**GEOPHYSICAL INVESTIGATION OF GROUNDWATER EXPLORATION USING SELF-POTENTIAL AND RESISTIVITY METHOD IN VEPPILAIPATTI VILLAGE, SALEM DISTRICT, TAMIL NADU, INDIA**

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**INTRODUCTION**

Geophysics is a substance of study concerned with physiological processes and physiological properties of the Object and its surrounding set surroundings, and the use of different methods for their analysis. The period geology sometimes refers exclusive to the geological applications. Material's contour, its gravitational and magnetic comic construction and arrangement, its mechanics and their opencast look in bag geomorphology, the its internal procreation of magmas, volcanism and careen formation. Over the bygone individual decades, geophysical surveying has prettified increasingly potent and helpful for module the submersed watertable ranges (Murthy et al; 1968 and Raman et al: 2000).

**GEOPHYSICAL EXPLORATION OF GROUNDWATER**

It is the technological analysis of material properties of the connective encrustation for enquiry of mineralized deposits or geologic artifact. With the uncovering of oil by geophysical methods in 1926, efficient method for locating oil and pigment deposits aroused the use and betterment of many geophysical methods and equipment. Geophysical methods notice differences or anomalies of somatic properties within the earth's freshness. Spacing, attraction, elasticity, and electrical resistivity are properties most commonly rhythmic. The important exploratory techniques normally adopted are Geological methods, Geomorphological methods, Remote sensing methods, and Geophysical methods.

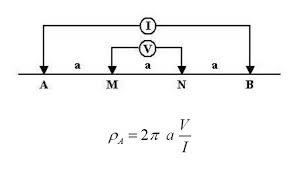
**GEOPHYSICAL METHODS**

Geophysical methods depend on confident physical properties of earth materials. The properties are plumbed and variations in their values in lateral or straight directions are made use of for assemblage underground content. The significant properties of rock that are made use are Gravity prospecting, Magnetic prospecting, Seismic prospecting, Electrical prospecting and Radiometric prospecting.

**ELECTRICAL METHODS**

Electrical resistivity method depends on the activity of earth to course of electric ongoing. The resistivity of an earth interior depends on its mineral composition and is influenced to a very sizable alter by the interstitial liquid accumulation tell there in. Resistivity method involves the measurement of open cut possibility caused by the passageway of an exciting current. In real set measurements, a show of electrode arrangement is victimized.

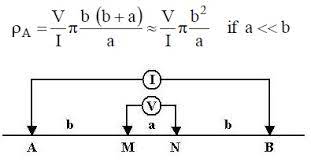
**ELECTRICAL RESISTIVITY METHOD**

Electrical resistivity technique based on the measurement of surface potential caused by the flowing of an electric current on the ground from an artificial source depends on the validity of Ohm's law for linear conductors R-Av/1, where the resistance is R in Ohms, offered to current flow I and P - conducting layer, then is Ρ= (A/L) R = (∆v / I) A/L

The above figure shows the arrangement and the current and potential lines in a homogeneous and isotropic medium.

**ELECTRODE SETUP**

The real-time measurements involves a various kinds of electrode setup are made, setups may differ in the electrode distance and geometry. Familiarly used configurations are Wenner, Schlumberger and dipole-dipole.In Wenner electrode setup, 4 electrodes, equi-distant one with respect to another.

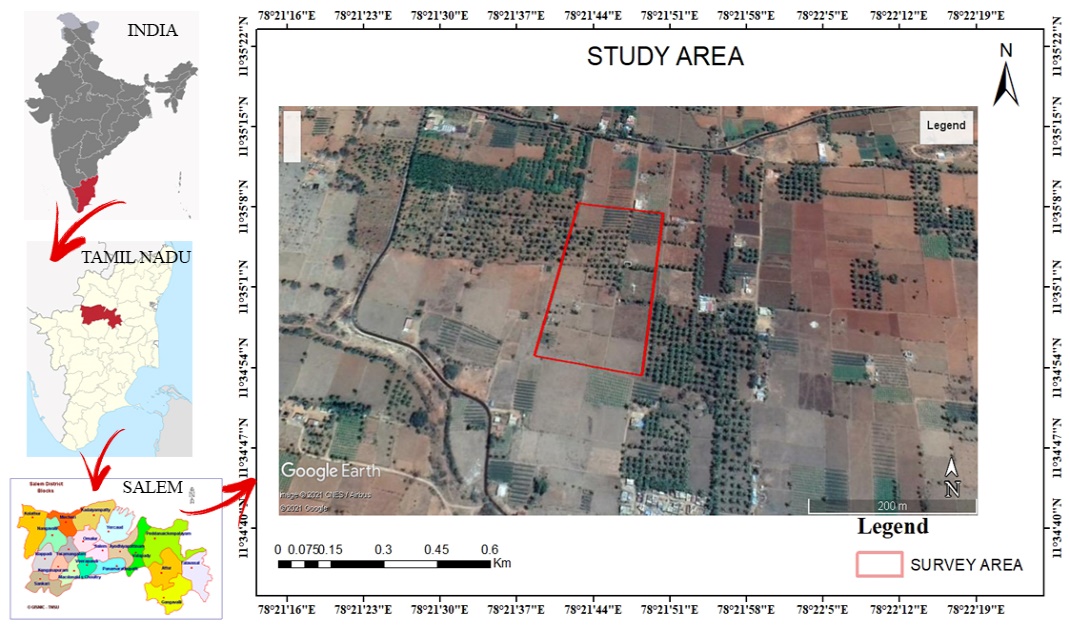
 Schlumberger setup is also similar to Wenner configurations, but in this condition the potential electrodes are kept close to one another and away from the current electrodes, with the distance between the potential electrodes (MN) being generally kept less than 0.2 AB.

