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A Report.

Geophysical Investigation Report on komenda sugar factory

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Seftech India pvt Limited engaged Gyam Engineering and Construction Works Limited to provide a hydrogeological studies leading to construction of two boreholes at the site of the Komenda Sugar Factory. Based on the results, the points VES2 and VES3 were selected for the drilling with expected aquifer zones of 10m-80m, average weathering depth of 5m – 15m and maximum drilling depth of 80m.

INTRODUCTION

Seftech India PVT limited engaged Gyam Engineering and Construction Works Limited to provide hydrogeological services leading to the construction of two boreholes at the ongoing construction site of the defunct sugar factory at Komenda which is within the Komenda-Edina- Eguafo-Abrem Municipal of the Central Region of Ghana.

The scope of works included the Geophysical Investigations to delineate potential sites for the drilling of the borehole, drilling and construction, well head construction, pumping test and water quality analysis, and pump installation.

Gyam Engineering and Construction Works Limited carried out the Hydrogeological studies (Siting) to ensure a smooth and successful implementation of the project and also to achieve a high success rate for the drilling works. This was done by a conscientious terrain evaluation after a desk study and by applying the most scientific approach to the site selection activity. The study did not show potential sources of pollution that may affect the groundwater point sources recommended. The ensuing pages elaborate on the studies carried out.

INITIAL STUDIES

The geophysical investigations carried out were preceded by socio-economic and reconnaissance studies designed to help select the best sites for the boreholes. From these studies, two traverse lines were delineated for the geophysical tests, and this report describes the results of the geophysical investigations for the selection of definite sites in the acreage.

Desk Study

Relevant data on the area were collected and collated from

- Topographic maps (scale 1:50,000);
- Geological maps of Ghana and the Central Region; and
- Records of existing boreholes in the area.

Topography and Drainage

The landscape of the Komenda-Edina- Eguafo-Abrem Municipality is generally undulating, dominated by batholiths. Along the coastal zone is a series of lagoons and wetlands which include the Benya, Brenu, Susu, Abrobi and

Ankwanda. The slopes and hills are steep in inland areas. In between the hills are valleys with various streams which drain into the coastal lagoons and the Atlantic Ocean. These streams include the Iture and Ante in the west and the Udu and Suruwi in the east.

Vegetation and Climate

The vegetation varies according to the rainfall pattern. There is the coastal shrub and grassland type with scattered trees trading into the coastal savannah forest with a variety of timber species of economic value. The coast itself is mainly characterised by mangrove and palm fronds. The district is generally humid with the 30 kilometre coastline forming part of the littoral anomalous zone of Ghana and experiencing less rainfall than the interior.

Geology/Hydrogeology

The Komenda-Edina- Eguafo-Abrem Municipality is known to be underlain by mainly the Birimian rock type consisting of schist and granites as well as pegmatite. On the slopes of the hills, the overburden soils are sandy clayey soils while the valleys have gravely sandy colluvium. Geologically, the project site is underlain by granite which is shown on figure 2.1 which represent the geological map of Ghana.

Groundwater storage is expected to occur mainly as a result of weathering and fracturing in the granite. The granites are amongst the moderately high yielding formations in terms of groundwater exploitation. The water quality in some part of the municipality is normally characterised by presence of concentration of salt.

Reconnaissance Fieldwork

Reconnaissance survey was conducted in the area. The reconnaissance survey involved a terrain evaluation from which the hydrogeology of the area was assessed. The main objectives of this fieldwork included:

- Assessing the area's water points; and
- To select best possible areas for geophysical investigations.

After these the terrain was assessed with a view to delineating the best (hydrogeological) places, and traverse lines were marked for a more detailed geophysical study.

