

## REMOTE SENSING AND GIS-MULTICRITERIA DECISION ANALYSIS FOR GROUND WATER RESOURCES MAPPING OF THALAVADI BLOCK - ERODE DISTRICT IN TAMIL NADU

P. MUTHUKUMAR, E. SAKTHIVEL

Department of Civil Engineering, Karpagam College of Engineering, Coimbatore- 32, India.

Article received 26.7.2017, Revised 20.8.2017, Acceptance 8.9.2017

### ABSTRACT

Water is one of the most vital natural resources for our daily life. This essential resource is obtained mainly from surface water and ground water. Inconsistency and unequal availability of surface water leads to the search for ground water. Ground water is profoundly utilized in irrigation, industries and for domestic purposes. Therefore, the quality of ground water is equally important as its quantity. The present study makes use of geo-spatial technology in mapping the spatial variability [Choudhary, et al.,1996] of ground water quality. Ground water samples were collected in study area. The major water quality parameters such namely pH, Electrical Conductivity[EC], Total Dissolved Solids, Total hardness, Iron, Chloride, Nitrate and Fluoride have been estimated for all the sampling locations. The spatial variation maps of these ground water quality parameters were generated and utilize as thematic layers. The thematic layers were given ranks based on their relative importance. Different classes within each thematic layer were assigned weight ages in numerical rating from 1 to 3 as attribute values in GIS environment. Summation of these attributes [Ganesh and Sashikkumar, et al., 2015] values and the corresponding rank values of the thematic layers were utilize to generate the final ground water quality map. The final map shows the different classes of ground water quality within the district. This can be utilized in giving guideline for the suitability of ground water uses.

### INTRODUCTION:

Growth of population, rapid urbanization and increasing uses in domestic and agricultural sectors necessitate the demand for good quality of water supply. One of the most vital natural resources and easily accessible source of fresh water [Goyal, et al., 2013] is ground water. Therefore, finding the potential areas, monitoring and conserving ground water have become extremely important at the present moment.

Thalavadi is high degree of slopes and narrow intervening hills area. Faulting in many places has produced steep fault scarps. Consequently, majority of the rain water is lost as surface runoff even though the state received high amount of rainfall. Springs are the main sources of water with in the state. Hence, the quality of water from such sources needs to be carefully analyzed and represented in a GIS environment [Kumar, et al., 2012].

Advent of geospatial technology permits swift and cost-effective survey and management of natural resources. Geographical Information System (GIS), Global Positioning System (GPS) and remote sensing are the major tools in this newly introduced technology [Lalparma and Mishra, et al., 2012]. This technique has wide-range applications in geo-scientific researches including ground water quality mapping.

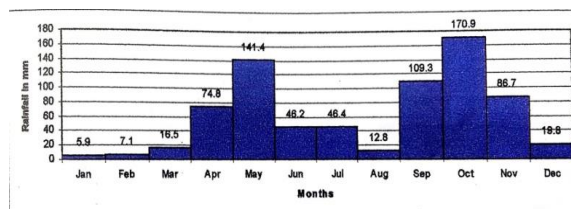
For these reasons, many researchers have utilized these techniques successfully in ground water studies, both for prospecting and quality mapping. The same techniques have been proved to be of immense value not only in the field of hydrogeology but also for the development of surface

water resources as well [Majumder and Sivaramakrishnan, et al., 2014].

**Study Area:** Thalavadi block is one of the 20 blocks of erode districts. It is located in the northwestern side of erode district. this block lies between 11degree 30 minute and 11degree 50 minute north latitude and 76 degree 50 minute and 77 degree 20 minute east longitude. The block is surrounded by Bhavanisagar block in the south, sathiyamangalam block in the east, Karnataka state in the north, uthagamangalam district in the west. Thalavadi block is 50% covered by dense forest and 50% plain. It is drained by Moyar River in the southwest.

**Administrative setup:** Thalavadi block consists of 10 village panchayats. There are 123 rural habitations in this block. The aerial extent of thalavadi is 940.80 sq.km. All the habitations of the block are covered by the road network. The block head quarter is thalavadi.

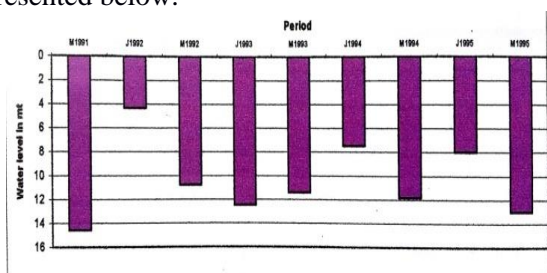
**Rainfall:** There is a rain gauge station present within thalavadi block. The 50year average normal rainfall is 737.8mm. The monthly normal rainfall for the thalavadi rain gauge station is presented below. The major contribution of rainfall is during north east monsoon.



