"The contributed chapters in the book written by the faculties of science stream in the light of the recent thinking and developments in the field of science and education.- Science& Technology is now dominates almost every field of our activities.In summary, The faculties (Science stream) of GEMS Arts & Science college have made an excellent attempt to bring about this book Homo Scientia", covering almost all the important areas from biological sciences to artificial intelligence. Every article has its own merits in both academic and research fronts..I record my grateful appreciation and thanks to the contributors of this book for their untiring efforts."

Dr. Balagopalan Unni

Gems Arts & Science College (Affiliated to University of Calicut),Ramapuram, kadungapuram (PO), Malappuram (DT) Pin -679321

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Smitha Pramod V

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Brief Biography

Dr. B.G.Unni, (Balagopalan Unni) Ph.D
(Allahabad central University)
FRES (London), FIANSc , FISAgBc, FICCE

Former Chief Scientist and Area Coordinator (Biotechnology & Biological Sciences) DADD and Fulbright Fellow retired from CSIR service in 2015 after 38 years of research career at CSIR North East Institute of Science & Technology Jorhat Assam. Appointed at Assam down town University as Director-Research in March 2015 and continued up to June 2019 and then re-designated as Adviser Research in August 2019). Back in Kerala, Dr.Unni is appointed as Director Academic & Research at GEMS College of Arts & Science affiliated to University of Calicut from August 2019. Both the positions are on honorary basis to strengthen the institutions in research areas. He did his BSc Biology (1972-74, Ewing Christian College, Alld University), MSc in Biochemistry(1974-76)(Second Rank) and Ph.D in Biochemistry from Allahabad University(1976-80) and PDF in Molecular Biology from Texas A&M University, USA(1988-91). Dr. Unni is specialized in Biochemistry, Molecular Biology, and Biotechnology and well established in his area of research and completed more than 40 years of research in both basic and applied fields of research. Dr.Unni got more than 130 research papers, 190 abstracts, 35 papers in proceedings, 7 patents,1 technology.18 chapters in books, edited 3 books and 29 students

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received PhD degrees under his guidance and supervision. Dr. Unni had completed more than 20 projects sponsored by Commonwealth Science Council, London, Ministry of Non conventional Energy Sources, Department of Non conventional Energy Sources Govt of India, North Eastern Council Govt of India, Department of Science &Technology, Department of Biotechnology, Central Silk Board,GB Pant Institute of Himalayan Environment and Development, CSIR and DRDO, Ministry of Defense, Govt of India during his scientific tenure at CSIR NEIST. Dr Unni received- Fulbright Travel Award/ Fellowship (USA) Dr. B.M. Das Memorial Science award, Hebrew University Award , H.R. Cama Memorial Travel Award,COSTED Travel Award,. DAAD- fellowship-Germany, Well Mark International Scholarship (USA) & Technology award in life sciences by CSIR,Govt of India . Best Fulbright Alumni Chapter Leader-South Asia Selected by the United States Education Foundation In India (USIEF), New Delhi .Nominated to represent India at the International Fulbright Scholars meet at Marrakech, Morocco- Nominated by United States Education Foundation In India, New Delhi . Dr. Unni is in the editorial board of more than eight indexed journal in the country .Dr.Unni was nominated to various state and central committees such as High power committee for development of sericulture activities Muga, Eri,Tassar and Mulberry in Assam nominated by Governor of Assam, .Expert in the area of non mulberry sericulture, Ministry of Textiles, Advisory Board, Post graduate Biotechnology programme, Academic Council, Assam Agricultural University, Research Council, Central Silk Board, Ministry of Textiles , DBT's Nominee for Biosafety Committee ,Vice President SBC (India) Indian Institute of Science Bangalore, Vice President Indian Academy of Neuro-sciences, Member Fulbright Academy of Science & Technology, USA, Board of studies- Botany Nagaland University and Biotechnology Saugar University Madhya Pradesh., Fellow, Indian Academy of Neurosciences & Indian Society of Agricultural Biochemists, Fellow Royal Entomological Society, London UK and Scientific

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Advisor International Foundation of Science, Sweden, Member, Board of Studies Raiganj University (2017----), Member Research Review committee Tea Board of India (2016-2019), Member Advisory Committee Cancer Research Advisory Board, North East Cancer Hospital & Research Institute (2017--) President, Tea Improvement Consortium, Ltd, Tocklai Assam (2018-2020) .

Dr.Unni visited USA, Germany, Israel, Jordan, France, Morocco ,UK, Thailand ,Jordan, Singapore , China and UAE under various exchange program.

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Preface

I am very happy to learn that, the GEMS Arts & Science College is bringing out a series of books written by the faculty in this academic year. The college is occupying a very important position among the colleges in Kerala, the same way the college is having unique standing in both academic and research fronts too. This is because of the excellent management, faculties and the best performances of the students.. I have full confident that in the course of time, and with the sincere commitment and dedication of the faculties , students and with management , the college will attain high level perfection and excellence and became a model college in the state of Kerala