Schlumberger electrode configuration

**HORIZONTAL PROFILING AND VERTICAL ELECTRICAL SOUNDING**

These methods are supported in greeting of the object to travel of galvanic prevailing. The resistivity of a shake object depends on its asphaltic schoolwork and is influenced to a really broad change by the interstitial food collection recognize there in. Electrical resistivity method involves the activity of layer possibility caused by the delivery of an electric underway. In factual earth measurements, a variety of electrode arrangements are utilized.

**STUDY AREA**

 The study area is from Veppilaipatti village, Salem district, Tamil Nadu. This area lies between north latitude and longitude 11⁰35’03″ and 78⁰21’35″,11⁰35’03’’ and 78⁰21’39’’ and south latitude and longitude 11⁰34’51’’ and 78⁰21’33’’ , 11⁰34’56’’ and 78⁰21’38’’. Salem district is bounded north Tamil Nadu and located between on 11.669437°N Lat, 78.140865°E Long at an average elevation of 278 m (912 ft) above the mean sea level except Yercaud hills. It has an area of about 7905.38 Kms with 38, 96,388 inhabitants. Salem surrounded by hills on all sides.

**GEOLOGY AND GEOMORPHOLOGY OF STUDY AREA**

Salem district is rich in mineral deposits like Magnesite, Bauxite, Granite, Limestone, Quartz and Iron ore. Geologically, the entire Salem district can be classified into hard rock formation. More than 90 percent of the district is underlain by hard rock of Archaean age. Quartz, Feldspar, and limestone those are resistant to weathering and also seen as patches in Charnockite and gneissic varieties and the above rock types found Sedimentary Formation. The granulite terrain of Salem area has witnessed two major periods of granitic activity – one during Late-Archaean to Early Palaeo-Proterozoic and the other during Neo-Proterozoic times. The granites of older event are restricted to the southern part of Salem district i.e. North of Moyar – Bhavani – Attur Lineament (MBAL), while the younger Pan-African event is spread in the terrain south of MBAL.

**RAINFALL AND CLIMATE**

Salem locale gets precipitation underneath the affect of both southwest and northeast rainstorm. The northeast rainstorm fundamentally contributes the precipitation inside the range. Precipitation data from six stations over the period 1901-2003 were utilized and a examination of the investigation shows up that the standard annually precipitation over the zone shifts from around 800 mm to 1600 mm. It is the slightest around Sankari (800 mm) inside the southwestern parcel of the area. It persistently increases towards north, northeast and east and achieves a most prominent around Yercaud (1594.3 mm) inside the northern portion.

**HYDROGEOLOGY OF THE STUDY AREA**

Salem locale is underlain totally by Archaean Crystalline courses of action with afterward alluvial stores happening along the conduit and streams courses like Cauvery, Thirumanimutharu, Sarapangandhi are the imperative conduits inside the district. But Cauvery, other streams stream because it were in the midst of swirling seasons. Weathered, fissured and broken crystalline rocks and the afterward alluvial stores constitute the imperative aquifer systems inside the zone. The penetrable courses of action inside the zone are spoken to by conduit alluvium. These alluvial stores are kept to the Major Stream and stream courses because it were. Ground water happens underneath phreatic conditions. The most prominent drenched thickness of these aquifers is up to 10 m depending upon the topographic conditions. The troublesome cemented crystalline rocks of Archaean age speak to weathered, fissured and broken courses of action of gneisses, stones, Charnockite and other related rocks.

**OBJECTIVES OF THE STUDY**

The objectives of present study is to explore ground water.

1. To portray the outcrop geology of ponder area.
2. To investigate sub surface breaks, weathered zone and water filled pores spaces at a chosen depth.
3. To choose appropriate area to vertical electrical sounding utilizing profile information 3D plot created from surfer.
4. To investigate ground water potential of the chosen point and to choose a point to penetrate for high yielding bore well. (Using Vertical electrical sounding, Schlumberger electrode configuration).

**MATERIALS AND METHODOLOGY**

There are a few variations in electrical method. In reality, biggest assortment of strategies is conceivable in electrical method of prospecting and it'll be no shock in case unused strategies are created in upcoming years. In electrical methodologies, the characteristic electrical field in a locale was inspected or the ground is charged by an manufactured electrical field and scattering of the electric field at the surface of the soil was explored.

