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RESEARCH ARTICLE

IDENTIFICATION OF GROUNDWATER CONTAMINATION IN NEEDAMANGALAM BLOCK, MANNARGUDI TALUK, THIRUVARUR DISTRICT, TAMIL NADU USING REMOTE SENSING AND GIS TECHNOLOGY

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ABSTRACT

Water is renewable resource occurs in three forms viz, Liquid, solid, vapor (gaseous), all these tree forms of water are extremely useful to man. No life can exist without water. Since, water is an essential for life as like that of air, it has been estimated that in the human body two-third portion is constituted by water. The water is not only essential for survival of human beings, but also for animals, plants and other living beings. The present study is attempted to identify the groundwater contamination zones using remote sensing and GIS techniques. Using sequential by preparing of thematic maps like EC, pH, Ca and TDS maps managing these GIS layers in Geo-database and assigning weightages based on the correlative factors that appear to be important in holding / processing of recharge of water and ground water contamination content. This study helped to delineate the part have been classified as high contamination zones.

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INTRODUCTION

Water is a natural material it may exist in either solid, liquid (or) gas form. It is a fluid having no fundamental strength and no definite shape. The main source of water on the earth is rainfall. As the rainfall allows a portion to get evaporated into the atmosphere and of it runs off in the form of streams and rivers. The portion which is penetrated into the earth is called groundwater. Biological minimum requirement of water per person it just 10 liters per day. As against this, affluent communities use over 1000 liters per for toilets, bathing, cashing and lawn maintenance. Water between man and water. The earliest human beings settled on river banks, beside lakes and on the sea coast, and there too flourished agricultural and much of industrial activity. The proper management of water, for domestic and economic purpose, is a basic aspect of social management and governance. Water a gifted boon of Almighty to human beings, turns out to be unwanted and undesirable, if it becomes as wastewater.

Natural water never is pure. Being a profile solvent, water readily dissolves a variety of substance. So that even in a pristine environment it may be expected to contain relatively high concentrations of dissolved chemicals, some of the constituents in water beneficial to health, while other are not. As groundwater moves along flow lines from recharge to discharge areas, its chemistry is altered by the effect of variety of geochemical processes. Ground water may be described as subsurface water in a state of temporary storage in earth materials. Its movement and chemistry are intimately influenced by the nature of sediments and rocks within which it is found of all the worlds water only about six-tenths of one percent is found underground. Never the less, the amount of water stored in the rocks and only source of freshwater is considered, the significance of groundwater becomes more apparent. Clearly the largest volume occurs as glacial ice. Second in rank is ground water, with slightly more than 14 percent of the total. However, when ice is excluded and just liquid water is considered, more than 94 percent in groundwater. Ground water that is being exploited by means of

dug wells and drilled wells is confined mainly to the top 50 m of the weathered and fractured zone. Water in this zone is always on the move getting recharged by rainwater and discharged either through pumping (or) by flow to the lower sections of the valley and contributing to the base flow of rivers. There is however, a larger reservoir of water at depth extending perhaps to 500 m below ground level. Generally, groundwater is found to be more hard compared to surface water. In most regions, ground water in recharge areas percolated down ward under the pull of gravity. If moves away from hills steams, valleys, where it may emerge to supply steam. In dry regions, the ground water in responsible for producing the surface depressions known as sinkholes as well as creating subterranean cavers. Groundwater is thus a form of storage that sustains steams during periods when rain does not fall. In a densely populated country like India, groundwater resources is of extreme importance. In many place of the world including India, this in dispensable resources is under stress due to continuous failure of monsoon and excessive extraction and use. To overcome such problem, proper assessment of groundwater is essential understand the groundwater condition of an area, various models have been proposed and evolved by various hydrologists, yet the problem still persists, more correctly the problem has become, mote acute in many areas resulting severe drought. This situation is worse and more complex in the hard rock terrain. In a hard rock terrain, where primary porosity is negligible, the accumulation and flow of groundwater is a function of the density orientation length, width and intersection of fractures and joints. Water is an economic asset and also a critical environmental factor. In India more work manifests on water development and management. Water is considered as an economic asset of ecological system. In India, water management assumes gigantic proportion because of the size and topography of the country. In India where agriculture is the manifest of the people and where there is explosive growth of human population, the wayward behavior of monsoon, plays a dominant role for water utilization and brings India as third drought prone country in word. In some regions heavy deluges in rivers brings in their wake destruction of property and loss of life. Drought prone interlinks of river dams brigs and small watersheds have been built to utilize surface water for irrigation and power generation. But it is not dependable because of wayward insufficient surface water research. Residential area increases due to over explosion of population, hence recharge of groundwater becomes lesser. Agriculture land was not properly managed in previous days, at present it is forced for proper management and extraction, of groundwater for agricultural lands. In recharge area extraction water has increased for several bodies which have slowly replenished the groundwater level. Hence water management is essential for perfect utilization of present groundwater situation. Hence an attempt has been made in the study area to identified exact location of groundwater recharge along with quality aspect.