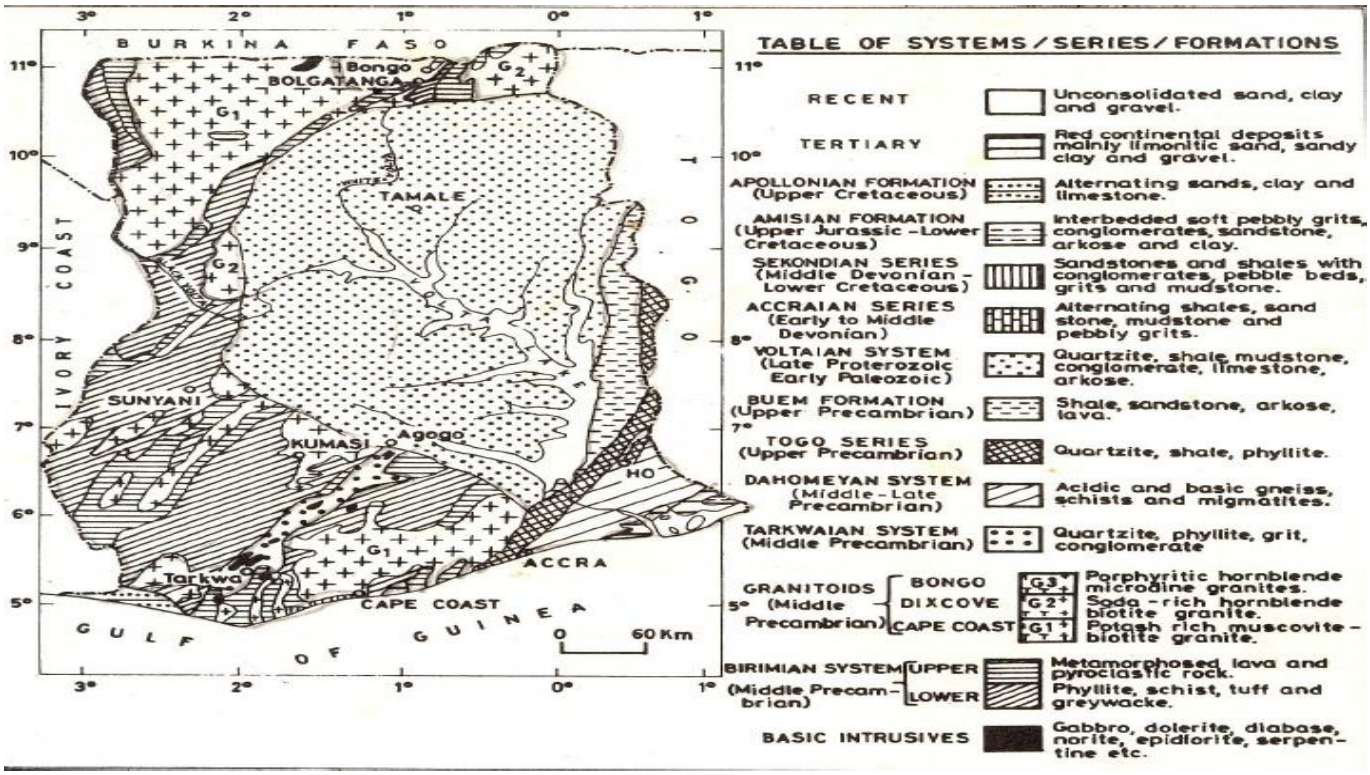


Figure 1: Geological Map of Ghana

GEOPHYSICAL INVESTIGATIONS

Geophysical investigations were carried out using the electrical resistivity methods in the horizontal profiling and vertical sounding. The DDR1 resistivity meter was used for both the horizontal and vertical resistivity methods.

Background

The purpose of the geophysical investigations is to determine the stratification and structure of the geological sequence using some physical properties of the subsurface material and in this case, the electrical resistivity. Most geological formations behave as insulators when dry, however in the presence of water the dissolution of minerals produces an electrolytic effect, which reduces the resistivity of the formation. The presence of metal ores and other minerals may also cause a reduction in the resistivity. Thus, when the geology of the area is also known then the cause of the reduction in resistivity can be properly assessed from the geophysics

Methodology

Two traverse lines were cut along which the horizontal profiling was conducted. The main object of the horizontal profiling is to detect any lateral variations in the geology that may suggest the presence of water or a structure with the potential to store water. These may be seen as anomalies in the general background conductivity values in the lateral profile. These anomalies lateral points are then picked for vertical sounding to estimate the depth to the suspected water bearing formation. Commonly, more than such point would be observed on a traverse line if long enough; the points are then studied and ranked in order of their likelihood to contain water.

