EDAL DRILLING COMPANY LTD.

BOREHOLE SITTING REPORT

SUBMITTED TO:

SIERRA LEONE BOTTLING COMPANY LIMITED
DWORZAK
FREETOWN

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1. INTRODUCTION

Sierra Leone Bottling Company uses water as one of the main component of their production activities. As a result, they want to explore the possibility of harnessing groundwater to increase water supply that will meet their current demand.

EDAL Drilling Company Limited was therefore contracted to drill a number of boreholes which should be preceded by hydrogeological and geophysical investigations to locate suitable borehole positions and the feasibility of accessing groundwater.

These studies, among others, provided enough data and information used in assessing the possibility of striking groundwater in the project area.
This report documents the work carried out during the investigations.

2. BACKGROUND / GEOLOGY OF PROJECT AREA

The project area lies within the Freetown Basic Complex.

The Freetown Complex outcrop in the west as a result of younger igneous intrusions and it is predominantly of basaltic magmatism. The Freetown Complex is a layered gabbroic anorthosite intrusion, emplaced gneisses and schist of the Kasila group. It forms part of the Peninsula and Banana Island.
It is thought to have been formed due to multiple injections of magma that occurred intermittently.

Therefore, groundwater potential of the Freetown Basic Complex is found within fractured zones of these igneous (crystalline) rocks.
However, groundwater quality and quantity could be high if properly located through the appropriate hydrogeological and geophysical investigations.

3. FIELD WORK

3.1 Reconnaissance Survey

The aim of the reconnaissance survey was to select suitable area (s) for geophysical survey. The field reconnaissance survey was undertaken together with the Company's technical manager on the 6th January, 2015; and included the following:

- Geomorphological survey of the area
- Geological / hydrogeological survey to determine the formation of the area and to identify possible features.
- Demarcation of area for traverse line for geophysical survey.
- Assessment of existing boreholes

3.1.1 Selection of Traverse Line

Traverse line was selected on the basis of geomorphologic and hydrogeological features as well as the location of the project area. There were no visible strike directions of the geological formation of the area due to weathering and engineering activities at the site.

Points for the Vertical Electrical Sounding (VES) were obtained from the resistivity profiling result and were marked with pegs for identification.
VES points are represented by inscriptions such as **Point A** and **Point B** respectively in the data sheet.

3.2 Geophysical Survey

The Geophysical survey consisted mainly of Electrical Resistivity i.e. Resistivity Profiling and Vertical Electrical Sounding (VES) using ABEM SAS 1000 Terrameter System.

3.2.1 Resistivity Profiling

Electrical resistivity profiling was carried out along the selected traverse of 100m length at 10m interval to determine the lateral variation in subsurface resistivities so as to delineate anomalous point(s) with groundwater potential which can be used for the Vertical Electrical Sounding (VES).
Resistivity values were obtained at two depth horizons (i.e. the weathered zone and at depth within fresh or fractured bed rocks). The Schlumberger electrode configuration was used with the following electrode separation in meters; AB/2 = 20; MN/2 = 0.5; and AB/2 = 40; MN/2 = 5.0. However, only the values at depth were considered.

3.2.2 Selection of VES points

The Vertical Electrical Sounding (VES) points were selected based on the resistivity profiling results as well as the location of the project area. Two points were therefore selected for the VES as indicated in **table 1**. below.

3.2.3 Vertical Electrical Sounding (VES)

Vertical Electrical Sounding (VES) was carried out with the aim of determining the formation resistivities and the depth to bedrock, as well as the possibility of finding water bearing fractures or aquifers at depth with the corresponding thicknesses of such aquifers. The Schlumberger electrode configuration and the required procedures were used for the VES.

4.0 DATA ANALYSIS AND INTERPRETATION

4.1 Resistivity Profiling Data Sheet (Schlumberger Electrode Array)

Table 1.