Aim and Objective: The main aim and objectives are.

- Mainly to identify the Spatio-temporal variation in the groundwater quality in Needamangalam block.

METHODS OF STUDY

They present study provides a good description of physical and chemical criteria of groundwater by field measurements and laboratory analysis. Twenty groundwater samples were collected from different production wells of Needamangalam Block (Fig.1) in June 2012. For chemical analysis the groundwater samples were collected in polyethylene bottles. The bottles were rinsed before sampling, tightly sealed after collection and were labeled in the field. Samples were collected from a well after pumping the well for at least 10 minutes, and were treated with a few drops of 0.5 N HCL to secure low pH in order to present precipitation of iron. The concentration of major cations (Na+,K+,Ca2+,Mg2+,Fe total) and anions (HCO3-,CL-,NO3-,SO4-), concentrations in water were determined by chemical analysis using standard procedures analyzed from Groundwater Division, public works Department (PWD) / Water Testing Laboratory, Trichy-20. (Table.1)

About the Study Area: The study area Needamangalam block, where groundwater is the main source of water supply. Location and Extent Needamangalam block is bounded by Needamangalam block in the north, by Mannargudi blocks in the east and by Mannargudi blocks in the east and by Ammapettai block on the west. It falls within the following co-ordinates: East Longitude: $70^0$30’30” East Latitude:$10^0$28’0”-$10^0$50’0” North of toposheets 58N/5 and N/6. This block has a total extent of 378.70 sq.km.

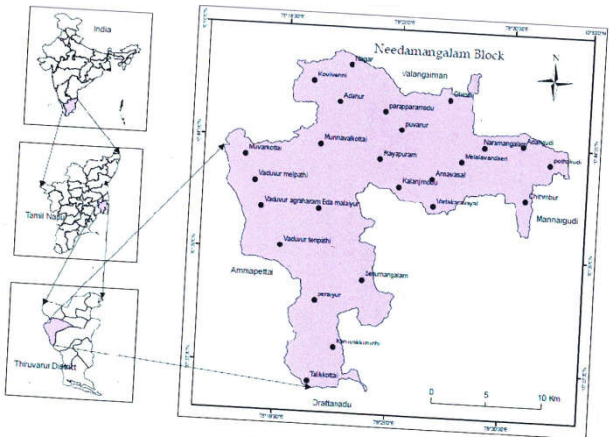

Figure 1. Study area map

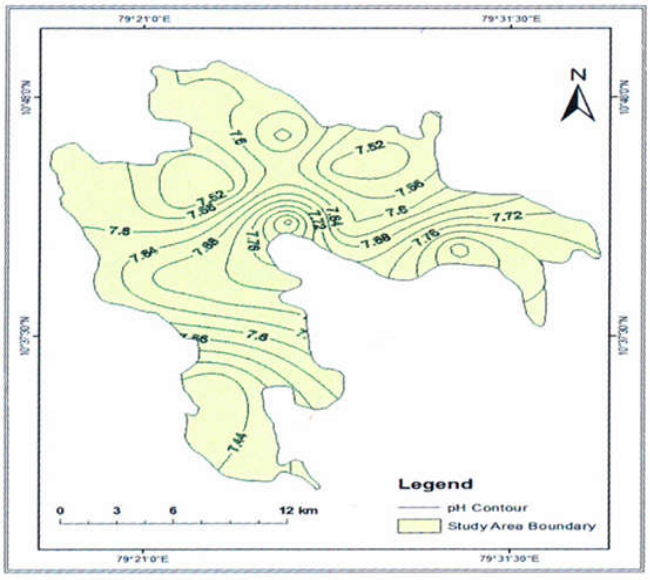

Figure 2. Shows pH Concentration of Needamangalam Block, Thiruvarur District

Table 1. Geo Chemical Parameters in (ppm) the Needamangalam Block, Thiruvaru District