This book entitled " Homo Scientia" had comprehensive research topics in various aspects in the topics of cyber security, biotechnology, microbiology and geology.A brief description about the cybersecurity, the protection of computer set up such as hardware, software data from several threats have been described in the chapter The best practices for deploying and managing IPS network security tools have been explored. The integration of intrusion prevention system (IPS) solutions, adherence to security policies, regular updates, monitoring and the implementation of incident response procedures are considered to be the essential components of a comprehensive network security framework. The risk management in cyber security, various cyber-attack kinds, malware, and some strategies to tackle these attacks are also explained by the authors. A comprehensive overview of the evolution of computer graphics, exploring the advancements in hardware, software, algorithms, and techniques that have propelled the field from its early pixel-based beginnings to the current state of realism etc also described. Optical character recognition has been extensively investigated in the past few years, and has been proven that high recognition rates can be achieved in specific

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application scenarios using some standard and well-studied methods such as neural network, support vector machine (SVM), etc. The possibility of learning an appropriate set of features for designing optical character recognition (OCR) has been investigated

Biotechnology is an interdisciplinary science using modern technologies to construct biological processes in research, agriculture, formulation of pharmaceutical products and other related fields. The better understanding of advances in plant genetic resources, genome modifications, omics technologies to generate new solutions for food security under changing environmental scenarios etc have been discussed in this chapter. The increasing demand for food had a great impact on the agriculture sector to address the various challenges associated with crop productivity. The tremendous advancement in plant research helps in understanding plant biology for sustainable food security, functional ecosystems, crop improvement and human health. One of the sustainable farming techniques is the use of fertilizer at nano level. Nanomaterials that enhance plant nutrition could be considered as an alternative to the conventional chemical fertilizers. one chapter covered the importance of nano fertilizer to enhance metabolic processes in plants and reviewed the concerns in developing nanotechnological methods in the future. Metabolomics has now emerged as a powerful tool for the comprehensive analysis of metabolites within biological systems. One of the chapters provides a review on metabolomics, encompassing its methodologies, applications, potential impact on personalized medicine ,and discusses further the need for advancements in analytical technologies. The antifungal activity of mangroves, particularly Rhizophora species are one of the main sources for fungicidal compounds due to the presence of high concentration of phenols. The antifungal activity of Rhizophora species has been elucidated, and could be further utilized as biocontrol agents for fungal disease in agricultural crops. One of the chapters discussed the species identification and its impact on economical and ecological level in the species like Nutmeg, one of the important medicinal plants that had a greater attention ,however, it was very difficult to differentiate the sexual identity

in the seedling stages. But the protein content screening among the studied plantlets had differentiated the sexes in the species as explained by the author.

AI (Artificial Intelligence) or machine intelligence enables farmers to enhance the quality and ensure a quick go-to market strategy for crops, and adoption of these algorithms to improve food industries. Artificial intelligence (AI) has also the potential to revolutionize education, from personalized learning to assessment and grading. Additionally, AI-powered tools can provide greater accessibility to students with disabilities, while also enabling more engaging and interactive content. AI continues to develop and become more prevalent in education, towards responsible and equitable implementation. However the negative and positive part of the AI may also be looked into.

The chapters related to microbiological aspects have also been incorporated in this book . Carbapenem-resistant A. baumannii (CRAb), bacteria that cause multi-infections in humans and resistant to multiple drugs too. The study attempted to isolate and characterize the bacterial species from the clinical specimens using biochemical techniques. The enzyme, carbapenemase produced by the bacteria was isolated and determined by different assays. Another study identified the antibacterial, antioxidant and anticancer activities of Ganoderma lucidum by various chromatographic techniques. Anticancer activity was also assessed on HeLa cell lines using MTT assay and DPPH assay. In one of the chapters,the author discussed L-asparaginase, one of the widely exploited enzymes for the treatment of acute lymphoblastic leukemia (ALL). Also attempted to isolate and characterize the enzyme from soil samples collected from different locations at Kerala. The study indicated that soils can provide a rich source for L-asparaginase which has got ample application in pharmaceutical industries.

The studies on various geological aspects with respect to different geographical areas in Kerala soil has been included in the book. The vertical geochemical variation and elemental mobility of the lateritic terrain in the Makkaraparamba of Malappuram District, Kerala has been very well investigated. Under extremely oxidizing and leaching conditions, laterite

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soil transformed into a variety of rocks and further developed into stable secondary product in the existing humid tropical and subtropical environments. The hydrogeological conditions in Kumbala- Kaliyar river basin, Kasaragod district, Kerala was assessed by means of Vertical Electrical Sounding (VES). The digital spatial data output of the present study would be much helpful for planning and management of surface and sub-surface water resources of Kasaragod River basin in which the Kasaragod township is centrally located

The contributed chapters in the book written by the faculties of science stream in the light of the recent thinking and developments in the field of science and education.Science& Technology is now dominates almost every field of our activities. In summary , The faculties (Science stream) of GEMS Arts & Science college have made a n excellent attempt to bring about this book Homo Scientia".covering almost all the important areas from biological sciences to artificial intelligence. Every article has its own merits in both academic and research fronts..I record my grateful appreciation and thanks to the contributors of this book for their untiring efforts.

