muabider J. Morgan	Cluster leader	08037942657	Male	
2	CHIDORIE NEATKID	CD CHAIRMAN	08026050541	MATE	
3	Sir C.S.C. Danyale	Member	08037598999	Male	
4	Eze Nwankwo Reginald	Chief of Okole	08074717110	Male	
5	Eze Emmanuel Oluo	Chief, Unwemeta	08032576517	Male	
6	Eze Gabriel O.A. Nwankwo	Edogwu	08059554535	Male	
7	Okeke Isaac Chikeike	Imunodakile-Idunma	0806531032	Male	
8	Kingsdon Oba Williams	Unwemeta	08028205440	Male	
9	Ekeoma Adior	Unwemeta	08103661684	Female	
10	Mrs Chukwae Mary	Unwemeta	0906113061	Female	
11	Cyprian Nwagwu		08079315640	Male	
12	Okeke Samuel B.	Edogwu Youth Leader	08025416937	Male	

CATKOCATS - ETCATE

4th 27th 11th 7th 2nd 13th 2nd

INDORAMA

INDORAMA ELEME FERTILIZER & CHEMICALS LIMITED, ELEME, RIVERS STATE, NIGERIA

ATTENDANCE SHEET

PROJECT	76KM GAS PIPELINE FROM ANOM GAS MANIFOLD TO INDORAMA COMPLEX				
DATE & TIME	14 th DECEMBER, 2028				
VENUE	CATOKO CATO COMM. HALL				
TOPIC	76KM GAS PIPELINE PROJECT ESIA - FIELD DATA GATHERING EXERCISE				
S/N	NAME	ORGANIZATION / ORGANIZATION	PHONE NUMBER	Gender	Sign
1	Nwankwo Simeon	Cluster Leader	080394266811	Male	
2	Clifford Nwankwo	Agua Kubi Group	08162977384	Male	
3	David Michael O. Nwagwu	Agua Kubi Group	09067104193	Male	
4	Mr. S. S. Simeon A. Nwagwu	Agua Kubi Group		Male	
5	Eze Samuel O. Nwagwu	Agua Kubi Group	081654145796	Male	
6	Gen. Ihuo Gent. M. Nwagwu	Opinion leader/Chairman	04036117158	Male	
7	Gen. Ihuo Gent. M. Nwagwu	Chairman/Secretary	08142935978	Male	
8	Gen. Ihuo Gent. M. Nwagwu	C.D.C Member	08070029025	✓	
9	Gen. Ihuo Gent. M. Nwagwu	Chairman	08160257995	Male	
10	Gen. Ihuo Gent. M. Nwagwu	Secretary	07028830625	Male	
11	Mrs. Ihuo Gent. M. Nwagwu	Member	08041923791	Female	

12 Mrs. Ihuo Gent. M. Nwagwu 07062947254 for CATKOCATS

UMUAKURU - ETATE
INDORAMA
INDORAMA ELEME FERTILIZER & CHEMICALS LIMITED, ELEME, RIVERS STATE, NIGERIA
ATTENDANCE SHEET

PROJECT	76KM GAS PIPELINE FROM ANOH GAS MANIFOLD TO INDORAMA COMPLEX				
DATE & TIME	14TH DECEMBER, 2023				
VENUE	UMUAKURU COMM. HALL				
TOPIC	76KM GAS PIPELINE PROJECT ESIA - FIELD DATA GATHERING EXERCISE				
S/N	NAME	Community/ ^{Postcode} ORGANIZATION	PHONE NUMBER	Gender	Sign
1	Nwobodo J. Nwofor	Cluster leader UMUAKURU UMUAKURU	0803740571	Male	
2	Izue Nwofor I. Nwofor	UMUAKURU UMUAKURU	08039450252	✓	
3	OJue Chinaka	UMUAKURU UMUAKURU	081711091840	✓	
4	Izue Nwofor I. Nwofor	UMUAKURU UMUAKURU	08162600161	✓	
5	Chike Nwofor	UMUAKURU UMUAKURU	09020718799	✓	
6	Izue Nwofor	UMUAKURU UMUAKURU	08165110947	✓	
7	Izue Nwofor	UMUAKURU UMUAKURU	08138370545	✓	
8	Izue Nwofor	UMUAKURU UMUAKURU	08165237345	✓	
	Nwofor Nwofor	UMUAKURU UMUAKURU	07010641894	✓	
	Nwofor Nwofor	UMUAKURU UMUAKURU	08142871139	✓	

PHOTO GALLERY



Cluster 3 (Ipo, Omademe, Ozuoha, Omanwa, Ubima, Omereolu)

Date of Engagement: 20th December 2023
Venue Village Town Hall/Palace
Facilitator Consulting Team

Stakeholder's Groups Present

- The Paramount Ruler of Community
- Community Chairman
- Fishermen and Hunters Association
- Consulting Team (Safespace)
- Security Guards
- Youth President and Executives
- Women Leader and Executives
- Community Members

Attendance of participants by Gender

Total - **135**

Aim and Objective of the Engagement

The objective of this engagement was to establish a productive dialogue with Cluster 3 communities to be affected by the proposed Indorama 76km pipeline. The engagement sought to address community concerns, share project information, and build relationships to foster understanding and cooperation.

Key Activities:

1. Community Meetings:

- The seven communities under this Cluster 3 were visited individual and reported under cluster 3.
- Meetings were held in village town halls/palace, ensuring maximum accessibility.
- Presentations were made to disseminate project details, including its purpose, expected benefits, and potential impacts on communities.
- Opportunities for questions, comments, and concerns were provided, facilitating an open and transparent dialogue.

2. Stakeholder Consultation:

- Stakeholder consultations were conducted with local community leaders, opinion leaders, and representatives.
- These consultations aimed to gather insights into the project's potential social, economic, and environmental impacts, as well as suggestions for mitigation measures.
- Stakeholder feedback was documented and will be considered in future project planning and implementation.

3. Village Visits:

- The team visited various villages within Cluster 3 to gather firsthand information such as infrastructural development, sacred site and questionnaire administration within the communities
- This allowed for a more personal and detailed understanding of community concerns, needs, and aspirations.
- The team sought to build trust and rapport through these interactions.

Key Findings:

1. Community Concerns:

- Key concerns revolved around Youth employment/empowerment, land acquisition potential disruptions to farming activities, pollution, land ownership, and compensation for land use.
- There were also concerns about vandalism and possible fire outbreak
- Certain households expressed concerns about the potential impact on their livelihoods and income streams.

2. Information Gaps:

- Some community members expressed a lack of clear understanding of the project's objectives, timeline, and potential benefits.
- Limited awareness of sustainable construction practices and environmental mitigation measures was also observed.

