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ASSESSMENT OF GROUNDWATER QUALITY IN RAMPUR BAGHELAN BLOCK SATNA DISTRICT, MADHYA PRDESH, INDIA

Shweta Rai, Research Scholar MGCGV University Satna M.P [1]; Shyam Avtar, Research Associate MPCST Bhopal M.P [2]; Dr.Shashikant Tripathi, Reader Research Scholar MGCGV University Satna M.P[3]

Abstract

Due to limited source of surface water available for the dependency on groundwater is increasing in the current era. Groundwater is mainly used for drinking purpose and irrigation. Assessment of groundwater quality is very much important because it directly affect health of human beings. An attempt has been made to study the groundwater quality of Rampur Baghelan block of Satna district. Quality is based on three parameters which are pH, Cloride and Total Hardness. Pre monsoon and post monsoon data is used for analysis because rain water percolation affects very much the quality of groundwater. There are six classes are delineated in the area. It is found that 467.69 sq km of area covers a land with groundwater quality of non potable in both season and only 1.53 sqkm land having good groundwater quality in both season.

Introduction

Water is one of the most essential requirements of life. It is required in all aspects of life and health for producing food, agricultural activity and energy generation. Groundwater is one of the important natural resource used for drinking and irrigation purposes. The quality of groundwater is largely controlled by discharge-recharge pattern, nature of host and associated rocks as well as contaminated activities. Moreover, the nature and amount of species in natural water is strongly influenced by mineralogy and solubility of rock forming minerals (Raymahasay, 1996).

The quality of groundwater is function of various parameters which determines its suitability for drinking purposes (WHO 1984; Trivedy and Goel 1986; ISI 1991; APHA 1998). In the present study, an attempt has been made to interpret quality of groundwater for the purpose of drinking and irrigation around Rampur Baghelan area, Satna District, Madhya Pradesh.

Study Area

The study area lies within the hard rock terrain of Vindhyan Supergroup. Assessment of groundwater resource is a need of present day because most of the development activities are based on the water resources. Rampur Baghelan is located between 24° 30' 6" N to latitude and 81° 02' 54" E longitude (figure 1). Most of the part of area covered in Survey of India Toposheets 63H/2 and 63H/3. Major part of the area is in Satna district.Rampur Baghelan block comes in pediplain with gentle undulations of about 291 -303m above mean sea level (MSL) Satna district of Madhya Pradesh. The river flows through Rampur Baghelan block is Tons which accounts for most of drainage runoff of the entire block flowing in northeast direction. Tons river is a part of the large Ganga basin.

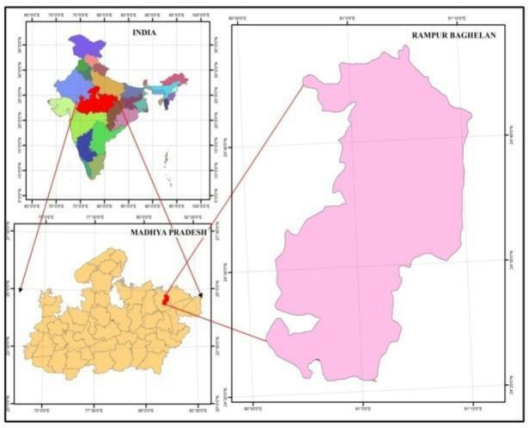

Fig 1: Location Map of Study Area

Groundwater Quality Parameters:

Table 1.1: Water quality parameters considered for the study

S.N	Parameters
1	pH
2	Electrical Conductivity
3	Total Hardness
4	Total Dissolved Solid
5	Chloride
6	Fluoride
7	Sulphate
8	Nitrate
9	Calcium and Magnesium
10	Sodium and Potassium

pH

pH value of an aqueous solution provides information that whether it is acidic or basic. In general water with pH less than 7 is considered as acidic and pH greater than 7 is considered as basic. Exposure to extreme pH value results in irritation to the eyes, skin and mucous membranes.

Total Hardness (as Caco3)

Water hardness is the traditional measure of the capacity of water to react with soap, hard water requiring considerably more soap to produce lather hardness is most commonly expressed as milligrams of calcium carbonate and magnesium equivalent per litre.

Chlorides (as Cl)

Chloride concentrations in excess of about 250 mg/litre can give rise to detectable taste in water, but the threshold depends upon the associated cautions. Consumers can, however, become accustomed to concentrations in excess of 250 mg/litre.

