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GEOELECTRICAL INVESTIGATIONS FOR SHALLOW GROUND WATER AT SUKRULI BLOCK IN MAYURBHANJ, ODISHA

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ABSTRACT

Geo resistivity of sounding of Sukuruli block was conducted to delineating the ground water potential of the areas. Ten (10) Schlumberger vertical electrical resistivity soundings were acquired with Geo Resistivity Meter. The electrode spacing AB/2 was varied from 1.5 to 65 m with maximum spread length of 100 m. The interpretation of resistivity curve is done by JSIX soft ware. Four to five distinct subsurface geologic layers were identified from the geoelectric layers, aided by borehole lithological logs. These include; the topsoil, Lateritic soil, Sandy Clay, Weathered Granite, Fractured granite gneiss, and clay, the top soil layer of variable nature has resistivity value between 22 to 587ohm m whose thickness is ranging from 0.7 to 2.4 m. The weathered layer in identified with resistivity value ranging from 78 to 430 Ω m whose thickness is 3.1 to ∞. After investigation we find that out of ten seven points are suitable for Bore well and three points are not suitable for bore well. Most of the feasible sites are Fractured granite gneiss accept location one, which is Weathered Granite Gneiss. Rock type of study area is granite. The Sukuruli block site is feasible for Bore Well.

KEYWORDS: Geo resistivity method; Schlumberger configuration; Ground water potential

INTRODUCTION:-

Water is the most precious and commonly used resource in nature. It is essential for survival and sustenance of life and environment. (P.C Sahu,H,K Sahoo et al. 2006). Identifying a good site for groundwater exploration in hard rock terrain is a demanding task. In hard rocks, groundwater occurs in secondary porosity developed due to weathering, fracturing, faulting, etc., which is highly variable within short distance and contributing to near-surface in homogeneity. Where surface water is limited. The conventional Schlumberger resistivity sounding is extensively used for routine groundwater investigations both in alluvial and hard rock terrain. In the crystalline hard rock groundwater generally occurs in the weathered basement, or regolith, and the fractured rock (Verma et al., 1980). The presence of weathered and fractured quartzite and granites, generally associated with weathered zones may enhance the chances of high yielding boreholes. The ideal resistance for feasible of a layer in 50-100 mtr, which is manly found in weather rock the resistance between 100-300 mtr is manly found in fractured rock. In our study we take two villages i.e Budhamara and Tingiria of sukuruli block, which is a hard rock area archian group and singhbhum granaide. In this block most of the people are depend on their harvesting, but due to water scarcity ground water is the only ultimate source for all needs. So Schlumberger resistivity sounding method has been successfully employed in the delineation of subsurface geological sequence, geological structures/features of interest, aquifer units, types and depth extent in almost all geological terrains. This is because of the significant resistivity contrasts that exist between different earth materials (Olorunfemi &Fasuyi 1993). The resistivity method can therefore map interface along which a resistivity contrast exists. This interface may or may not coincide with geological boundary (Telford et al. 1990).Geo resistivity method works on the basis of energizing the subsurface via the use of two current electrodes with the resulting potential difference measured by another two electrodes termed the potential electrodes.

STUDY AREA:-

The present study area is situated in the Sukuruli block of Mayurbhanj district. The area lying between the parallels Latitude 21º53’N - 21º54’ N North and Longitudes 85º52’E - 85º55’ E East.The study area are chronically drought prone and faces acute water scarcity not only drinking purposes but also agriculture purpose. The available surface water resources are inadequate to meet the entire water requirement for different purposes. Farming is the major activity in this area, seasonal runoff in the rainy season is not sufficient to fulfil the water requirement for both domestic and irrigational purposes. The ground water is the only ultimate source for all needs. In this scenario of more dependence on groundwater, existing open wells are deepened and new deep bore wells are constructed for irrigational practice. So demand for underground water has increased each and every year.