3. Community Support:

- Despite concerns, there was a general willingness among community members to collaborate, provided their concerns were adequately addressed.
- Many expressed interest in potential job opportunities and sought guidance on ways to maximize the project's benefits to their communities.

Response

Based on the findings of this engagement, the following steps are proposed:

1. Addressing Concerns:

- Engage with relevant stakeholders to develop a comprehensive plan to address community concerns related to youth employment/empowerment farming disruptions, land ownership, compensation, and monitor potential impacts on water sources.
- Develop an information package in local languages to better communicate project objectives, benefits, and timeline.

2. Mitigation Measures:

- Collaborate with environmental experts to devise comprehensive mitigation measures to minimize the project's environmental impact, and also employ the use of technology for surveillance
- Engage local communities in environmental awareness and education programs, promoting sustainable practices.

3. Ongoing Engagement:

- Work with community liaison office to maintain regular communication and feedback channels with Cluster 3 communities throughout the project's lifecycle.
- Organize regular community meetings, informative sessions, and project updates to foster transparency and community involvement.

Conclusion:

The engagement with Cluster 3 communities was successful and productive in establishing a dialogue and addressing initial concerns. It is important to implement the proposed next steps to ensure effective mitigation of community concerns and maximization of project benefits. Continuous engagement and transparency will be key to maintaining positive relationships with affected communities.

PHOTO GALLERY



INDORAMA ELEME FERTILIZER & CHEMICALS LIMITED, ELEME, RIVERS STATE, NIGERIA

ATTENDANCE SHEET

PROJECT 76KM GAS PIPELINE FROM ANOH GAS MANIFOLD TO INDORAMA COMPLEX

DATE & TIME

20th December, 2023 8.30am

VENUE

Ipo Community Hall

TOPIC

76KM GAS PIPELINE PROJECT ESIA - FIELD DATA GATHERING EXERCISE

S/N	NAME	COMMUNITY / ORGANIZATION	PHONE NUMBER	Gender	Sign
1	Eze Othma Gibson Odiagbo	PARAMOUNT KULU	09071723745M	M	
2	ELDER, TIMOTHY WOSTI	HEAD, OMARUKE	090337692	M	
3	CHIEF, STEPHEN OKPARANTA	HEAD, OMUAGWU	08038830375	M	
4	ELDER, EPHRAIM NNADI	HEAD, OMUWUBA		M	
5	CHIEF EDWIN OKAENAKWU	COMMUNITY CHIEF	09122876065	M	
6	ELDER, ALPHONSAUS AMADI	HEAD, MGBUMINI		M	
7	CHIEF JOHN AMAS OKA	CHIEF, OMAGWU	09134768950	M	
8	CHIEF DOMITIUS ODIAGBO	CHIEF OMARUKE	08037400164	M	
9	KECHI ISAAC. O.	COMMUNITY LEADER	07067481380	M	
10	CHARLES MOSES	COMMUNITY MEMBER	08038491392	M	
11	ABIGAIL MOBAY		07037666262	M	

IPo Community 503'13 **INDORAMA**
INDORAMA ELEME FERTILIZER & CHEMICALS LIMITED, ELEME, RIVERS STATE, NIGERIA

ATTENDANCE SHEET

B 2 02

PROJECT	76KM GAS PIPELINE FROM ANOH GAS MANIFOLD TO INDORAMA COMPLEX
DATE & TIME	20th December 2023
VENUE	IPo Community Hall
TOPIC	76KM GAS PIPELINE PROJECT ESIA - FIELD DATA GATHERING EXERCISE

S/N	NAME	COMMUNITY / ORGANIZATION	PHONE NUMBER	Gender	Sign
01	Modu Peccore		09064248900	M	
02	Blali Samuel		08130280719	✓	
03	Joy Sunday		08155581002	F	S.S
04	Emmanuel Thantagel		07068712391	M	
05	Ramson Amadi		0703766262	M	
06	Odigwe Monday		0703766262	M	
07	Charles Moses		09038491392	M	CP
08	Colins Okhura		09015002805	M	
09	Eltue Chidi		09095170049	M	
10	Emmanuel Amadi		09047071921	M	
11	Samson Amadi		078198870	M	PS

ATTENDANCE SHEET

INDO RAMA

76KM GAS PIPELINE FROM ANOH GAS MANIFOLD TO INDORAMA COMPLEX

25th December, 2023. 12.45pm

Feb 25 Palace - Omloma

76KM GAS PIPELINE PROJECT ESIA – FIELD DATA GATHERING EXERCISE

[illegible]

OXAFEME

INDORAMA

INDORAMA ELEME FERTILIZER & CHEMICALS LIMITED, ELEME, RIVERS STATE, NIGERIA

ATTENDANCE SHEET

PROJECT	76KM GAS PIPELINE FROM ANOH GAS MANIFOLD TO INDORAMA COMPLEX				
DATE & TIME	28th December, 2023 10:13 am				
VENUE	Ego's Palae Onademu.				
TOPIC	76KM GAS PIPELINE PROJECT ESIA - FIELD DATA GATHERING EXERCISE				
S/N	NAME	Person Community / ORGANIZATION	PHONE NUMBER	Gender	Sign
01	Hon CMT IK MORDE		08053061197	M	OKL
02	Mr Ebenezer Nwobu	Family Head.	0813444654	✓	Headed in
03	Mr Christian Mgo	Family Head	08103623975	M	Headed in
04	Mr Chiechi Nwagbo	Family Chairman	08031515446	"	Headed in
05	Onunakwe J. Wali	Family Head	07035959283	M	Headed in
06	Temple Nwagbo	Onunakwe	07030934328	M	Headed in
07	Mr Simen Nwobu	Family Head		M	Headed in
08	Sylvanus Anodi	Onunakwe		M	Headed in
09	Mr Anodi	Onunakwe		M	Headed in
10	Chief JNO Nwagbo	Paramount Ruler	091168555138	M	Headed in
11	Chief Patricia Anodi - Mordi	Ego Nwagbo-Kg	09165662263	M	Headed in

DATE

INDORAMA

INDORAMA ELEME FERTILIZER & CHEMICALS LIMITED, ELEME, RIVERS STATE, NIGERIA

ATTENDANCE SHEET

PROJECT	76KM GAS PIPELINE FROM ANOH GAS MANIFOLD TO INDORAMA COMPLEX
DATE & TIME	28th December, 2023 10:13 am
VENUE	Ego's Palace Oradelem.
TOPIC	76KM GAS PIPELINE PROJECT ESIA - FIELD DATA GATHERING EXERCISE