Total Dissolved solids (TDS)

Total dissolved solids (TDS) are the term used to describe the inorganic salts and small amounts of organic matter present in solution in water.

Alkalinity

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Village name	Type of Source	pH	Total Hardness (as CaCo3) mg/l	Chlorides (as Cl) mg/l	Village name	Type of Source	pH
		Pre	Post	Pre	Post	Pre	Post
Aber	Deep Tubewell	7.5	7.5	344	340	29	29
Andharwar	Deep Tubewell	7.5	7.5	340	348	28	29
Asarar	Deep Tubewell	7.5	7.5	388	380	27	26
Badhaiya	Deep Tubewell	7	7.5	272	276	34	35
Bagahai	Deep Tubewell	7.5	7.5	320	316	32	31
Bairiha	Deep Tubewell	7	7	420	312	33	31
Bakiya bailo	Deep Tubewell	6	7.5	350	352	35	30
Bamhauri	Deep Tubewell	7	7.5	248	300	32	34
Beeda	Deep Tubewell	7	7.5	440	388	31	31
Bela	Deep Tubewell	6.5	7	380	220	34	28
Chakdahi	Deep Tubewell	7.5	7.5	280	292	-	31
Chormari	Deep Tubewell	7	7	192	308	26	27
Chund kalan	Deep Tubewell	7.5	7.5	280	280	33	33
Deomau daldal	Deep Tubewell	7.5	7.5	272	272	31	29
Gada	Deep Tubewell	7	7.5	292	296	27	27
Ganesha	Deep Tubewell	7.5	7.5	292	288	27	29
Goraiya	Deep Tubewell	7.5	7	372	248	30	33
Hinauti	Deep Tubewell	-	7.5	268	392	28	26
Itaur	Deep Tubewell	7	7.5	396	260	31	40
Jamuna	Deep Tubewell	7.5	7.5	264	364	29	29
Kandwa	Deep Tubewell	7	7	400	382	33	35
Kathar	Deep Tubewell	6.5	6.5	272	272	31	31
Laulachh	Deep Tubewell	7	7.5	268	292	27	28
Lohara	Deep Tubewell	7.5	7.5	292	292	28	28
Mahidal kalan	Deep Tubewell	7.05	7.5	252	388	29	31
Mahurachh kadaila	Deep Tubewell	7.5	7.5	332	328	35	25
Narsinghpur	Deep Tubewell	7	7	176	328	23	37
Patarhai	Deep Tubewell	7	7.5	264	260	31	33
Saraya	Deep Tubewell	7.5	7	312	332	37	-
Semara	Deep Tubewell	8	7	440	388	33	33
Sijahata	Deep Tubewell	7.5	7.5	328	240	31	29
Sonaura	Deep Tubewell	7.5	7.5	332	388	26	33
Tikuri	Deep Tubewell	6.5	7.5	216	312	-	30
Bhatgawan	Hand Pump	7.4	6	400	255	38	33

Table-1.2: Physicochemical characteristics of ground water samples of the study Area (Pre and Post monsoon 2011).

Materials and Method

Groundwater quality mapping process includes selection of sites for groundwater collection in two different season i.e. Pre monsoon and Post monsoon. Groundwater samples data of 35 ground water sites from website of ministry of drinking water and sanitation i.e http://indiawater.gov.in were used which may be of Tube well and hand pumps of the locations in the study area during pre-monsoon season and post-monsoon season of 2011 which are extensively used for drinking and irrigation purposes. Optimization is also necessary process because some sources are not properly working in all seasons. Spatial and attribute data is generated for entire area using interpolation of available data of different thematic maps are generated for entire area using interpolation of available data of different water quality parameters. These maps show the groundwater quality status in pre-monsoon and post-monsoon season in the study area. on the basis of BIS standard for drinking water, the groundwater of the study area is classified into two classes i.e. Potable and non potable. Table 1.2 shows the BIS standard for groundwater quality values.