Horizontal Profiling

The horizontal profiling along each traverse line was conducted with the DDR1 resistivity meter using the Schlumberger configuration. The probing depths were 30m and 40m from which anomalous points were selected for vertical sounding.

Vertical Electrical Sounding

The vertical electrical sounding (VES) is a technique used to investigate the variation of apparent resistivity with depth beneath a point on the surface of the earth. From this sounding the extent of weathering and or possible fracture zones at depth may be inferred. The DDR1 resistivity meter and the Schlumberger configuration were used for the vertical sounding at the selected points along each traverse line.

Data Analysis and Interpretation

The results of the geophysical measurements were analysed and plotted as apparent resistivity against depth for each sounding point. From the behaviours of the curves and the geology, a suitable site with an alternative are selected and ranked for construction.

ANALYSIS AND DISCUSSIONS OF RESULTS

Horizontal Profiling

The horizontal profiling was run along two (2) traverse lines with a length of 420m as detailed in Table 1. A plot of apparent resistivity against chainage (m) along the traverse line is presented in appendix. The anomalous points were picked based on both direct observation and results of the resistivity readings.

Table 1: Results and interpretation of horizontal profiling.

Line	Length (m)	Anomalies	Remarks
1	210	30 , 150	VES1, VES2
2	210	110, 130	VES4, VES5

Vertical Electrical Sounding

Four (4) points were identified from the horizontal profiling for vertical investigation and these are labelled as VES1,

VES2, VES3 and VES4. Table 2 shows deductions made from the VES results and the sounding curves are also shown in the appendix.

Table 2: VES results and their interpretation.

Site No.	App. Resistivity range (Ohm-m)	Expected aquifer Zones(m)	Average weathering depth(m)	Remarks
VES1	19-176	10-80	10	Water may occur in the weathered Zone
VES2	12-78	10-80	10	
VES3	9-168	10-80	10	
VES4	13-189	10-80	10	

Recommendations

Two boreholes were proposed for construction. The investigated sites have been ranked as shown in Table 3. The recommended maximum drilling depths for the various sites may not be exceeded.

Table 3: Recommended drilling depths and order of drilling

Site No.	Max. drilling depth(m)	Order of drilling
VES1	80	4th
VES2	80	1st
VES3	80	2nd
VES4	80	3rd