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A STUDY ON GEOELECTRICAL RESISTIVITY SURVEY OF KUMBALA- KALIYAR WATERSHED, KASARAGOD DISTRICT, KERALA, INDIA

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[1]Assistant Professor,
PG Department of Applied Geology
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Department of Geology, Governmental College, Kasaragod

ABSTRACT

Vertical Electrical Sounding has been carried out in Kumbala- Kaliyar river basin, Kasaragod district, Kerala to assess the hydrogeological conditions. Schlumberger electrode configuration is used for recording the resistivity in seven vertical electrical soundings. Here the current electrode configuration ranges from 2 to 100m.The data obtained from field area is interpreted using curve matching and electrical imaging computer software IPI2WIN. The curves obtained include H &K types. Depth, thickness and apparent resistivity is obtained. Spatial variation maps prepared using QGIS software are interpreted in terms of resistivity and thickness of various layers. These resistivity values are compared with the existing lithology of the area. The depth values obtained from the wells is compared with the resistivity values of different geo-electrical layers and the aquifer extend can be determined. From the spatial variation map of first layer resistivity, it indicates that the high resistivity value is seen towards the eastern side of the

basin. Resistivity of second layer increases towards West. In most of the locations second layer shows extremely high values for resistivity which indicate the presence of a thick unsaturated layer below the surface possibly the laterite. Aquifer resistivity varies widely in the study area and major part of the study area has resistivity less than 75 ohmm. This indicates towards good groundwater potential in the basin area. All the location in the study area shows relatively better aquifer thickness .Major part of the area shows aquifer thickness less than 9m which indicate that majority part shows a moderate groundwater potential in the study area.

INTRODUCTION

Groundwater forms one of our important necessities in daily life. Consumption of groundwater is not only as a source of drinking but also to meet other domestic and industrial necessities. Groundwater is exploited in greater amount than surface water because they are safer and economically viable. Groundwater is found almost everywhere and also lies contaminated compared to surface water. Due to this groundwater investigation has been considered as topic of the hour. But in the case of groundwater it is the water held in porous soils or rock materials. Area below the water table in which the soil is completely saturated with groundwater is termed as saturated zone. It may be shallow or deep. On these days the use of geophysical methodology for groundwater examination and water quality appraisals has increased due to quick advances in PC programming and other numerical showing methodologies. The usage of Vertical Electrical Sounding has become well known with groundwater prospecting due to ease of the technique. The purpose of electrical geophysical technique is to analyze the surface effects that is produced by the electric stream inside the earth. The name, Kasaragod, is stated to be derived from the word 'Kusirakood' that means Nux vomica forests (Kanjirakuttom). Kasaragod is the northernmost district of Kerala, bordering Karnataka State. The availability of water in the valley parts and tunnel wells has decreased significantly as a result of the increased number of borewells in the slopes

and laterite terraces. Borewell pumping has a negative impact on the water level of the phreatic zone in several places. The area has many industries and other activities like thermal power plants and international tourist centers. The main objective of the present study is to understand the nature of aquifer in Kumbala-Kaliyar watershed. This is done with the help of resistivity survey values and water table data obtained from the field. It also aims to study the spatial variation of resistivities and thickness of subsurface layers derived from resistivity survey.

STUDY AREA

The area selected for the study is Kumbala – Kaliyar river basin which is situated at the part western of Kasaragod district. Study area has a total areal extend of about 35.58 sq km and it is surrounded by Arabian Sea in the west. The area falls in the Survey of India topo sheet number 48P3 and it is located between Longitude 74 °55 '52.89996"E to 75°0'54.3132"Eand Latitude 12° 34' 18.3324" N to 12° 37' 36.9048"N which is passing through the east of the area. The district receives an average of about 3500 mm rainfall annually. The major source of rainfall is southwest monsoon from June to September which contributes nearly 85.3% of the total rainfall of the year. The northeast monsoon contributes nearly 8.9% and balance of 5.8% is received during the month of January to May as pre monsoon showers. Out of the 106 rainy days in a year, 87 rainy days occur during south west monsoon season. The locale shapes a piece of the Precambrian metamorphic terrain, significant piece of which is occupied by Archaean rocks. Along the western edges patches and disintegrated capping of Warkalli Formation and low-lying Quaternary alluvial deposits are seen. Both the Archaean and Tertiary rocks have been seriously lateritised. The regions has significant basement rocks have a place with Khondalite Group, Charnockite Group, Wayanad Schist Complex and Peninsular Gneissic Complex. The study area has mainly three litho types i.e., charnockite, laterite and also coastal sand and alluvium. Towards the coastal region the major litho type seen is coastal sand and alluvium. Western part of study area shows quaternary and tertiary lithology. Charnockite is seen mostly at

the center and also towards northern and eastern parts of the basin. Laterite forms the major rock type in the western part of the basin.

From the point of view of yield of groundwater, the area can be divided into four zones – (i) the coastal tract with alluvium is a highly potential aquifer, (ii) the midlands with laterite cover are suitable for dug wells. Depth to water is between 5and 20m below the ground level, (iii) areas underlain by thin laterite cover and /or weathered zone. The valleys and topo-lows are good for open wells. Borewells are feasible along fractures but are site-specific and (v)foothills and highly undulating terrain exposing basement rocks or with thin soil cover. The terrain can rarely sustain domestic wells. Fractures are potential zones and bore wells are site-specific. Chandragiri is the major stream draining the territory. Karyamkote stream drains the southern piece of the locale. The locale gets incredible precipitation, 300-350cm consistently. Because of the slanting region additionally, impermeable basement rocks, major part of the water goes as overflow. The Kumbala river is a minor river which has from approximate length of 82 km. The water flows east to west and debouches into Arabian sea. The drainage pattern of the river is dendritic to subdendritic.