S/N	NAME	Community / Organization	PHONE NUMBER	Gender	Sign
01	HON CHF IK WARDU		08053061197	M	AKLYN
02	Ador Ebenezer Herbas	Family Head.	08134494684	F	Herbas
03	Mr. Christian Mgo	Family Head	08103628975	M	Christian
04	Mr. Chinedu Ntiegbo	Family Head	08031515446	M	Chinedu
05	Onumakwe J. Wali	Family Head	07035959283	M	Onumakwe
06	Temple Ntiegbo	Family Head	07030934328	M	Temple
07	Oba Simon Nwosulu	Family Head		M	Oba
08	Sylvanus Anadi	Family Head		M	Sylvanus
09	Ador Anadi	Family Head		M	Ador
10	Chief JNO Nwogu	Paramount Ruler	091168555138	M	JNO
11	Chief Patricia Anadi - Wardu	33rd Nwadi-Kg	09165662963	M	Patricia

Omura

INDORAMA
INDORAMA ELEME FERTILIZER & CHEMICALS LIMITED, ELEME, RIVERS STATE, NIGERIA

ATTENDANCE SHEET

2 of 24

PROJECT	76KM GAS PIPELINE FROM ANOH GAS MANIFOLD TO INDORAMA COMPLEX
DATE & TIME	25th December 2023 12:45pm
VENUE	Fg's Palace, Omura
TOPIC	76KM GAS PIPELINE PROJECT ESIA - FIELD DATA GATHERING EXERCISE

S/N	NAME	COMMUNITY / ORGANIZATION	PHONE NUMBER	Gender	Sign
12	Etise Christopher	Omura	0906604006	M	
13	Emmanuel Eke	"	09062899109	"	
14	Felix Eke	"	08403654737	"	
15	Amadi Emmanuel Henry	Omura	09683805444	M	
16	Dimitry Kugley	Omura	09079255946	M	
17	Samuel Eke	"	07036543985	M	
18	Chimezie Eke	"	08161154443	M	
19	Imoseat Eke	"	08140023549	M	
20	Chimezie Anthoni	Omura	0912453251	M	
21	Thane God Mokedina	Omura	08066629017	M	
22	Amaki Godwin Chiem	Omura	08037751642	M	

Emmanuel

INDORAMA

INDORAMA ELEME FERTILIZER & CHEMICALS LIMITED, ELEME, RIVERS STATE, NIGERIA

ATTENDANCE SHEET

3 of 4

PROJECT	76KM GAS PIPELINE FROM ANOH GAS MANIFOLD TO INDORAMA COMPLEX
DATE & TIME	25th December, 2023 12:45pm
VENUE	Fgo's Palace - Omurua
TOPIC	76KM GAS PIPELINE PROJECT ESIA - FIELD DATA GATHERING EXERCISE

S/N	NAME	COMMUNITY / ORGANIZATION	PHONE NUMBER	Gender	Sign
23	WHL. Edegaro	Omurua	08102889248	m	WHL
24	ASANI THAKKAD	Omurua	07049217084	m	THAKKAD
25	BALAKAS WILLY	Omurua	09069734314	m	WILLY
26	ODINAKACHU WAD	Omurua	0707444350	m	ODINAKACHU
27	CHINEDU WAD	Omurua	08102582637	m	CHINEDU
28	Dchebe wadi	Omurua	09025916576	m	Dchebe
29	ANADI progress	Omurua	081023	m	ANADI
30	OBINICH ANADI	Omurua	070695019	m	OBINICH
31	Chunakor Agorin	Omurua	08126528540	m	Chunakor
32	CHIBUZA WADI	Omurua	08102946479	m	CHIBUZA
33	Arundah Emmanuel	Omurua	08130905689	m	Arundah

INDORAMA

ATTENDANCE SHEET

PROJECT 76KM GAS PIPELINE FROM ANOH GAS MANIFOLD TO INDORAMA COMPLEX

22nd December, 2023 12:45pm

Fig's Palace - Emma

76KM GAS PIPELINE PROJECT ESIA – FIELD DATA GATHERING EXERCISE

S/N	NAME	COMMUNITY / ORGANIZATION	PHONE NUMBER	gender	Signature

INDORAMA
INDORAMA ELEME FERTILIZER & CHEMICALS LIMITED, ELEME, RIVERS STATE, NIGERIA

ATTENDANCE SHEET

PROJECT	76KM GAS PIPELINE FROM ANOH GAS MANIFOLD TO INDORAMA COMPLEX
DATE & TIME	20th December 2023 1:20 pm
VENUE	Ukoma Community
TOPIC	76KM GAS PIPELINE PROJECT ESIA - FIELD DATA GATHERING EXERCISE

S/N	NAME	COMMUNITY / ORGANIZATION	PHONE NUMBER	Gender	Sign
1.	FRINCE NINAMDI KIDSY	CED UKOMA	08077776662	M	
2.	BRACHI ISAH AKAMIA	SECEETARY	08134602777	M	
3.	MATAMELL Semud Eze	Youth	08032932676	M	
4.	OTURUM CHINYEM CHARLES	Plant Leader	08033925909	M	
5.	AGBARAKUN GEORGE	CDC Ukoma	08062874630	M	
6.	NINAMDI PHILIP		09131706677	M	
7.	CHINEKE DINKPA		090334733		
8.	Chunaka Igwe	08066449672	0703676261	M	
9.	MOSUW UGBILO	Security	07632335081		
10.	Ameobi Nyelue	Security	08160187126		
11.	Nwa Agbarakun		09166801984		

12/11/2023

INDORAMA

INDORAMA ELEME FERTILIZER & CHEMICALS LIMITED, ELEME, RIVERS STATE, NIGERIA

ATTENDANCE SHEET

P 292

PROJECT	76KM GAS PIPELINE FROM ANOH GAS MANIFOLD TO INDORAMA COMPLEX
DATE & TIME	28th December, 2023 1:40 pm
VENUE	Ikem Community
TOPIC	76KM GAS PIPELINE PROJECT ESIA - FIELD DATA GATHERING EXERCISE

S/N	NAME	COMMUNITY / ORGANIZATION	PHONE NUMBER	Gender	Sign
12	James Odeh	Security	0813166 0591	M	[Signature]
13	Chinonso Kefuwa		08109443785	M	[Signature]
14	Isaac Dahun		08108168439	M	[Signature]
15	Desha Sabius		0903321159	F	[Signature]
16	Ameeze Ineok			F	[Signature]
17	Kamymma Kedi	Youth		F	[Signature]
18	Mary Wogburu	Komen Assembly	08140277188	F	[Signature]
19	Christina Kisi	Komen Assembly	08161768832	F	[Signature]
20	John Maxwell	Youth	09067686148	F	[Signature]
21	Scholar Olu Dara	Youth	08167987492	M	[Signature]
22	Chigere Dinkis	Youth		M	[Signature]
23	Kibodo Ukeana	Security	09060544145	M	[Signature]