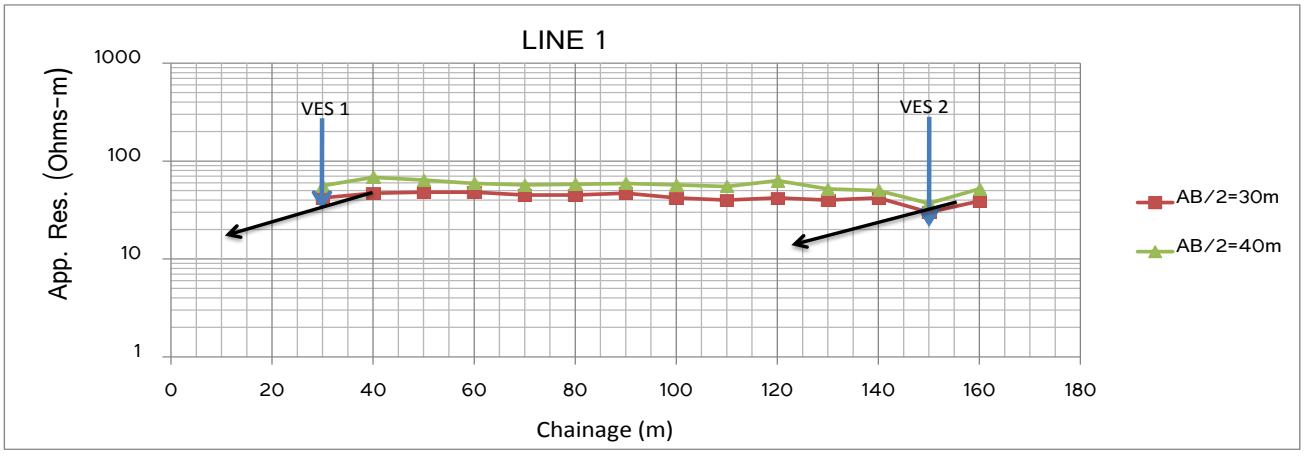
APPENDIX

SCHLUMBERGER HORIZONTAL PROFILING RESULTS

LOCATION : KOMENDA SUGAR FACTORY DATE : 12-04-2015

LINE : 1

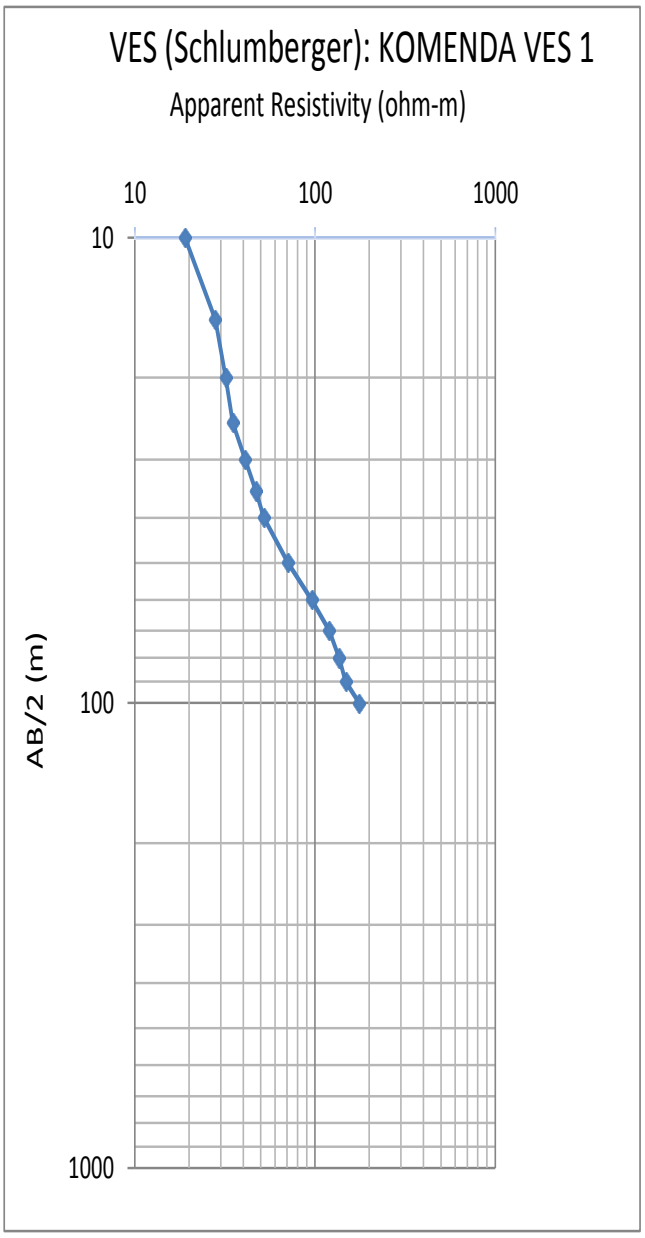
	30	40	50	60	70	80	90	100	110	120	130	140	150	160
30	42	47	48	48	45	45	47	42	40	42	40	42	30	39
40	56	68	64	59	57	58	59	57	55	63	52	50	37	52