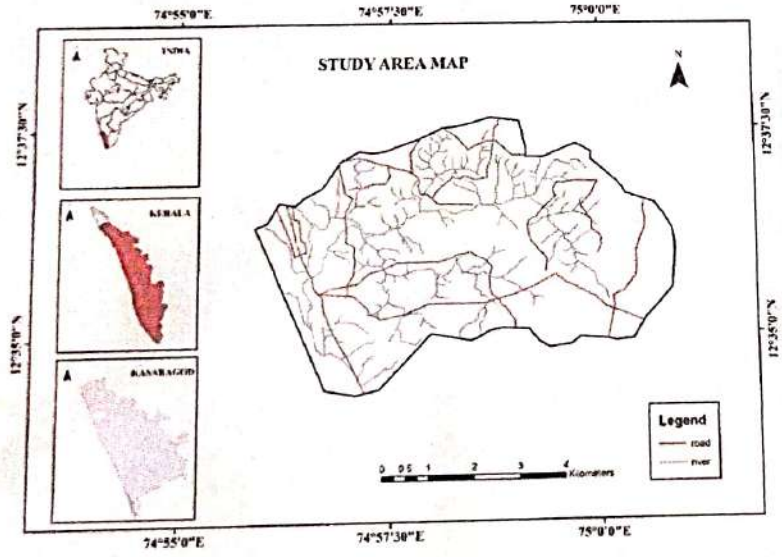


Fig. 1: Study area map of Kumbala- Kaliyar river basin

METHODOLOGY

Vertical electrical resistivity sounding procedure is used to investigate the variation of subsurface resistivity with depth. This is achieved by arranging the measurement lay-out in such a way that for every consecutive measurement the measured potential difference is affected by the formations that lie at increasingly greater depths: the spacing of the current probes is increased systematically. Schlumberger's array is made up of four collinear electrodes. The two outer electrodes are current (source) electrodes, while the two inner electrodes are potential (receiver) electrodes. Vertical Electrical Sounding data collected from the 7 locations of the study area are interpreted both quantitatively and qualitatively to obtain the layered resistivity parameters. The double log sheet graph from IPI2win software is used to plot the apparent resistivity and AB/2 values. The layered model obtained are interpreted for different resistivity layers. From the layered resistivity model apparent resistivity, thickness and depth to interface are analysed.

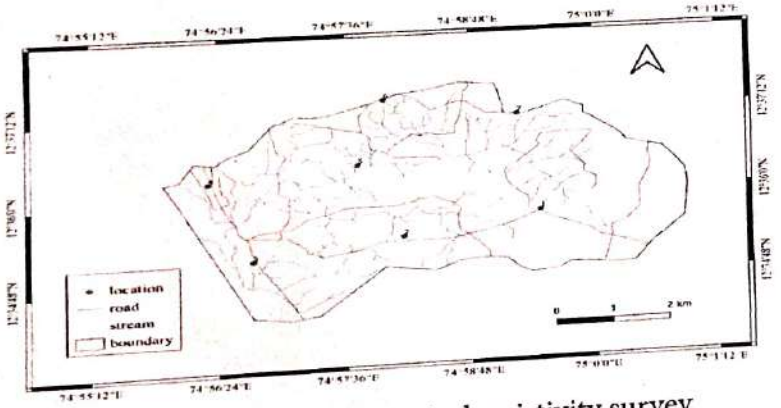


Fig. 2: Locations of electrical resistivity survey

In VES data analysis both quantitative and qualitative methods are used. Qualitative methods directly inspect the change of apparent resistivity values with respect to electrode separation. Here the apparent resistivity values increases or decreases with increase in electrode separation and it is studied by plotting on a double log graph. For one dimensional inversion

of VES data an interactive inversion code is used which is IPI2Win for quantitative analysis. Here IPI2Win provides a set of equivalent solutions in which one of the best fitting solution is chosen which provides least fitting error between observed and inverted data

Based on the vertical electronic sounding of the 7 locations the subsurface geology can be delineated. Layer parameters such as resistivity, thickness of the underlying layer along with the total depth determines the shape of VES curve. For a three layered section different combination of resistivity distribution provide four types of curves. The four curve types are A type ($\rho1 < \rho2 < \rho3$) Q type ($\rho1 > \rho2 > \rho3$), H type ($\rho1 > \rho2 < \rho3$) and K type ($\rho1 < \rho2 > \rho3$).

Using GIS software thematic maps are prepared. Spatial tools in QGIS software is used for the preparation of spatial variation map of apparent resistivity and thickness of subsurface geo electrical layers. Measuring the depth of the water table below the ground surface, or its height above sea level, is an important dataset for understanding groundwater. The depth to water table is measured from six open wells in the study area.