S.NO	LOCATION	EC	pH	Ca	Mg	Na	K	HCO3	Cl	SO4	NO3	F	TDS
1	KOVILVENNI	1420	7.6	36	39	207	19	297	259	29	5	0.26	793
2	CHITHAMALLI	1220	7.6	36	52	131	23	415	177	25	4	0.36	656
3	NEEDAMANGALAM	800	7.7	24	43	76	18	342	96	7	3	0.11	438
4	ADANUR	1520	7.5	40	38	232	19	433	269	48	3	0.34	866
5	KALACHERI	1650	7.5	50	40	242	20	445	298	53	4	0.1	930
6	PERAMBUR	980	7.6	20	36	129	20	451	89	10	5	0.56	535
7	NARAMANGALM	1260	7.7	22	35	196	18	488	160	23	2	0.41	700
8	MUVARKOTTAI	510	7.9	38	23	28	18	201	67	7	7	0.16	289
9	RAYAPURAM	1340	7.5	38	27	216	19	470	184	50	3	0.48	772
10	KEELAVAZHASERI	1480	7.5	22	55	216	18	494	206	72	5	0.09	841
11	POTHAKUDI	1510	7.9	20	19	290	17	512	238	29	1	1.3	870
12	VADUVUR MELPATHI	660	7.6	38	26	53	18	262	82	7	4	0.2	359
13	KALANJIMODU	970	7.6	30	29	131	18	323	163	12	1	0.37	546
14	ARICHAPURAM	1350	7.5	2.6	33	214	18	421	152	115	14	0.42	783
15	VADAKARAVAYAL	990	7.6	36	23	138	19	372	110	40	3	0.75	553
16	EDAMELAYUR	780	7.7	30	43	55	18	293	99	17	2	0.25	411
17	VADUVUR THENPATHI	710	7.7	40	33	51	19	238	106	19	9	0.29	396
18	SERUMANGALAM	480	7.7	28	22	30	19	183	60	9	6	0.24	266
19	PERAIYUR	500	7.6	32	27	23	20	159	71	30	9	0.12	292
20	KARUVAKURICHI	820	7.4	20	39	87	19	305	99	25	12	0.34	454

Table 2. Geochemical Charactertrics of Needamangalam Block, Thiruvarur District

S.NO	LOCATION	TH	SAR	RSC	Na%	P.I	CR	MR
1	KOVILVENNI	71.88	33.82	222	75.08	79.51	0.46	52
2	CHITHAMALLI	39.45	19.75	327	63.63	0.65	0.21	59.09
3	NEEDAMANGALAM	47.65	13.14	275	58.38	66.07	0.4	64.17
4	ADANUR	79.9	37.17	355	76.29	81.54	0.55	48.71
5	KALACHERI	100	6.7	355	74.43	79.24	0.64	44.44
6	PERAMBUR	39.8	24.38	395	72.68	81.2	0.04	64.28
7	NARAMANGALM	43.7	36.77	431	78.96	86.2	0.15	61.4
8	MUVARKOTTAI	75.95	5.07	140	42.99	47.38	0.06	37.7
9	RAYAPURAM	75.8	37.89	405	78.33	84.58	0.39	41.53
10	KEELAVAZHASERI	44	35.52	417	75.24	81.3	0.59	71.42
11	POTHAKUDI	39.95	69.75	473	88.72	95.02	0.25	48.71
12	VADUVUR MELPATHI	75.95	9.38	198	52.59	59.12	0.05	40.62
13	KALANJIMODU	59.87	24.12	264	71.63	78.4	0.122	49.15
14	ARICHAPURAM	35.67	50.83	385.6	86.69	93.95	0.88	92.69
15	VADAKARAVAYAL	67.81	25.89	315	73.36	80.65	0.27	40.35
16	EDAMELAYUR	59.67	9.1	220	50	56.33	0.13	58.9
17	VADUVUR THENPATHI	43.63	8.44	175	48.95	53.56	0.19	45.2
18	SERUMANGALAM	55.94	6	133	49.49	54.4	0.09	44
19	PERAIYUR	34.36	4.23	100	42.15	43.41	0.38	45.76
20	KARUVAKURICHI	39.87	16.02	246	64.24	71.54	0.2	66.1

Table 3. Maximum and Minimum and Mean Value of Geochemical Parameter of Needamangalam Block, Thiruvarur District

Parameters	Minimum value	Maximum value	Mean
EC	480	1650	1047.5
pH	7.4	7.9	7.62
Ca	2.6	50	30.03
Mg	19	55	34.1
Na	23	290	137.25
K	17	23	18.85
HCO3	159	512	355.2
Cl	60	298	149.25
SO4	7	115	31.35
NO3	1	14	5.1
F	0.1	1.3	2.1395
TDS	266	930	587.5

Figure 2. Shows pH concentration in the Needamangalam block could be seen from this figure the maximum concentration are seen in the area of South-West parts of the study area whereas minimum concentration are seen in the area of North-East position of the study area.

