

# Electrical Resistivity Technique for Demarcation of Groundwater Quality Zones in Parts of Vanur block, Villupuram district, Tamil Nadu

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**Abstract:** *Geoelectrical Studies were carried out in parts of Vanur blocks of Villupuram District, Tamilnadu. The geological formations comprise Coastal alluvium with clay, Beach sand, Cuddalore sandstone and limestone underlain by Charnockite at different depths. 50 Vertical Electrical Soundings were carried out to assess the quality of ground water in the area. All VES were interpreted through Curve Matching Technique using Standard Master Curves as well as IP 2 WIN program through the computer. Based on the results, various thematic maps have been prepared, viz., Iso resistivity contour, apparent resistivity contour for different depth ranges, longitudinal conductance contour and Electrical Conductance contour. Interpreted VES results coupled with Hydrochemical data have been used to demarcate the area with different ground water quality. The results revealed that in the Shallow zones (down to 50 m) with saline formation water exists in the northeastern part, while brackish water is present in the central part and Fresh water occurs in the eastern and western part of the area.*

**Keywords:** Coastal, Ground Water, Geoelectrical, Isoresistivity, Longitudinal conductance.

## 1. Introduction

There is an ever-increasing demand for fresh water resources to meet the requirements for industrial, agricultural and domestic sectors. The over-exploitation of groundwater resources and its contamination have put a stress on the available groundwater resources in the country. Geophysical surveys are useful in the study of most subsurface geologic problems. Such surveys have found enormous applications in hydrogeological studies. Electrical resistivity method of geophysical technique happens to be the most preferred methods in groundwater contamination studies and hydrogeologic investigations [12] and [4] However, Electrical resistivity surveys have been found very useful for mapping the resistivity structure of the complex subsurface geology [17] and [9] and the integrated use of hydrochemical and geophysical methods is often recommended [2], [11], [10], [15] and [1].

Vanur watershed is located in the Vanur block of Villupuram district between Latitude 12°10'00" to 12°50'00" and Longitude 79°44'00" and 79°47'00" of Survey of India Top sheets 57P/12, 16 and 58M/13. The aerial extent of the watershed is 156.4 kms. (Fig 1). Sankaraparani river traverses at Southwestern part, Nallavur Ar. Traverses through the central portion of the block. The block enjoys a typical semi-arid climate. It receives an average annual rainfall of about 1220 mm. The Vanur watershed is located in the Southeastern portion of the Vanur block.

In the present study an attempt has been made to assess the quality of ground water using surface electrical methods in Vanur Block, Villupuram district, Tamil Nadu.

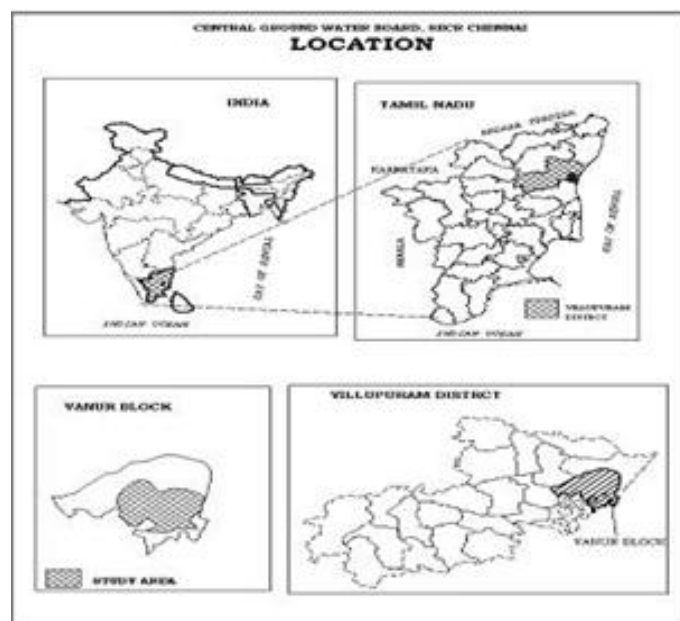


Fig: 1 Location Map of the study area

## 2. GEOLOGY

The block is underlain by the crystalline metamorphic complex in the northwestern side and sedimentary track on the southeastern side. Thickness of sediments exceeds 600m near the southeastern part of the block [5] and [8]. The stratigraphic succession of litho units encountered in the area is shown in table-1

