MANTECH Publications

Journal of Water Resource Engineering and Pollution Studies
Volume 2, Issue 1, January-April, 2017

Assessment of Ground Water Quality in Bhavani Taluk

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Abstract

Contamination of water resources available for household and drinking purposes with heavy elements, metal ions and harmful micro organisms is one of the serious major health problems. As a result huge amount of money is spent for chemical treatment of contaminated water to make it portable. Thus there is a need to look for some useful indicators, both physical and chemical which can be used to monitor drinking water operation. For the present study the area selected was is Bhavani Taluk which is located in Erode district of Tamilnadu, India. Ground water samples collected from different localities in Bhavani Taluk, were analyzed for their Physio-chemical characteristics. This result was compared with the WHO standards of drinking water and the water quality parameters such as pH, electrical conductivity, Cl-, Na +, K+, Ca, Mg, total dissolved solids, total hardness and F. The usefulness of these parameters in predicting ground water quality of ground water in Bhavani Taluk. This study found that continuous disposal of municipal solid wastes and industrial waste on land, which has limited capacity to assimilate the pollution load, has led to groundwater pollution. Groundwater quality of shallow wells surrounding the municipal waste yard locations has deteriorated and the application of polluted groundwater for irrigation has resulted in increased salt content of solids. In some locations drinking water also have high concentration of salts. Since the farmers had already shifted their cropping pattern to salt tolerant crops. In which remedial measurements have been already adopted.

Keywords: *pH, Electrical conductivity, Total hardness, Total dissolved solids, Cropping pattern, Fluoride, Chlorides, Sodium, Nitrates.*

1. INTRODUCTION

Water is one of the vital components of the physical environment. The quality of drinking water is closely associated with human health and providing safe drinking water is one of important public priorities. Water scarcity is increasing worldwide and pressure on the existing water resources is increasing due to the growing demands in several sectors such as, domestic, industrial, agriculture, hydropower generation, etc. The quality of ground water depends on various chemical constituents and their concentration, which are mostly derived from the geological data of the particular region.

Ground water occurs in weathered portion, along the joints and fractures of the rock. In fact, industrial waste and the municipal solid waste have emerged as one of the leading cause of pollution of surface and ground water. At present there is no major industry in and around the study area, yet household waste and garbage (municipal sewage) are directly discharged into the area. The waste supply for human consumption is often directly sourced from ground water without biochemical treatment and the level of pollution has become cause of major problem. The water used for drinking purpose should be free from toxic elements. Living, non living organism and excessive amount of minerals that may be harmful to health. Keeping this in focus, the quality aspects of ground water in lower Bhavani basin area were analyzed for general water quality and pollution due to industrial discharges. Hence, it is highly essential to examine the presence of substances in drinking water for portable purposes, example: pH, electrical conductivity, total dissolved solids and total hardness etc. Thus this is an attempt to assess the physical and chemical properties of ground water in Bhavani taluk area.

The suitability of drinking water is determined not only by the total amount of salt present but also by the kind of salt. Various soil and cropping problems develop as the total salt content increases, special management practices may be required to maintain acceptable crop yields. Water

quality or suitability for use is judged on the potential severity of problems that can be expected to develop during long term use. Pollutants are being added to the groundwater system through human activities and natural processes. Solid waste from industrial units is being dumped near factories and is subjected to reaction with percolating water and reaches the ground level. The perolating water picks up large amount of dissolved constituents and reaches the aquifer system and contaminates the groundwater level.

The treatments are usually very expensive, time consuming and not always effective. An alarming picture is beginning to emerge in many parts of our country. Groundwater quality is slowly but surely declining everywhere. Groundwater pollution is intrinsically difficult to detect, since problem may well be concealed below the surface and monitoring is costly, time consuming and somewhat hit or miss by nature. Many times the contamination is not detected until obnoxious substances actually appear in water used, by which time the pollution has often dispersed over large area.