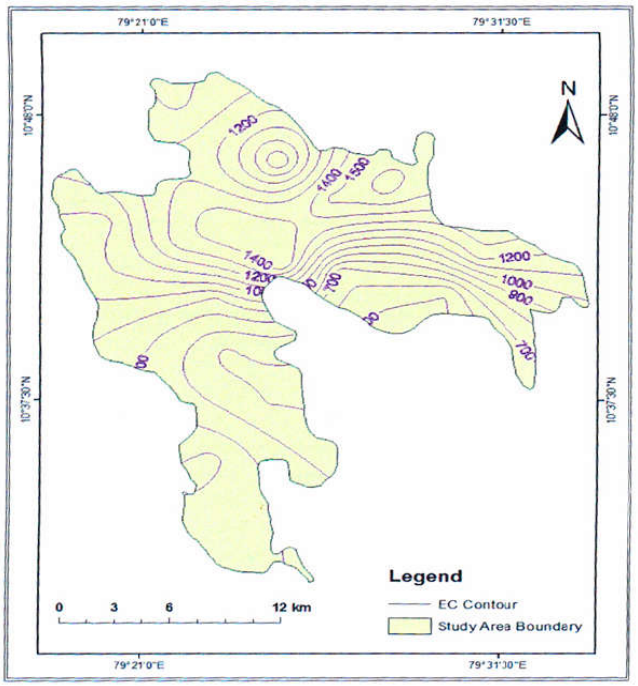

Figure 3. Shows Electrical Conductivity of Needamangalam Block, Thiruvaru District

Figure 3. Shows Electrical Conductivity in the Needamangalam block could seen from this figure the maximum concentration are seen in the area of Alangudi whereas minimum concentration are seen in the area.

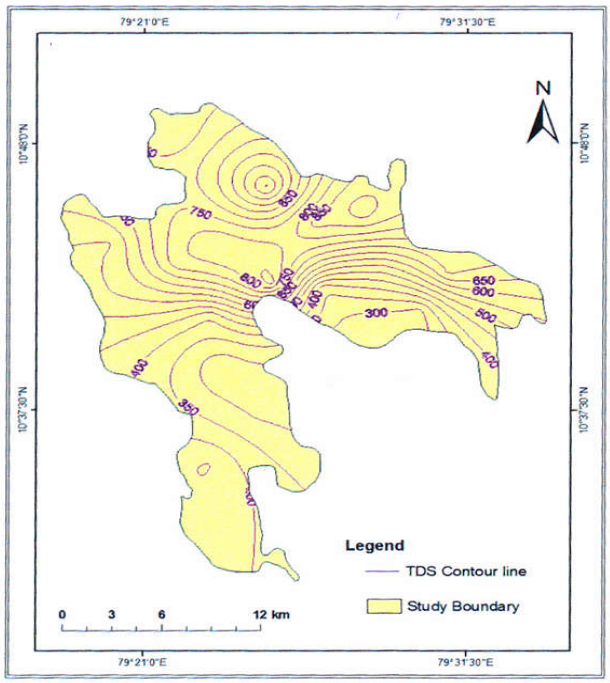

Figure 4. Shows Total Dissolved Solids of Needamangalam Block, Thiruvaru District

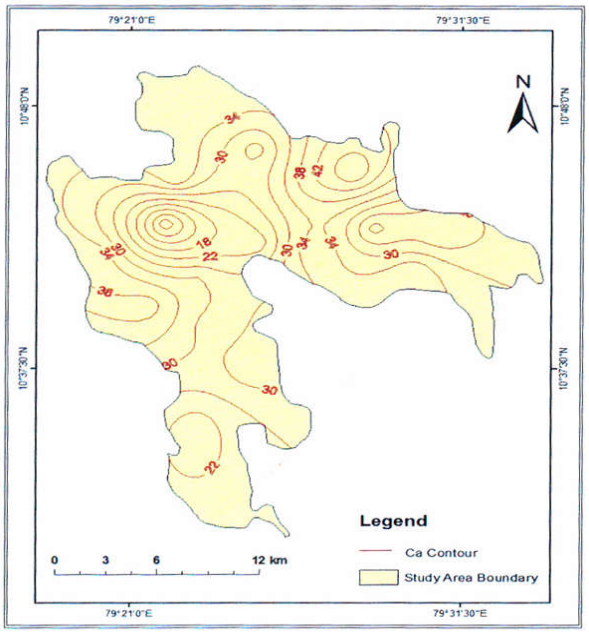

Figure 5. Shows Calcium Concentration of Needamangalam Block, Thiruvaru District

Figure 4. Shows Total Dissolved Solids in the Needamangalam block could be seen from this figure the maximum concentration are seen in the area of Thenkuvalaveli 930 parts of the study area wheras minimum concentration are seen in the area of North-West study area 266 Thenkuvalaveli.

