International Journal of ChemTech Research
CODEN (USA): IJCRGG, ISSN: 0974-4290, ISSN(Online):2455-9555
Vol.10 No.8, pp 573-579, 2017

Analysis of Ground Water Quality in Ramanathapuram Municipality

M.Priyanga, P.Srishadurya, R.Anuradha*

Department of Civil Engineering, SNS College of Technology, Coimbatore, India

Abstract : The present work is aimed at assessing the water quality index (WQI)for the groundwater of Ramanathapuram Municipality. This has been determined by collecting groundwater samples and subjecting the samples to a comprehensive physicochemical analysis. For calculating the WQI, the following 7parametershave been considered:pH, Total hardness ,Electrical conductivity, Chloride, Calcium ,Alkalinity, Magnesium.The WQI for these samples ranges from 89.21 to 660.56. The high value of WQI has been found to be mainly from the higher values of iron, nitrate, total dissolved solids, hardness, fluorides, bicarbonate and manganese in the ground water. The results of analyses have been used to suggest models for predicting water quality. The analysis reveals that the groundwater of the area needs some degree of treatment before consumption, and it also needs to be protected from the perils of contamination.
Keywords : Ground water Quality, Ramanathapuram Municipality.

1.0 Introduction

Water is the basic requirements of all life on Earth. The origin of life has been attributed is water along with other basic elements water the source of life is passionate. Too passionate to manage excess of, it leads to flood and lack of its results in drought and famine[1]. It must be remembered that any natural or manmade activity on the surface of the earth will have it's for most impact on the quality and quantity of water this will be taken into the biosphere systems and ultimately lead to hydrological extremes. The increase in population and urbanization and urbanization necessitates growth in the agricultural and industrial sectors which demand for more fresh water. When surface water is the non-available mode the alternative is to depend on ground water.

2.0 Literature Survey

2.1 General

In India, most of the population is dependent on ground water as the only source of drinking water supply. The ground water is believed to the comparatively much clean and free from pollution than surface water. Ground water can become contaminated either naturally or because of numerous types of human activities, residential, municipal, commercial, industrial, and agricultural activities can all affect ground water quality[2]. Now a days, the ground water is facing threats due to anthropogenic activities. So a detailed examination of ground water quality is essential in our life.

2.2 Literature Review

In past years, the water quality analysis are done in many areas for example Assessment of Water Quality Index for the

Groundwater: A case study of Tumkur Taluk,Karnataka State, India at 2011.
Water quality assessment of Yamuna River in delhi region at 2012.
Assessment of water quality in tigris river-iraq at 2013.

But there is no such case study or examination are done in india, tamilnadu.in this study, ground water samples were collected in 10 different areas of Ramanathapuram, municipality, Tamilnadu, India. Thee water samples were analysed for physico-chemical parameters like ph, hardness, calcium, magnesium, alkalinity, chloride, electrical conductivity and water quality index using standard the laboratory.

The final integrated values shows three priority classes such as excellent, good, poor and unsuitable ground water quality zones of the study areas and provides a guide line for the suitability of ground water or domestic purposes.

3.0 Problems in Study Area

There are three main sources of groundwater pollution. These includes natural sources, waste disposal activities, spills, leaks and non-point source activities such as agricultural management practices. Here in Ramanathapuram Municipality area the groundwater could be spoiled due to waste disposal and Improper Agricultural practices. The groundwater quality in and around Ramanathapuram Municipality is potable. All the people used the groundwater for domestic purposes[3]. The Agricultural communities utilized the groundwater for farming in their lands. But today the scenario is completely different. In many part of Ramanathapuram Municipality, groundwater usage is obsolete. Therefore water quality monitoring is necessary in Ramanathapuram municipality.

4.0 Need for the Study

Now a day's water scarcity increases rapidly due to decrease of ground water. The ground water is also polluted due to various artificial man-made activities. Due to this, quality of the water is reduced. This will produce various adverse impacts on human beings, animals and plants. Therefore, it is necessary to monitor the water quality.