2. LITERATURE SURVEY

Pragathi prakash and Manivasagam describes about the sense of feeling. They states that the hard water causes symptoms such as scum in wash basins, whitish scale deposits in pipes and water heater which may be due to calcium and magnesium salts. It may lead to serious health effects such as kidney and bladder stones. The treatment process may include water softener and reverse osmosis.

V.S.Hart, C.E.Johnson and R.Leherman explains about the sense of smell. They states that the odor in the water causes musty, earthy or wood smell. They are generally harmless organic matter. The health effects may include aesthetic only. The treatment process is by using activated carbon filter. The chlorine smell is due to excessive chlorination. The treatment process includes dechlorinate with activated carbon filter.

R.A.L.Rana and M.Abdul Hameed explains about the sense of sight. He states that the turbidity in the water may be due to dirt, salt and clay. It causes suspended matter in the surface water pond, stream or lake. Turbid water contains disease causing microorganisms. The treatment process may

include “calcite” or Neutralize type filter up to 50 ppm. Acid water causes rust. The treatment process includes Neutralizing calcite filter to correct low pH acidity and remove precipitated iron.

Ravi Kumar Gangwar, Jaspal Singh, A.P.Singh made an attempt to study water quality index and pollution or changes in the quality of water in the river Ramganga. On the basis of various parameters analyzed in this investigation, it was concluded that the water quality of river Ramganga is unfit for drinking purposes. WQI may be used as indicator to know the health of river.

The discharging of domestic and industrial water and also other anthropogenic activities were the main factors for contaminating Ramganga stream. Hence there is a need for regular monitoring of water quality in order to detect changes in physiochemical parameters of river water at different sites, implementation of remediation measures and public awareness.

3. SITE LOCATION AND STUDY AREA

The Bhavani Taluk lies in the North west part of Tamil Nadu between North latitude 10°35’00’’ and 11°58’00’’ and East longitude 76°05’00’’. The total covered area 1503.98 sq.km.

It includes the block of Bhavani, Ammapet and Andhiyur comprising of 57 total villages. The main physiological division of Bhavani Taluk are hilly upland and plains. The hilly area is represented in the North West part of the region. The Cauvery and Bhavani river passes over the Western Ghats. The south of Bhavani river passes under the Bhavani basin.

The normal and average rainfall over the district varies from about 575mm to about 833mm. It is the minimum in the south and south eastern parts of the district and it is the maximum in the north and northwest parts. The cooler and pleasant climate prevails in the hilly regions. The weather is extremely pleasant during the period from November to February both in plains and on hills. Mornings in general are humid than in afternoons.

