Hydrogeophysical Assessment for Groundwater Resources In Lower Vellar Watershed, Cuddalore District, Tamilnadu, India

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Abstract: Seventeen Vertical Electrical Soundings were carried away in vellar river Bank of Bhuvanagiri and Chidambaram Taluk, Cuddalore District, Tamil Nadu to classify the development and management through Artificial Recharge zone in alluvium formation and identify the sub-surface lithological series. The most electrode division used is 100m by Schlumberger pattern. Geologically, sedimentary rocks are alluvium and tertiary formations. The resistivity reports were interpreted by using IPI2WIN software. The construe outcome shows 3 and 4 layer strata. It has been prepared pseudo section in comparison with the subsurface strata to validate the results.

Keywords: Vellar River, Artificial Recharge, Vertical Electrical Resistivity.

I. INTRODUCTION

The escalating demands for groundwater, in various parts of Coastal areas are of huge ecological, financial, public, and civilizing consequence. Therefore, the achievement of appropriate monitoring and safety actions is primary for their protection and for assuring upcoming use of this resource (Antonio Satriani 2012). At present, enormous awareness is created on modern geophysical methods for resolvehydro geological and environmental problems (D.W.Steepeles 2001, V. Naudet, 2008). Electrical and electromagnetic geophysical methods have been broadly used in groundwater investigations because, geophysical survey as a veritable tool in groundwater exploration.

Still, groundwater exploration in hard rock areas are often more complicated, as sedimentary terrain must be situated closely successful. Vertical Electrical Soundings is a familiar technique to assess electrical resistivity; this technique has been used for hydrogeological survey of sedimentary basin (Kelly and stanislav 1993). In general schlumberger array assumes importance and well used for groundwater survey due to the simplicity of the system, simple interpretation and rocky character of the allied instrumentation. The method is commonly used in sedimentary and hard rock region (Urish and Frohlich, 1990.). In addition, the method has been developing effectively to solve groundwater evils by several researchers (Yadav et al., 2010).

II. METHODOLOGY

In the present study, to know the subsurface Lithology and layer thickness of groundwater latent zone were carried out on different locations in seventeen vertical electrical soundings (VES). The resistivity signal dimensions were collected by using SSR-MP-AT model resistivity meter. A limit of 100m AB/2 spacing is used by Schlumberger configuration. The attain data were explored by using IPI 2WIN software.
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![Flow chart showing the methodology](Image)

**Figure 1 Flow chart showing the methodology**

In the present study, IPI2win software has been used for interpreting the field data and curve matching techniques. From the apparent resistivity data, the interpreted resistivity curve obtained using the software is shown in the Figure 3. It is observed that 3 layer curves are conquered in the Lower Vellar bank, however, 4 layer curves also obtained from the interpretation. The resistivity and thickness of various layers is given in the Table 1.

### III. RESULT AND DISCUSSION

The study helped to understand the sub surface Lithology and its groundwater latent regions in the Lower Vellar bank and its quality.

The electrical resistivity technique applied in sedimentary terrain to understand groundwater potential and sub surface lithological studies is little bit difficult and complex in terms of data analysis and interpretation. The present study reveals the hydro geological condition of the area with reference to groundwater potential using electrical resistivity survey helped to identify the potential groundwater zones and for better understanding the subsurface lithological variation and shallow aquifer potential an attempt has been produced to practice pseudo section and suitable recharge structure of the Lower Vellar bank. It is observed that 3 layer curves are conquered in the bank, but 4 layer curves also obtained from the interpretation. In general resistivity and layer thickness are varied from 0.02 ohm m to 18424 ohm m and 0.4 m to 66.6 m respectively. The curve types obtained are A, H, and QH, KH, HK, KQ. The output of the infer data using IPI 2WIN is presented in the Figure 3. The investigate on illustrate that the resistivity and thickness for first layer varied from 1.45 ohm to 1517 ohm and the layer thickness varied from 0.75m to 9.6 m. The dry soil might be the cause for high resistivity values over coastal alluvium. The second layer thickness 0.5 ohm to 45.8 ohm and 0.4m to 12.10 m. The underlying formation resistivity is generally depends on the compaction and water diffusion level. This low resistivity value range could be the presence of saline water formation. The third layer resistivity and thickness value range from 0.74 ohm to 18424 ohm and 1.67 m to 66.6 m respectively. The fourth layer resistivity and thickness range from 0.02 ohm to 149 ohm. The third and fourth layer resistivity values are detected high in the dry sand and low in Lower Vellar bank due to sandy clay are salt water interface formation.