5.0 Study Area

Ramanathapuram District is an administrative district of Tamil Nadu state in southern India. The city of Ramanathapuram is the district headquarters. Ramanthapuram District has an area of 4123 km^2. It is bounded on the north by Sivaganga District, on the northeast by Pudukkottai District, on the east by the Palk Strait, on the south by the Gulf of Mannar, on the west by Thoothukudi District, and on the northwest by Virudhunagar District. The district contains the Pamban Bridge, an east-west chain of low islands and shallow reefs that extend between India and the island nation of Sri Lanka, and separate the Palk Strait from the Gulf of Mannar. The Palk Strait is navigable only by shallow-draft vessels.

5.1 General

In Tamil Nadu, Ramanathapuram is one of the famous Tourist Destination which is well known for its Rice Cultivation. It is situated in the southern part of Tamil Nadu. Out of total geographical area of 4123 km^2 and an elevation of 2 m (7 ft). The entire district lies in the southern seas.

Its summer temperature is Max 33'C – Min 23'C. Winter Temperature Max 27'C – Min 18'C. The sources of irrigation are pond, tanks and wells. Ground water plays a major role for Irrigation as well as Domestic uses.

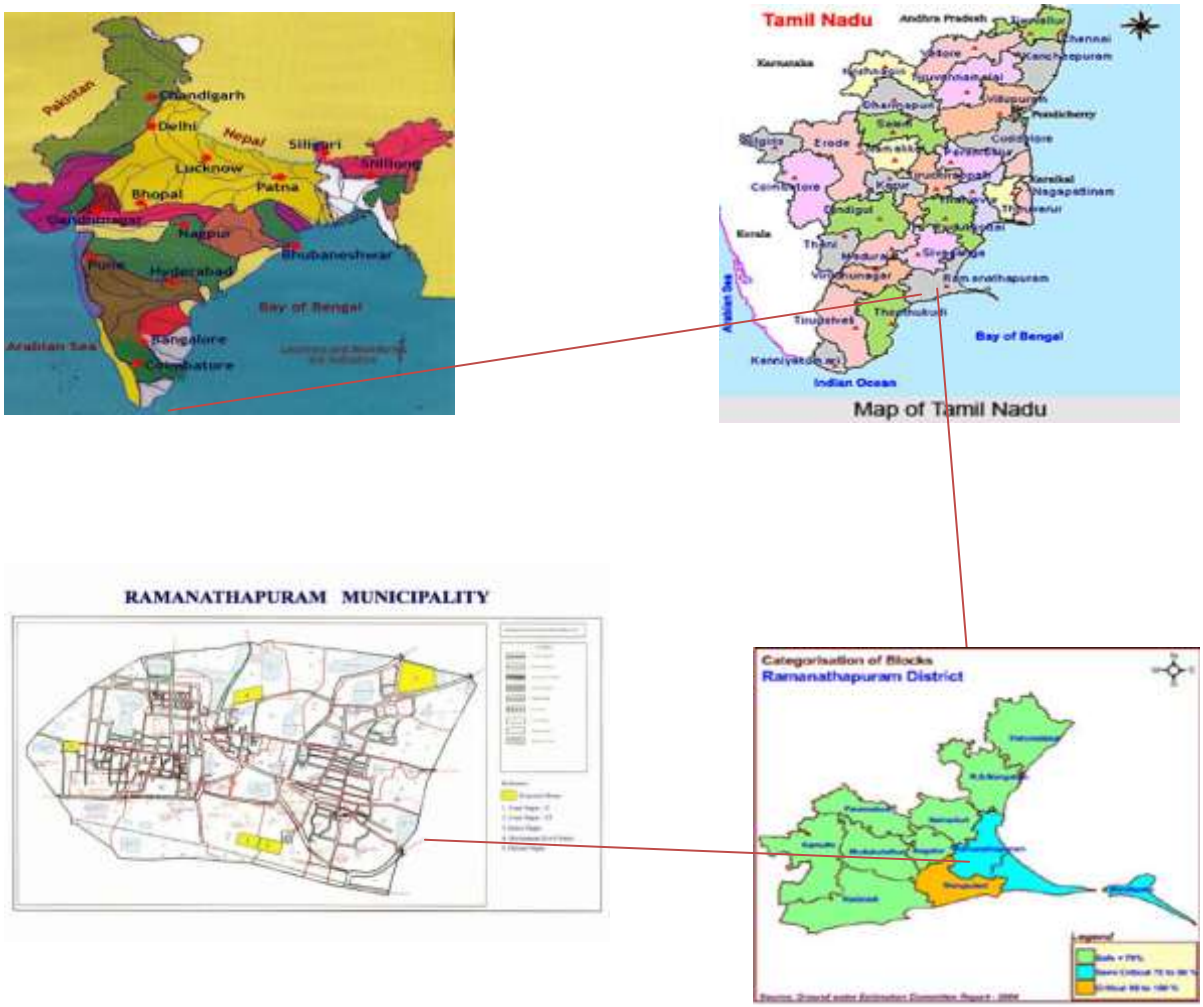

Figure 1: Study Area

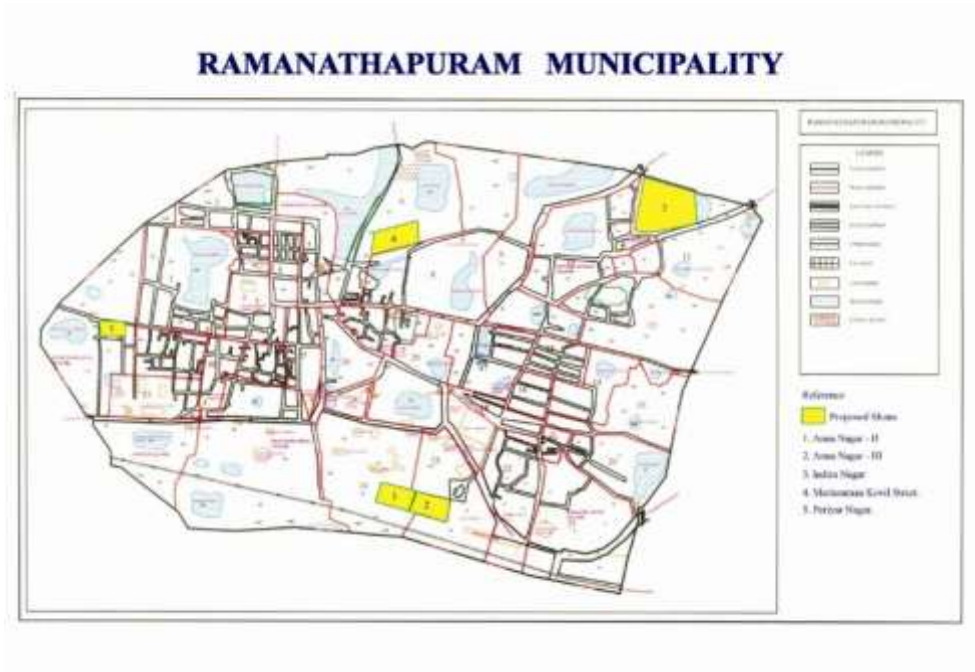

Figure 2: Location of sampling station

5.2 Location of the Study Area

And our study area covers Ramanathapuram municipality which lies between North Latitudes 9˚ and 9˚ 55' East Longitudes 77˚ 02' and 77˚ 5'.

5.3 Ramanathapuram Municipality

The total area of this municipality is 6.3 sq.km. The cultivatable area is irrigated by Local streams and also irrigated by ground water. Ramanathapuram municipality comprises of Areas Namely Anna Nagar, Indira Nagar, PattanamKathan, SakkaraiKottai, R.S Madai, PeriyarNagar, Kuuriyur, Mariamman Kovi lStreet, Surankottaiand Taluk office.