SCHLUMBERGER RESISTIVITY SOUNDING RESULTS

Survey No.:VES 1 DATE : 12-04-2015

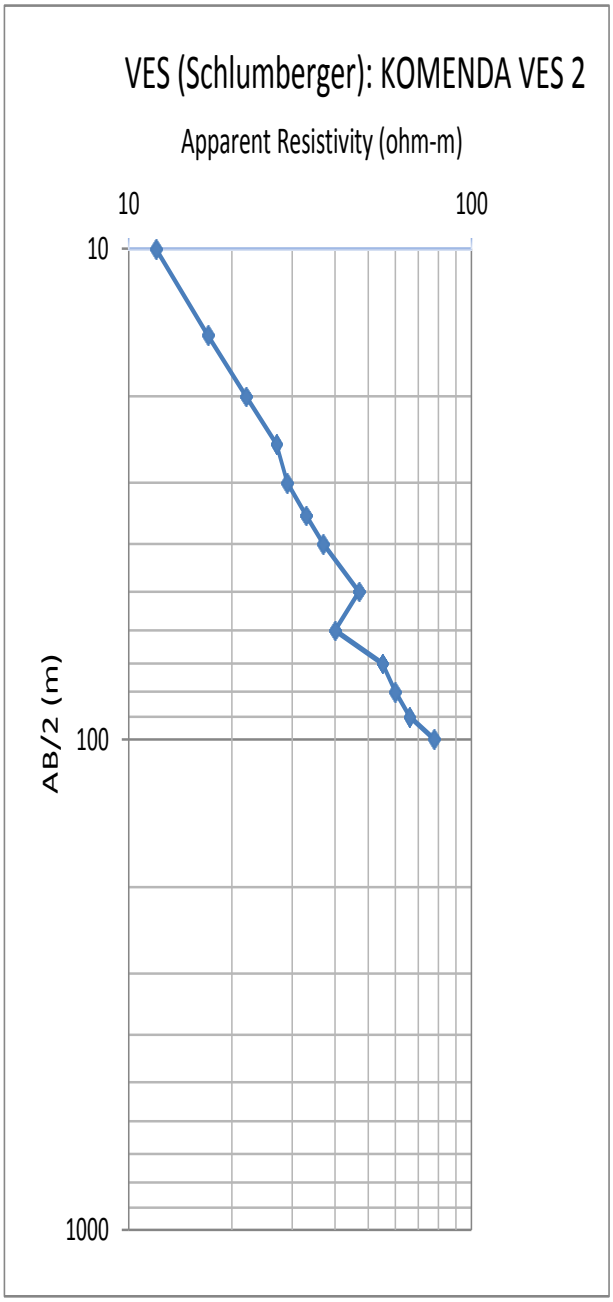
AB/2 (m)	MN/2 (m)	R(ohm)	Mult factor	App Res (ohms-m)
10	0.5	0.06061	313.50	19
15	0.5	0.03964	706.36	28
20	0.5	0.02547	1256.36	32
25	5	0.18561	188.57	35
30	5	0.14909	275.00	41
35	5	0.12462	377.14	47
40	5	0.10505	495.00	52
50	5	0.09128	777.86	71
60	5	0.08544	1123.57	96
70	5	0.07832	1532.14	120
80	5	0.06788	2003.57	136
90	10	0.11773	1257.14	148
100	10	0.11313	1555.71	176