METHODOLOGY FLOW CHART

**ELECTRICAL RESISTIVITY METHOD**

Electrical strategy methods depend on the response of the soil in passing the stream of power. Among the geophysical strategies, electrical resistivity procedures appreciate the foremost critical notoriety and are broadly utilized for both regional and point by point groundwater overviews since of its better settling control, less costs as well as run of fittingness. Electrical resistivity procedures have utilized in this case to Depict potential zones of subsurface water and to find thickness of submerged layers, significance to the subsurface geography.

**SCHLUMBERGER ARRANGEMENTS**

The Schlumberger terminal setups are additionally a cluster like Wenner method, contrasts in putting the two current terminals in bigger gap, between the potential (inward) arrays. As it were one set of cathodes either potential or current are moved to extended interims at a time whereas conducting profundity soundings not at all like in Wenner cluster where there are four electrodes are moved at the same time.

**INTERPRETATION OF RESISTIVITY DATA**

Elucidation of resistivity information in words of the subsurface geology and hydrology shapes 2 imperative stage within investigation of subsurface water. Point of translation of resistivity, to decide the thickness of layer and resistivity of diverse horizons present. Interpretation of V.E.S information is both quantitative and subjective. The sort of V.E.S bend gotten demonstrates the nature of subsurface that will be anticipated in a zone. For case, a H sort bend with difficult shake territory be deciphered.

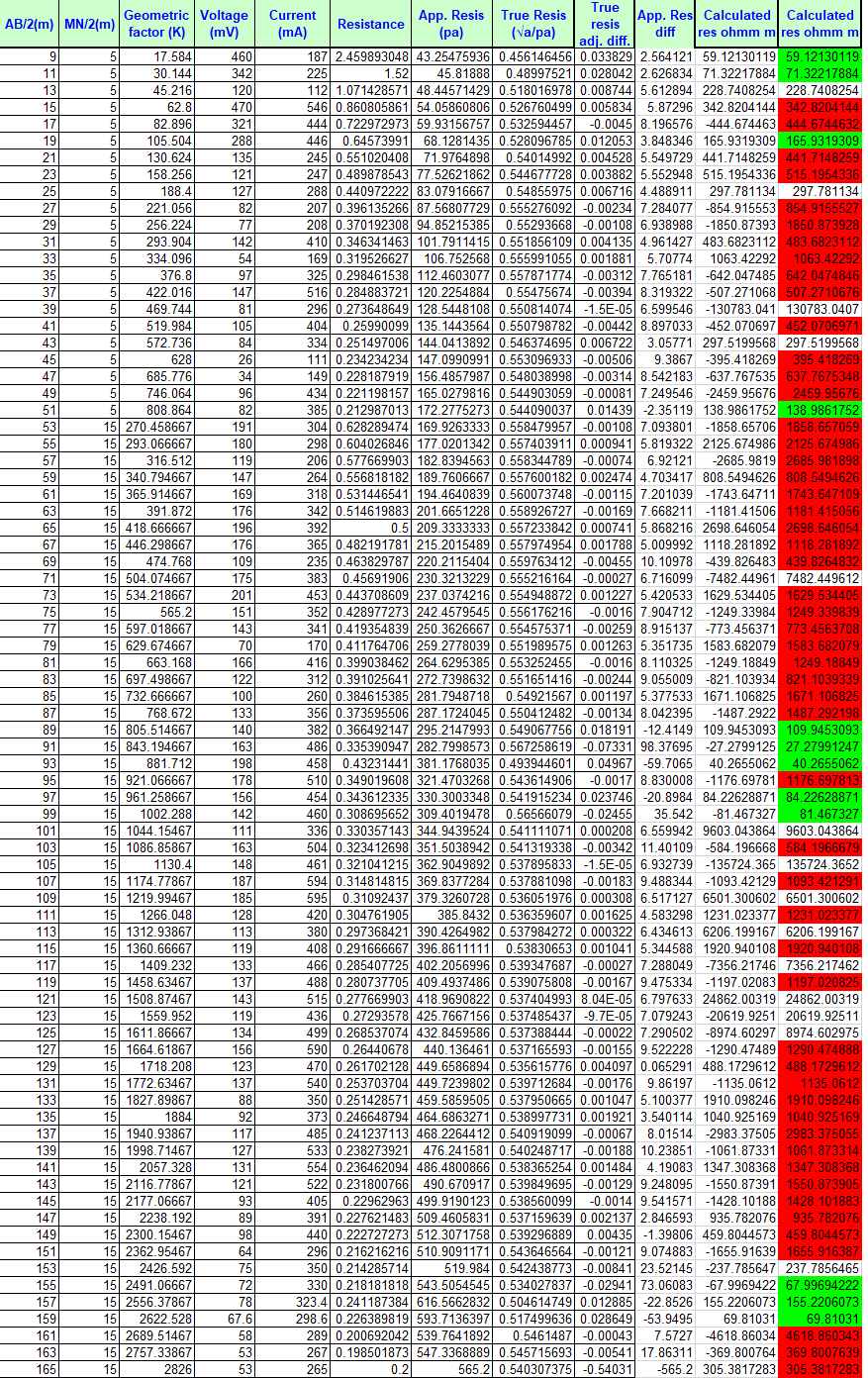
**SELF-POTENTIAL**

The self-potential (SP) strategy may be an inactive electrical geophysical strategy based upon the estimation of spontaneous or natural electrical potential created within the soil due to: electrochemical interactions between minerals and subsurface liquids, electro kinetic forms coming about from the flow of ionic liquids or thermoelectric mechanisms from temperature angles within the subsurface. A few physical forms caused sources of SP are still hazy. Groundwater is thought to be common calculate capable for SP. Potentials are produced by the stream of water, by water responding as an electrolyte and as a dissolvable of distinctive minerals.