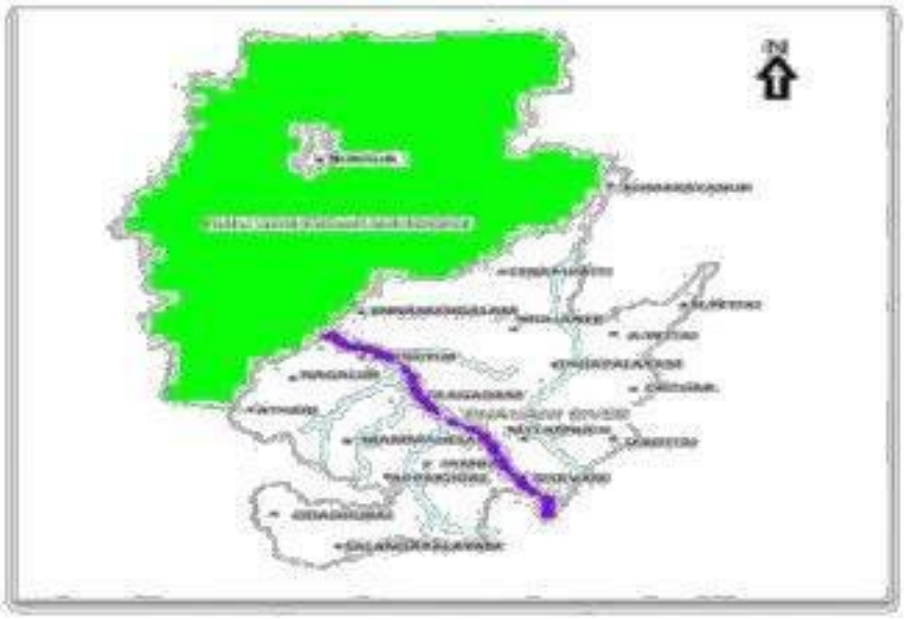

Figure 1

4. METHODOLOGY

All the samples are collected during the post monsoon period during January- March 2016, the samples are collected from shallow depth less than 150ft. The samples are collected in and around Bhavani basin. For sampling well which are constant use and approachable are selected. The sampling are made according to the standard procedure i.e., prewashed one liter bottle are used for sample collection. The collected water samples are tested for its water quality then the graphical representation of various parameters are made and the calculation of water quality are index are made and then the results are obtained.

5. SAMPLE COLLECTION

Water samples from selected sites are collected three times during January to March using pre cleaned bottles. The collected samples are analyzed for major physical and chemical parameters like pH, Electrical conductivity, Cl-, Na+, Ca, Mg, K, F, Total dissolved solids, Total hardness as per the method of water quality assessment of water described in American Public HealthAssociation (APHA), Washington DC.2012.

Figure 2.

6. STANDARD METHODS OF TESTING

There are various standard methods for testing various parameters. They include pH meter for testing pH, titration for chlorides, Magnesium, Calcium and Total Hardness, oven method for testing Total dissolved solids, Conductivity meter for Electrical conductivity, Flame photometer to detect Sodium and Potassium and Calorimeter to test Fluoride.

7. STANDARDS FOR DRINKING WATER

There are various standards for drinking water as prescribed by the World Health Organization.

They include: See Table 1

8. PARAMETERS OF ALL GROUND WATER SAMPLES

The ground water samples at different locations are collected and the various parameters are obtained as follows: **See *Table 2 & 3.***

Table 1

S.NO	PARAMETERS	DESIRABLE LIMIT	MAXIMUM LIMIT
1	pH	6.5-8.5	No relaxation
2	TDS(mg/l)	500	2000
3	TH(mg/l)	300	600
4	Chloride(mg/l)	250	1000
5	Calcium(mg/l)	75	200
6	Magnesium(mg/l)	30	100
7	Sodium(mg/l)	200	600
8	Potassium(mg/l)	50	150
9	Electrical conductivity(µS/cm	1400	2000

10	Fluoride(mg/l)	1	15

Table 2

S.No	LOCATIONS	pH	TDS (mg/l)	Na^+ (mg/l)	K^+ (mg/l)	TH (mg/l)
	STANDARDS	**6.5-8.5**	**500-2000**	**200-600**	**50-150**	**300-600**
1	Bhavani	7.57	660	290	80	599
2	U.Kottai	7.28	550	510	55	461
3	Chithar	7.37	540	280	51	460
4	Unjapalayam	7.42	570	330	53	338
5	Ammapet	7.24	500	455	87	584
6	N.Pettai	7.54	520	502	105	476
7	Mulianur	7.89	660	600	128	322

8	Ennamangalam	7.68	730	408	107	448
9	Chennampatti	7.65	970	468	96	529
10	Komarayanur	7.37	550	539	84	388
11	Burgur	7.44	630	333	81	558
12	Andhiyur	8.26	740	287	79	518
13	Olagadam	7.3	670	371	104	331
14	Nagalur	7.54	560	560	76	391
15	Atthani	8.06	790	349	75	402
16	Brammadesam	7.7	530	256	133	490
17	Jambai	7.67	660	600	149	533
18	Appakudal	7.57	550	234	120	558
19	Odadurai	7.78	780	431	136	438
20	S.Palayam	7.49	550	221	110	399