**TABLE-1 STRATIGRAPHIC SUCCESSION OF LITHO UNITS**

<b>A. Age</b>	<b>B. Formation</b>
C. Recent	D. Alluvium
E. Tertiary	F. Cuddalore sandstone, Ottai clay
G. Upper Cretaceous	Turuvai Limestone, Vanur sandstone
-----Unconformity-----	
H. Archean	Crystalline (Gneisses & Charnockites)

**3. METHODOLOGY**

Fifty Vertical Electrical Soundings were conducted in the study area. Schlumberger configuration had been employed with D.C resistivity meters (DDR-4 of IGIS Hyderabad). Current electrode separation could extend up to a maximum of 600 m. Initially, the VES curves were interpreted during field survey by curve matching techniques using two and three layer master curves [14] and [3] and subsequently IPI 2 Win program is used on interpretation thereafter equivalent resistivities of different layers were estimated.

**4. RESULTS AND DISCUSSION**

Based on the interpreted results of Vertical Electrical Sounding conducted in the area, three to seven subsurface Geoelectrical layers could be deciphered [6] and [7]. With a view to depict the survey results in a realistic and effective way, various thematic maps have been prepared, viz., Iso resistivity contour, and apparent resistivity contour for different depth ranges, longitudinal conductance contour. From chemical analyses of ground water sample electrical Conductance contours have been prepared.

The Iso resistivity contour map has been drawn on the basis of VES results is shown in Fig 2. It is possible to demarcate the area with different ground water quality [16]. Sand with saline water with low resistivity of less than 5 ohm. m is present in Vilvanatham and Kaluvari villages in the northeastern part of the survey area. Brackish water with moderate resistivity values is present in the central part. Fresh water with high resistivity value of more than 20 ohm. m is present at Mattur village in the eastern part and Kuthapakkam village in the western part of the area.

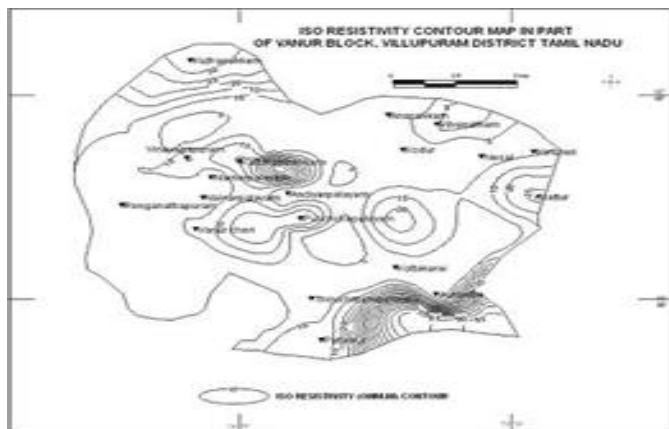


Fig: 2 Iso Resistivity Contour Map

The apparent resistivity contour maps (Fig 3) have been drawn on the basis of apparent resistivity values (AB/2=20 m) for different electrode separations. Sand with saline water with a low resistivity value of 3 ohm. m is present in Vilvanatham and Kaluvari villages in the northeastern part. Brackish water with moderate resistivity values is present in the central part. Fresh water with high resistivity value of more than 20 ohm.m is present at Mattur village in the east and Kuthapakkam village in the west.

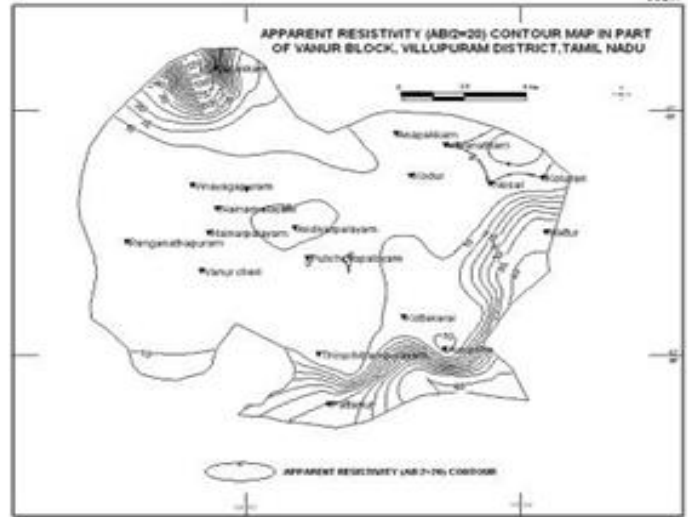


Fig:3 Apparent Resistivity (AB/2 = 20) Contour Map

Longitudinal conductance ( $S = h/\rho$  in mhos) contour map (Fig 4) has been drawn on the basis VES results. Sand with saline water with maximum S value of 25 mhos is present at Vilvanatham and Kaluvari Village in the northeastern part. Brackish water with moderate S values are present in the central part. Fresh water having minimum S values of 5 mhos is present in the east and west.