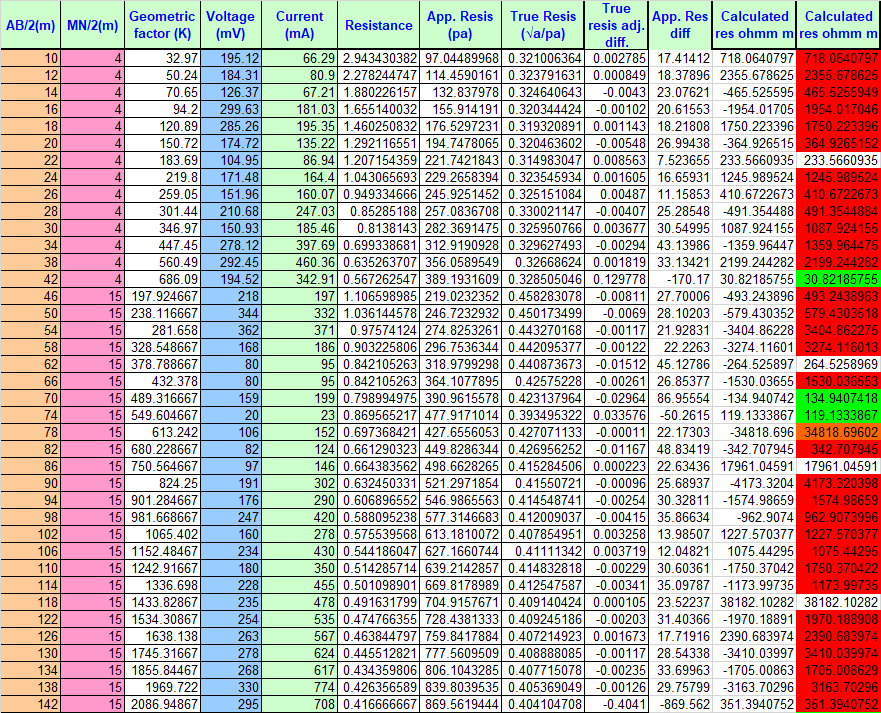
**RESULT AND DISCUSSION**

VES are done in field utilizing shlumberger arrangement additionally self-potential itself. In all 3 soundings were done and analyzed. The least and most extreme value of AB/2 ( currentelectrode division) chosen for the studies is 2m to 60m, the clear resistivity information of Vertical Electrical Sounding areas has plotted on graph (log-log) and coordinated with master curve for getting the layers. The depth sounding curves are classified based on layer resistivity combinations.

