Available online at www.elixirpublishers.com (Elixir International Journal)

Earth Science

Elixir Earth Science 101 (2016) 43854-43857

ISSN: 2229-712X

Deep fracture rock of Groundwater potential zone by using Geophysical Electrical Resistivity Inverse Slope Method in the Kandili Panchayat Union,Vellore District, Tamilnadu, India

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ARTICLE INFO

Article history:

Received: 10 October 2016;

Received in revised form:

19 November 2016;

Accepted: 2 December 2016;

Keywords

Vertical Electrical Sounding,

Groundwater Potential Zone,

Kandili Panchayat Union.

ABSTRACT

The Electrical Resistivity investigation was carried out around, Kandili Panchayat union, Vellore District, to identified the moderate and deep depth of groundwater potential zone and understand the subsurface geologic layer, the maximum electrode separation 360m by schlumberger configuration. Geologically, denoted metamorphic rock, basement of Precambrian age. The field data obtained have been analyzed using IPI2WIN software, Inverse slope which gives an automatic interpretation of the apparent resistivity data was interpreted. The investigation data from groundwater potential zone divided as priority vies minimum to maximum resistivity value (I- Kannalapatti 0.010 to 0.805), (II-Koratti0.042 to 1.077), (III-Thokkium 0.054 to 3.651), (IV –Natham 0.045 to 4.124), (V-S.Pallipattu0.195 to 6.108).

Introduction

Groundwater is one of the most valuable natural resources, which supports human health, economic development and ecological diversity. The largest available source of fresh water lies underground. Increased demands for water have stimulated development of underground water resource. India is a largest country which supports about 1/6th of the world' populations,1/50th of the world's water resources. But now India suffers severe water shortage in many of its sates. It averages about 120cm/yr of precipitation, which is more than other country of comparable size, but the rain is unevenly distributed (kumar2006). Tamil Nadu mainly is mainly depending upon its water resources for agricultural activities, food production and domestic's uses. Agriculture is the major occupation in the sub basin. It is essential to analyses water resources conditions upon which the irrigated agriculture depends. Owing to the uncertainty of rainfall, the ground water is being continuously exploited for irrigation. As environmental problem are becoming more serious, the concern on quality of groundwater becomes the most important factor (karuppannan2013). To understand the subsurface lithology and delineate the groundwater potential zones the vertical electrical sounding (VES) survey has been proved useful and cost-effectiveness (Dushiyanthan et.al 2011). The Schlumberger array is found to be more suitable and common in ground water investigations (Zhody, Eaton & Mabey 1974). Moreover, the technique has been utilized effectively to solve groundwater problems by many researchers (Karanth 1978;Janardhana Raju, Reddy & Naidu 1996;Balasubramanian, Sharma & Sastri 1985; Jagadeeswara Rao et al., 2003; Ranjit Kumar Majumdar & Das Debabrata 2009; Yadav et al., 2010).

As the study area comes under the high ground water demand category, an attempt has been made to delineate the potential of the aquifer zones.

Study Area

The study area is part of the NW basement terrain underlain by basement rocks of Precambrian age. They are mainly granites, gneisses, and schist. The Study located between 12^{0}47'85" latitude and 78^{0}45'33" longitude (fig.1). Physiographically, the area is characterized by hills and plains. The western part of the district is flanked by the Eastern Ghats and Baramahal range of Andhra Pradesh. Absence of any structural control of the drainage is striking. The Palar is a seasonal river that flows eastwards running parallel to the ridges and valleys. Springs found in the sandy bed are the main source of water supply. Generally, sub-tropical climate prevails in the district. The temperature remains high in the summer months and then drops down with the onset of monsoons.

