EDAL DRILLING COMPANY LTD.

GEOPHYSICAL SURVEY REPORT

NATIONAL YOUT FARM - MASIAKA

SUBMITTED TO:

NATIONAL YOUTH FARM

35[A] Clewry's Lane, off Main Motor Road, Congo Cross, Freetown, Sierra Leone
Cell Numbers: 076 601 550 / 076 204 816 Phone No. 230745 Email: edalltd@gmail.com

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1. INTRODUCTION

Geological and Hydrogeological/ Geophysical surveys were conducted at the Masiaka Youth Farm on the 25th June, 2015 to explore the groundwater potentials of the area.

These studies among others, provided enough data and information used in assessing the possibility of striking groundwater in the project area.

This report therefore documents the work carried out during the investigations at the site.

2. BACKGROUND / GEOLOGY OF PROJECT AREA

The project area lies within the Bullom sedimentary formation.

The Bullom sedimentary Formation is comprised of unconsolidated to poorly consolidated sediments occupying the coastal plains of Sierra Leone. The deposits extend up to 50k inland and are found at heights up to 40m above present sea level (Culver and Williams, 1979). Although outcrop of the Bullom Group are rare and generally poor, the available evidence suggest a lateral variable sequence of poorly consolidated, near horizontal, often iron-stained gravels, sands, clays with occasional intra- formational laterites.

However, groundwater potential is very high in the Bullom Sedimentary Formation.

3. FIELD WORK

3.1 Reconnaissance Survey

The aim of the reconnaissance survey was to select suitable area (s) for geophysical survey; considering the geological/hydrogeological, environmental and other physical conditions.

The reconnaissance survey included the following:

- **Geomorphological Survey of the Area**

This includes the landscape and other physical features.
The project area is relatively flat with minor elevated grounds in the immediate surroundings.
The Geomorphology of the area therefore suggests high groundwater potentials.

- **Geological Survey to Determine the Formation of the Area and to Identify Possible Features.**

The project area is overlain by loose sedimentary materials which holds high groundwater potentials .
Trees within the area are fresh with green leaves indicating that they are getting direct water intake at a more or less shallow depth.
Note that trees/plants are essential component of the Hydrological Cycle.

- **Selection of Traverse Line for geophysical Survey**

The traverse line for resistivity survey was selected on the basis of geomorphologic and geological/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 other activities.

Point for the Vertical Electrical Sounding (VES) was selected based on the location of the project area, considering the environmental and other physical conditions and was marked with a peg for identification.

3.2 Geophysical Survey

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

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 formations or aquifer(s) at depth with the corresponding thicknesses of such aquifer(s). The Schlumberger electrode configuration and the required procedures were used for the VES at the three proposed drilling points (i.e. Points **A**, **B** $**C**)

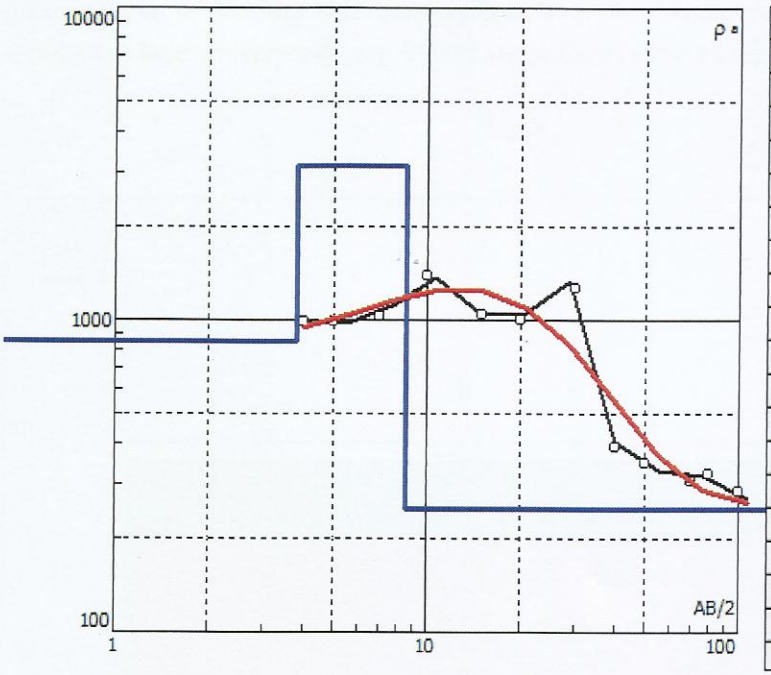
4.0 DATA ANALYSIS AND INTERPRETATION

The Vertical Electrical Sounding (VES) data and their corresponding curves are presented below:

Table 1: Schlumberger Array VES Data at Point A

Client: **National Youth Farm**			Community: **Masiaka**
Project: **Geophysical Survey**			Sounding Number: **1 (A)**
District: **Northern Province**			GPS Coordinate East: **0745122**
Date: **25th June, 2015**			GPS Coordinate North: **0940056**
Field Operator: **Morlai Kanu**			Elevation: **42m**
Schlumberger Array VES Field Data			
No.	**AB/2**	**MN**	**Apparent Resistivity (ohm-m)**
1	4	0.8	982.18
2	5	0.8	983.7
3	7	0.8	1020
4	10	1.5	1379
5	15	1.5	1038
6	20	1.5	1001
7	30	1.5	4263
8	40	7.6	394.1
9	50	7.6	348.4
10	70	7.6	305.7
11	80	14	323.5
12	100	14	282.5

The VES data is first presented in the form of a table (as shown above) from which a graph of Apparent Resistivity ($p_{a)}$ Vs half the Current Electrode Spacing (AB/2) is plotted.



N	ρ	h	d	Alt
1	858	3.83	3.83	-3.825
2	3123	4.68	8.5	-8.501
3	249			

Figure 1. Schlumberger Array VES Curve and Model at point A.

The data shows a two-layer subsurface in which $\rho_1 > \rho_2$. The unusually low apparent resistivity registered in layers 1 and 2 are indicative of the presence of pore electrolyte, possibly groundwater within the sedimentary top layer and underlying sedimentary formations. The equivalent layer thicknesses are 3.83m and 4.68m respectively.