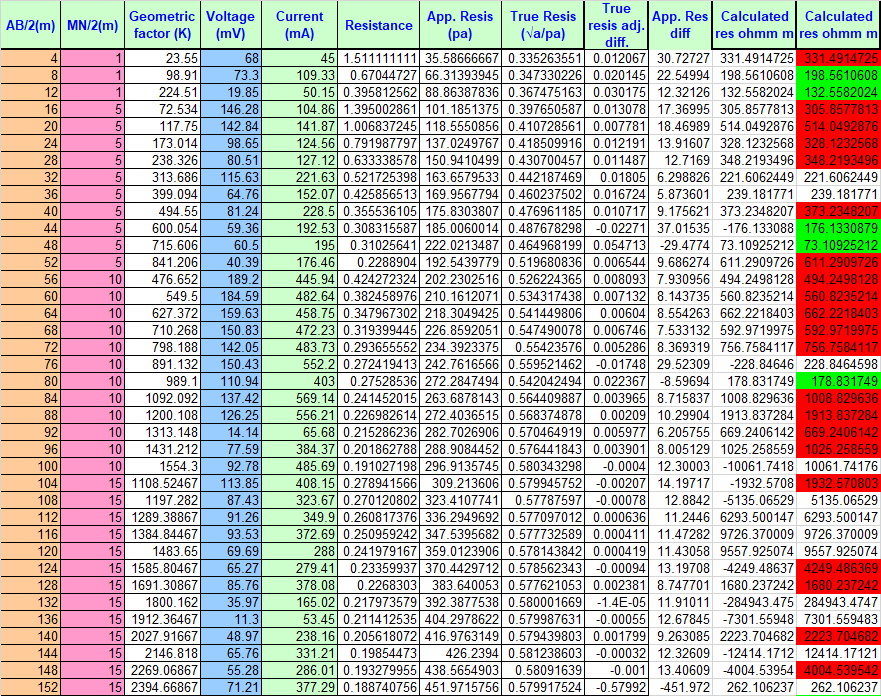
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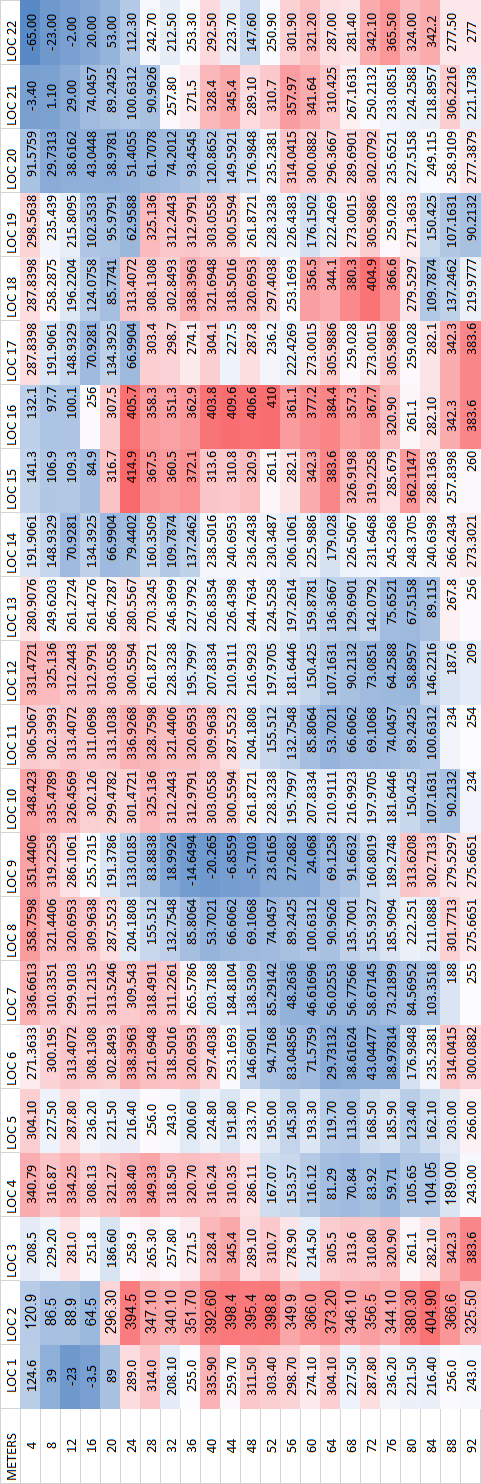
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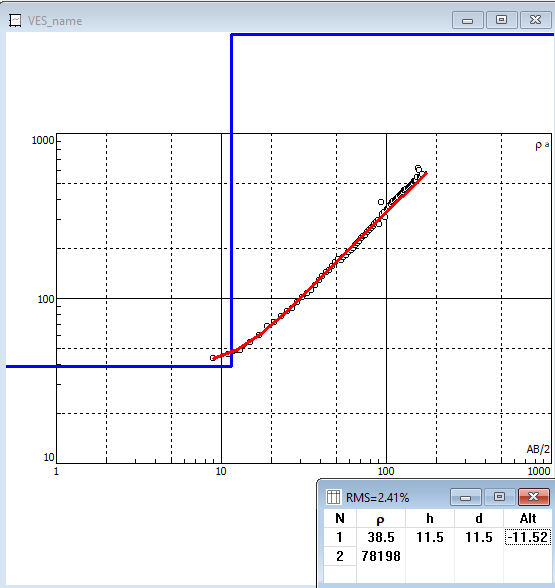
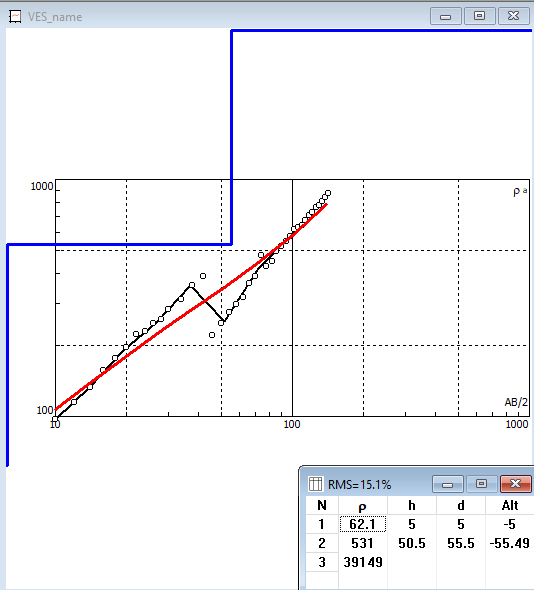


**DATA OF VES READING 3**

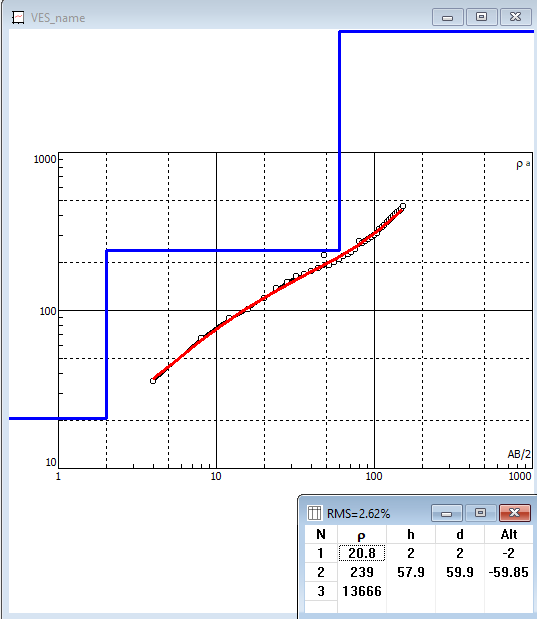
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**TABLE OF SELF-POTENTIAL DATA**