The average annual rainfall of the study area is 954.4 mm. Southwest and Northeast monsoon together account for approximately 85 % of the rainfall. The area is classified into hard rock and sedimentary formations. Hard rock formations constitute 90 % of the area. Most common hard rock formations are gneisses and charnockite (fig.2). Gneissic formations are found in all the taluks of the district. They are known by various names based on their mineral content. Charnockite formations were found in areas like Javadu Hills and Amirthi reserve forests. The Regional faults of Javadi Hills are considerably long. Groundwater in the hard rock formations is controlled by depth, degree of weathering and development of fractures. In alluvial formations, groundwater occurs under semi-confined conditions. These formations are highly porous and permeable and develop into potential water bearing zones.

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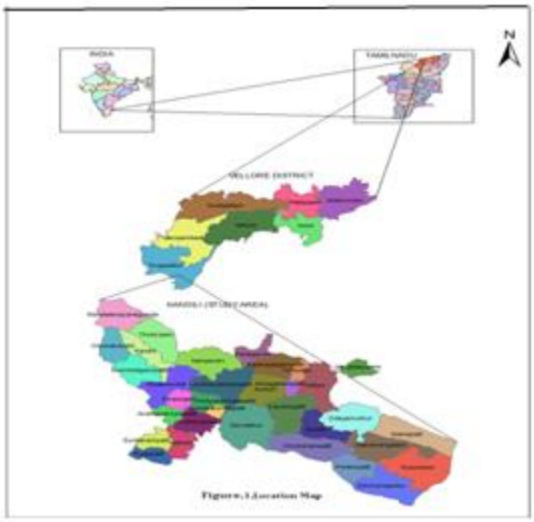

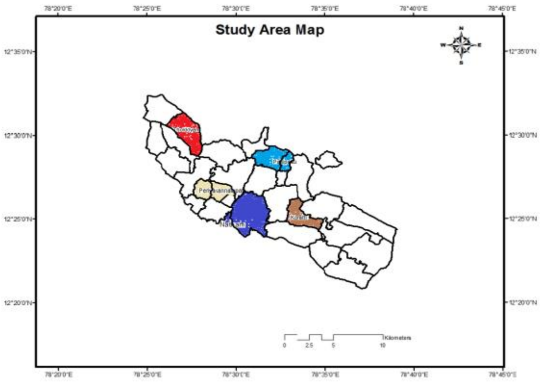

Fig 2. Study area map.

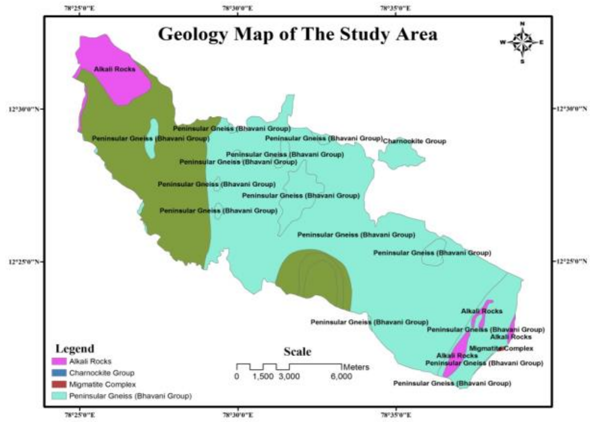

Fig 3. Geology map.

Methodology

The Geophysical survey in the form of Vertical Electrical Soundings (VES), conducted in the study area to assess the lateral variations, vertical in homogeneities and the sub surface geology with respect to the availability of ground water.

About 5 stations have conducted within the investigated area. The maximum depth 360 m AB/2 Schlumberger electrode set up was employed for making sounding measurements by using the instrument SSR-MP-ATS model resistivity. Since it is least influenced by lateral in homogeneities and is capable of providing higher depth of investigation. The interpreted resistivity and thickness of the layer from to delineate the groundwater potential zone priority vise.

Results and Discussion

The interpreted resistivity data is presented in Table 1. In this attempt total of five selected location VES were conducted on different locations of the study area as. The Maximum Depth of investigation was only 360m. The apparent resistivity and thickness of the different layers intergraded area.

Table 1. layer thickness for resistivity of Kandili Panchyat union.