OMERELA COMMUNITY

INDORAMA

INDORAMA ELEME FERTILIZER & CHEMICALS LIMITED, ELEME, RIVERS STATE, NIGERIA

ATTENDANCE SHEET

Pg 1/2

PROJECT	76KM GAS PIPELINE FROM ANOH GAS MANIFOLD TO INDORAMA COMPLEX
DATE & TIME	20th December, 2023 2:12pm
VENUE	Omerela Town Hall
TOPIC	76KM GAS PIPELINE PROJECT ESIA - FIELD DATA GATHERING EXERCISE

S/N	NAME	COMMUNITY / ORGANIZATION	PHONE NUMBER	Gender	Sign
1.	HIGH CHIEF C.D. CHUKWU JP	OMERELA	08053262915	M	
2.	Chief, Imocest Opara	Omerela Community	07086581151	M	
3.	Chief Albert Wondol	Omerela Community	081074832411	M	
4.	Chief A.U. Ejirogha	Omerela Comm.	08022451731	M.	
5.	Samuel Chima	Omerela Community	08125531566	M	
6.	A. Gyuma Akoyi	Omerela Community	09042001478	M	
7.	Chief Sunday Anaka	Omerela	090128214722	M	
8.	Chief Gabriel Anedi	Omerela	08083400973	M	
9.	Christian Sunday Rite	Omerela	09066275336	M	
10.	Immanuel Okegha	Omerela	091653140348	M	
11.	Chief Ikemba Lawrence	Omerela	08085821905	M	
12.	Chief Godwin Akala	Omerela	09031070329	M	
13.	Chief James Enyindeli	Omerela	08147391838	M	

OMERELU COMMUNITY . INDORAMA

INDORAMA ELEME FERTILIZER & CHEMICALS LIMITED, ELEME, RIVERS STATE, NIGERIA

ATTENDANCE SHEET

12/12

PROJECT	76KM GAS PIPELINE FROM ANOH GAS MANIFOLD TO INDORAMA COMPLEX
DATE & TIME	20th December 2023 2:12pm
VENUE	Omerele Town Hall
TOPIC	76KM GAS PIPELINE PROJECT ESIA - FIELD DATA GATHERING EXERCISE

S/N	NAME	COMMUNITY / ORGANIZATION	PHONE NUMBER	Gender	Sign
14	Kenneth Idoruma	Omerele Omerele	07012333197	M	[Signature]
15	Peter Opara . S.	Omerele - Omerele	-	Male	[Signature]
16	Sunday Amaobi	Omerele - Omerele	07030976648	M	[Signature]
17	Samuel Opara Obo	Omerele - Omerele	07081480437	M	[Signature]
18	Chief Samuel Igwe . N.	Omerele - Oga	08023682337	M	[Signature]
19	Solomon Igwe E	Omerele - Oga	08131290105	M	[Signature]
20	OMAH Augustinus	Ogala	08030663170	M	[Signature]
21	Jeffrey Uosa	Magnisium	08032548105	M	[Signature]
22	James Idoruma	Omerele	0810760313	M	[Signature]
23	Sunday Waghara	Uo Oga	08077611218	M	[Signature]
24	Sunday Iyie	Omerele	07012224807	M	[Signature]

25 Okechukwu D. Idoruma Omerele 0813558680914 M [Signature]

Cluster 4 (Omuapu, Awara1, Awara 2, Ochia and Asa)

Date of Engagement: 19th December 2023
Venue Village Town Hall/Palace
Facilitator Consulting Team

Stakeholder's Groups Present

- The Paramount Ruler of Community
- Community Chairman
- Fishermen and Hunters Association
- Consulting Team (Safespace)
- Security Guards
- Youth President and Executives
- Women Leader and Executives
- Community Members

Attendance of participants by Gender

Total - **91**

Aim and Objective of the Engagement

The objective of this engagement was to establish a productive dialogue with Cluster 4 communities to be affected by the proposed Indorama 76km pipeline. The engagement sought to address community concerns, share project information, and build relationships to foster understanding and cooperation.

Key Activities:

1. Community Meetings:

- The seven communities under this Cluster 4 were visited individual and reported under cluster 4.
- Meetings were held in village town halls/palace, ensuring maximum accessibility.
- Presentations were made to disseminate project details, including its purpose, expected benefits, and potential impacts on communities.
- Opportunities for questions, comments, and concerns were provided, facilitating an open and transparent dialogue.

2. Stakeholder Consultation:

- Stakeholder consultations were conducted with local community leaders, opinion leaders, and representatives.

- These consultations aimed to gather insights into the project's potential social, economic, and environmental impacts, as well as suggestions for mitigation measures.
- Stakeholder feedback was documented and will be considered in future project planning and implementation.

3. Village Visits:

- The team visited various villages within Cluster 4 to gather firsthand information such as infrastructural development, sacred sites and questionnaire administration within the communities.
- This allowed for a more personal and detailed understanding of community concerns, needs, and aspirations.
- The team sought to build trust and rapport through these interactions.

Key Findings:

1. Community Concerns:

- Key concerns revolved around Youth employment/empowerment, land acquisition potential disruptions to farming activities, pollution, land ownership, and compensation for land use.
- There were also concerns about vandalism and possible fire outbreak.
- Certain households expressed concerns about the potential impact on their livelihoods and income streams.

2. Information Gaps:

- Some community members expressed a lack of clear understanding of the project's objectives, timeline, and potential benefits.
- Limited awareness of sustainable construction practices and environmental mitigation measures was also observed.

3. Community Support:

- Despite concerns, there was a general willingness among community members to collaborate, provided their concerns were adequately addressed.
- Many expressed interest in potential job opportunities and sought guidance on ways to maximize the project's benefits to their communities.

Response

Based on the findings of this engagement, the following steps are proposed:

1. Addressing Concerns:

- Engage with relevant stakeholders to develop a comprehensive plan to address community concerns related to youth employment/empowerment farming disruptions, land ownership, compensation, and monitor potential impacts on water sources.
- Develop an information package in local languages to better communicate project objectives, benefits, and timeline.

2. Mitigation Measures:

- Collaborate with environmental experts to devise comprehensive mitigation measures to minimize the project's environmental impact, and also employ the use of technology for surveillance
- Engage local communities in environmental awareness and education programs, promoting sustainable practices.