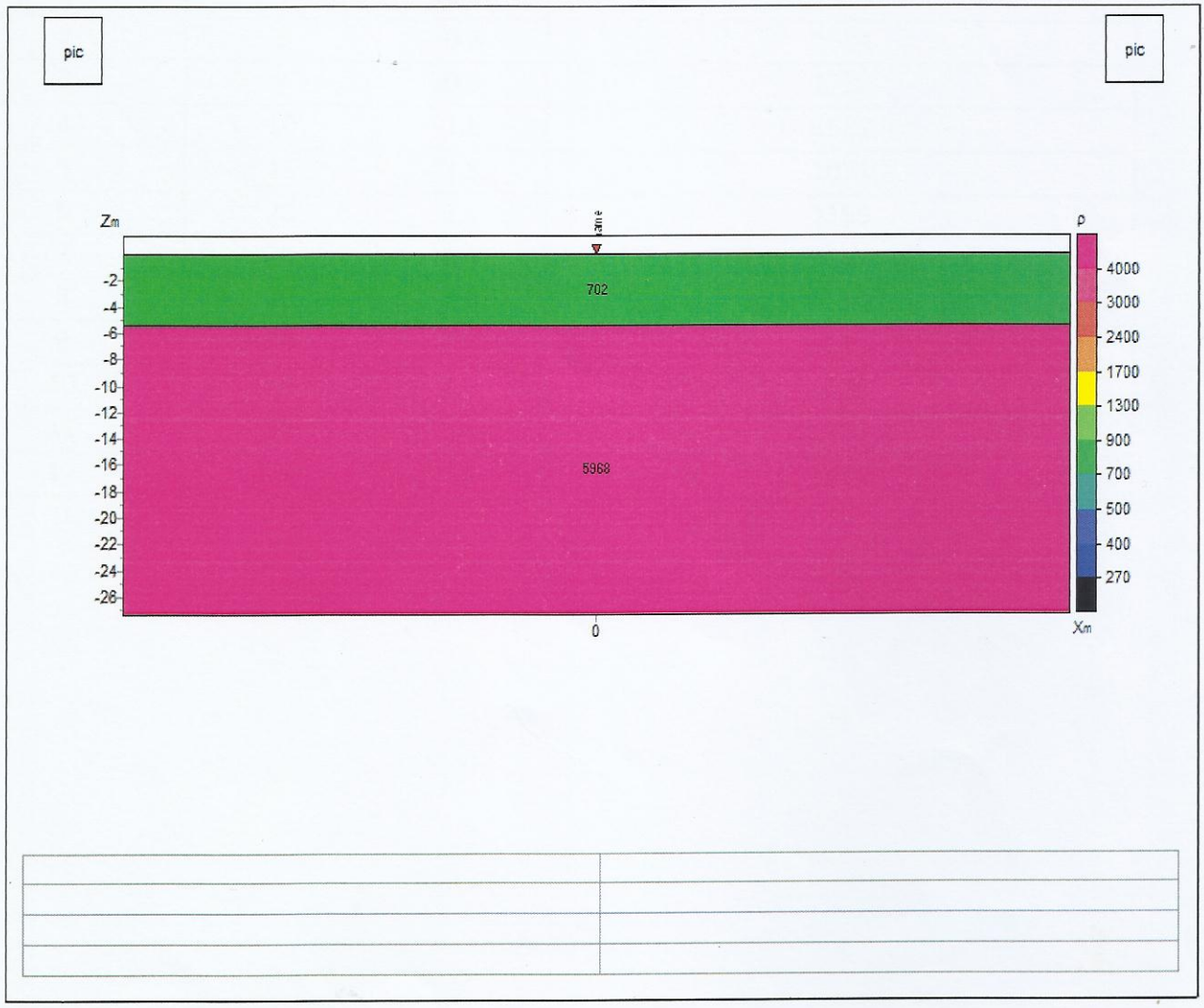
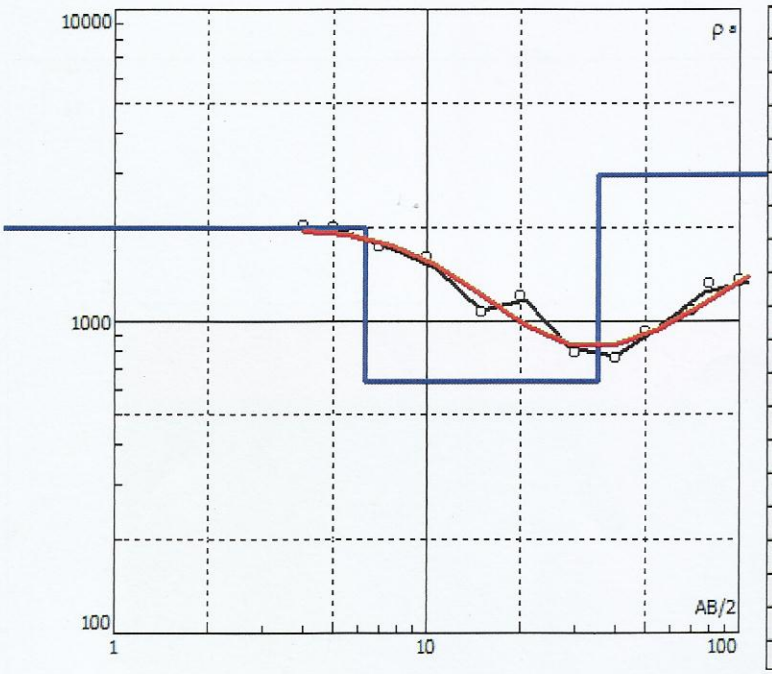


Figure 2. Pseudo - section Showing Apparent Resistivities and Layer Thicknesses at point A.

Table 2: Schlumberger Array VES Data at Point B.

Client: **National Youth Farm**			Community: **Masiaka**
Project: **Geophysical Survey**			Sounding Number: **2 (B)**
District: **Northern Province**			GPS Coordinate East: **0745392**
Date: **25th June, 2015**			GPS Coordinate North: **0940113**
Field Operator: **Morlai Kanu**			Elevation: **43m**
Schlumberger Array VES Field Data			
No.	**AB/2**	**MN**	**Apparent Resistivity (ohm-m)**
1	4	0.8	2019
2	5	0.8	1984
3	7	0.8	1732
4	10	1.5	1587
5	15	1.5	1071
6	20	1.5	1195
7	30	1.5	788.6
8	40	7.6	763.2
9	50	7.6	924.9
10	70	7.6	1079
11	80	14	1309
12	100	14	1342

The VES data is first presented in the form of a table (as shown above) from which a graph of Apparent Resistivity (ρ_a) Vs half the Current Electrode Spacing (AB/2) is plotted.



N	ρ	h	d	Alt
1	2002	6.37	6.37	-6.37
2	642	28.9	35.3	-35.31
3	2927			

Figure 3. Schlumberger VES Curve and Model at Point B.

