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IMPACT OF POTENTIALLY VULNERABLE SITES OVER THE GROUNDWATER QUALITY OF RAMAYANPATTI

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ABSTRACT

Groundwater has been a very potential resource to mankind for ages but the human activities over the years have led to wide spread degradation of this valuable resource. In this study, the alteration in groundwater quality parameters TDS, alkalinity, hardness, chloride, pH around the Ramayanpatti village, due to the presence of solid waste dumpsite and waste water treatment plant has been studied. The results suggest a wide fluctuation in the groundwater quality parameters except pH hence emphasizing the need for continuous monitoring around such areas and further taking appropriate treatment measures.

Keywords: Alkalinity, Chloride, Groundwater quality, Hardness, TDS

I. INTRODUCTION

Water is an important constituent of all living organisms present on the earth and has most significance for humans for adequate life. The Ground and surface water lakes on the land are the most essential freshwater reservoirs. These are used for domestic and irrigation purposes **(Muhammad et al., 2014)**.

In recent years, the increasing threat to groundwater quality due to human activities has become a matter of great concern. A vast majority of groundwater quality problems present today are caused by contamination and by overexploitation, or by combination of both. Rapid urbanization and industrialization in India has resulted in steep increase of generation of wastes. Due to lack of adequate infrastructure and resources, the waste is not properly collected, treated and disposed; leading to accumulation and infiltration causing groundwater contamination. The problem is more severe in and around large cities as also various clusters of industries. In many of these areas groundwater is only source of drinking water, thus a large population is exposed to risk of consuming contaminated water **(Status of Groundwater Quality in India -Part – I, Groundwater Quality Series: Gwqs/ 09/2006-2007)**.

Urbanization and industrialization are recognized to be main causes for water quality degradation over the years **(Sekhar and Raj 1995)**.

Water quality monitoring has a high priority for the determination of current conditions and long term trends in effective management. The supply of unsafe water has a magnificent impact in the anticipation of water

transmitted diseases **(Muhammad et al., 2014)**. Therefore, it is necessary to monitor water quality regularly before using it for drinking purposes.

In this study, the major water quality parameter around the Ramayanpatti village has been tested. This study has been initiated to get an in depth knowledge about the drastic variation in groundwater quality due to the presence of solid waste dumpsite and waste water treatment plant around the study area, keeping in view the vulnerable nature of solid waste dumpsite and waste water treatment plant.

II. STUDY AREA

Tirunelveli district is located in the southern part of Tamil Nadu and surrounded by Virudhunagar District on the North, Western Ghats on the West, Kanyakumari District on the South and Tuticorin District on the East. This District is having three Revenue Divisions comprising of 11 Taluks, 19 Development Blocks, 628 Revenue Villages and 425 Village Panchayats.

Tirunelveli district is provided with varied agro climatic conditions ranging from extreme tropical to subtropical. Tirunelveli District is located in the world map, between 08º 8' and 09 º 23' of Northern latitude and 77 º 09' and 77 º 54' of Eastern longitude. In this paper, Ramayanpatti village of Tirunelveli was selected for the study area. The area of region under study was 98.062 Km^2.

A wastewater treatment plant of capacity 24.2 MLD is established in Ramayanpatti in the Tirunelveli district. The treatment technique used is both aerobic and anaerobic which are done using stabilization ponds. Though it is designed for the capacity of 24.2 MLD it only receives and treats about 10 MLD. Also the site contains solid waste dumpsite having the capacity of 100 Metric Tons per Day located nearby waste stabilization pond.

Tirunelveli, unlike other cities practices agriculture even in the corporation area and with the application of fertilizers in such areas; the water quality gets affected seriously due to waste water discharges.

80 small scale industries are operating around Ramayanpatti village manufacturing Calcium powder for commercial uses from the lime stone quarry. It also adds concern to the degradation of water quality around the region.