Table 3

S.No	LOCATIONS	Ca (mg/l)	Mg (mg/l)	Cl (mg/l)	EC (µs/cm)	F (mg/l)
	STANDARDS	**75-200**	**30-100**	**250-1000**	**1400-2000**	**0.2-1**
1	Bhavani	193	97	284	2170	1.314
2	U.Kottai	281	43	777	2190	1.215
3	Chithar	239	53	1213	2120	1.443
4	Unjapalayam	277	60	270	2210	1.338
5	Ammapet	138	73	363	2380	1.345
6	N.Pettai	142	32	534	1960	1.453
7	Mulianur	230	84	273	1780	1.277

8	Ennamangalam	156	45	982	1980	1.023
9	Chennampatti	96	80	1136	1989	1.354
10	Komarayanur	78	66	890	1770	1.184
11	Burgur	129	31	653	2140	1.433
12	Andhiyur	213	97	586	1880	1.856
13	Olagadam	147	44	1033	1780	1.263
14	Nagalur	115	66	742	2010	1.441
15	Atthani	149	33	435	1700	1.356
16	Brammadesam	175	70	924	1620	1.282

17	Jambai	87	51	436	1740	1.005
18	Appakudal	133	30	1157	2040	1.322
19	Odadurai	92	98	507	1760	1.400
20	S.Palayam	88	45	365	1890	1.500

9. WATER QUALITY INDEX

WQI is a dimensionless number that combines multiple water quality factors into a single number by normalizing values to subjective rating curves. Factors to be included in WQI model could vary depending upon the designated water uses and local preferences. The WQI takes the complex scientific information of these variables and synthesizes into a single number. The WQI was calculated using the weighted arithmetic index method. The overall WQI was calculated by using equation

Water Quality Index=ΣWiQi/ΣWi

Where,

Wi = Unit Weight or Weight Factor

Qi = Quality Rating

Qi = 100[Vn-Vi]/[Sn-Vi]

Vn = Observed values, **Sn** = Standard Values, **Vi** = Ideal Values of Pure Water

[Vi for **pH =7** and for other parameters **it equals to zero**]

WATER QUALITY INDEX AT BHAVANI

(0-25=Excellent, 25-55=Good, 55-65=Bad, 85-100=Worst)

Table- 4

S.NO	PARAMETERS	UNIT WT (Wi)	Q VALUE(Qi)	WQI
1	pH	0.21	114	23.94
2	TDS	0.0037	33	0.1221
3	Na	0.967	48	46.416
4	K	0.667	53	35.353
5	TH	0.0062	99.8	0.61876
6	Ca	0.025	96.5	2.4125
7	Mg	0.062	97	6.014
8	Cl	0.0074	28.4	0.210
9	EC	0.371	108.5	40.25
10	F	0.136	91.6	12.45
		2.4553		**167.78**

Water Quality Index (WQI) = ∑ WiQi/∑Wi

= 167.78/2.4553

WQI = 68.34 (BAD)

Table- 5

S.No	LOCATIONS	WQI	RANGES
1	Bhavani	68.34	BAD
2	U.Kottai	69	BAD
3	Chithar	58.42	MEDIUM
4	Unjapalayam	63.26	MEDIUM
5	Ammapet	59.43	MEDIUM
6	N.Pettai	22.3	EXCELLENT
7	Mulianur	56.3	MEDIUM
8	Ennamangalam	225.9	EXCELLENT
9	Chennampatti	56	MEDIUM
10	Komarayanur	47.52	GOOD

11	Burgur	67.143	GOOD
12	Andhiyur	63	MEDIUM
13	Olagadam	55.9	MEDIUM
14	Nagalur	56	MEDIUM
15	Atthani	51.64	GOOD
16	Brammadesam	34.22	GOOD
17	Jambai	45.79	GOOD
18	Appakudal	59.153	MEDIUM
19	Odadurai	23.704	EXCELLENT
20	S.Palayam	64.5	GOOD