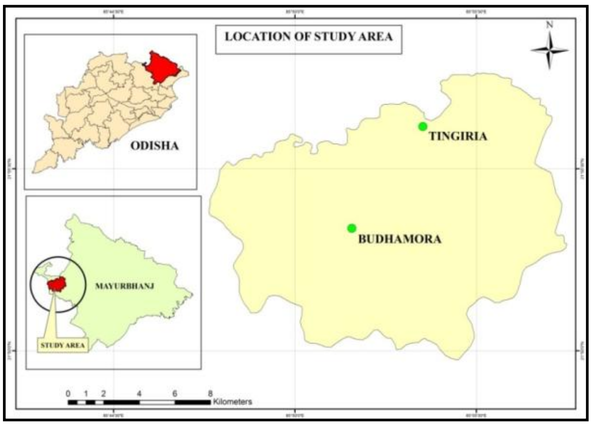

Figure 1: location of study area

METHODOLOGY

The electrical resistivity survey involves electrical sounding using schlumberger configuration. The potential electrodes remain fixed and the current electrodes are expanded simultaneously about the center of the spread. The distance between the electrodes gets too large, it then mandatory to increase the distance between the potential electrodes to have a measurable potential difference. The schumberger array used, with maximum current electrode separation of 100m-150m electrodes are normally arranged along a straight line, with the potential electrode placed in between the current electrodes. This configuration is mostly used as it would provide subsurface information considering the depth of penetration which ranges between 1/3 and ¼ of the total current electrode separation (David and Ofrey, 1989; Osemeikhian and Asokhia, 1994; Mallam and Ajayi, 2000).The resistivity sounding curves were interpreted quantitatively; this is done by partial curve matching technique and computer iteration of the interpreted resistivity curves. Partial curve matching method involves a segment matching of the sounding curves with theoretical schlumberger layer. The interpretation was done by matching the VES curves segment by segment, starting from small electrode spacing gradually to larger electrode spacing. The process involves taking the apparent resistivity data in ohm-meter obtained from the study area and plotting it against the electrode spacing in meters on a JSIX Soft ware to obtain a curve.

The fundamental equation for resistivity survey is derived from Ohm's low the voltage applied across the conductor is directly proposal to the current flowing through it.

That is $V \alpha I$

V=RI (R=Constant &Resistivity)

R= V/I

Where, V: - voltage across the conductor

I: - current flowing through the conductor

R: - Resistance

According to Ohm's law and from the primary data, the mathematical process is as follows:-

Resistivity of the soil (R) =K.V / I

K=constant (ohm's constant)

V= voltage across the conductor

I = current in ampere

VES Location	**Apparent resistivity in ohm-mtr.**	**Thickness in mtr.**	**Probable Strata**	**Feasibility**
1	417.0 104.3 223.1 78.1	1.50 7.0 26.1 inf	Top soil Weathered Granite Gneiss Fractured granite gneiss Weathered Granite Gneiss	Feasible for B/w
2	98.6 16.7 33.9 236.0	1.3 1.5 3.1 inf	Top soil Lateritic soil Sandy Clay Fractured granite gneiss	Feasible for B/w
3	47.1 22.9 30.7 34.8 1031.1	0.7 0.9 1.9 3.3 inf	Top soil Lateritic soil Clay Weathered Granite Gneiss Hard Granite	Not Feasible for B/w
4	446.1 45.1 33.2 209.3	1.1 11.0 11.3 Inf	Top soil Clay Sandy Clay Fractured granite gneiss	Feasible for B/w
5	587.8 93.8 28 430.6	1.40 5.6 11.5 inf	Top soil Clay Sandy Clay Fractured granite gneiss	Feasible for B/w
6	62.4 30.1 10.8 447.2	1.3 5.5 10.6 Inf	Top soil Lateritic Soil Clay Hard granite	NOT Feasible for B/w