Union Analysis

Union capability of GIS technology provides a composite analysis of various factors responsible for desirable output or activity. Thematic layers of all water quality parameters are reclassified into three classes which are Potable water with desirable limit, potable water with acceptable limit and last class is non potable water. These reclassified raster layers convert into vector format and used for union analysis. Union analysis is performed for pre monsoon and post monsoon season, it will reveal the available water quality status of study area in both season. The overall union analysis is performed on following equation:

Water Quality = Max of (pH, TDS, Alkalinity, Hardness, Cl,)

If an area with all parameters having value of class one is considered as potable water with desirable limit and if any parameter have value related to class 2, it will considered as potable water with acceptable limit. In the same manner if any parameter in the area having value related to class three, it is considered as non potable water. Water quality statistics in pre monsoon and post monsoon is shown in Table 1.3 and Table 1.4 respectively.

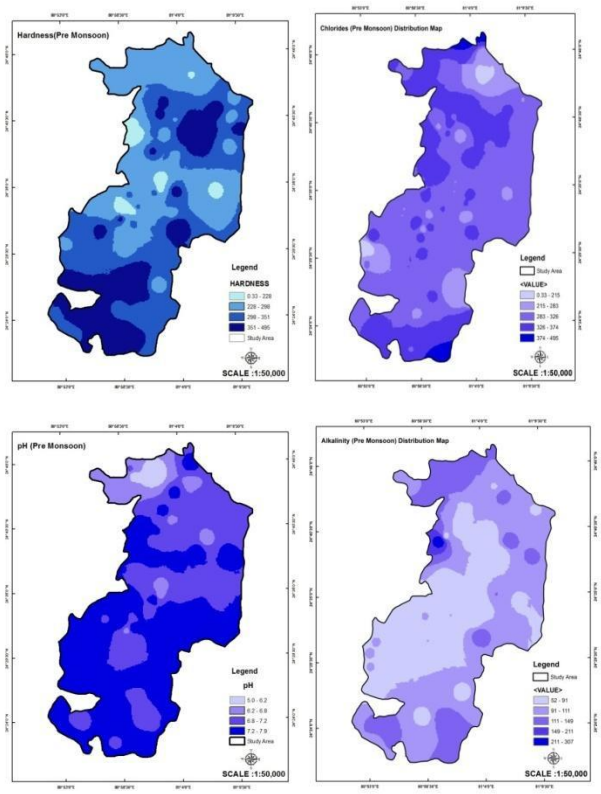
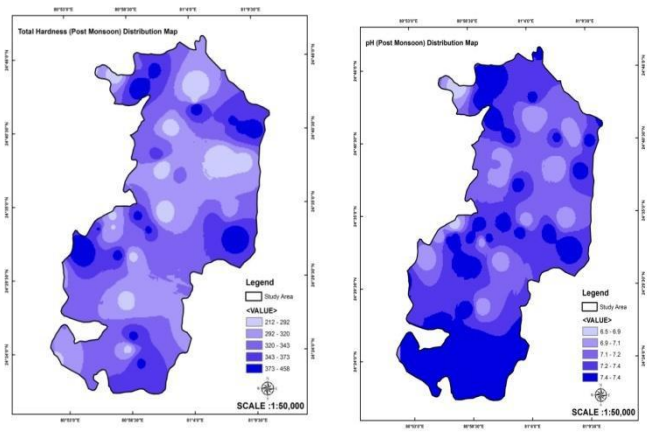


Fig1.1: Water Quality map of pre monsoon



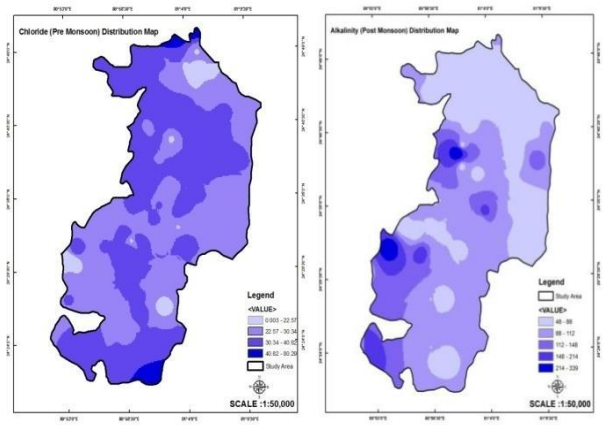


Fig1.2: Water Quality map of post monsoon

Table 1.3: Water Quality of Study Area in pre monsoon

S.No.	Water Quality Class	Area (Sqkm)	Percentage
1	Potable water with desirable limit	12.63	1.44
2	Potable water with acceptable limit	71.37	8.14
3	Non potable water	790.00	90.38
	Total	874.00	100

According to table no 1.3 there are three classes of water quality in pre monsoon is found in the study area. The overall geographical area is divided as land with potable water with desirable limit covers an area of 12.63 sqkm, land having potable water with acceptable limit covers area of 71.37 sqkm and 790.00 sqkm land is having non potable water.

