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GEOELECTRICAL CHARACTERIZATION OF SUBSTRATA BY USING GEOELECTRICAL IMAGING TECHNIQUE IN ONGUR RIVER SUB BASIN, TAMILNADU, INDIA

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ABSTRACT

This Paper describes the results of the study of Geo electrical characterizes of the substrata with respect to Hydrogeology by using Geo electrical Imaging technique in Ongur River Sub Basin, Tamil Nadu. In all, 77 Vertical Electrical Soundings (VES) were carried out using CRM 500 resistivity meter, adopting Schlumberger configuration method with the maximum current electrode separation of 200m depending on the available spread. The study area spreads over an area of 1480.08 Sq.km. The VES data were interpreted by 'IPI2Win' software. Based on the VES results, pseudo geo-electric sections and geo-electrical resistivity cross-sections along two different directions have been generated. The disposition and vertical extensions of the sub surface geological formations have been deciphered with the help of these sections. The VES results of the study area were correlated with local geology and hydrogeology. Major part of the study area is covered by crystalline formations, whereas few VES locations at VES 8, 24, 31, 45, 52 and 62, presence of Shale formations were observed, which covers the north central part of the study area and locations at VES 67, 69 and 70 are falling in alluvium covered area on the eastern part. The estimated depth of the basement is more than 10 mbgl in north central and eastern part of the study area, where as remaining area is less than 10 mbgl. The VES technique can be effectively used for deciphering the subsurface lithological contacts, which will help in identifying areas suitable for sustainable development of ground water resource in hard rock terrains.

Keywords: Ongur River Sub-basin, Geo Electric Imaging, Pseudo Cross Section, Schlumberger Configuration.

1. INTRODUCTION

Ongur river sub basin is one of the sub basin of Varahanadi river basin in Tamil Nadu. Ongur River sub basin consists of Ongur and Periar rivers, which are ephemeral in nature. The sub basin includes major part of Kancheepuram district and remaining part from Tiruvannamalai and Villupuram districts. The sub basin is observed with sedimentary formation along the coast and hard rock terrain in the western part. The sub basin lies between 79°30’ and 80°00’ east longitudes & 12°15’ and 12°30 north latitudes. The total areal extent of the Ongur sub basin spreads to an area of 1480.08 Sq.km. The study area is covered by Survey of India topographic sheets 57P/11, 52P/15, 57P/16 and 57P/12 **(Fig 1).** Geoelectrical techniques have been successfully applied for deciphering the characteristics of substrata by many workers (S.V.S.Sarma et al 2004, Narendra P, et al 2010). Arulprakasam et. al., (2009) have used the geoelectrical imaging technique for deciphering the sub surface geological formations, which will help in identifying areas suitable for sustainable development of ground water resource. Singh et al. (2006) have studied the 1-D resistivity-depth models and 2-D resistivity structures in terms of pseudo and resistivity sections. Singh et al. (2006) stated that the inversion of IP and resistivity pseudo sections generate a 2-D model that is in accordance with geologic constraint. Barker et al (2001) were used electrical imaging technique for delineation of contaminant groundwater zones due to the tannery effluents. Murali Krishna (2007) has used IPI 2Win for pseudo cross section and 2D geoelectrical sections to identify characteristics of the fault zone to construct artificial recharge structure. When compared to geophysical investigations this method obviates the need for manual investigation of spatial extension of various layers and can hence provide more accurate results. The deciphered aquifer geometry can be used in formulating strategies for sustainable development of ground water resource. An attempt has been made to decipher the aquifer boundary and variation in substrata by utilizing geo electrical-imaging techniques in Ongur River Sub Basin, Tamil Nadu.