7	145.8 24.0 26.7 185.2	1.1 3.8 7.5 inf	Top soil Lateritic Soil Clay Fractured Granite Gneiss	Feasible for B/w
8	74.3 32.2 354.3 155.9	2.4 13.4 16.1 inf	Top soil Clay Fractured Granite gneiss Fractured Granite gneiss	Feasible for B/w
9	22.3 12.0 34.5 372.4	1.7 1.0 6.8 inf	Top soil Clay Sandy Clay Hard granite	Not Feasible for B/w
10	113.5 21.0 19.0 186.9	1.0 5.3 7.6 inf	Top soil Clay Clay Fractured granite gneiss	Feasible for B/w

Table-1: Apparent resistivity, thickness and probable strata

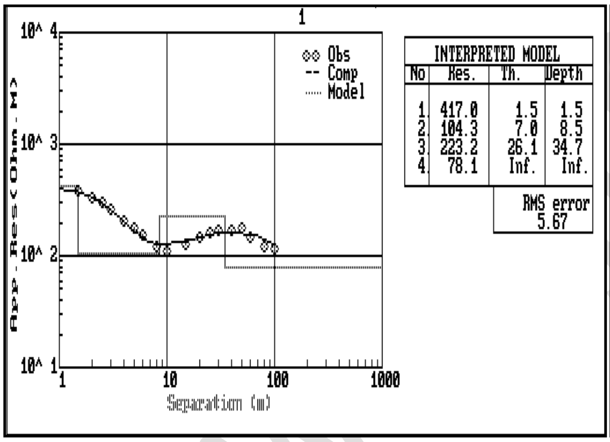

Figure 2 Geo resistivity curve of location 1

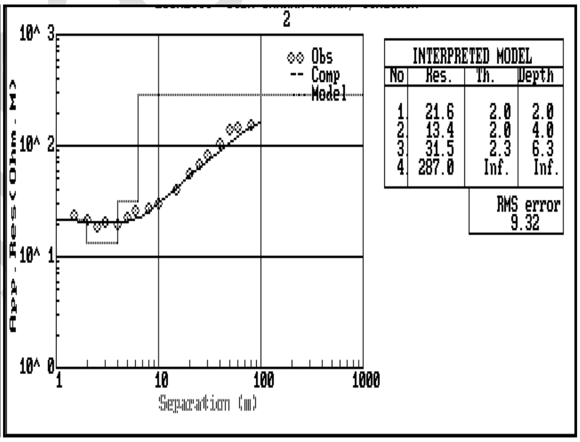

Figure 3 Geo resistivity curve of location 2

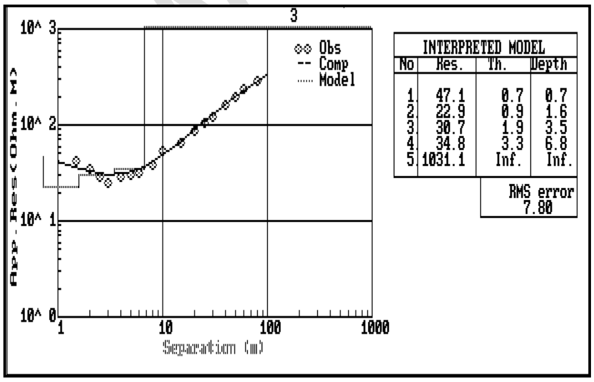

Figure 4 Geo resistivity curve of location 3

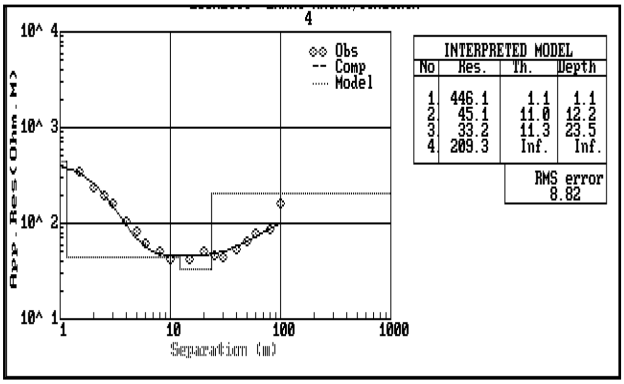

Figure 5 Geo resistivity curve of location 4

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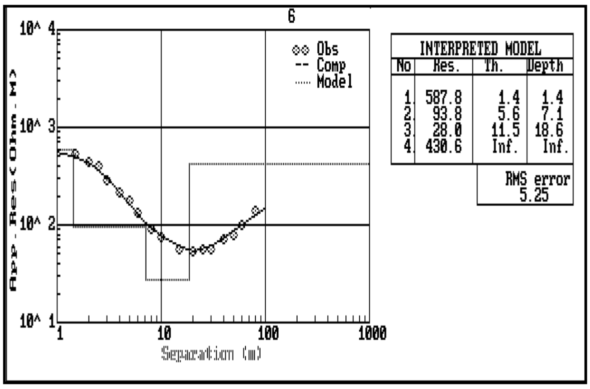