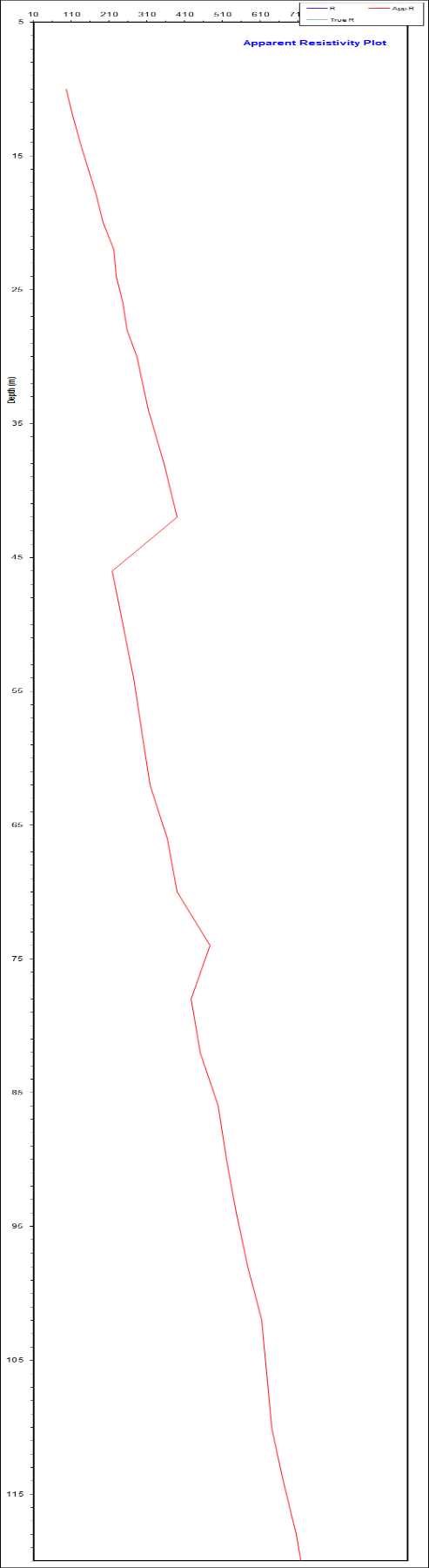
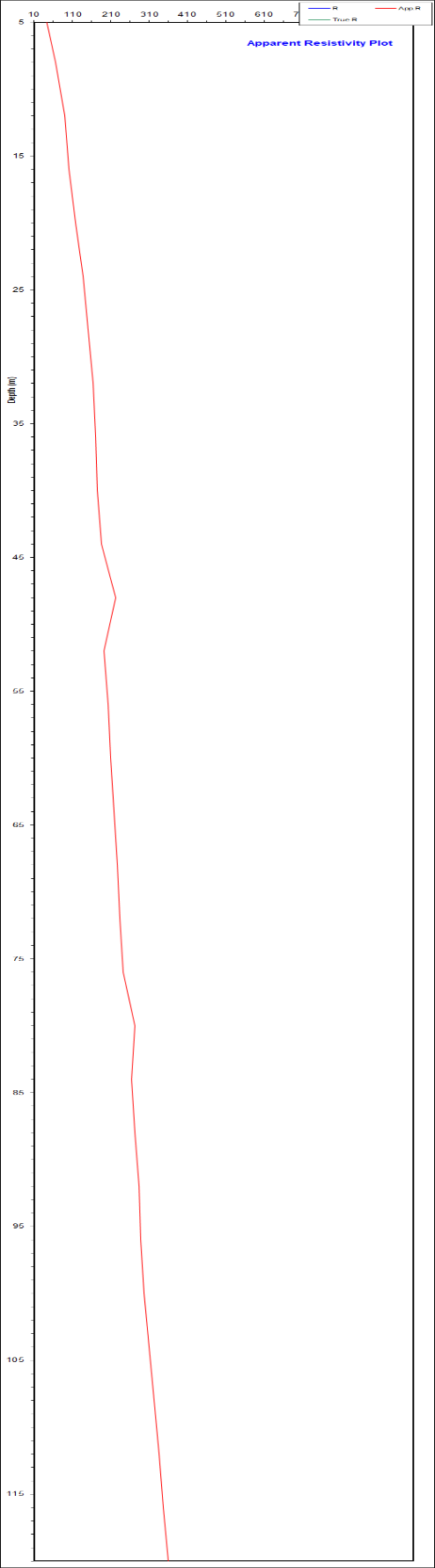
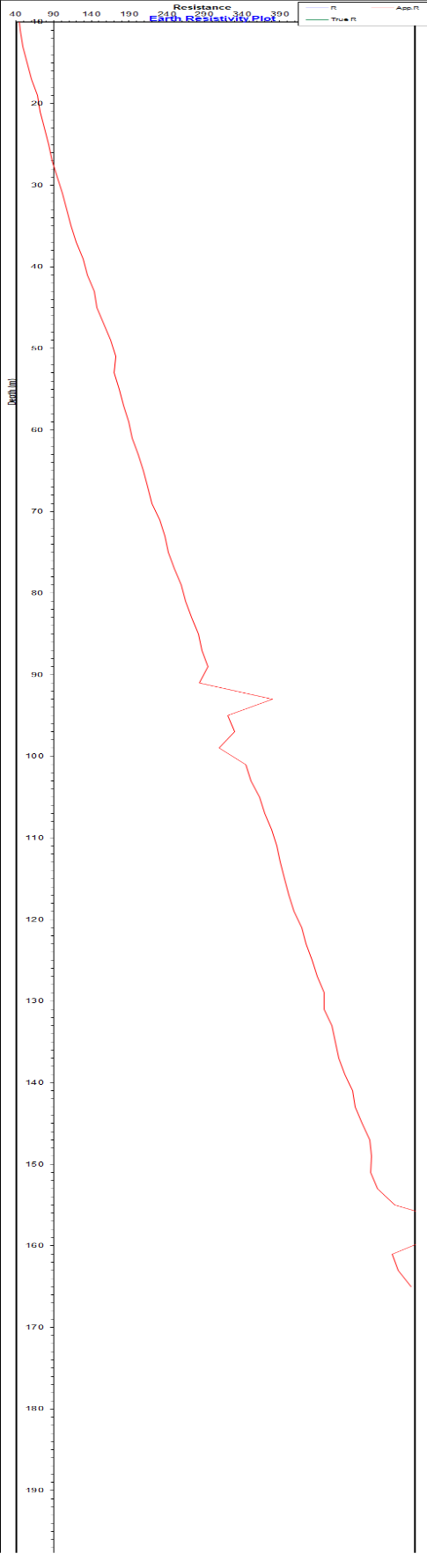
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**Fig - VES CURVE AT LOCATION 1 Fig - VES CURVE AT LOCATION-2**