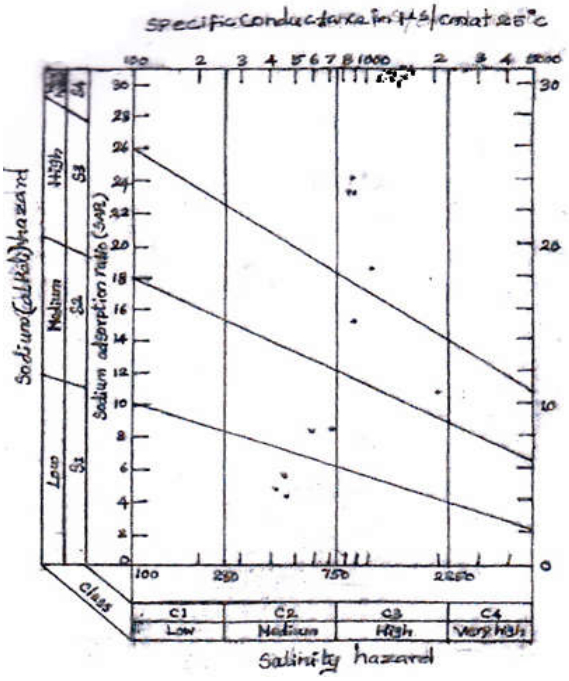

Figure 6. U.S.SALINITY HAZARD

Figure 5. Shows Calcium concentration in the Needamangalam block could be seen from this figure the maximum concentration are seen in the area of 50 Kalacheri parts of the study area whereas minimum concentration are seen in the area of North-West of study area 2.6 Arichapuram. U.S. Salinity Laboratory Diagram are shown in the figure Needamangalam block Thiruvarur District could be seen from this figure 6. Most of the samples (65%) falls under the C_3S_4 remaining classified as C_3S_4 (10%),C_2S_2 (10%) and C_2S_1 (15%)

Table 5. Hardness Classification of Needamangalam Block

Hardness mg/l as Caco3	Water Class	No. Of Sample	Name of the Location
0-75	Soft	Nil	Nil
75-150	Moderately hard	1	11
150-300	Hard	18	1,3,4,5,6,7,8,9,10,12,13 ,14,15,16,17,18,19,20.
>300	Very hard	1	2

Table 6. Identification of Irrigation Water in Needamangalam Block

Zone-Classification	No. of Sample	% of Sample
C2 S1	3	15
C2 S2	2	10
C3 S3	2	10
C4 S4	13	65

CONCLUSION

- pH concentration in the Needamangalam Block could be seen from this figure the maximum concentration are seen in the area of South-West parts of the study area whereas minimum concentration are seen in the area of North-East position of study area.
- Electrical Conductivity in the Needamangalm Block could be seen from this figure the maximum concentration are seen in the area of North-East parts of the study area whereas minimum concentration are seen in the area of North-West position of study area.
- Total Dissolved Solids in the Needamangalam Block could be seen from this figure the maximum concentration are seen in the area of South-West parts of the study area wheres minimum concentration are seen in the area of North-West of study area.
- Calcium Concentration in the Needamangalam Block could be seen from this figure the maximum concentration are seen in the area of South-West parts of the study area whereas minimum concentration are seen in the area of North-West of study area.
- Magnesium concentration in the Needamangalam Block could be seen from this figure the maximum concentration are seen in the area of South-West position of study area.
- Sodium concentration in the Needamangalm Block could be seen from this figure the maximum concentration are seen in the area of South-West parts of the study area where as minimum concentration are seen in the area of North-East position of study area.
- Potassium concentration in the Needamangalam Block could be seen from this figure the maximum concentration are seen in the area of North-East parts of the study area whereas minimum concentration are seen in the area of three direction of study area.
- Bicarbonate in the Needamangalam Block could be seen from this figure the maximum concentration are seen in the area of North-East parts of the study area whereas minimum concentration are seen in the area of South-West position of study area.
- Chloride concentration in the Needamangalam Block could be seen from this figure the maximum concentration are seen in the area of North-East parts of the study area whereas minimum concentration are seen in the area of North-West of study area.
- Sulphate concentration in the Needamangalam Block could be seen from this figure the maximum concentration are seen in the area of South-East parts of the study area whereas minimum concentration are seen in the area of all other three direction position of study area.

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