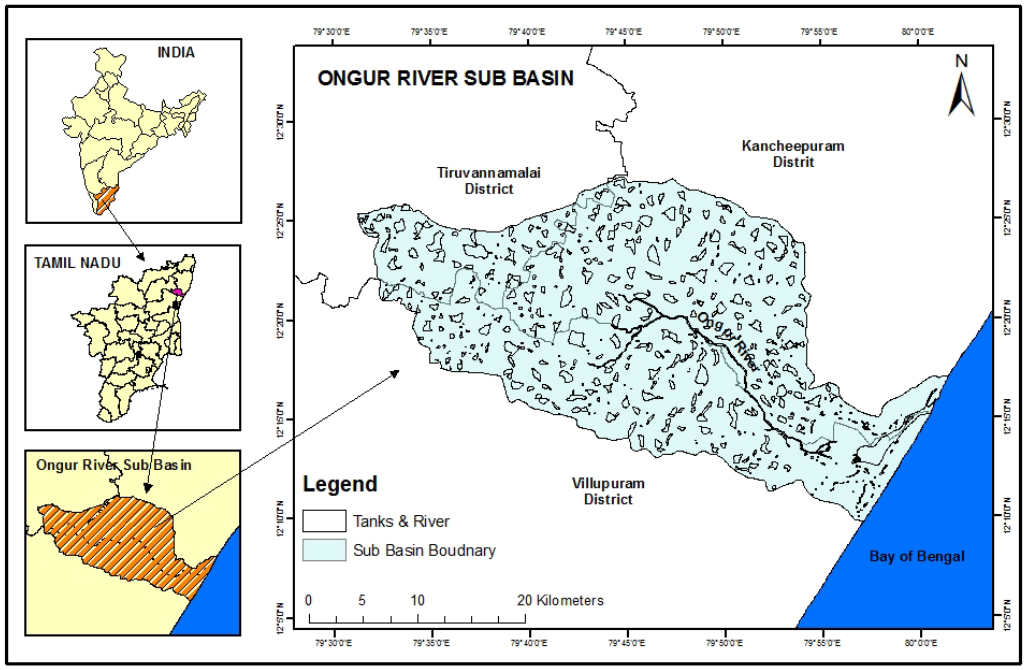

Fig1.Location Map of Study area.

2. METHODOLOGY

Vertical Electrical Resistivity Surveys were conducted at 77 sites at regular interval in Ongur River Sub Basin, Tamil Nadu, to delineate the geo electric spectrum of subsurface geological formations of the area. The electrodes were arrayed in Schlumberger configuration with CRM 500 resistivity meters depending on the availability of required space. The collected data was analyzed to infer the subsurface geo-electric substratum. The locations of the VES points and the representative VES profile lines are shown in **Fig.2**. The interpreted geo electrical layers were then used for generating pseudo geo-electrical sub surface images and cross sections using IPI2WIN software.