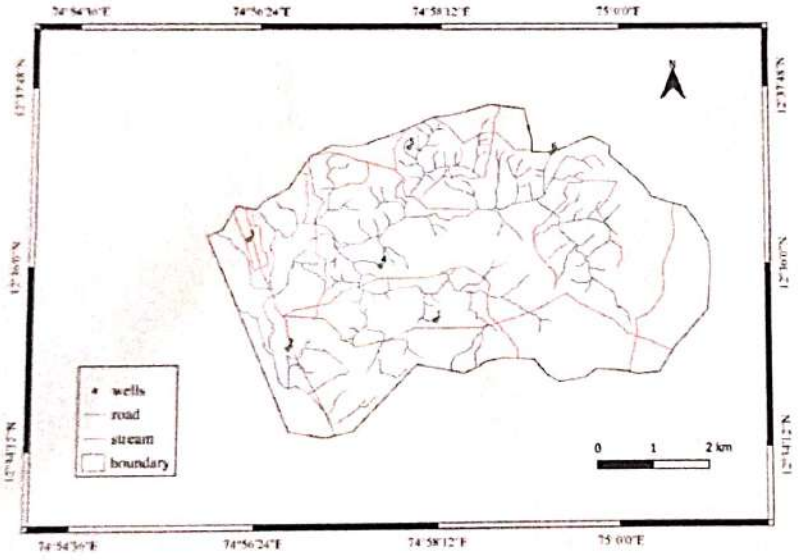
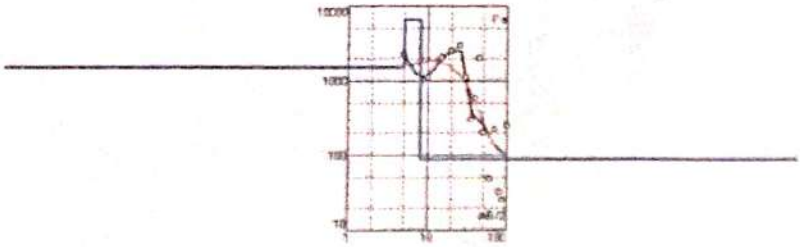


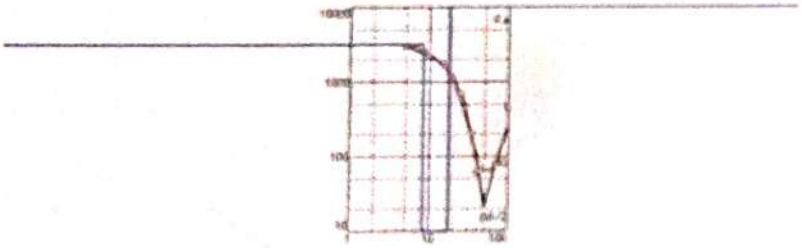
Fig. 3: Location of observation wells

RESULTS AND DISCUSSION

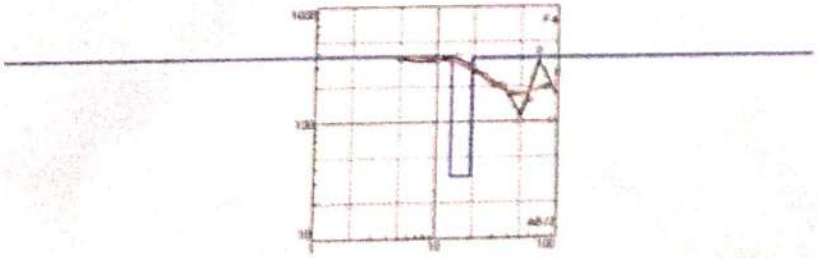
The curves obtained from the IPI2Win analysis are shown in the following curves. In the figure the red curve represents standard curve and black curve with circle represent the observed data