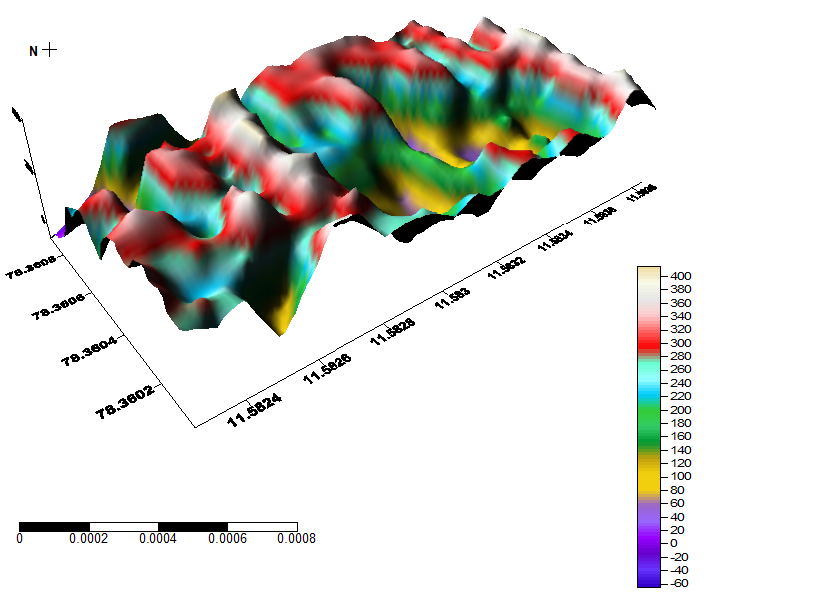
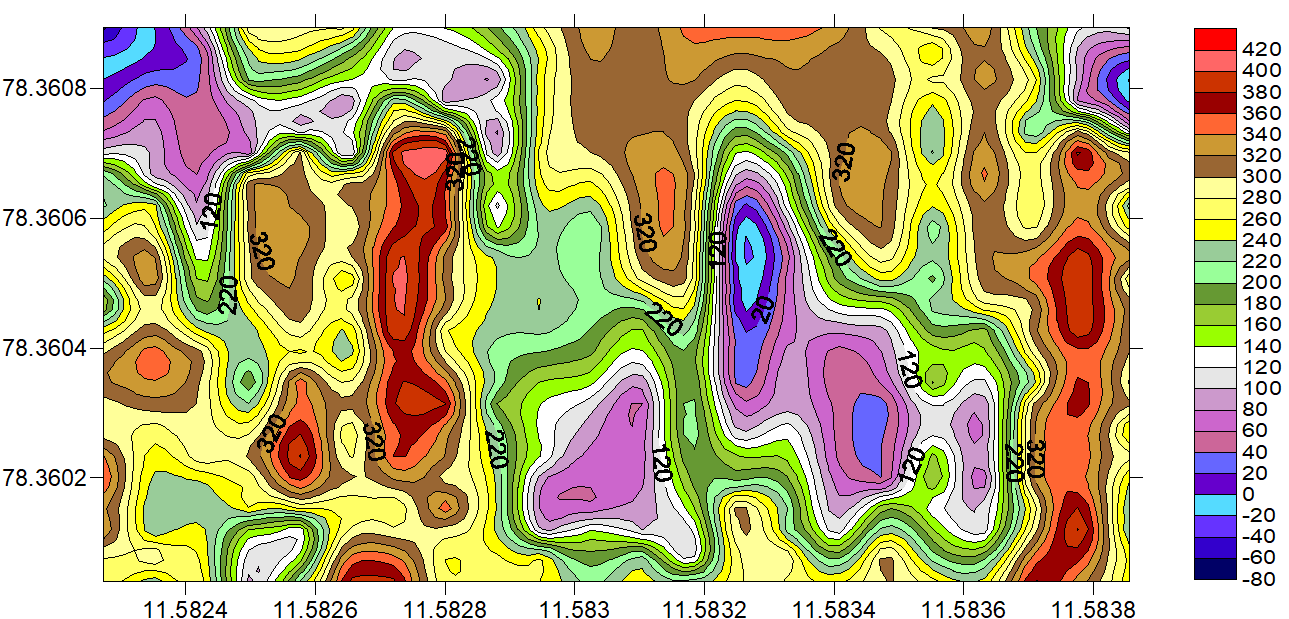
**Fig - VES CURVE AT LOCATION 3**