The data shows a two-layer subsurface in which $p_1 > p_2$. The unusually low apparent resistivity registered in layers 1 and 2 are indicative of high groundwater potential of the area. The equivalent layer thicknesses are 6.34m and 28.9m respectively.

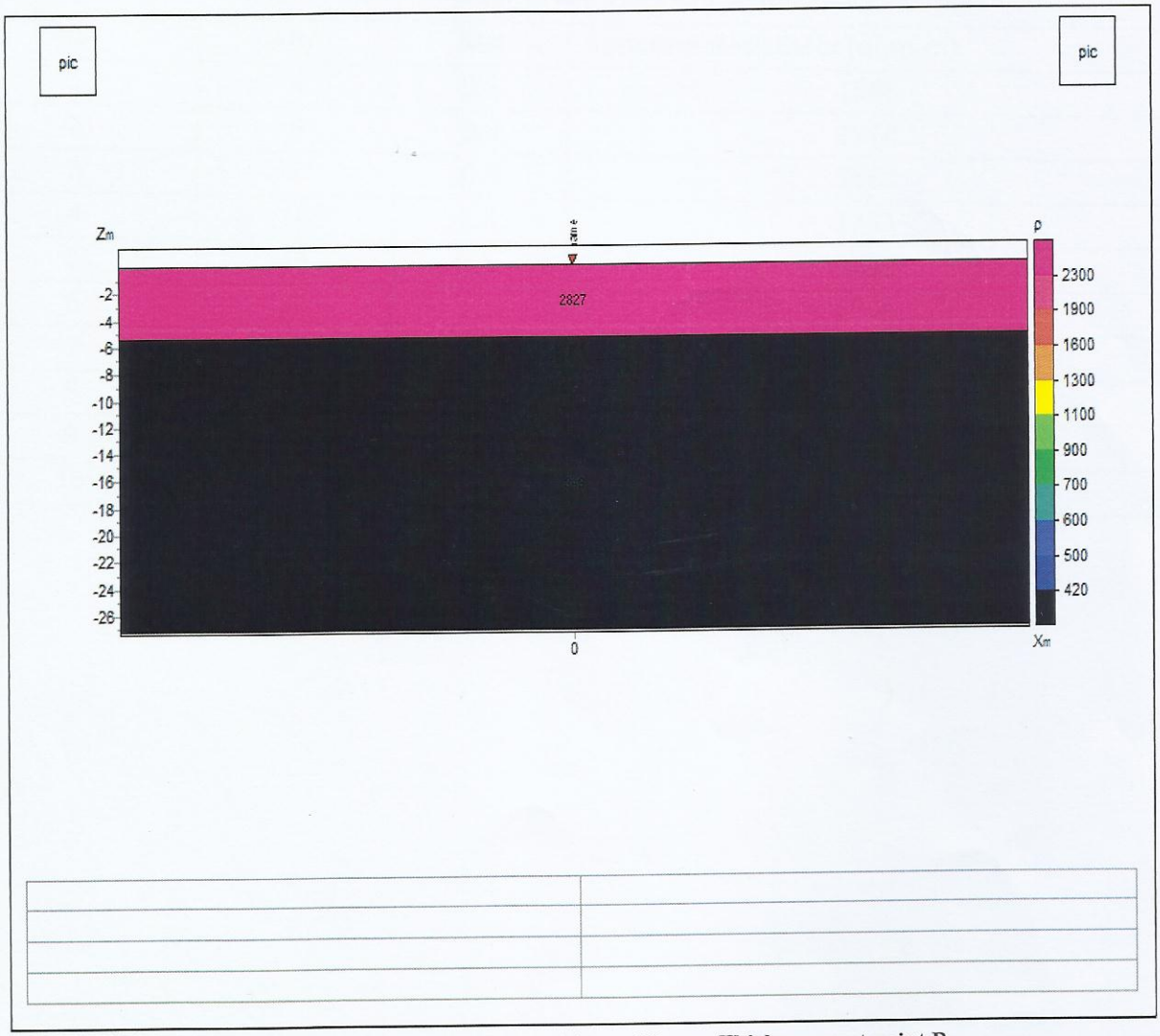
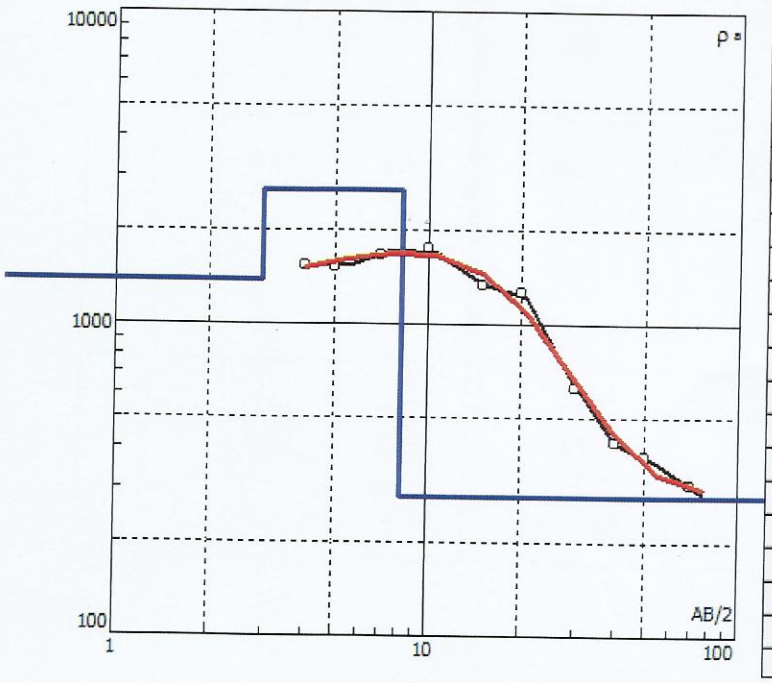