3. Continuous Engagement:

- Work with community liaison office to maintain regular communication and feedback channels with Cluster 4 communities throughout the project's lifecycle.
- Organize regular community meetings, informative sessions, and project updates to foster transparency and community involvement.

Conclusion:

The engagement with Cluster 4 communities was successful and productive in establishing a dialogue and addressing initial concerns. It is important to implement the proposed next steps to ensure effective mitigation of community concerns and maximization of project benefits. Continuous engagement and transparency will be key to maintaining positive relationships with affected communities.

PHOTO GALLERY



INDORAMA ELEME FERTILIZER & CHEMICALS LIMITED, ELEME, RIVERS STATE, NIGERIA

ATTENDANCE SHEET

15/12/2023

PROJECT	76KM GAS PIPELINE FROM ANOH GAS MANIFOLD TO INDORAMA COMPLEX
DATE & TIME	19th December, 2023 9:03
VENUE	
TOPIC	76KM GAS PIPELINE PROJECT ESIA - FIELD DATA GATHERING EXERCISE

S/N	NAME	Position / ORGANIZATION	PHONE NUMBER	Gender	Sign
1	Com. ATHAN UCHE ALI	YOUTH LEADER	08062655828	M	
2	ENG. KENNEDY OGBURN	VICE YOUTH LEADER	08064600454	M	
3	Catherine Ogburn		02011489059	F	
4	Mrs Elechi Laurencia Ogburn	Woman leader	01137658975	F	
5	Blessing Ekezie		070120146205	F	
6	Pst Fidelis Anaghi	Paster	07065629778	M	
7	Uwegbu Macmillian C	Chairman	08066988020	M	
8	Terrence Udenma Ogburn	Secretary (Youth)	07031316834	M	
9	Cynthia Ogburn	Youth President (Former)	08084300733	M	
10	Sylvester Udenma	C.O.C. Chairman	09039378409	M	
11	D/DA MITCHELL	Chair	08108863055	M	

2 of 2

2 of 2

PROJECT	76KM GAS PIPELINE FROM ANOH GAS MANIFOLD TO INDORAMA COMPLEX
DATE & TIME	
VENUE	
TOPIC	76KM GAS PIPELINE PROJECT ESIA – FIELD DATA GATHERING EXERCISE

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INDORAMA ELEME FERTILIZER & CHEMICALS LIMITED, ELEME, RIVERS STATE, NIGERIA

ATTENDANCE SHEET

PROJECT 76KM GAS PIPELINE FROM ANOH GAS MANIFOLD TO INDORAMA COMPLEX

DATE & TIME 19th December, 2023 12:15pm

VENUE

TOPIC 76KM GAS PIPELINE PROJECT ESIA - FIELD DATA GATHERING EXERCISE

S/N	NAME	POST / COMMUNITY / ORGANIZATION	PHONE NUMBER	Gender	Sign
	Hidellis Sunday P.	C.O.C. - ^{Chairman} Youth Patsi	07088147332	M	
	GREEN O. OGBUJI	Secretary	08038494701	M	
	12E CHUKA		08038453988	M	
	Omyusoma Akpetose		08086490763	M	
	Nke Henry Nnandu		07083147381	M	
	Ogboye Isma			M	
	Pastor Jackmore Ogboye		07088256529	M	
	Pastor Paul Ogburnadi		08025339142	M	
	Ngboe Savvins		09123091334	M	
	Sunday Benfidance	Norman Jendon	08026493224	F	
	Bright Chikezie		09059472630	M	

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INDORAMA

INDORAMA ELEME FERTILIZER & CHEMICALS LIMITED, ELEME, RIVERS STATE, NIGERIA

ATTENDANCE SHEET

B. 2 4 2

PROJECT	76KM GAS PIPELINE FROM ANOH GAS MANIFOLD TO INDORAMA COMPLEX
DATE & TIME	19th December, 2023 12:31pm
VENUE	Arena Community Hall.
TOPIC	76KM GAS PIPELINE PROJECT ESIA - FIELD DATA GATHERING EXERCISE

S/N	NAME	Community / ORGANIZATION	PHONE NUMBER	Gender	Sign
	Okeagbala Ufili		08032686706	M	
	Olu Osoo			F	
	Adama Egbelu			F	
	Isreal Umuora		07012088073	M	
	Ugo Egbelu		09014474860	M	
	James Bekee		08026646315	M	
	Achu Okechukwu			M	
	Emudo Chigozie			M	
	Richmond Igbeh			F	
	Joy Okechukwu			F	
	Muntha Sunday			F	

INDORAMA ELEMENTAL FERTILIZER & CHEMICALS LIMITED, ELEMENT, RIVERS STATE, NIGERIA

ATTENDANCE SHEET

Page 1 of 2.

PROJECT	76KM GAS PIPELINE FROM ANOH GAS MANIFOLD TO INDORAMA COMPLEX
DATE & TIME	19th December 2023 12:20pm
VENUE	Avkara R Community Hall.
TOPIC	76KM GAS PIPELINE PROJECT ESIA - FIELD DATA GATHERING EXERCISE

S/N	NAME	ORGANIZATION	PHONE NUMBER	Gender	Sign
1	Ihuaze Kennedy	C D Community	09024158416	M	[Signature]
2	Enyia Sunday	C D Community	09081957787	M	en
3	Chibwike Ekeoma	Household	09124603357	M	Enw?
4	Obekwue Anura	Household	0708646776	M	Enw
5	Oji Leonard	Household	080839741362	M	Enw
6	Igwe Chibwike Dennis	Household	08122145951	M	Enw
7	Abegwu Emmanuel Gue	YOUTH'S SEC.	07061179224	M	[Signature]
8	Isinwa Joy	Woman leader	09079415486	F	[Signature]
9	Abuho Chibwike	Woman	09072245933	F	en
10	Anura Nwabuchi	Woman	08140185619	F	en
11	Goodman's Kennedy	Woman	09097164165	F	en

4th AR 2

INDORAMA ELEME FERTILIZER & CHEMICALS LIMITED, ELEME, RIVERS STATE, NIGERIA

ATTENDANCE SHEET

B. 2 of 2.

PROJECT	76KM GAS PIPELINE FROM ANOH GAS MANIFOLD TO INDORAMA COMPLEX
DATE & TIME	19th December, 2023.
VENUE	Anlona 22 - Tem Hall.
TOPIC	76KM GAS PIPELINE PROJECT ESIA - FIELD DATA GATHERING EXERCISE