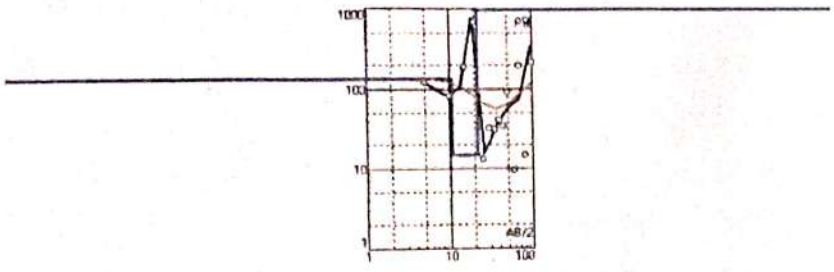
Location :1 curve type: K type



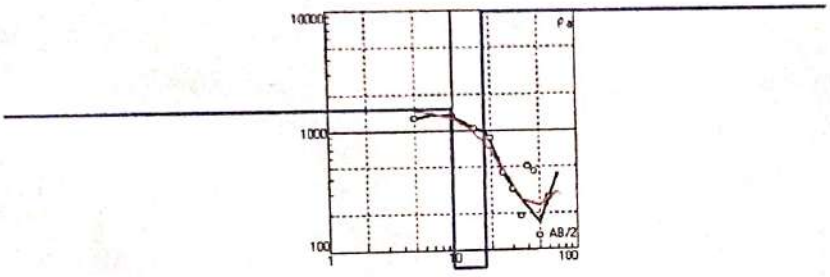
Location:2 curve type: H type



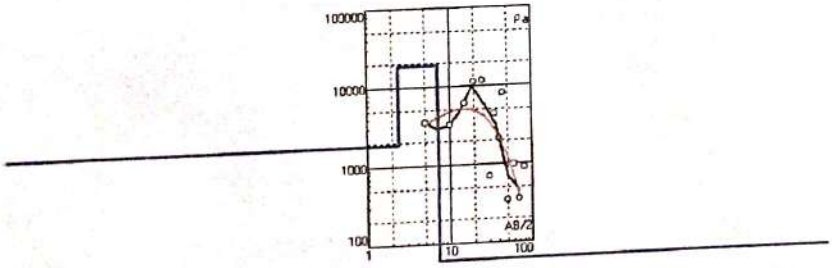
Location:3 curve type: H type



Location: 4 curve type: H type



Location: 5 curve type : H type



Location: 6 curve type: K type

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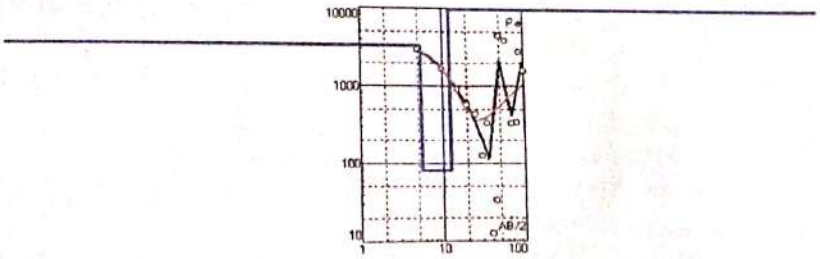

Location: 7 curve type: H type

The apparent resistivities and thickness of different layers are given in the Table No:1 below

Table No:1 Vertical electrical sounding (VES) results of Kumbala - Kaliyar river basin

Location No	Location Name	Layer Thickness(m)		Apparent resistivity (ohm m)			Curve Type
		h1	h2	p1	p2	p3	
1	Seethangoli	5.01	3.09	1527	6575	88.2	K type
2	Narayanamangalam	8.25	9.48	3244	10.1	10259	H type
3	Mavinakatta	13.3	6.22	374	34.1	359	H type
4	Arikady	10.6	10.9	135	15	11116	H type
5	Kotaikar	9.77	8.18	1509	37.2	50921	H type
6	Near Poomani Kinnimani temple	2.42	4.74	1900	18824	51.1	K type
7	Kalathur	5.5	6.93	3300	80.2	59132	H type

All locations are of three layered structure, in which, five points show H type and the remaining two are of K type. The wide spread distribution of H types is an indication of a top resistive layer and thus it is predicted here that a water saturated zone is overlained by a top hard layer and underlained by

another resistive layer possibly the basement.

Resistivity of first layer is ranging from 135 ohmm to 3300 ohmm. From the spatial variation map of first layer resistivity, it indicates that the high resistivity value is seen towards the eastern side of the basin. The resistivity value decreases towards the coastal region. First layer thickness varies from 2.42 m to 13.3m. Maximum thickness is found in the western side of the study area. Resistivity of second layer varies from 10.1 ohmm to 18824 ohmm. Second layer thickness is ranging from 3.09 m to 10.9 m. It also increases towards West. In most of the locations second layer shows extremely high values for resistivity which indicate the presence of a thick unsaturated layer below the surface possibly the laterite. Resistivity of third layer varies from 51.1 ohmm to 59132 ohmm.

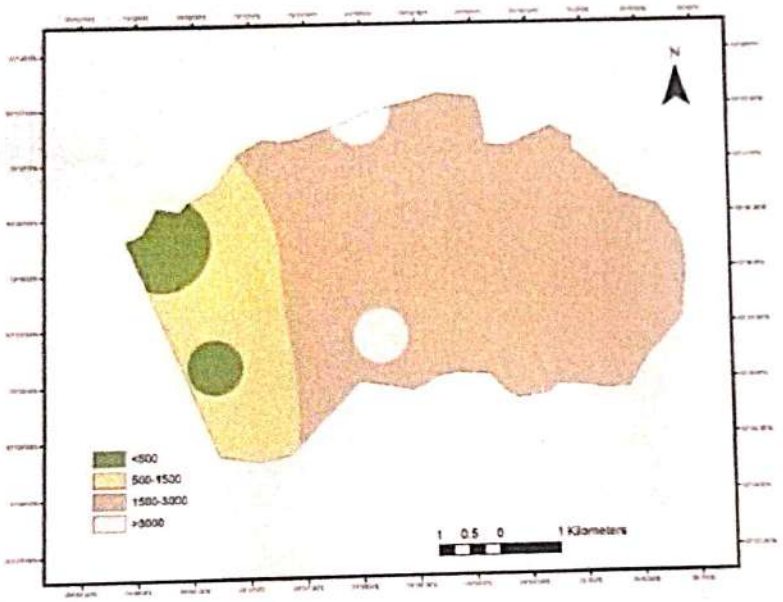

Fig. 4: Spatial variation map of
first layer apparent resistivity (ohmm)

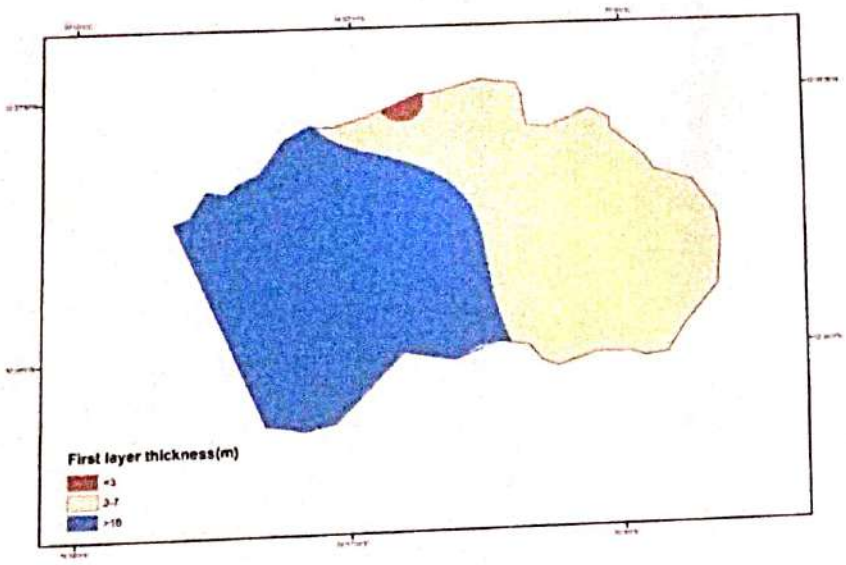

Fig. 5: Spatial variation thickness map of first layer (m)

