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Research Article

GROUND WATER PROBLEM AND ITS IMPACT ON POPULATION, SOUTH TRIPURA, INDIA

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ABSTRACT

With the increase in demand for water for competing uses, it is difficult to meet the entire demand from a single source and it is a challenge to plan and manage the different water resources. Among the two major water resources, surface and ground water, it is the ground water resources, which needs to be managed carefully, especially in drought prone area. The hydro-geological features such as sub-soil structure, rock formation, lithology and location of water play a crucial role in determining the potential of water storage in ground water reservoirs. To assess the ground water potential, a suitable and a accurate techniques is required for a meaningful and objective analysis. A critical study is carried out on the different methods of estimating the ground water potential and compared to arrive at the most suitable technique for practical utility. In this work four methods of estimating ground water recharge were studied yearly water level fluctuation, ten year average water level fluctuation, fluctuation between the lowest and highest water levels over ten years and fluctuation in monsoon seasons. The results of this study help in accurate prediction of ground water availability, which in turn may avoid ground water over exploitation and help restore the aquatic eco-system. So different minerals are came out and its contaminated with ground water.

INTRODUCTION

The quality of ground water is an important aspect of the ground water, because without good quality there is no use for its quantity. The suitability of ground water for different purposes like drinking and irrigation is based on the Chemical characteristics ground water.To ascertain the present status of the ground water quality in the study area 58 number of 1 liter samples were collected for general chemical analysis and 47 number of acidified samples for Iron analysis and sent to the Chemical laboratory CGWB,NER Guwahati for Chemical analysis. besides that 42 number of additional sample were collected and sent to ICAR chemical laboratory, Agartala for iron analysis. The results of the chemical analysis are given .The water samples were collected from different formation with three different depth zones/ranges. Sample were collected during pre-monsoon surveys for shallow aquifer zones from dug wells, middle aquifer zones from Mark-II, Mark-III wells and the third level of deeper aquifer zones from deep tube wells.

Location

The study area ,south Tripura district lies between North Latitudes $22^0$56'41" and $23^0$45'56" and East Longitude $91^0$15'30" and $91^0$52'37"falling in the survey of India degree sheet number 79M and toposheet nos 79M/3,6,7,8,10,11,12,15 AND 16.The location of the study area

Geology

Age	Group	Formation	Lithology
Quarternary	Recent	Recent	Alluvium, represented by unconsolidated pale to dirty gray, silt, sand, clay, silty clay, sandy clay etc and yellowish brown coarse river sand, gravels & concretions.
	---------- UNCONFORMITY----------		
	Dupitila	Dupitila	Brown to buff sandy clay with grayish sandy loam, clayey sandstone with ferruginous materials & laterites.
	---------- UNCONFORMITY----------		
Upper Tertiary	Tipam	Champakn agar	Massive medium to coarse sandstone with sandy shale.
		Manubazar	Fairly bedded fine to medium sub-arkosic sandstone with sandy shale and siltstone.
	---------- UNCONFORMITY----------		
	Surma	Bokabil	Thinly laminated, bedded sandstone and silt (repetition) with ferruginous material, medium to coarse micaceous sandstone with mudstone.
		Bhuban	Intruded, hard compact, both massive & well-bedded sandstone, dark to olive shale repeated.

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Quality of Ground water in Phreatic Aquifer

The analytical results of the Ground water monitoring wells in the area have been studies to assess the chemical quality of ground water. The range of major constituents in ground water is presented and the analytical result has been presented in table. The ground water in the area is alkaline in nature with pH Values ranging from 7.63-8.5.The Electrical conductivity value in general range from 86-492Us/cm at 250c.High value of EC is noted at Dhawajnagar and Udaipur. Among the anions, in all the samples there in no carbonate trace. The bicarbonate ranges from 6.15-246mg/l. The chloride concentration varies from 11 to 133 mg/l. Fluroride concentration in the study area ranges 0.01 to 0.41 mg/l. High Iron concentration in ground water is the major problem in the area and studied separately. The study of the ground water quality in major part of the study area is potable for drinking and irrigational purposes and all the chemical constituents are within the permissible limit as per BIS norms, expecting the iron concentration. During 2004-2005, the round water was slightly acidic and by 2009 the ground water has became slightly alkaline. Iron concentration in the ground water has increased in 2009 wart 2004.