S/N	NAME	Post STS COMMUNITY / ORGANIZATION	PHONE NUMBER	Gender	Sign
12	Oji Jey	Member	09079415786	F	
13	Iwe Chace	Member	08124291718	F	
14	Iyilene belawel	Member	08064956449	F	
15	Opas Ching	youth member	09077602976		
16	Amadi Eligah	youth Prov	0904779412	M	
17	Obiareje Vitus	youth member		M	
18	Odi Confidence	09027935057	09027935057	M	
19	Iwee N9021	youth member	09030834101	M	
20	Egbelaji Ndokwisi	Ikwerre youth leader	08038937778	M	
21	Egbelaji Nns	youth member	08184337345	M	
22	Aloysius Monday	youth member	0906117924	M	

OCHA Community
INDORAMA
 INDORAMA ELEME FERTILIZER & CHEMICALS LIMITED, ELEME, RIVERS STATE, NIGERIA

ATTENDANCE SHEET

Pg 1

PROJECT	76KM GAS PIPELINE FROM ANOH GAS MANIFOLD TO INDORAMA COMPLEX
DATE & TIME	19th December 2023. 1:20pm
VENUE	Ocha Community
TOPIC	76KM GAS PIPELINE PROJECT ESIA - FIELD DATA GATHERING EXERCISE

S/N	NAME	Community / ORGANIZATION	PHONE NUMBER	Gender	Sign
1	ELUZZE PRISCILLA				
2	ELUZZE PRISCILLA	MEMBER	09112189242	F	
3	ULUWAH MONDAY	VILLAGE YOUTH LEAD	09011617484	M	
4	AMADI SILAS	VILLAGER YOUTH LEAD	08141116052	M	
5	QUUDHU ANYEKWERE	MEMBER	090445767436	M	
6	EGBU OKOY	MEMBER	07014238063	M	
7	ABABE Ehi	Member	08141116052 08141116052	M	
8	Onina Danjins	Member	08068917341	M	
9	Nunamozie Ogunji	Ogunji	08129250072	M	
10	Wuechi Ogunji	Ogunji	07085200645	F	
11	Emelo Nathaniel		09044581029	F	

ASSA COMMUNITY INDORAMA INDORAMA ELEME FERTILIZER & CHEMICALS LIMITED, ELEME, RIVERS STATE, NIGERIA

ATTENDANCE SHEET

12/10/22

PROJECT	76KM GAS PIPELINE FROM ANOH GAS MANIFOLD TO INDORAMA COMPLEX
DATE & TIME	19th December 2023 3:12pm
VENUE	ASSA Community Hall
TOPIC	76KM GAS PIPELINE PROJECT ESIA - FIELD DATA GATHERING EXERCISE

S/N	NAME	ORGANIZATION	PHONE NUMBER	Gender	Sign
1	Chukwura Timothy C.	OBOSI Youth President	07065091550	Male	Chukwura
2	Eunegie Adesisi C	Youth member	07069123018	Male	Eunegie
3	Ejingu Cosmas C.	Youth member	08021732057	male	Ejingu
4	Okocha Rudeye	Youth member	09169551872	male	Okocha
5	Uhu bright Ezendo	Youth Member	07040749786	Male	Uhu
6	Chukwu Promise	Youth Member	08087582162	Male	Chukwu
7	Uhu destiny Ozoms	Youth Member	07040749786	Male	Uhu
8	Orji BEITH LHEBINACH	Youth member	08065954858	male	Orji
9	Ugonne Godstime Ezakue	Youth member	09076426932	male	Ugonne
10	Ikenna Bright Ezekwe	Youth member	07047247452	male	Ikenna
11	Ulliane Anthony	Youth member	09073950692	male	Ulliane

A SA COMMUNITY
INDORAMA ELEME FERTILIZER & CHEMICALS LIMITED, ELEME, RIVERS STATE, NIGERIA

ATTENDANCE SHEET

Pg 2 of 2

PROJECT	76KM GAS PIPELINE FROM ANOH GAS MANIFOLD TO INDORAMA COMPLEX	
DATE & TIME	19th December, 2023 3:12 pm	
VENUE	A Sa Community Hall.	
TOPIC	76KM GAS PIPELINE PROJECT ESIA - FIELD DATA GATHERING EXERCISE	

S/N	NAME	POSITION / ORGANIZATION	PHONE NUMBER	Gender	Sign
12	Omenudo Kingsley	youths member	08167981752	male	[Signature]
13	Odinaka Uwakaka	OG -	09114056445	-	[Signature]
14	Uhu Smart Akachi	Youth member	08042055884	male	[Signature]
15	CHUKA JERRY	Youth member	07064490931	male	[Signature]
16	Oyubu Templa	-		=	[Signature]
17	Odoeze C. Mesmer	-	0806446289	=	[Signature]
18	OGARANYA WISDOM	-	09021668057	=	[Signature]
19	Asor Emmanuel	-	070644550949	=	[Signature]
20	Chief Felix Udoaka	-	08064462884	[Signature]	[Signature]
21	Chief Edson Udoaka		08024205684	[Signature]	
22	Asor Jonathan		08087602977		[Signature]

ANNEXURE 4.12

Indorama Engagements with Stakeholders in Pipeline Host Communities and CSR Projects

MOU with Pipeline Communities

Harmonious relationship with local environment plays an important role on the overall industrial peace. Since 2014 company has MOU with Pipeline Host Communities. Highlight of budgets are as under:

MOU's with Pipeline Communities – 25% increase in 2023 – 2025 MOU in view of Line 3

MOU Period	Duration (Yrs.)	No of Communities	Budget (Naira)
2014 - 2016	3	30	150,000,000
2017 - 2019	3	30	240,000,000
2020 - 2022	3	30	300,000,000
2023 - 2025	3	30	375,000,000

MOU with 30 Pipeline Communities		
Initiatives	2023-25 Budget (Mn Naira)	Cumulative Impact
Community Development Projects	375	Completed 75 projects
Women Micro Grants		Supported 180 women
Scholarships for students		Bursary support to 420 students
Skill Acquisition and Youth Empowerment		Trained 180 Youths & Women on various skills