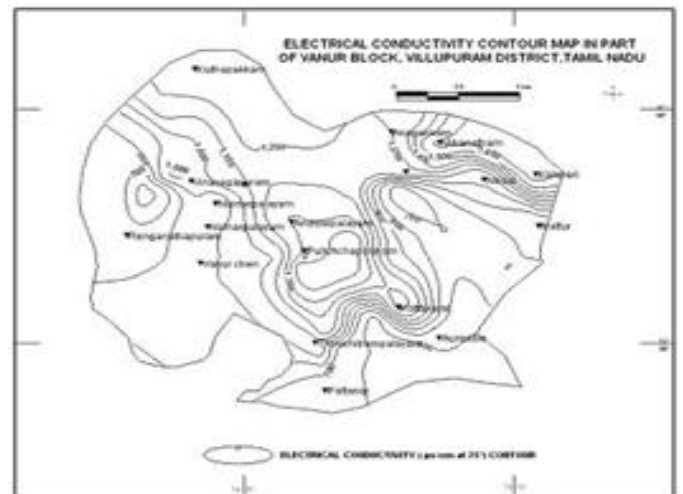


Fig. 4 Longitudinal conductance contour map

Electrical Conductance contour (Fig 5) has been drawn on basis of EC values. The values were analysed from water sample collected in field near by VES points. The groundwater in the area has EC values ranging from 447 to 2480  $\mu\text{s} / \text{cm}$ . Saline groundwater with maximum EC value of 2480  $\mu\text{s}/\text{cm}$  at 25 $^{\circ}\text{C}$  exists at Vilvanatham, Kazuperumbakkam and Kaluvari Village in the northeastern part. Brackish water with moderate EC values is present in the central part. Fresh water with minimum EC value of 447  $\mu\text{s}/\text{cm}$  at 25 $^{\circ}\text{C}$  occurs in the eastern and western part of the area.

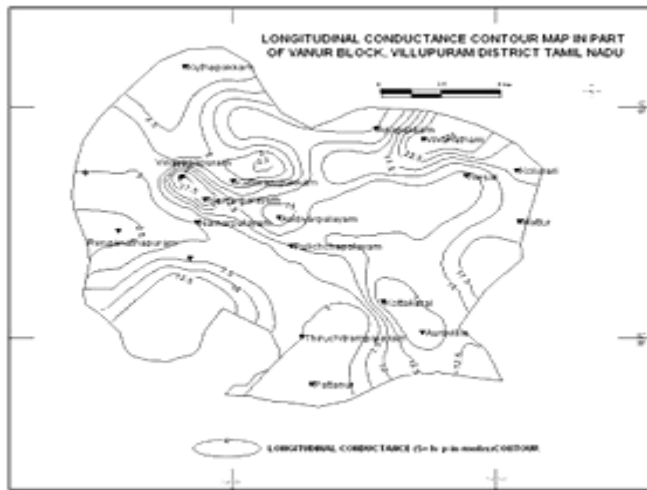


Fig.5. Electrical Conductance contour map.

## 5. CONCLUSIONS

Surface electrical methods can be used as a tool to assess the quality of ground water. It is possible to demarcate areas with different ground water quality. Interpreted VES results coupled with hydrogeological data have been used to demarcate the area with different ground water quality. An attempt have been made to correlate the results of Geoelectrical studies and chemical studies and a broad guide line values are prepared to identify the quality of formation water with Geoelectrical survey. Sand with saline water with low resistivity of less than 5 ohm.m is present at Vilvanatham and Kaluvari villages in the northeastern part of the survey area. Brackish water with moderate resistivity values are present in the central part. Fresh water with high resistivity value of more than 20 ohm. m is present in the eastern and western parts.

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