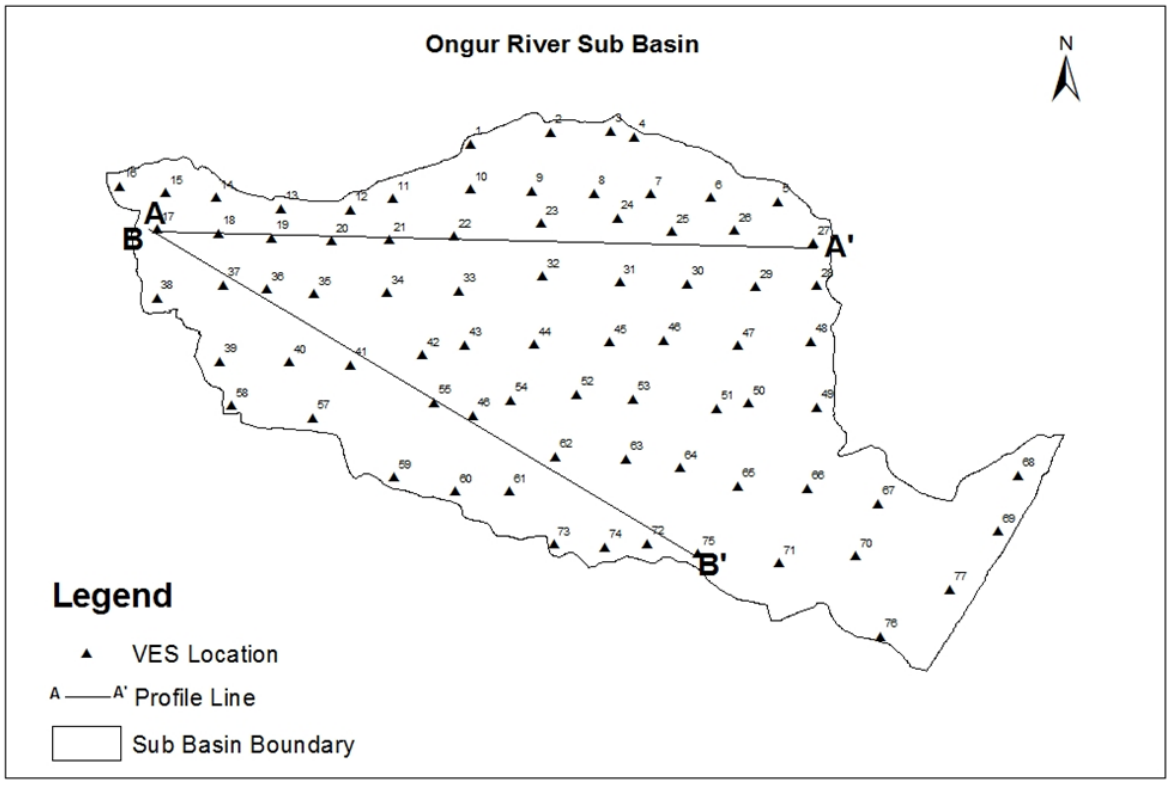

Fig. 2: VES Locations and Profile Section

3. RESULTS AND DISSCUSSION

Subsurface Imaging is a geophysical imaging technology that measures electrical resistivity in sub surface geological formations. This technology can be used to obtain "snapshot" images of relatively static subsurface conditions for site screening or characterization. The VES sounding curves brought out three to four geo electric layer sections revealed AA, HA, QQ and QH types of curves. The theoretical curves (Orellana and Mooney, 1966), which are normally used in the quantitative interpretation of VES data, are with the assumptions that the subsurface layers are regular, homogeneous and plane-parallel and have infinite lateral extent. Based on the analysis of apparent resistivity and quantitative VES results, pseudo-cross sections were prepared in different direction in NW-SE and W-E, to delineate various subsurface geological formations and are detailed below.

3.1. Geoelectrical cross-section along Kodiyalam - Palavur (W-E; A-A').

Geo electrical Imaging Technique is applied for sub-surface pseudo cross-section A-A' along Kodiyalam - Palavur in West – East direction and shown in **Fig 3**. This technique reveals that formation with resistivity less than 25 ohm.m indicate top soil, resistivity ranges of 25-100 ohm.m indicate weathered formation, resistivity ranges of 100-400 ohm.m indicate fractured rock and more than 400 ohm.m indicate massive rock. In this pseudo cross section, it can be deciphered that location at VES 23 (Kil athivakkam) is occupied by shale formations where as other VES occupied by Charnockite. Thickness of the bedrock is more than 10m at VES 23 (Kilathivakkam) which is due to the presence of Shale and VES 27 (Palavur) due to the presence of highly weathered rock.

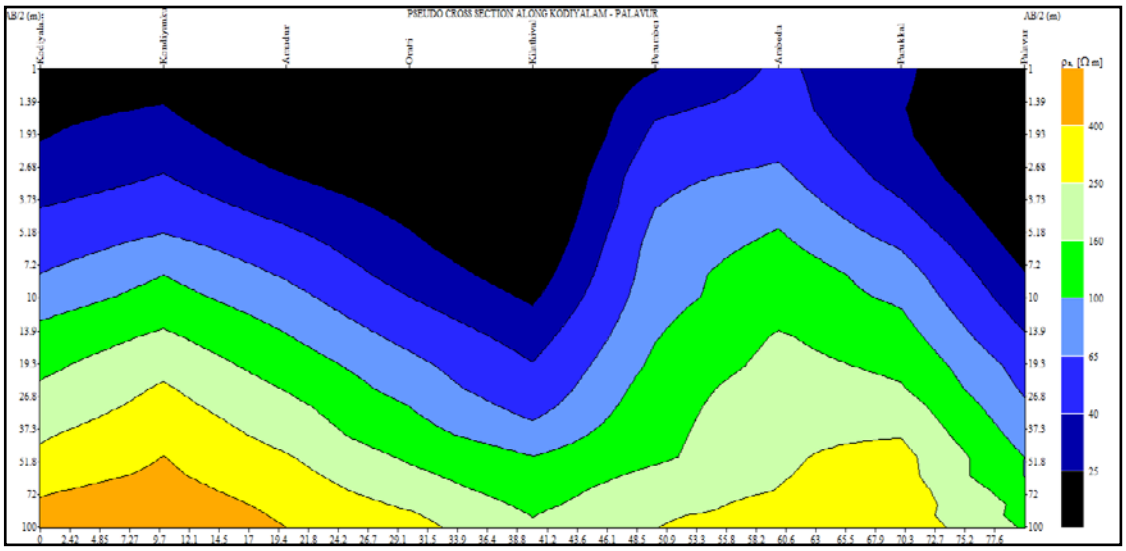

Fig 3. Pseudo-Cross Section along Kodiyalam - Palavur.