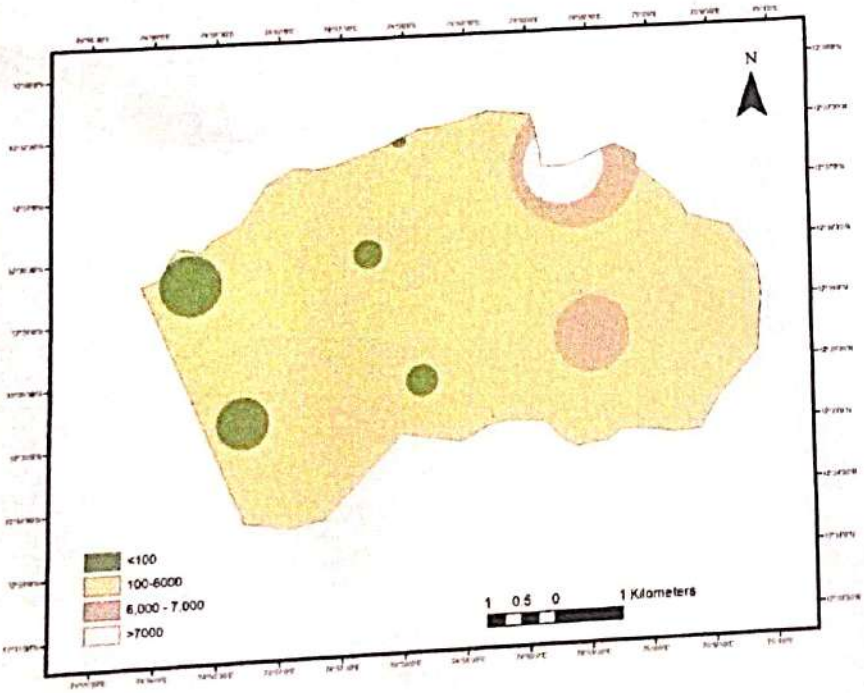

Fig. 6: Spatial variation map of
second layer apparent resistivity (ohmm)

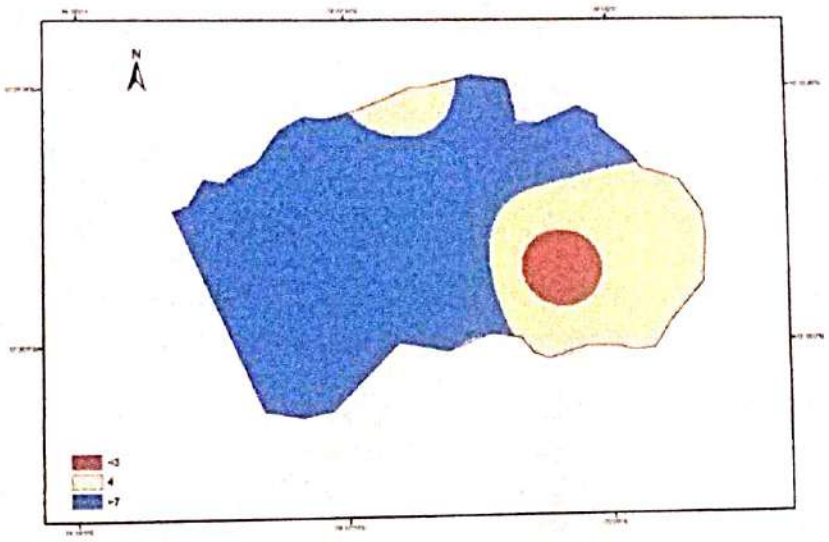

Fig. 7: Spatial variation thickness map of second layer (m)

In the present study area, the deepest water table is found at OW 4 and shallowest water level is found at OW 2 . There is deepening of water table towards the central part of the basin