Table 1 Ranges of Chemical Constituents in the study area

Chemical constituents	Year in 1991 minimum and maximum	Year 2005 Minimum and Maximum	Year 2009 GWM station Minimum and Maximum
Ph	7.0/7.8	6.5/7.1	7.63/8.50
EC	93/515	121/560	86/492
TDS	0/0	0/79	55.9/319.6
CO_3	11/92	0/0	BDL/8
HCO_3	0/0	18/55	6.15/246
Cl	24/207	11/128	10.63/133.4
SO_4	0/0	1/8	3/8
Ca	6/40	6/42	6/24
Mg	ND/13	1.2/11	1.25/23.75
TH	30/155	20/120	55/110
Na	3/36	0/0	0.13/4.72
K	0/12	0/0	0.01/0.41
Fe	ND/5.5	0.39/1.52	0.13/4.72

SOURCE: Ground water commission, Agartala

Ground water Suitability for Various Purposes

Suitability of ground water for drinking and domestic use
Ground water in the area is potable excepting the iron concentration. The Ph values of the ground water and concentration of all the chemical constituents like sodium ,calcium, magnesium, chloride, Sulphate, Fluorides etc. in the ground water of area is within permissible limits fixed by the Bureau Of India Standards.

Iron Concentration in Ground water

Discussed below

The four major techniques foe iron removal from water is

1. Oxidation-precipitation-filtration.
2. Manganese zeolite process.
3. Lime softening filtration.
4. Iron exchange.

Aeration- filtration, Chlorination- filtration and manganese zeolite processes are commonly used for public water supply.

Oxidation-Filtration

The majority of iron filtration systems operate on the principal of oxidizing the dissolved Fe+2 iron to convert into the fe+3 state to produce a filterable particle. In the ferric state, iron can be filtered with a filtration media under the right conditions. Effective oxidants used for this conversion include chlorine, permanganate and ozone.Aeration has also been used for years in both small and large water systems, but the kinetics of iron conversion are relatively slow compared with chemical oxidants. The Ph should be above 6.8 and preferably in the range of 7.5-8.5 for optimal removal.

Chlorination- filtration

A chlorine solution is injected with a chemical feed pump ahead of a sand filter. Soluble iron beings to precipitate almost immediately after contact with the chlorine solution. However, approximately 20 minutes of contact time is needed for the precipitate to from particles that can be filtered. This type of system will remove both soluble and suspended particles of insoluble iron from the source water. Backwashing the sand filter to remove precipitated iron is an important part of continued filtration .An additional advantage of using the chlorination system is removal of iron and manganese bacteria, along with some other bacteria. The optimum rate of oxidation of iron and manganese by chlorination is at a PH of about 8.0 AND 8.5, repectively. Soda ash injected with the chlorine will increase the PH to optimum levels. Adjusting the pH to alkaline levels also reduces the corrosively of water in pipes and plumbing material. Chlorination and filtration will work at all levels of soluble iron, however it is recommended for levels above 10 ppm.

Greensand filtration

The active material in greensand filter is glauconitic a green clay mineral that contains iron and has ion exchange properties. Glauconitic is treatment with manganese dioxide to produce a durable greenish –black product that has properties to adsorb soluble iron. When water is passed through the filter soluble iron is filtered from solution as insoluble iron. Insoluble iron from the greensand filter must be removed by backwashing. The greensand must be regenerated by washing with a permanganate solution. Most greensand filters are rated to be effective treating water with iron concentration up to 10 ppm. The acidity of pH of the water will influence the ability of the filter to remove iron. If the ph of the water is lower than 6.8 the greensand will probably not adequately, filter out the iron. In such case the pH can be raised above 7 by running the water through a calcite filtration.

Ion Exchange

Soluble iron can be exchange for sodium on an exchange resin or zeolite. This process of iron removal is the same as in the ion exchange process that removes hardness or calcium and magnesium. Iron is removed during normal operation of the water softener. They are later removed from the exchange medium along with calcium and magnesium during regeneration and backwashing. The method can be effective for reducing low levels of dissolved iron, but for iron removal alone it is not the most practical solution.

In situ Iron Removal from Ground water

In situ iron removal is conducted routinely in a number of European countries. A volume of oxygen eaten water is injected and subsequently a average volume of ground water can be pumped with a lower iron concentration than is found in