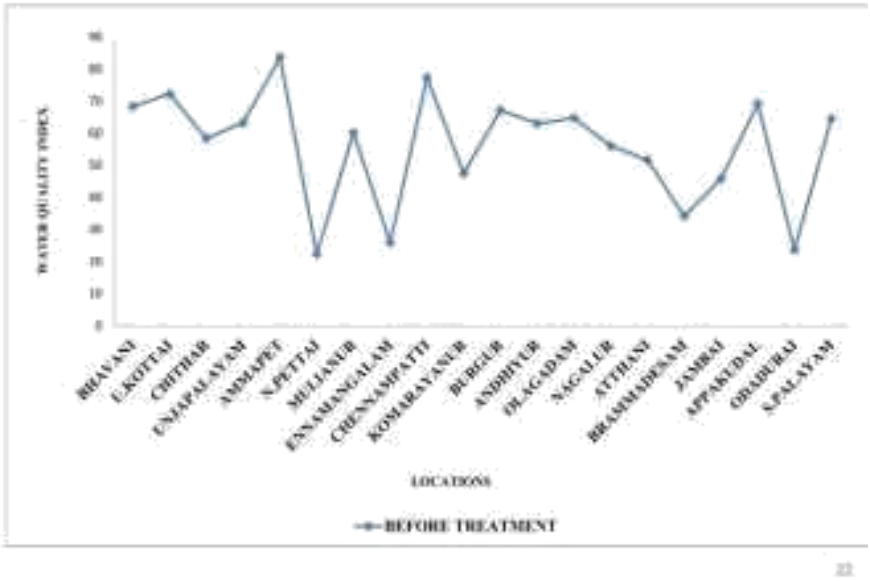

Figure-3 Variation of Water Quality Index in Graph

10. TREATMENT PROCESS

10.1 Reverse Osmosis

Reverse osmosis is a water purification technology that uses semi permeable membrane to remove ions, molecules, and large particles from drinking water. In reverse osmosis, an applied pressure is used to overcome osmotic pressure, a colligative property that is driven by chemical potential differences of the solvent. A thermodynamic parameter.

Reverse osmosis can remove many types of dissolved solids and suspended specimens from water including bacteria and is used in industrial purpose and production of pure water. It is a natural process, it is the process of forcing a solvent from a high solute concentration through a semi permeable membrane to a region of low solute concentration by applying pressure which is in excess of osmotic pressure.

The applications of reverse osmosis include separation of pure water from a brackish or sea water. It has also been used to purify fresh water for medical, industrial and domestic purposes. The cost for commercial and residential use is about Rs 4000- 50000 and is for municipal is about Rs 4- 4.5 lakes.

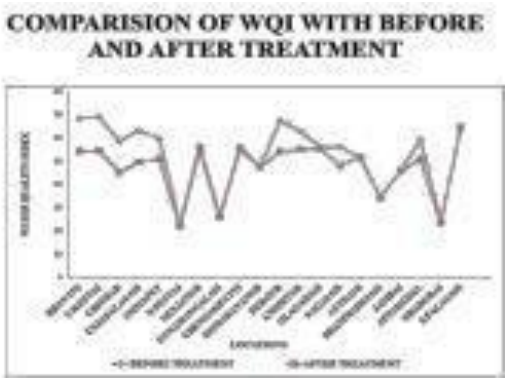

Figure-4

11. WATER QUALITY INDEX (AFTER TREATMENT)

Table-6

S No	Locations	WQI (AT)	Ranges
1	Bhavani	54.3	GOOD
2	U.Kottai	54.5	GOOD
3	Chithar	45.24	GOOD
4	Unjapalayam	49.69	GOOD
5	Ammapet	50.9	GOOD
6	Mulianur	55	GOOD
7	Chennampatti	55.02	GOOD
8	Burgur	54.08	GOOD
9	Andhiyur	55	GOOD

10	Olagadam	55.26	GOOD
11	Nagalur	48.05	GOOD
12	Appakudal	50.71	GOOD
13			

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