CLIENT: **Sierra Leone Bottling Company**
DISRICT: **Western Area**
PROFILE LENGTH (m): **100**
STATION INTERVAL (m): **10**
PROFILE No. **1**

STATION	ELECTRODE SEPERATION (m) AB/2 = 20; MN/2 = 0.5 MULT. FACTOR = 1255		ELECTRODE SEPARATION (m) AB/2 = 40; MN/2 = 5 MULT. FACTOR = 495		REMARKS
A	RESISTANCE (ohm)	APP. RESISTIVITY (ohm.m)	RESISTANCE (ohm)	APP. RESISTIVITY (Ohm.m)	
10			0.297	147.02	VES
20			0.164	081.18	
30			0.146	072.27	
40			0.159	078.71	
50			0.151	074.75	VES
60			0.161	079.69	
70			0.144	071.28	
80			0.131	064.85	
90			0.139	068.81	
100			0.152	078.21	

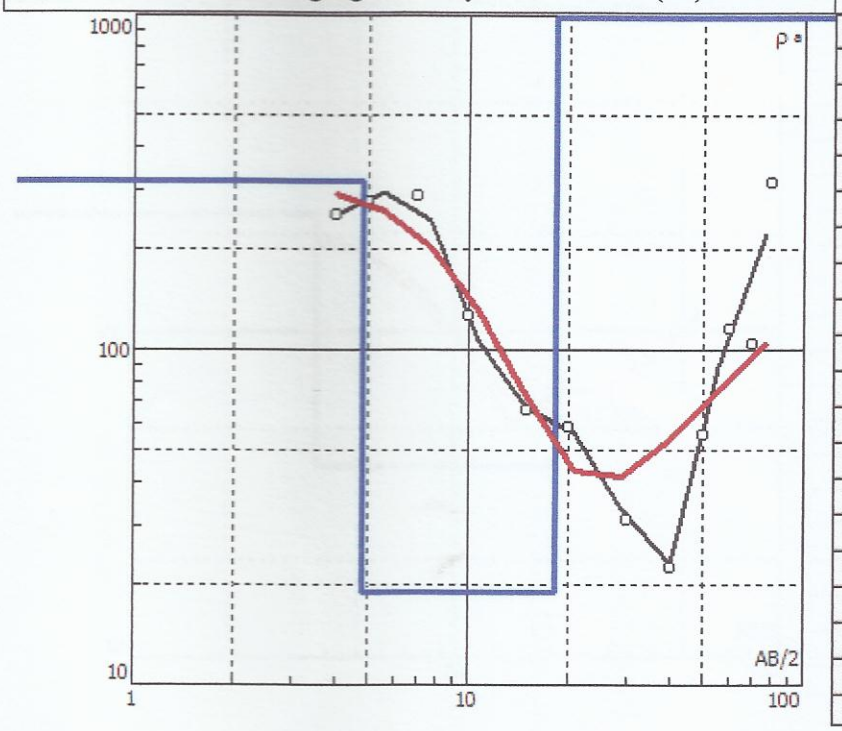
Figure 1. Schlumberger Array VES Data and Corresponding Curve and Model at Point A.

Client: **Sierra Leone Bottling Company**	Community: **Dworzak**
Project: **Borehole Drilling**	Sounding Number: **A**
District: **Western Area**	GPS Coordinate East: **0694195**
Date: **08/01/2015**	GPS Coordinate North: **0936445**
Field Operator: **Morlai Kanu**	Elevation: **77m**

Schlumberger Array VES Field Data

No.	AB/2	MN	Resistance (ohm)	Apparent Resistivity (ohm-m)
1	4	0.8	4.0711	253.27
2	5	0.8	2.8165	274.78
3	7	0.8	1.4943	286.64
4	10	0.8	0.3146	125.73
5	15	1.5	0.1731	065.88
6	20	1.5	0.0701	058.65
7	30	1.5	0.0165	031.08
8	40	3.8	0.0067	022.45
9	50	3.8	0.0545	056.00
10	60	3.8	0.0776	115.23
11	70	3.8	0.0518	104.63
12	80	7.0	0.2210	315.00

Schlumgerger Array– VES curve (A)