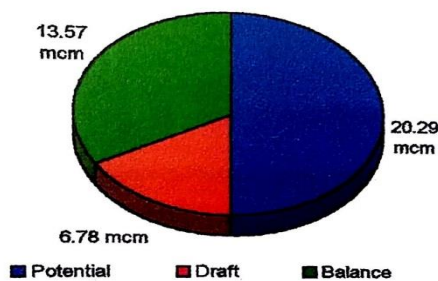
**Geology:** Geologically, thalavadi block is covered by hard rock. 50% of the area is covered by charnockite and other rock type include hornblende biotite gneiss fissile hornblende biotite gneiss and Dyke.

**Geomorphology:** The entire block is geomorphology classified as structural hills having ridges and valleys with plateau region on the North- West part of the block where the thalavadi town is situated, with limited deep buried pediment and shallow buried pediment and pediments [Mishra and Lalzahawmi et al., 2014].

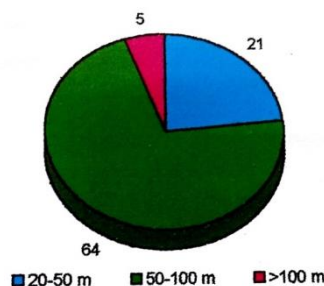
**Ground water level:** We are observing water level is selected observation well throughout the district in the thalavadi block two observation wells are located the average water level Data for the observation wells collected from May 2011 is presented below.



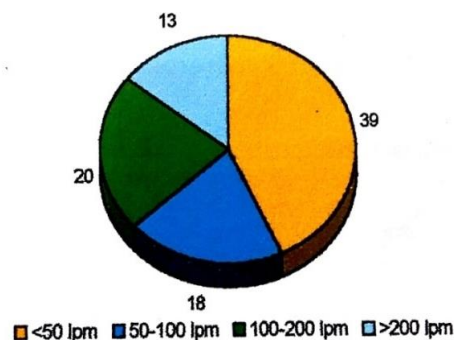
**Ground water potential:** As per the estimation committee 2011 thalavadi block has been categorized as white block (extraction of ground water is more than 65%). Utilizable ground water potential is 20.29 mcm, draft is 6.78 mcm and balance is 13.57 mcm.



**Drinking water sources depth range:** The bore well data collected from all the 123 habitations have been used to classify the depth range. The counter map drawn for the above data reveals that the minimum depth of wells in the block range is 20 to 50 m and majority of the habitations in the block the bore well depth is 50-100m. More than 100m depth range bore wells are noticed in isolated patches of the block.

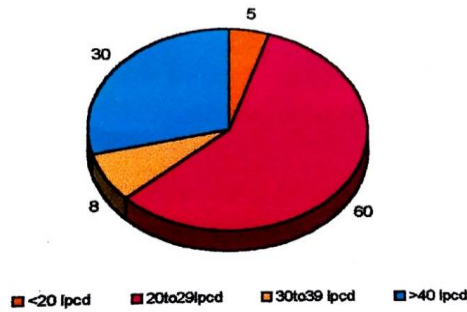


**Drinking water sources yield range:** The bore well yield range of the thalavadi block has also been assessed spatially using the bore well yield data collected from bore wells and open wells in the habitations. The analysis of data reveals that the lowest yield recorded in the block is 2 lpm (litres per minute) and the highest yield recorded is 426 lpm. About 30 % of the bore well in thalavadi block have yield less than 50 lpm. The high yielding bore wells are noticed in the panchayats in Mallakudi, Byannapurum and Thingalur.



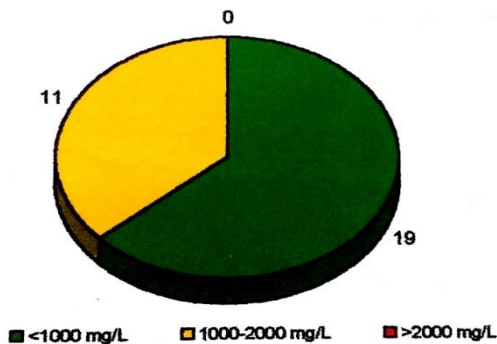
**Rural habitation and water supply status:** We conducted resurvey status for drinking water supply coverage status during 1999. (Statement 1) the Habitation are marked on the map from SOI on 1:50000 scale for analysing the spatial distribution of the coverage status of the habitations. According to the survey out of 123 habitations 29 habitations are fully covered [40 and more than 40 lpcd (litres per capita per day)] and 94 habitations are partially covered (less than 40 lpcd). The partially covered habitations are covered throughout the block.