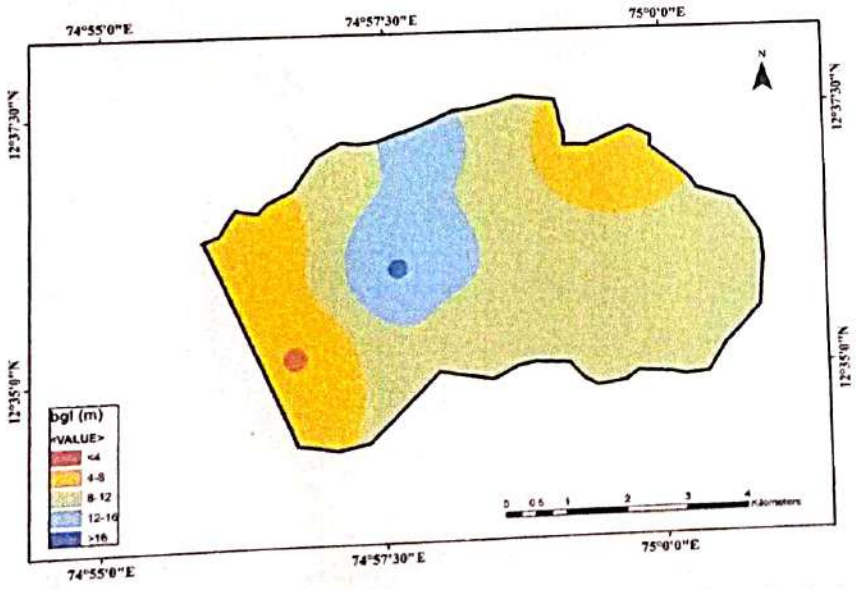

Fig 8: Spatial variation map of depth to water table below ground level (m)

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Out of 7 possible locations of the study area it is found that the second layer is acting as aquifer in 5 locations (location no 2,3,4,5 & 7) first layer (location no. 3 & 4) and third layers in two locations (location no. 1 & 6). From the possible data derived from the VES analysis results, spatial variation maps of the resistivity and thickness of aquifer in the study area are made and are shown in figure 9 &10. Aquifer resistivity varies widely in the study area and major part of the study area has resistivity less than 75 ohmm. This indicates towards good groundwater potential in the basin area. Apart from resistivity of the aquifer another factor which decides the groundwater potential of the area is thickness of the aquifer. All the location in the study area shows relatively better aquifer thickness .Major part of the area shows aquifer thickness less than 9m which indicate that majority part shows a moderate groundwater potential in the study area.

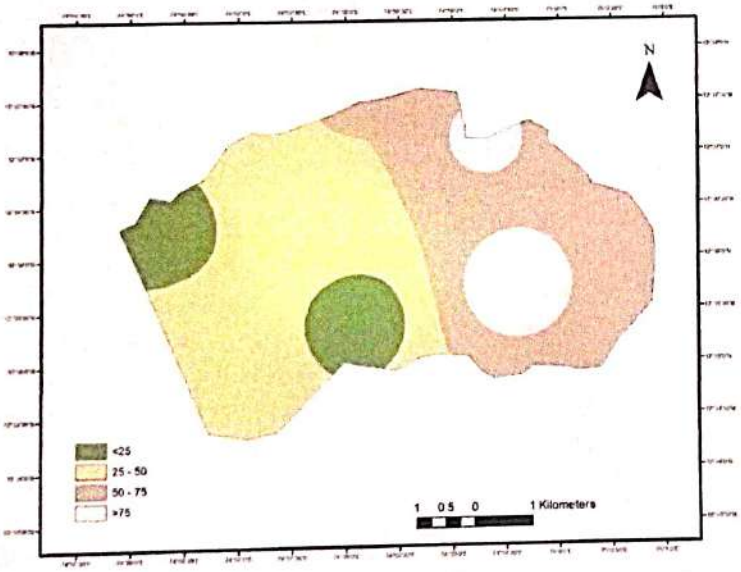

Fig. 9: Spatial variation map of aquifer resistivity (ohmm)

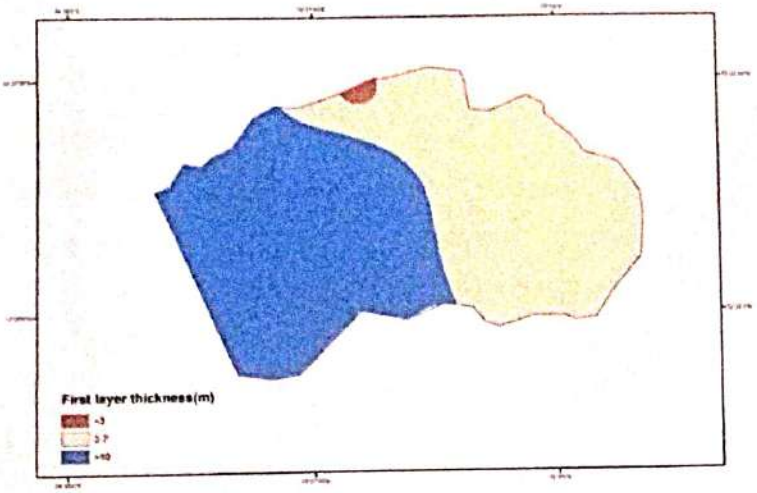

Fig. 10: Spatial variation map of aquifer thickness (m)

CONCLUSION

In the present study electrical resistivity surveys are used to derive subsurface and hydrogeologic conditions of an area. Kumbala – Kaliyar watershed was selected for the present study and the fieldwork was done during March 2021. The characteristics and subsurface structure of the study area is inferred from the results obtained from geoelectrical resistivity survey. All locations are of three layered structure, in which, five points show H type and the remaining two are of K type (location no. 1 & 6). The widespread distribution of H types is an indication of a top resistive layer and thus it is predicted here that a water saturated zone is overlained by a top hard layer and underlained by another resistive layer possibly the basement. On examining the depth to water table recorded at the observation wells and the resistivity of the subsurface geo-electrical layers , it is possible to demarcate the vertical extent of aquifer in the study area. The resistivity and thickness of aquifer derived from the data favours a moderate groundwater potential for the study area.