3.2 Geo electrical cross-section along Astinapuram - Kolapakkam (NW-SE; B-B').

Geoelectrical Imaging Technique is used to draw sub-surface cross-section (B-B') along Astinapuram - Kolapakkam in NW –SE direction (Fig 4). It is observed that the resistivity less than 16 ohm.m at Astinapuram (VES 17), Palaveri (VES 37), Dhadapuram (VES 40), Panchalam (VES 55) and Pasar (VES 61) indicate saturated top soil where as other VES are more than 16 ohm,m indicate wet top soil. Depth to bedrock is encountered at 4 m at Sengenikuppam (VES 36) where as other VES are more than 4 m. Resistivities ranging of different litho unit are similar to that of cross section described earlier.

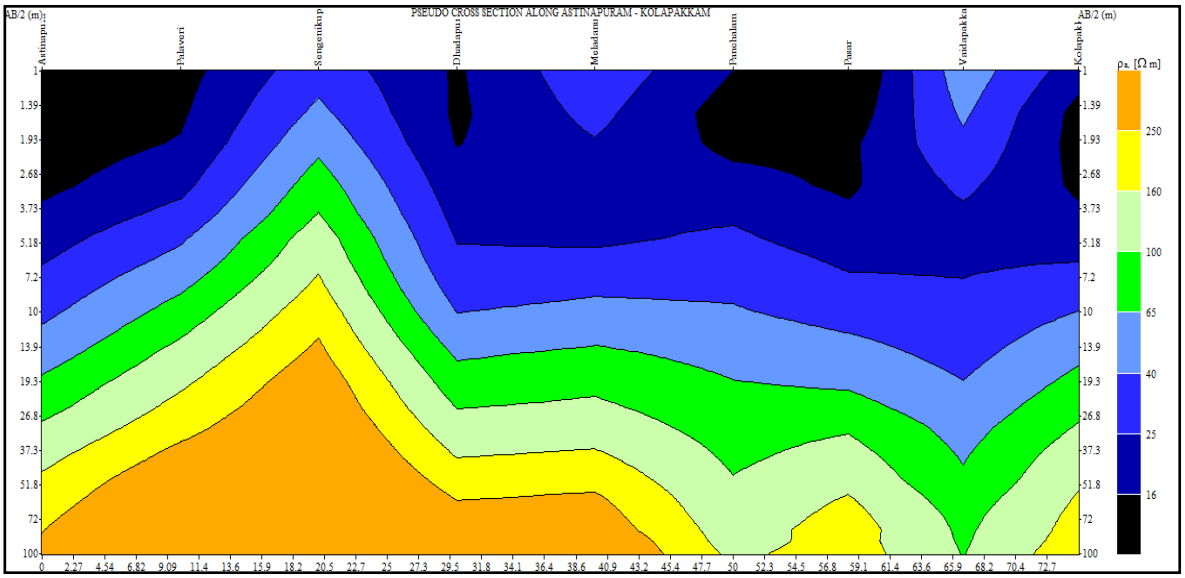

Fig 4.Pseudo Cross Section along Astinapuram - Kolapakkam

4. CONCLUSIONS:

Geoelectrical Imaging Techniques have been successfully applied for delineating the subsurface geological formations. Pseudo cross-section has been prepared using geoelectric imaging techniques. As compared to geophysical investigations, this method obviates the need for manual investigation of spatial extensions of various layers and can hence provide more accurate results. Based on the correlation of the results of the study with the field condition, the resistivity ranges were found to denote formations mentioned against each. Resistivity ranging less than 25 ohm.m indicate top soil, between the range of 25-100 ohm.m indicate weathered formation, between the range of 100-400 ohm.m indicate fractured rock and more than 400 ohm.m indicate massive rock. At few VES locations (VES 8, 24, 31, 45, 52 and 62) having Shale formations covering the north central part of the study area and VES 67, 69 and 70 in the alluvium covered area covering the East coastal area. The estimated depth of the basement more than 10 mbgl where as remaining area is less than 10 mbgl. The study shows that Geo electrical Imaging Techniques can be successfully employed to map various litho units. The deciphered aquifer geometry can be used in formulating strategies for sustainable development of ground water resource.

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