**Drinking water sources:** In thalavadi block numbers of bore wells have been drilled for the drinking water purpose. The drinking water sources have been plotted on the map to analyse the spatial distribution of the drinking water sources. Total number of bore wells taken is 30 of which 9 are hand pumps and 21 are power pumps. The location of the hand pumps and power pumps are marked on the map in the respective habitations.

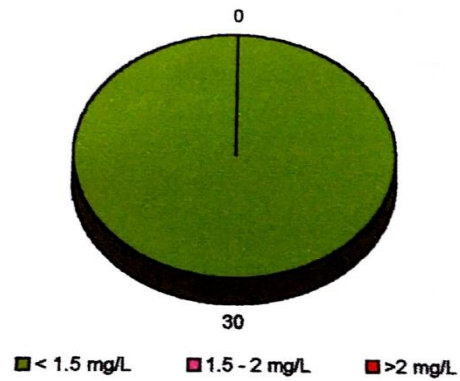


**Ground water quality:** The water samples collected from the 123 drinking water sources are tested for physical and chemical parameters. the bore wells from each habitation is taken as location of the sampling. The locations are plotted on the map for analyzing the spatial distribution of ground water quality in thalavadi block. The parameters such as total dissolved solids, fluoride and nitrate have been plotted on the map for analysis. A drinking water quality map has also been prepared.

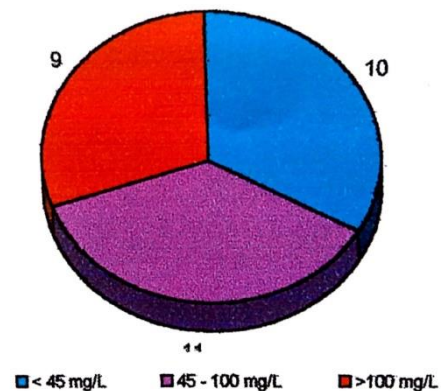
**Total dissolved solids in the drinking water sources (TDS):** If the total dissolved solids concentration in the drinking water is more than 2000 mg/L, it is not potable for drinking purpose (according to CPHEEO standards). The spatial distribution of TDS in ground water reveals that “not potable zones” are not found in this block. 1000 to 2000 mg/L TDS is isolated patches of the block. The minimum and maximum TDS values in the block are 364 mg/L and 1666 mg/L respectively.



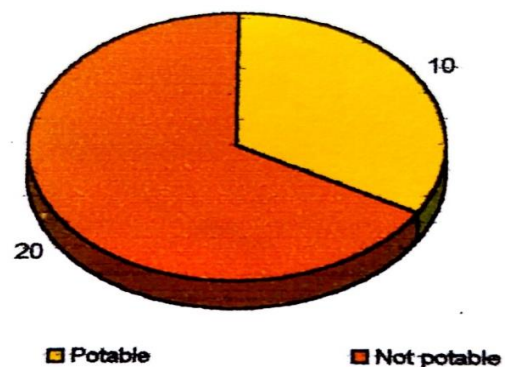
**Fluoride in the drinking water sources:** The fluoride concentration in the drinking water constitutes one of the health hazards parameters. If its concentration in the drinking water more than 1.5 mg/L (CPHEEO standards) it is potable. The spatial distribution of fluoride in the groundwater reveals that in the majority of the block the fluoride concentration is less than 1.5 mg/L. however, 1.5-2 mg/L zone is noticed in Byannapuram panchayat. more than 98% of the area the concentration of fluoride is less than 1.5 mg/L. the minimum and maximum fluoride values in the block are 0.4 mg/L and 1.6 mg/L respectively.



**Nitrate in the drinking water sources:** The nitrate is also one of the health hazards parameters. If its concentration in drinking water exceeds 45 mg/L (CPHEEO standards) is not potable. The spatial distribution of nitrate in ground water reveals that 25% of the block the concentration of nitrate exceeds 45 mg/L. in part of thalavadi, thalamalai panchayats the nitrate concentration exceeds 100mg/L and 145 mg/L respectively.



**Drinking water quality:** The drinking water is assessed based on all the physical and chemical parameters tested from the samples collected from the habitations. The overall drinking water quality of thalavadi block is moderate which is about 50%. The poor drinking water quality is noticed in parts Talamalai, Mallankuli, Thinginagri, Thingalur panchayats.



## CONCLUSION

The Ground water quality map helps us to know the existing ground water condition of the study area. The calculation of ground water quality zones can be used for ground water exploration, development and management programme. The main alarming chemical characteristic of the water quality is pH value at few paces. Fluoride content of the water needs to be monitored regularly as the map shows that the value is above desirable limits in almost the entire area. Geo-spatial technology has been proven to be useful tools for mapping ground water quality. The ground water quality map prepared through this study will be useful for planning future ground water developmental programme.

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