Model Parameters

N	ρ	h	d	Alt
1	319	4.81	4.81	-4.809
2	18.9	13.5	18.3	-18.28
3	5088			

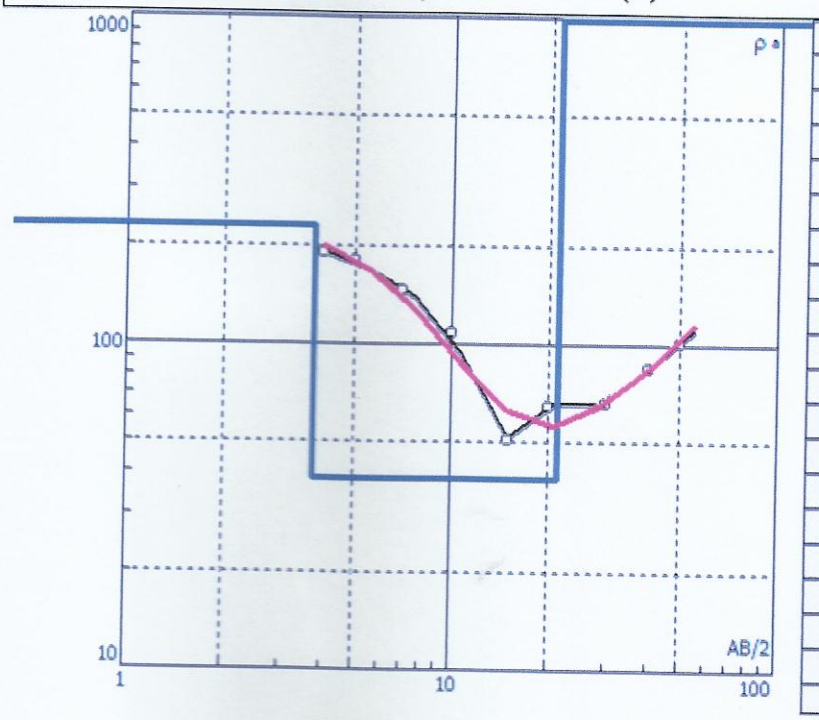
Figure 2. **Schlumberger Array VES Data and Corresponding Curve and Model at Point B.**

Client: **Sierra Leone Bottling Company**	Community: **Dworzak**
Project: **Borehole Drilling**	Sounding Number: **B**
District: **Western Area**	GPS Coordinate East: **0694225**
Date: 08/01/2015	GPS Coordinate North: **0936418**
Field Operator: **Morlai Kanu**	Elevation: **77m**

Schlumberger Array VES Field Data

No.	AB/2	MN	Resistance (ohm)	Apparent Resistivity (ohm-m)
1	4	0.8	3.0312	188.56
2	5	0.8	1.8321	178.74
3	7	0.8	0.7553	144.88
4	10	1.5	0.5179	107.87
5	15	1.5	0.0148	050.63
6	20	1.5	0.0768	064.26
7	30	1.5	0.0352	066.32
8	40	3.8	0.1286	084.29
9	50	3.8	0.0989	101.52

Schlumberger Array –VES Curve (B)



Model Parameters

N	ρ	h	d	Alt
1	229	3.77	3.77	-3.768
2	38.8	17.5	21.3	-21.3
3	3788			

Table 2: Selected Promising Points from VES Data

List of VES Points in Order of Preference for Drilling

No.	VES POINT	LAYER	THICK-NESS (m)	DEPTH (m)	APPARENT RESISTIVITY (Ohm-m)	POSSIBLE WATER ZONES (M)	RANKING	MAX DRILLING DEPTH (M)
1	A	1 2 3	4.81 13.5	4.81 18.3	319 18.9 5088	15 - 60	2nd	70
2	B	1 2 3	3.77 17.5	3.77 21.3	299 38.8 3788	15 - 55	1st	70

CONCLUSION AND RECOMMENDATION

Conclusion

Based on the analyses of the entire results, and in line with the aims of the study, the conclusions are as follows:

- The project area lies within the Freetown Basic Complex lithological formation.
- Groundwater potential (i.e. quality and quantity) could be high at depth within fractured bedrocks.
- The potential water zones are found between 15 – 60m at **point A** and 15 – 55m at **point B** respectively as indicated from the resistivity values.
- It is premature, however, to estimate quantities, which could only be determined during test drilling and test pumping.
- It is also worth to note that, clay as a sedimentary material has very low resistivity values compared to pore electrolytes within fractures contained in crystalline bedrocks.

5.1 Recommendation

In this regard, it is recommended that,

- Drilling should be carried out at the selected **points A** and **B** respectively to confirm the existence of groundwater.
- The maximum drilling depths at **Points A** and **B** is 70m to cut across the promising zones of 15 – 60m at **point A** and 15 – 55m at **point B** respectively. However, the supervisor may exceed these depths based on the field conditions.
- Both physico - chemical and bacteriological test should be carried out on the water samples from completed boreholes.

REPORT SUBMITTED BY:

09/01/15

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