Figure 6 Geo resistivity curve of location 5

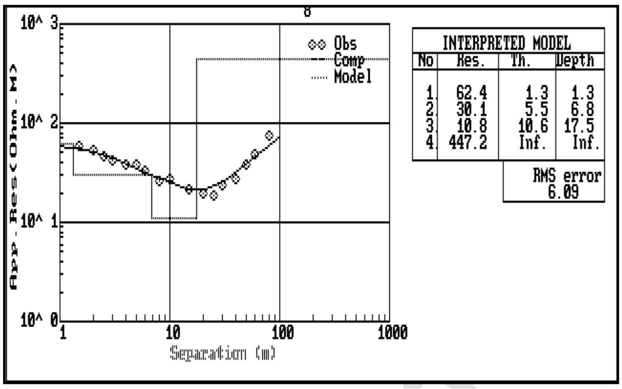

Figure 7 Geo resistivity curve of location 6

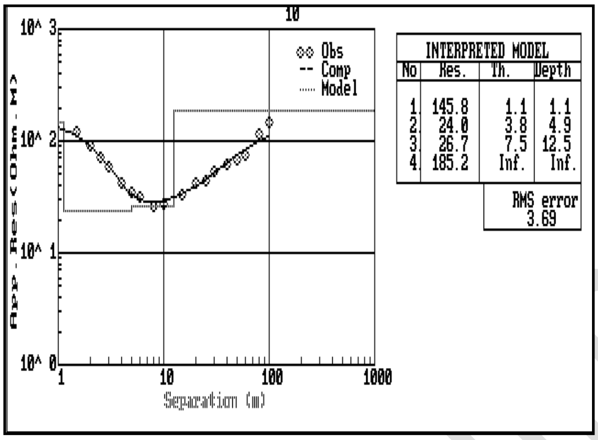

Figure 8 Geo resistivity curve of location 7

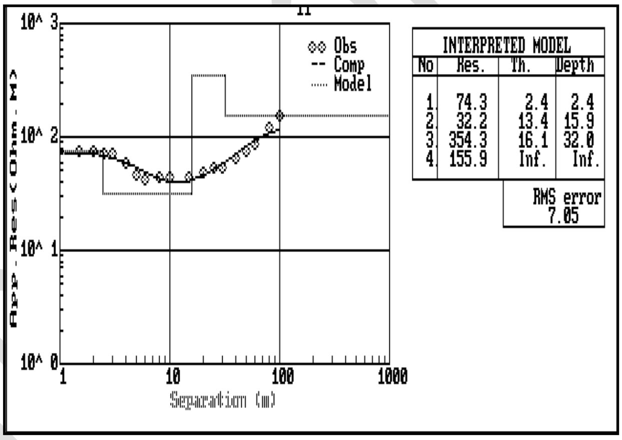

Figure 9 Geo resistivity curve of location 8

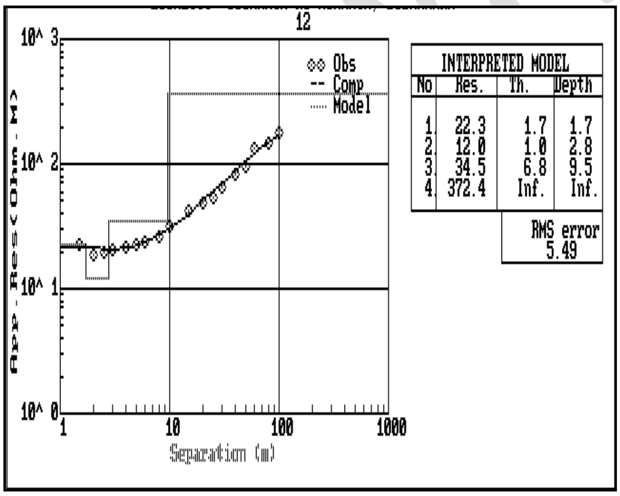

Figure 10 Geo resistivity curve of location 9

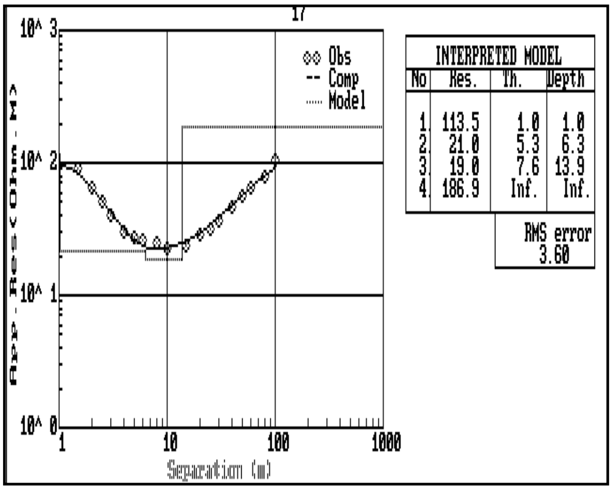

Figure 11 Geo resistivity curve of location 10

DISCUSSION & RESULT

After interpreted resistivity data, resistivity value range of the study area is found to be changes due to the sub surface strata dissimilarity. There resistivity value and layer thickness of the study area is given in the Table. It is observed that most of the VES locations (7Nos.) have four layer curves, whereas five layer curves are noticed in location 3.The top soil layer of variable nature has resistivity value between 22 to 587ohm. m whose thickness is ranging from 0.7 to 2.4 m. The weathered layer in identified with resistivity value ranging from 78 to 430 ohm.m whose thickness is 3.1 to ∞. Maximum resistivity of 1031 ohm m is observed in VES location 3, and Probable Strata is Hard Granite. So, VES location 3 is not suitable for Bor well. After investigation we find that out of ten seven points are suitable for bor well and three points are not suitable for bor well. Most of the feasible sites are Fractured granite gneiss accept location one, which is Weathered Granite Gneiss.

CONCLUSION

There are six geo electric layers were delineated within the study area. These include; the topsoil, Lateritic soil Sandy Clay, Weathered Granite, Fractured granite gneiss, and clay. Interpretation of the VES tests indicates the presence of an alluvial aquifer that mainly consists of fractured granite gneiss/Weathered Granite Gneiss, with intermediate resistivity range between73 to 430Ω m, In general the groundwater prospects are less in hard rock areas, especially in granitic terrains. The deeper aquifers in hard rock terrains have potential only when they are fed by fractures and thick weathered layer. The analysis and interpretation of resistivity data of the study area has shown low resistivity. Rock type of study area is granite & granite gneiss and soil type is clayey loam, sandy clay & lateritic soil. The Sukuruli block site is feasible for Bore Well. Probable depths of drilling are to be 75 to 80 mtr. The probable length of casing are to be 20 to 25mtr and the probable yield are to be 8500 to 11000 lph.

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