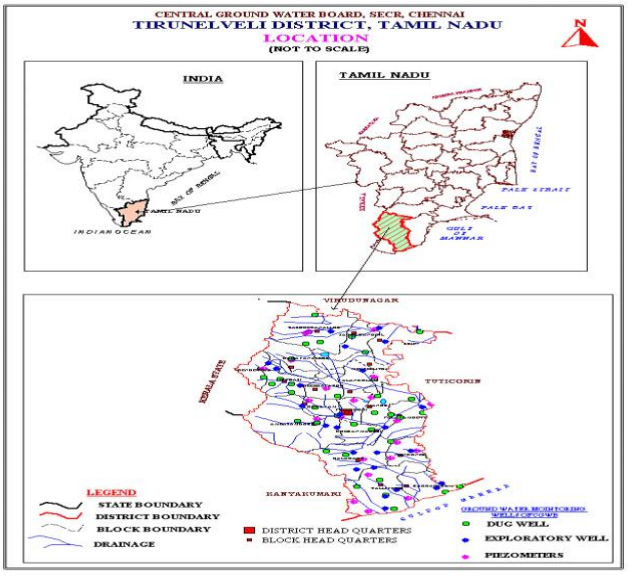

Figure 1 Geographical location of study area

Figure 2 Location of solid waste dump yard (1) and treatment plant (2) of tirunelveli

III. MATERIAL AND METHODS

3. 1 METHODOLOGY

Based on the various literature reviews, a methodology is formulated and adopted for the study. The following flow chart depicts the proposed methodology:

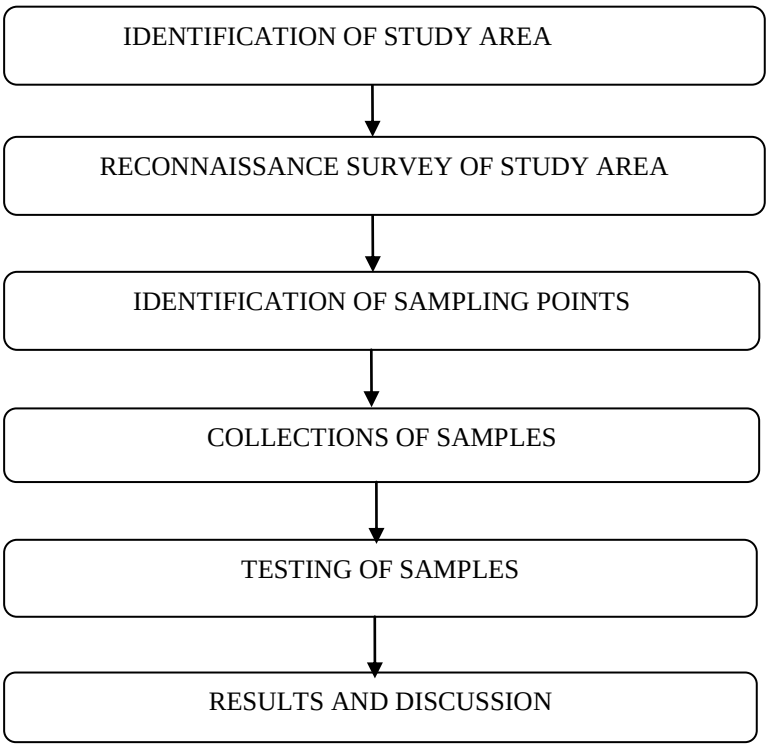

Figure 3 Methodology flowchart

3.2 SAMPLE COLLECTION:

Prior to sample collection, all the bottles should be washed with dilute acid followed by distilled water and dried out. Samples are stored in Polypropylene cans. Sample bottles are labelled with well type and well number. Latitude and longitude of the sampling points are noted down with the help of Global Positioning System (GPS). The sampling stations are randomly selected around solid waste dump site and treatment plant in Ramayanpatti. Further in this study, sampling was done for both open and bore well **(Sampling of groundwater-Guidelines, IS 13969:1994)**.

Table 1 List of well sites identified for sampling

S.NO	WELL NO	TYPE OF WELL	LATTITUDE	LONGITUDE
1	OW1	Open well	N 08°45.713'	E 077°41.388'
2	BW2	Bore well	N 08°45.516'	E 077°41.399'
3	BW3	Bore well	N 08°45.426'	E 077°41.408'
4	BW4	Bore well	N 08°45.296'	E 077°41.467'
5	BW5	Bore well	N 08°45.255'	E 077°41.609'
6	OW6	Open well	N 08°45.036'	E 077°41.157'
7	BW7	Bore well	N 08°44.097'	E 077°40.551'
8	BW8	Bore well	N 08°44.130'	E 077°40.397'
9	BW9	Bore well	N 08°44.456'	E 077°39.940'
10	BW10	Bore well	N 08°45.754'	E 077°38.395'
11	BW11	Bore well	N 08°46.206'	E 077°38.627'
12	OW12	Open well	N 08°47.804'	E 077°39.016'
13	BW13	Bore well	N 08°46.003'	E 077°41.032'
14	BW14	Bore well	N 08°45.682'	E 077°41.153'
15	BW15	Bore well	N 08°45.440'	E 077°41.289'
16	BW16	Bore well	N 08°45.514'	E 077°41.171'