S. No	VES Location Name	Layers thickness in Meter	Resistivity in Ohm Meter	Layer Inverse slope (1/S)	Spring Layers from Ground Level in Meter	Spring Layers Thickness in Meter	Spring Layer Resistivity in OHM Meter
1	S. Pallipattu	h_1=G.L-45 h_2=45 to 80 h_3=80 to155 h_4=155to230 h_5=230 to345 h_6=345 to ∞	9999 1460 9999 9986 4167	0.0001 0.0006 0.0001 0.0001 0.0002	80 345	40 115	1460 4167
2	Kannalapatti	h_1=G.L-40 h_2=40 to 145 h_3=145 to300 h_4=300to325 h_5=325 to340 h_6=340 to ∞	9999 9999 1005 56 216	0.0001 0.0001 0.0009 0.0178 0.0046	325 340	25 15	56 216
3	Koratti	h_1=G.L-40 h_2=40 to 55 h_3=55 to135 h_4=135to160 h_5=160 to325 h_6=325to ∞	9999 9999 2392 459 3100	0.0001 0.0001 0.0004 0.0021 0.0003	135 325	80 165	2392 459
4	Thokkium	h_1=G.L-20 h_2=20 to 60 h_3=60 to125 h_4=125to225 h_5=225 to275 h_6=275 to ∞	629 3268 1428 4684 1855	0.0015 0.0003 0.0007 0.0002 0.0005	125 275	65 50	1428 1855
5	Natham	h_1=G.L-20 h_2=20 to 35 h_3=35 to100 h_4=100to315 h_5=315to330 h_6=330 to∞	9999 537 2229 1878 200	0.0001 0.0018 0.0004 0.0005 0.0050	35 330	15 15	537 200

A perusal of this table shows that the most of the locations, the aquifer consists of six layers and the Fourth and Fifth layers normally weathered and highly fractured. The highly fractured layer has attained a maximum thickness range from 165m, and minimum thickness range from 15m. The electrical resistivity sounding data and graphs for S. Pallipattu, Kannalapatti, Koratti, Thokkium and Natham . Respectively Table1. Source the layer thickness for resistivity of Kandili Panchyat union.

1. S. Pallipattu area

The Pallipattu area VES data vise 1m to 25m top soil and 25m subsurface formation Charnokite rock covered following 20m to 250m, between 80 m the (I) spring layer and then between 180-90m (II) spring layer, 255 to 360 above in gneissic rock between 260 m of spring layers of (III&IV) 340m of spring layers present.

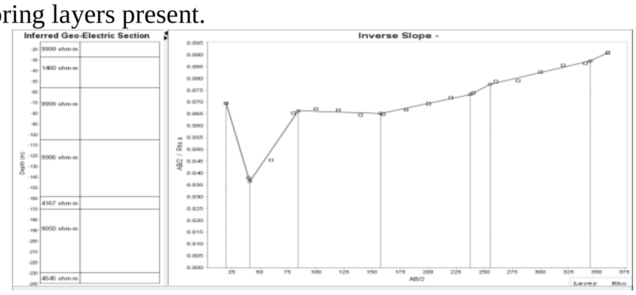

Fig 4. Inverse Slope curve of S. Pallipattu

2. Kannalapatti area

The Kannalapatti borehole lithology investigation result analyzed from following subsurface layer thickness and spring layer, 1m to 40m of the top soil thickness and 40m to 120m Charnokite rocks between spring layers covered 100m (I), 120m to 360m above covered gneissic rocks formations between160m of (II) spring layers and 280m of spring layer(III), and 320m to 330m spring layers (IV).