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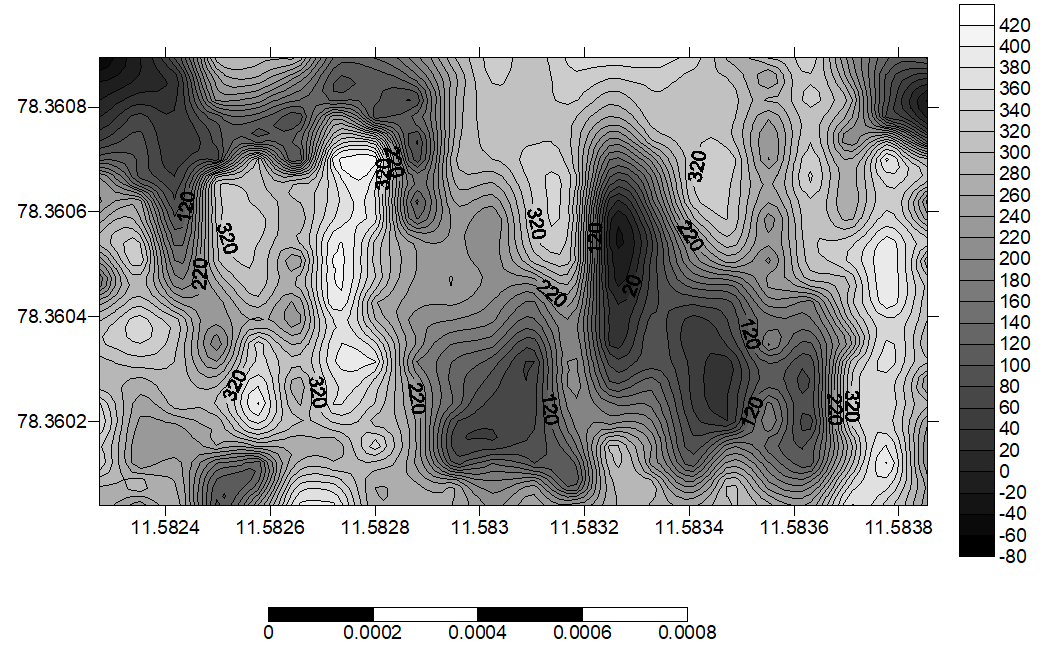
**Fig-1 LOC 1.APPARENT RES PLOT VS DEPTH**

**Fig-2 LOC 2.APPARENT RES PLOT VS DEPTH**

**Fig-3 LOC 3.APPARENT RES PLOT VS DEPTH**

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**3D APPARENT RESISTIVITY PLOT APPARENT RESISTIVITY CONTOUR MAP**



**APPARENT RESISTIVITY CONTOUR MAP AND THEIR DEPTH**

**CONCLUSION**

Ground water exploration has been done in part of the Veppilaipatti Village, Vazhappady Taluk, Salem District in Tamil Nadu using 2D profiling and VES using Schlumberger electrode configuration and self-potential method. Electrical sounding strategy of the electrical resistivity strategy and self-potential strategy has demonstrated to be effective and exceedingly successful within the recognizable proof and outline of underground. Based on self-potential information it shows the three negative values point within the zone considered as the streaming potential point within the area (the weathered water saturated point). At the same point took the VES based on Schlumberger strategy, distinguished three water bearing zone 67m, 30m and 73m depth. The explored VES (VES POINT 2, Depth at 73m) recommended as high yielding well bore point among the studied region. In final it is that the electrical resistivity study has helped in understanding the ground hydrology and the event of salt and brackish water within middle portion of the study region and the surfer diagram uncovers that 3D subsurface of the study area.

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