Overview of CSR Projects – to be carried out during Line 3

30 Pipeline Communities

Community	Total Spend	Projects
Cluster 1	FOR 2022, ₦ 37.5 Million for three (3), Akpajo community no project for 2022 due to pending litigation	Extension of Electricity in Atali Community, Construction of five (5) Classroom Block in Elemenwo Community School, Construction of 300 Meters Rumuwutche, Apamini Rumuwogo Concrete Road in Rumukwursi.
Cluster 2	₦ 87.5 Million	Construction of Fence around community Health centre in Abara Community, Extension of Electricity in Chokocho Community, Extension of Electricity in Umuogodo Community, Extension of Electricity in Imeh Community, /Renovation of Health Centre in Umuechem community, Construction of ICT Training Centre in Umuakuru community and Construction of Health Centre in Edegelem Community.
Cluster 3	₦ 75 Million	Construction of 5 Nos Overhead Tank Stands for Community Water in Ipo Community, Construction of Modern Market in Omuawa Community, Construction of Shops Inside Market in Omademe Community, Construction of 12 Lock Up Shop in Ozuaha, Construction of Civil Centre Phase II in Omerelu Community and Construction of Police Quarters in Ubima Community
Cluster 4	₦ 12.5 Million	Construction of Community Development Centre/Conference Hall in Akanu community
Cluster 5	₦ 100 Million	Rehabilitation of Technical Workshop Building in Modern Boys Secondary School in Omoku 1 Community, Construction of Health Centre in Omoku 2 Community, Construction of Drainage System in Obrikom Community, Renovation of Community Health Centre in Egbogoro Community, Construction of Administrative Office for Teachers & Classroom in Okpurukpuali Community, Extension of Electricity in Okansu Community, Construction of Administrative Block in Uju community and Construction of Market Complex in Obor Community

CSR Projects (MOU 2020-22)

30 Pipeline Communities

30 Pipeline Communities under MOU 2020-22			
Community	2020-22 MOU Projects	Total Spend (Mn Naira)	Status
Cluster 1	Extension of Electricity in Atali Community, Construction of five (5) Classroom Block in Elelenwo Community School, Installation of street Solar lights	40	All projects completed
Cluster 2	Construction of Fence around community Health centre in Abara Community, Extension of Electricity in Chokocho, Umuogodo and Imeh Communities, Renovation of Health Centre in Umuechem and Edegelem Communities, Construction of ICT Training Centre in Umuakuru community	70	All projects Completed
Cluster 3	Construction of 5 Nos Overhead Tank Stands for Community Water in Ipo Community, Construction of Modern Market in Omuawa Community, Construction of Shops Inside Market in Omademe Community, Construction of 12 Lock Up Shop in Ozuaha, Construction of Civil Centre Phase II in Omerelu Community and Construction of Police Quarters in Ubima Community	70	5 completed, 2 ongoing
Cluster 4	Construction of Community Development Centre/Conference Hall in Akanu community	10	1 completed, 2 pending
Cluster 5	Rehabilitation of Technical Workshop Building in Modern Boys Secondary School in Omoku 1 Community, Construction of Health Centre in Omoku 2 Community, Construction of Drainage System in Obrikom Community, Renovation of Community Health Centre in Egbogoro Community, Construction of Administrative Office for Teachers & Classroom in Okpurukpuali Community, Extension of Electricity in Okansu Community, Construction of Administrative Block in Uju community and Construction of Market Complex in Obor Community	90	8 completed, 1 ongoing

Pipeline Communities – Skill Acquisition & Scholarship

Skill Acquisition Programme

- On October 4th, 2021, a skill acquisition program was conducted.
- A total of **182 young** individuals successfully completed the program, with **64 being women**.
- Starter packs were provided to all trainees, and the vocational training program covered various skills, as outlined in the MOU, such as Scaffolding, Rigging, Electrical Wiring & Installation, Grinding, Tile fixing, Paint Production & Painting, Fish Farming, and more. scheduled to occur once during the MOU period of 2020-2022.

Scholarship

- Total of **56 young men & women** qualified for scholarship in 2022,
- 25 beneficiaries were women

Pipeline Communities – Skill Acquisition & Scholarship



Skill Acquisition and Scholarship Programmes

Pipeline communities; Cluster 1 CSR Projects

CLUSTER 1 is made up of four (4) communities group into one cluster as see below,

S/N	COMMUNITY	PROJECTS	PHASES	STATUS
1	Akpajo Community	Purchase & installation of 500KVA Transformer	I	Completed
		Purchase & installation of 500KVA Transformer	II	Completed
2	Rumuokwurus i Community	Interlocking & construction of pavement round Rumuokwurusi Civic center	I	Completed
		Construction of Road	II	Completed
		Construction of 300 Meters Concrete Road	III	WIP
3	Atali Community	Grading of Road	I	Completed
		Construction of Borehole water	II	Completed
4	Eledenwo Community	Construction of Police station at Mangrove Estate	I	Completed
		Construction of police administrative block	II	Completed
		Construction of five (5) classroom blocks	III	WIP



Pipeline communities; Cluster 2 CSR projects

CLUSTER 2 is made up of Seven (7) communities group into one cluster as see below

S/N	COMMUNITY	PROJECTS	PHASE S	STATUS
1	Abara	Renovation of Community Health Center	I	Completed
		Renovation of Community Health Center	II	Completed
		Construction Fence around Community Health Center	III	Completed
2	Umuecheme	Construction of Borehole water with solar	I	Completed
		Construction of Corpers Lodge	II	Completed
		Rehabilitation /Renovation of Health Centre	III	WIP
3	Chokocho	Electricity Extension	I	Completed
		Electricity Extension and Purchase & installation of two (2) Transformers	II	Completed
4	Umuakaru	Construction of Borehole water	I	Completed
		Electricity Extension	II	Completed
		Construction of ICT Training Centre	III	WIP
5	Edegelem	Electricity Extension	I	Completed
		Electricity Extension	II	Completed
		Construction of Health Centre	III	WIP
6	Imeh	Grading of four (4) different farm roads	I	Completed
		Construction of seven lock-up shops	II	Completed
7	Umuogodo	Construction of Borehole water	I	Completed
		Construction of mini daily market shops	II	WIP



INDORAMA

Pipeline communities; Cluster 3 CSR projects

CLUSTER 3 is made up of six (6) communities group into one cluster as see below

S/N	COMMUNNITY	PROJECT	PHASES	STATUS
1	Ipo Community	Construction of Market shops	I	Completed
		Construction of Teachers Quarters	II	Completed
		Construction of five (5) Nos over Head Water Tank stands	III	WIP
2	Omademe Community	Construction of Chapel Hall in community Secondary School	I	Completed
		Construction of Corpers Lodge	II	Completed
		Construction of Shops inside market	III	WIP
3	Ozuoha Community	Construction of Town Hall	I	Completed
		Construction of Community Development Center	II	Completed
4	Ubima Community	Construction of Corpers Lodge	I	Completed
		Construction of police station	II	Pending
		Construction of police Quarters	III	WIP
5	Omerelu Community	Purchase of land/Fencing	I	Completed
		Construction of Civil center	II	On - going
		Construction of Civil center Phase 2	III	WIP
6	Omanwa Community	Construction of Chapel Hall in community Secondary School	I	Completed
		Construction of five bedroom Corpers Lodge	II	Completed
		Construction of Modern Market	III	WIP