IV. RESULT AND DISSCUSSIONS

4.1TESTING OF SAMPLES:

The samples were tested for various water quality parameters and the results obtained are tabulated below:

Table 2 Analysis of water quality parameters

WELL NO	pH (No unit)		TDS In mg/l		CHLORIDE In mg/l		ALKALINITY In mg/l		TOTAL HARDNESS In mg/l	
	OBSERVED	STANDARD	OBSERVED	STANDARD	OBSERVED	STANDARD	OBSERVED	STANDARD	OBSERVED	STANDARD
OW1	**7.64**	6.5-8.5	**2795**	500	**2149.33**	250	508	200	**1992**	200
BW2	7.8	6.5-8.5	823.6	500	649.79	250	**656**	200	736	200
BW3	8.31	6.5-8.5	1164	500	869.73	250	608	200	716	200
BW4	7.81	6.5-8.5	1519	500	939.7	250	588	200	976	200
BW5	7.99	6.5-8.5	538.2	500	519.83	250	496	200	408	200
OW6	8.27	6.5-8.5	862.2	500	729.77	250	564	200	704	200
BW7	7.69	6.5-8.5	404.4	500	369.88	250	452	200	360	200
BW8	8.13	6.5-8.5	359.6	500	339.89	250	**328**	200	**188**	200
BW9	**8.39**	6.5-8.5	**248**	500	**289.91**	250	448	200	220	200
BW10	8.03	6.5-8.5	279.8	500	309.9	250	348	200	208	200
BW11	7.93	6.5-8.5	638.3	500	559.82	250	424	200	484	200
OW12	7.91	6.5-8.5	501.1	500	529.83	250	408	200	424	200
BW13	7.78	6.5-8.5	924	500	709.77	250	424	200	768	200
BW14	7.88	6.5-8.5	1094	500	689.78	250	600	200	684	200
BW15	7.95	6.5-8.5	1153	500	879.72	250	636	200	700	200

WELL NO	pH (No unit)		TDS In mg/l		CHLORIDE In mg/l		ALKALINITY In mg/l		TOTAL HARDNESS In mg/l	
	OBSERVED	STANDARD	OBSERVED	STANDARD	OBSERVED	STANDARD	OBSERVED	STANDARD	OBSERVED	STANDARD
BW16	7.93	6.5-8.5	903.1	500	639.8	250	456	200	644	200

Calcium, magnesium, carbonates, bicarbonates, chloride and dissolved solids are some of the potential substances polluting the groundwater around the study area and the obtained results are a clear indication of that.

The maximum (2149.33 mg/l) and minimum chloride concentration (289.91 mg/l) are well above the acceptable range (250 mg/l), as specified by IS drinking water standards. The high value of chloride depicts the intense usage of fertilizers around the agricultural lands, which was confirmed through field visit.

The pH though was found to be within the acceptable standards (6.5-8.5) with a maximum value of 8.39 and minimum value of 7.64.

A wide fluctuation in TDS and hardness was found, with TDS values ranging from 248 mg/l to 2795 mg/l (acceptable standard: 500 mg/l) and hardness ranging from 188 mg/l to 1992 mg/l (acceptable range: 200 mg/l); the reason being the open dumping of waste mineral salts generated from small scale industries in and around the proposed study area.

Further an alkalinity value of, maximum 656 mg/l and minimum 328 mg/l was noted; both well above the acceptable standard of 200 mg/l; the presence of landfills being the core reason for the magnified alkalinity value.

Apart from the discussions, the results are tabulated (Table 2) above for the clear comparison of the observed and acceptable standards further giving a better picture of the water quality around the proposed study area.

V. CONCLUSION

The water quality seems to have degraded considerably around the Ramayanpatti village and the reason being the presence of solid waste dumpsite and waste water treatment plant. The leachate infiltration from solid waste dumpsite for a prolonged period of time affects the groundwater quality drastically and also the overflow from waste water treatment plant causes serious alteration in the groundwater quality, suggesting continuos groundwater quality checks in such areas in order to have a regular knowledge of the groundwater condition and to take appropriate treatment measures.

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