Figure 4 . Pseudo - section Showing Apparent Resistivities and Layer Thicknesses at point B.

Table 3: Schlumberger Array VES Data at Point C.

Client: **National Youth Farm**			Community: **Masiaka**
Project: **Geophysical Survey**			Sounding Number: **3 (C)**
District: **Northern Province**			GPS Coordinate East: **0745678**
Date: **25th June, 2015**			GPS Coordinate North: **0939769**
Field Operator: **Morlai Kanu**			Elevation: **39m**
Schlumberger Array VES Field Data			
No.	**AB/2**	**MN**	**Apparent Resistivity (ohm-m)**
1	4	0.8	1546
2	5	0.8	1514
3	7	0.8	1663
4	10	1.5	1761
5	15	1.5	1330
6	20	1.5	1265
7	30	1.5	629.3
8	40	7.6	416.2
9	50	7.6	378.2
10	70	7.6	307

The VES data is first presented in the form of a table (as shown above) from which a graph of Apparent Resistivity (ρ_a) Vs half the Current Electrode Spacing (AB/2) is plotted.



N	ρ	h	d	Alt
1	1379	2.93	2.93	-2.926
2	2698	5.32	8.24	-8.242
3	279			

Figure 5. Schlumberger Array VES Curve and Model at Point C.

Table 4: 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	3.83 4.68	3.83 8.5	858 3123 249	10-25 30-75	1st	80m
2	B	1 2 3	6.37 28.9	6.37 35.3	2002 642 2127	10-20 30-70	3rd	80m
3	C	1 2 3	2.93 5.32	2.92 8.24	1379 269 279	10 -70	2nd	70m

5.0 CONCLUSIONS AND RECOMMENDATIONS

Conclusions

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

- The project area lies within the Bullom Sedimentary formation.
- Groundwater potential could be high in the Bullom Formation
- The potential water zones are found between 10- 25m and 30- 75m at point **A**.; 10m – 20m and 30m-70m at point **B.**; 10m – 70m at point **C** respectively.
- It is premature, however, to estimate quantities, which could only be determined during test drilling and test pumping.
- The borehole location was selected in accordance with both national and international borehole siting guidelines.

Recommendation

In this regard, it is recommended that;

- Drilling should be carried out at the selected points (i.e. **A, B $ C**) in order of preference to confirm the existence of groundwater.
- The borehole must be constructed using the correct and standard materials such as standard uPVC screens and plain casings, well sorted gravels etc. for water quality and high yield.
- The maximum drilling depth should be 80m at point **A**, 80m at point **B** and 70m at point **C** respectively for sustainable productivity and high yield of the borehole.
- Both physico-chemical and bacteriological test should be carried out on the borehole water sample after completion.

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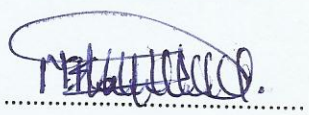

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Morlai Kanu
Geologist/ Field Operator
Cell: +232 76 950 032