5.4 Land Utilization Pattern

Within the Ramanathapuram municipality, the distribution of rainfall is uneven. The mean annual rainfall in this area is about 1350.4 mm. And a perusal of rainfall data collected over a period of ten years from 2000 reveal that the district receives major portion of its annual rainfall during the North East Monsoon.

6.0 Conventional Data Base

1. Layout Map of Ramanathapuram municipality
2. Groundwater quality parameters

6.1 Instruments Used

1. GPS – Garmin
2. Water Quality Field Kit

6.2 Creation of a Database

A collection of information in such a way that a computer program can quickly select desired pieces of data. Traditional database are organized by field, records and fields. A field is a single piece of information a record is one complete that of fields and a file is a collection of records[4,5]. Here data base was created using ground water quality parameters.

7.0 Analysis

7.1 Ground Water Quality Parameters

The major ground water quality parameters such as, have been estimated in 10 observation wells throughout the Ramanathapuram municipality.

1. pH
2. Total hardness
3. Electrical conductivity
4. Chloride
5. Calcium
6. Alkalinity
7. Magnesium

8.0 Water Quality Index

House and Newsome, 1989, stated that the Water Quality Index (WQI) allows 'good' and 'bad' water quality to be quantified by reducing a large quantity of data on a range of physical, chemical and biological variables to be a single number in a simple, objective an reproducible manner (Liousmet al., 2004). The WQI concept is based on the comparison of the water quality parameter with respective regulatory standards (Khan F, et al., 2003) and provides a single number that express overall water quality at certain location based on several water quality parameters (Yogendra and Puttaiah, 2008). WQI improves understanding of water quality issues by integrating complex data and generating a score that describes water quality status and evaluates water quality trends (Boyacioglu, 2007).In present study the WQI has been calculated by using standards of drinking

water quality recommended by the Bureau of Indian standards (BIS) and Indian Council for Medical Research (ICMR) and weighted index method developed by Tiwari and Mishra 1985; As adiet al., 2007 to determine the suitability of groundwater for drinking purposes. In the present study ten water quality parameters, namely, pH, Electrical Conductivity (EC), Alkalinity, TDS, Total hardness, Calcium, Magnesium, Nitrate, Chloride and Sulphate were considered for computing WQI by using the following formulas.

$WQI = \text{Antilog} [\Sigma W^{n}\ n=1 \log 10\ qn]$ ⟶ (1)

Where,

W, Weightage factor (W) is computed using the following equation, (Table 1)

$Wn = K / S_n$ ⟶ (2)

Where,

K, Proportionality constant is derived from,

$K = [1/ (\Sigma^{n}\ n=1\ 1/S_n)]$ ⟶ (3)

Where,

Sn and S_i are the BIS/ICMR standards values of the water quality parameter.

AndQuality rating (q) is calculated using the formula,

$qn_i = \{[(V_{actual} - V_{ideal}) / (V_{standard} - V_{ideal})]*100\}$ ⟶ (4)

Where,

qn_i = Quality rating of the parameter for a total of n water quality parameters

V_{actual} = Value of the water quality parameter obtained from laboratory analysis

V_{ideal} = Value of that water quality parameter can be obtained from the standard tables

V_{ideal} for pH = 7 and for other parameters it is equivalent to zero

$V_{standard}$ = BIS / ICMR standard of the water quality parameter

The standard of the water quality parameter is given in Table 2. Table 3 shows values of the all ten parameters that are experimented in the laboratory and values of WQI that is computed by using above formulae and Table 4 shows the indexing of WQI into categories of different types in order to assess the portability of ground water in the study area**.**

8.1. Water Quality Parameters, Their ICMAR/BIS Standards, and Assigned Unit Weight

Table-2

Parameter	**Standard (S_n&S_i)**	**1/ Sn**	**K**	**Weightage(W_n)**
PH	8.5	0.11747	5.020014437	0.590589934
Electrical conductivity	300	0.003333	5.020014437	0.016733381
Hardness	300	0.003333	5.020014437	0.016733381
Calcium	75	0.013333	5.020014437	0.066933526
Magnesium	50	0.02	5.020014437	0.100400289
Alkalinity	120	0.008333	5.020014437	0.041833454
chloride	250	0.004	5.020014437	0.020080058
		0.199203		1