Pipeline communities; Cluster 4 CSR projects

CLUSTER 4 is made up of three (3) communities group into one cluster as see below				
S/N	COMMUNITY	PROJECT	PHASES	STATUS
1	Awarra 1 community	Construction of police station	I	WIP
		Construction of six (6) classroom blocks	II	WIP
2	Awarra 2 community	Construction of police station	I	WIP
		Construction of six (6) classroom blocks	II	WIP
3	Akanu Community	Construction of Development Centre /Conference Hall	1	WIP

Pipeline communities; Cluster 5 CSR Projects

CLUSTER 5 is made up of nine (9) communities group into one cluster as see below				
S/ N	COMMUNITY	PROJECT	PHASES	STATUS
1	Omoku 1 Community	Construction of Borehole water	I	Completed
		Construction of four (4) classroom blocks	II	Completed
		Rehabilitation of technical workshop building in modern boys secondary school	III	WIP
2	Omoku 2 Community	Construction of Borehole water	I	Completed
		Renovation of six (6) classroom blocks	II	Completed
		Construction of Health Centre Building	III	WIP
3	Okprukpuali Community	Construction of six (6) classroom blocks	I	Completed
		Construction of Fence	II	Completed
		Construction of Administrative office for teachers & classroom	III	WIP
4	Obrikom Community	Construction of Borehole water	I	Completed
		Renovation of six (6) classroom blocks	II	Completed
		Construction of Drainages system	III	WIP
5	Obor Community	Electricity Extension	I	Completed
		Construction of lock-up shops	II	Completed
		Construction of Market complex	III	WIP
6	Okansu Community	Electricity Extension	I	Completed
		Renovation of Town Hall	II	Completed
7	Egbogoro Community	Construction of Chapel Hall for community secondary school	I	Completed
		Construction of six (6) classroom blocks	II	Completed
		Renovation of Health Center	III	WIP
8	Egbeda Community	Renovation of Health Center	I	Completed
		Renovation of Town Hall	II	Completed
9	Uju Community	Construction of six (6) classroom blocks	I	Completed
		Construction of Fence	II	Completed
		Construction of Administrative blocks	III	WIP



Pipeline communities; Cluster 5 CSR projects (continuation)



Palliative Measures During Covid-19

Executive Summary on Palliative Measures

Frequency	Rice (50 kg Bag)	Beans (50 kg)	Garri (50 kg)	Noodles (cartons)	Beneficiaries
Phase - I	1,320	880	880	4,400	6 Host Communities; 2 Jetty Communities; 30 Pipeline communities; 6 other communities from Eleme LG
Phase - II	240	160	160	800	6 Host Communities; 2 Jetty Communities
Phase - III	240	160	160	800	6 Host Communities; 2 Jetty Communities
Phase - IV	240	160	160	800	6 Host Communities; 2 Jetty Communities
Phase - V	240	160	160	800	6 Host Communities; 2 Jetty Communities
Phase - VI	240	160	160	800	6 Host Communities; 2 Jetty Communities
Phase - VII	240	160	160	800	6 Host Communities; 2 Jetty Communities
Total (Bags / Cartons)	2,760	1,840	1,840	9,200	
Total quantity distributed (Kgs / Packs)	138,000	92,000	92,000	552,000	** Noodles is in Pack. Other Items are Kgs
No of Household reachedout	17,250				
Avg Family Size	5				
Total No of people benefited	86,250				

Pictures From Palliatives Distribution



- CR&D staff with Ogoloma clan members Onne Community



2022 Flood relief outreach

- In the wake of the 2022 flood that hit some states in Nigeria and caused untold hardship, Indorama through its Community Relations & Development department donated some relief materials to the flood victims in its Cluster V Pipeline communities as well as some neighboring Communities within her sphere of influence and operations as a support to cushion the effects of flood induced challenges.
- A total of nine (9) Cluster V pipeline communities were affected and they include,

- Omoku I,
- Omoku II,
- Uju,
- Obor,
- Okansu,
- Ebogoro,
- Obrikom,
- Egbada,
- Okpurukpuali

And three (3) neighboring communities,

- Ebocha,
- Ahoada and
- Ahoada - West Communities.



2022 FLOOD RELIEF MATERIALS DONATION





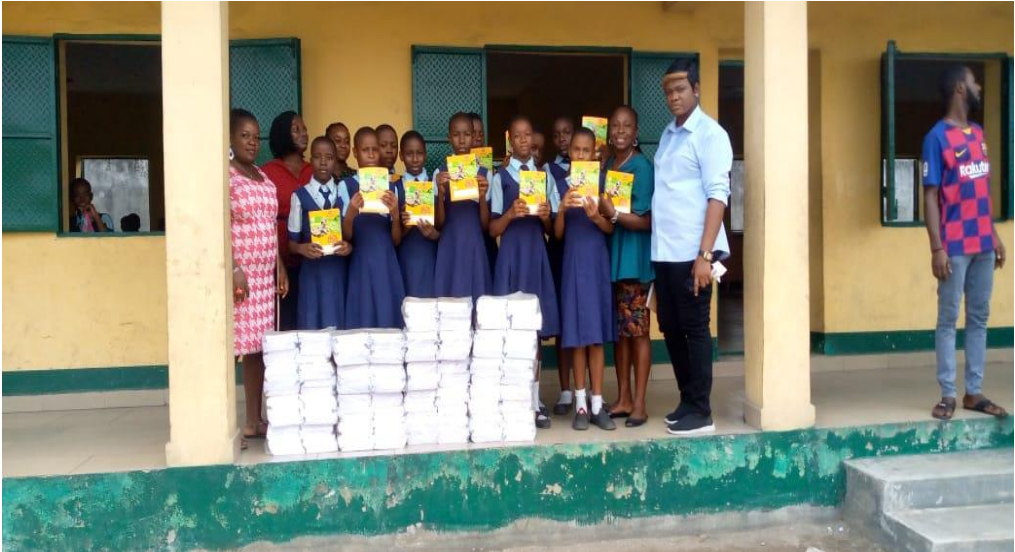
Customized Indorama Exercise Books Distribution

- ❖ The community relations department team embarked on the distribution of sixty thousand (60,000) customized exercise books
- ❖ To all the primary and secondary schools within our host and jetty communities.
- ❖ A total of twenty-two (22) schools benefited from the distribution
- ❖ They were super excited with Indorama for its benevolence towards them
- ❖ They send their appreciations

Pictures From The Exercise Books Distributions



Pictures From The Exercise Books Distributions



Pictures From The Exercise Books Distributions