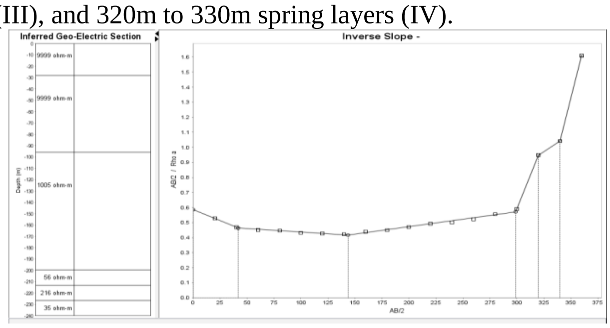

Fig 5. Inverse slope curve of Kannalapatti.

3. Koratti area

The Koratti area following top soil thickness of 1m to 32m. 32to 120m Charnokite between spring layers started from 40m (I), then 120m to 310m gneissic rock, the second spring layer find out from 160 to 170 m (II). Third spring layers shown in 240m to 250m (III), than 250 m to 360 m between Charnokite rocks present, the fourth spring layers available 320m to 340m.

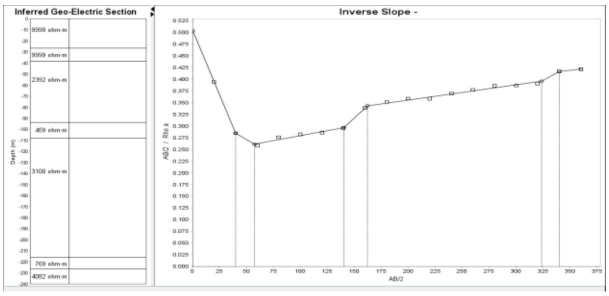

Fig 6. Inverse slope curve of Koratti.

4. Thokkium area

The Thokkium area thickness of topsoil ground level to 20m , below the formation 20m to 240m in Charnokite rocks, denote the first spring layer thickness 120m-130m and 270m to 290m.

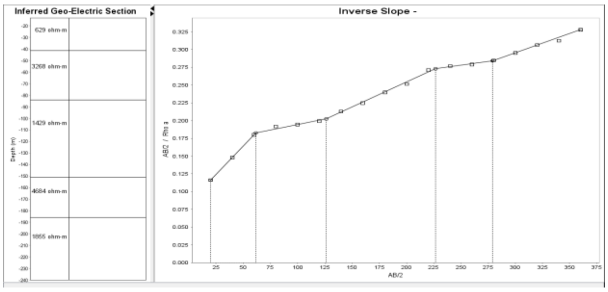

Fig 7. Inverse slope curve of Thokkium.

5. Natham area

The Natham area inverse slope result followed by top soil thickness of 1m to 20m, above 20m to 360m of the Charnokite. The first spring layers of 30m to 45m, second spring layers of 90m to 110m. third spring layers of 330m to 345m.

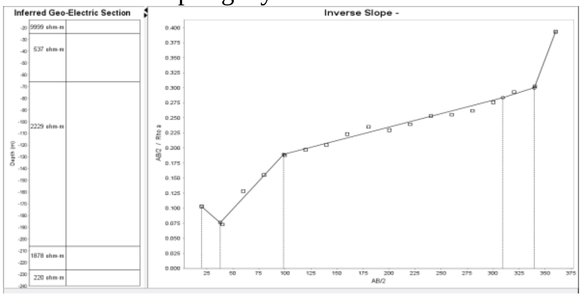

Fig 8. Inverse slope curve of Natham.

Conclusion

The selected location were identified the deep fracture zone and spring layer in deeper groundwater potential zone, priority vise. The outcome recommend from the VES priority zone vise (Priority I- Kannalapatti 0.010 to 0.805), (Priority II-Koratti 0.042 to 1.077), (Priority -III-Thokkium 0.054 to 3.651), (Priority-IV–Natham 0.045 to 4.124), (Priority-V-S. Pallipattu 0.195 to 6.108) groundwater development.

The vertical electrical sounding technique for identifying deep groundwater positional zones has been proved successful in this hard rock terrain. The VES interpretation results of the subsurface lithology and width of the layer, by via resistivity traverse subdivision, is extremely greatly supportive to extend and assemble wells to explore plenty quantity of groundwater.

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