8.2. Water Quality Parameter

Table-3

Sample	PH	Electrical conductivity	Hardness	Calcium	Magnesium	Alkalinity	Chloride	WQI
1.	7.4	700	325	94.5	12.25	280	138.45	24.35
2.	7.6	670	345	91.87	11	300	146.97	53.49
3.	7.9	668	200	83.12	18.81	260	176.79	25.85
4.	7.7	552	210	68.25	17	345	106.5	56.52
5.	7.25	498	215	49.87	16.6	305	115.02	42.07
6.	7.69	726	215	48.12	37	205	80.94	23.84
7.	7.45	968	320	43.75	34.12	300	83.07	36.17
8.	7.41	750	425	52.5	34.2	280	85.2	26.74
9.	7.11	747	180	56.87	36	300	87.33	28.86
10.	7.34	658	190	31.5	14	300	78.81	34.92

All units except pH and conductivity are in mg/l.

8.3. Status Of Water Quality

Table-4

Water Quality Index	Water Quality Status
0-25	**Excellent**
26-50	**Good**
51-75	**Poor**
76-100	**Very poor**
>100	**Unsuitable**

9.0 Conclusion

This study has demonstrated the utility of GIS combined with laboratory analysis to assess and mapping of groundwater quality. The spatial distribution map of pH, Chloride, Magnesium and Sulphate shows that, these parameters are within the permissible limit in the study area. The interpreted water quality with respect to EC indicates that more than 90% of the study area groundwater lies in bad range for drinking purposes except at sample $10^{6,7}$. The spatial distribution map of hardness concentrations illustrates that the majority of the samples are within the permissible limit except four samples i.e. sampling point 1, 2, 3 and 4. Calcium ion distribution is within the maximum permissible limits, except for three samples i.e. sampling point1, 2 and 3 which show Calcium concentration exceeding the permissible limit. The spatial distribution map of Alkalinity concentrations illustrates that all samples are beyond the permissible limit. TDS and Nitrate concentration in groundwater of the study area exceeds the maximum permissible limit in one location only i.e. sample 7 and sample 1 respectively. The overall view of the WQI of the present study showed that most of the area having a WQI value less than 50 except in the surrounding areas of sample 2 and sample 4. People can use the ground water for Drinking and Domestic purpose in the study area except in Upper Katrajnagar and BVU. This study has shown that the use of GIS and remote sensing is very useful tool for the assessment of ground water quality.

10. Reference

1. APHA (1998), Standard methods for the examination of water and wastewater,American Public Health Association, Washington D.C.

2. Asadi S. S., Vuppal P., and Reddy A. M. (2007), Remote sensing and GIS techniquesfor evaluation of groundwater quality in municipal corporation of Hyderabad (Zone-V), India, International Journal of Environmental Research and Public Health, 4(1), pp45–52.
3. BIS (2003), Indian standards specifications for drinking water IS: 10500, Bureau of Indian Standards, New Delhi.
4. Boyacioglu, (2007), Development of a water quality index based on a European classification scheme, Water SA, 33(1), pp 101-106.
5. Challerjee R., Tarafder G., and Paul S. (2009), Groundwater quality assessment of Dhanbad district, Jharkhand, India, Bulletin of Engineering Geology and Environment, 69(1), pp 137-141.
6. Collet C. (1996), Geographic Information System Needs and Software in : Geographical Information Systems in Hydrology, 1st Edition, Kluwer Academic Publishers, Boston, USA.
7. Dahiya S., and Kaur A. (1999), Assessment of physical and chemical characteristics of underground water in rural areas of Tosham subdivision, Bhiwani-Haryana, International Journal of Environment and pollution, 6(4), pp 281-288.

*****