### A. Pseudo section of electrical resistivity

For better understanding the subsurface lithological variation an attempt has been made to prepare pseudo section both side of river bank of the study area shown in the Figure 4. In the first zone resistivity value of < 5Ωm at 30 m depth which has saline water formation observed in near to the river boundary. The moderate resistivity > 20 to 30 Ωm observed at the depth varied from 5 to 10m in VES 3, 5 and 7 favorable for shallow groundwater development in the Lower Vellar bank. From this interpretation it shows clearly suitable place for Artificial Recharge zone Using Electrical Resistivity.

### IV. CONCLUSION

The study helped to learn the sub-surface Lithology and groundwater latent zones and its quality in the Lower Vellar bank. The present study reveals the hydro geological conditions of the area with reference to ground water potential.

The interpretation of true resistivity values and sub surface thickness has shown the potential of groundwater zones at various depths and location along the direction of Vellar River. Electrical resistivity survey helped to identify the potential groundwater zones and suitable recharge structure for the Lower Vellar bank. There are four layer strata in maximum VES location in the Lower Vellar bank.

The extremely low resistivity values are because of the presence of wet clay where as the high resistivity could be due to sand stone formation with ground water potential.

The resistivity pseudo cross section model is a more information techniques to analysis to sub surface variation at different depth levels in the Lower Vellar bank.

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Figure 2 VES Location Map

Figure 3 Geology Map of the Lower Vellar bank

VES 1 - Light House
VES 2 - Pudhukuppam
VES 3 - Thithampalayam
VES 4 - B.Mutlur
VES 5 - TN Pattinam
VES 6 - Bhuvanagiri
Figure 4 Interpreted resistivity curve of the Lower Vellar bank
Table 1 Interpreted resistivity data of the Lower Vellar bank.

| S.no | Location         | R1   | R2   | R3     | R4 | H1   | H2   | H3    | Curve Type |
|------|------------------|------|------|--------|----|------|------|-------|------------|
| 1.   | Light House      | 230.00 | 33.80 | 3806.00 | -  | 1.20 | 10.10 | -     | H          |
| 2.   | Pudhukuppam      | 1517.00 | 45.80 | 18424.00 | -  | 1.01 | 7.31  | -     | H          |
| 3.   | Thithampalayam   | 6.54  | 1.34 | 5.78   | 19.80 | 0.78 | 0.40  | 66.60 | HA         |
| 4.   | B.Mutlur         | 9.39  | 31.00 | 9.72   | -  | 6.19 | 6.08  | -     | K          |
| 5.   | Tn Pattinam      | 16.78 | 2.45 | 4.74   | 139.60 | 1.00 | 12.10 | 46.36 | HA         |
| 6.   | Melbuwanagiri    | 1.74  | 5.28 | 0.74   | 4.96 | 3.99 | 2.70  | 4.60  | KH         |
| 7.   | Adhivaraganatham | 1.69  | 7.59 | 0.00   | -   | 5.70 | -     | -     | A          |
| 8.   | Nallathattu      | 4.02  | 16.30 | 2.98  | 20.20 | 0.90 | 3.69  | 5.54  | KH         |
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|   |   |   |   |   |   |
|---|---|---|---|---|---|
| 9. | Siyappadi | 2.07 | 0.81 | 47.40 | 5.04 |
| 10. | Anaivar | 6.64 | 1.32 | 12.36 | 3.82 |
| 11. | Ponnathittu | 6.70 | 19.80 | 4.96 | 6.02 |
| 12. | Manambadi | 1.45 | 24.59 | 1.21 | 2.84 |
| 13. | Kizhamungiladi | 78.50 | 25.80 | 2.24 | 149.00 |
| 14. | Melungilladi | 2.79 | 2.36 | 118.00 | - |
| 15. | Keerapalayam | 9.99 | 3.61 | 34.80 | 13.40 |
| 16. | Ayipettai | 5.99 | 20.00 | - | - |
| 17. | Orathur | 3.96 | 0.50 | 376.00 | - |

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