Table 2 Fe, Mn, Cu, Zn in ground water in the study area

Serial No	Location	Types of Ground water structure	Fe(ppm)	Manganese(ppm)	Copper(ppm)	Zinc(ppm)
1.	Silghati-1	Deep tube well	3.309	0.152	Trace	0.063
2	Silghati-2	Hand pump	Nil	Trace	Trace	Trace
3	Silghati-3	Dug well	0.204	0.193	0.02	0.09
4	Kalirbazar-1	Deep tube well	0.06	0.115	Trace	0.339
5	Kalirbazar-2	Hand pump	3.54	Trace	Trace	1.436
6	Kalirbazar-3	Dug well	0.05	0.202	Trace	0.03
7	Pitra-1	Hand pump	2.263	0.114	Trace	0.025
8	Pitra-2	Dug well	1.165	2.501	Trace	0.025
9	Pitra-3	Deep tube well	1.578	0.152	Trace	0.033
10	Kedarnal-1	Dug well	3.05	0.144	Trace	0.022
11	Kedarnal-2	Deep tube well	1.532	0.306	Trace	0.04
12	Killa-1	Deep tube well	4.2	0.188	Trace	0.022
13	Killa-2	Dug well	4.123	0.02	Trace	0.412
14	South Srinagar-1	Deep tube well	0.088	0.327	Trace	Trace
15	South Srinagar-2	Dug well	0.56	0.105	Trace	1.362
16	South Srinagar-3	Deep tubewell	2.604	0.02	Trace	0.031
17	Belonia-1	Dug well	0.136	0.327	Trace	Trace
18	Belonia-2	Deep tubewell	0.065	0.105	Trace	Trace
19	East Bagafa-1	Hand pump	7.267	Trace	Trace	Trace
20	East Bagafa-2	Deep tube well	5.185	0.01	Trace	2.01
21	East Bgafa-	Hand pump	0.175	0.115	Trace	0.021
22	Rupaichari-1	Dug well	0.233	0.980	Trace	0.041
23	Rupaichari-2	Deep tube well	0.063	0.046	Trace	0.21
24	Rupaichari-3	Hand pump	3.227	0.08	0.011	0.021
25	Mirza-1	Deep tube well	6.651	Trace	Trace	0.004
26	Mirza-2	Hand pump	0.147	0.003	Trace	0.048
27	Taberia-2	Deep tube well	0.233	Tace	Trace	0.019
28	Taberia-3	Hand pump	2.68	Tarce	Trace	0.021
29	Maharani-2	Dug well	0.175	Trace	0.046	0.622
30	Maharani-3	Deep tube well	8.53	0.077	Trace	Trace
31	Ompi-2	Hand pump	0.043	0.426	Trace	0.466
32	Ompi-3	Dug well	3.338	0149	Trace	0.462
33	Haripur	Deep tube well	0.043	0.132	Trace	Trace
34	Bagbasa	Hand pump	3.07	Trace	Trace	0.073
35	Amarpur	Dug well	7.41	0.166	Trace	0.031
36	Rajanagar	Deep tube well	3.749	0.099	Trace	0.049
37	Rani	Hand pump	1.054	0.128	Trace	0.123
38	Hadra	Dug well	0.262	0.088	Trace	0.081

native ground water. The process has not been model quantitatively. The technique involves a cycle injection of oxygenated water into the aquifer and withdrawal of injected water and groundwater in which iron concentration are lower than in the native groundwater.

Methods of Iron Removal in south Tripura

Tripura filters are using three basic ingredients rice husk sand and clay in their manufacturing. The filter candle is prepared with 1 part of sand:3 parts of clay,1.5 parts of rice husk. The homogeneously mixed ingredients are puddle with suitable amount of water, molded into bricks of different sizes and then drying it in sun light. The same is burnt in a local special furnace with a peak temperature of 4400c.The candle is fitted into the standard 40 liter filter assembly. The average rate of filtration through the filters is slightly more than 1 liter per hour.

All India Institute of Hygiene and Health, Kolkata govt. of India has evaluated the filters and found that they are capable of removing iron up to 85% to 96%.It is also found that the filter removed the bacteriological contamination quite satisfactorily. Cleaning of the filter is recommended twice in a week. The present cost of the filter candle is Rs 30/- only with a life span of 2-3 years and the total filter assembly is Rs 650/-.

Ground water problems

The main problem of ground water encounter in the study area is high iron content. Tribal people living on the hill side use water from springs/streams for drinking and domestic purposes. During monsoon period, the spring/stream water sometimes contains pathogenic bacteria and people from such areas suffer from water borne diseases like diarrhea etc. State government has constructed dug wells add shallow tube wells for drinking water purpose. Still people prefer to use water from spring/cherries etc due to presence of high iron content in the water of the wells.

Small areas as isolated pockets of very shallow water level within 2 bgl during pre-monsoon period was observed at Manubazar and Manurmukh of the study area.

At present there is no indication of ground water pollution. However water in the shallow aquifer is prone to contamination due to urbanization. The towns have not yet been provided with proper sewerage system. Unplanned waste disposal in certain part of the urban areas may cause water contamination in pockets. There is no major industry discharge toxic element in the study area.

The study reveals that out of 6 hydrograph station 3 stations at Udaipur, Santirbazar and subroom are showing a declining trend. so there is a indication of depletion in ground water

levels. However the decline in water level is not significant. Particularly in Amarpur, Karbuk and Ompi blocks some of the dug wells are getting dry in summer season. This phenomenon is also observed in other block but with less intensity.

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