SCHLUMBERGER RESISTIVITY SOUNDING RESULTS

Survey No.:VES 2 DATE : 12-04-2015

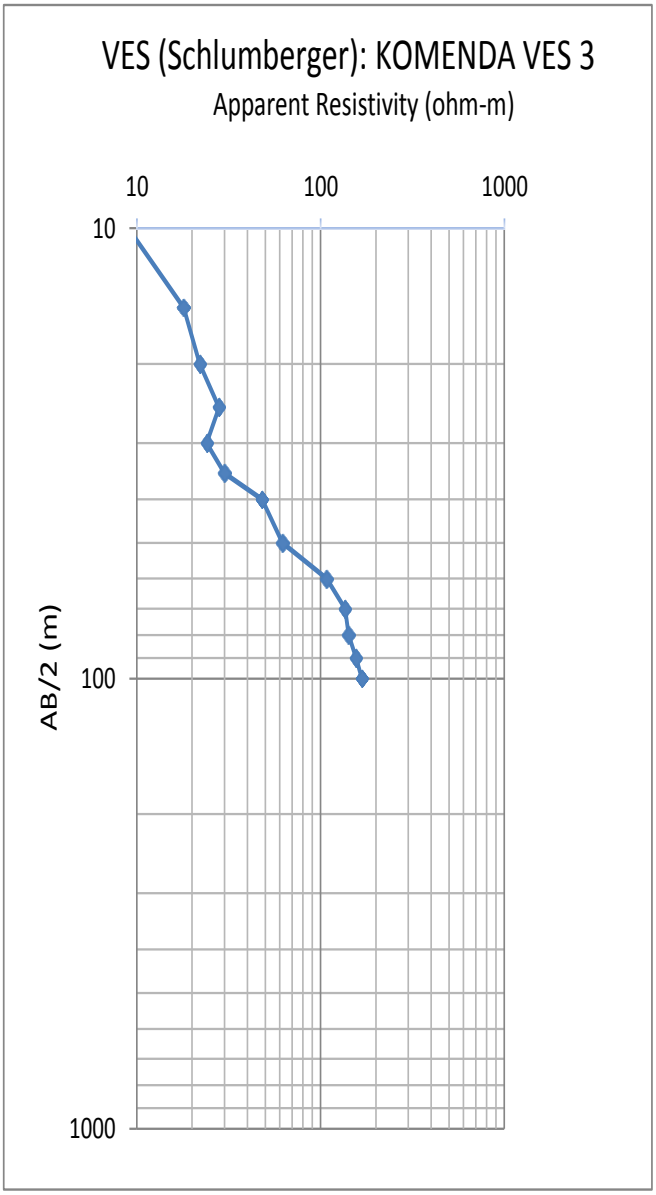
AB/2 (m)	MN/2 (m)	R(ohm)	Mult factor	App Res
				(ohms-m)
10	0.5	0.03828	313.50	12
15	0.5	0.02407	706.36	17
20	0.5	0.01751	1256.36	22
25	5	0.14318	188.57	27
30	5	0.10545	275.00	29
35	5	0.08750	377.14	33
40	5	0.07475	495.00	37
50	5	0.06042	777.86	47
60	5	0.03560	1123.57	40
70	5	0.03590	1532.14	55
80	5	0.02995	2003.57	60
90	10	0.05250	1257.14	66
100	10	0.05014	1555.71	78



SCHLUMBERGER RESISTIVITY SOUNDING RESULTS

Survey No.:VES 3 DATE : 12-04-2015

AB/2 (m)	MN/2 (m)	R(ohm)	Mult factor	App Res
				(ohms-m)
10	0.5	0.02871	313.50	9
15	0.5	0.02548	706.36	18
20	0.5	0.01751	1256.36	22
25	5	0.14848	188.57	28
30	5	0.08727	275.00	24
35	5	0.07955	377.14	30
40	5	0.09697	495.00	48
50	5	0.07971	777.86	62
60	5	0.09612	1123.57	108
70	5	0.08876	1532.14	136
80	5	0.07087	2003.57	142
90	10	0.12409	1257.14	156
100	10	0.10799	1555.71	168



SCHLUMBERGER RESISTIVITY SOUNDING RESULTS

Survey No.:VES4 DATE : 12-04-2015

AB/2 (m)	MN/2 (m)	R(ohm)	Mult factor	App Res
				(ohms-m)
10	0.5	0.04147	313.50	13
15	0.5	0.03539	706.36	25
20	0.5	0.01990	1256.36	25
25	5	0.12727	188.57	24
30	5	0.11273	275.00	31
35	5	0.11136	377.14	42
40	5	0.08283	495.00	41
50	5	0.07456	777.86	58
60	5	0.10947	1123.57	123
70	5	0.08485	1532.14	130
80	5	0.07586	2003.57	152
90	10	0.13682	1257.14	172