Table 1.4: Water Quality of Study Area in post monsoon.

S.No.	Water Quality Class	Area (Sqkm)	Percentage
1	Potable water with acceptable limit	223.58	25.58
2	Potable water with acceptable limit	112.42	12.82
3	Non potable water	538.00	61.36
	Total	874.00	100

According to table no 1.4 there are only two water quality classes in post monsoon is found in the study area which is Potable water with acceptable limit with an area of 223.58 sqkm Potable water with acceptable limit covers an area 112.42 sqkm and non potable water with an area covering of 538.00 sqkm.

Composite Ground Water Quality

Groundwater quality map of pre monsoon and post monsoon are overlaid to find composite groundwater quality status of the study area. Overall statistics of groundwater quality is presented in table no.1.5 out of eight classes, Desirable in Both Season is found in 1.53 sqkm of the study area and it covers some parts of 253 villages. The land with non potable water is considered as not suitable for urban development because groundwater is the most acceptable source for drinking purpose.

In the same manner Desirable in Pre Monsoon and Non Potable in Post Monsoon an area of 11.56 sqkm in which Non Potable water in Both Season is 467.69 sqkm and Non Potable in Pre Monsoon and Non potable water in Post Monsoon is 207.82 sqkm. The land with this category covers a part of 35 villages. This type of water is considered as most suitable land for urban development because it will provide a better source of groundwater resource. Groundwater with Non Potable in pre monsoon and Permissible in Post Monsoon covers an area of 108.43 sqkm and Permissible in pre monsoon and Desirable in Post Monsoon area covers is 16.37 sqkm.The land with Permissible in pre monsoon and Non Potable in Post Monsoon covers 50.79 sqkm and Permissible in Both Season 10.72 sqkm land with this type of characteristic is considered as average suitable for urban development

Table No 1.5: Groundwater Quality Statistics in the study area.

S.No.	Class	Description	Area (Sqkm)
1	Class I	Desirable in Both Season	1.53
2	Class II	Desirable in Pre Monsoon and Non Potable in Post Monsoon	11.16
3	Class III	Non Potable in Both Season	467.69
4	Class IV	Non Potable in Pre Monsoon and Non potable water in Post Monsoon	207.82
5	Class V	Non Potable in pre monsoon and Permissible in Post Monsoon	108.43
6	Class VI	Permissible in pre monsoon and Desirable in Post Monsoon	16.37
7	Class VII	Permissible in pre monsoon and Non Potable in Post Monsoon	50.79
8	Class VIII	Permissible in Both Season	10.72
Grand Total			874.00

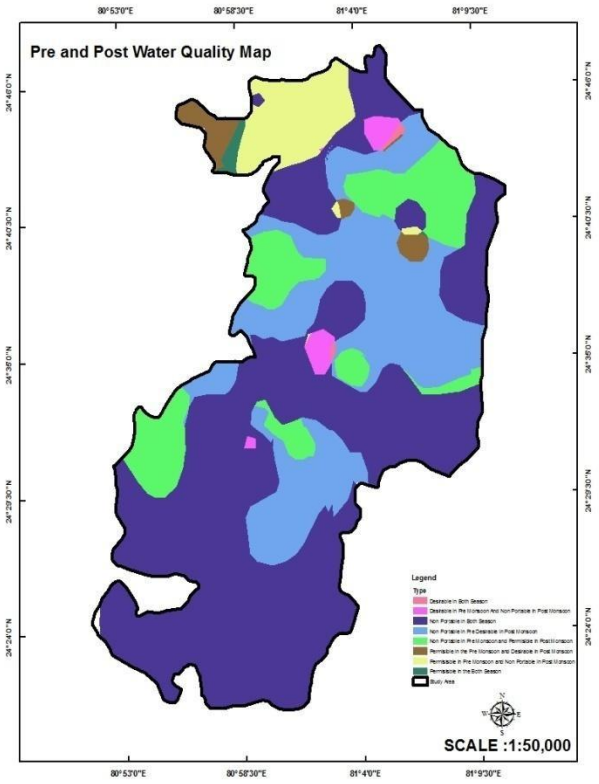


Fig1.3: Groundwater Quality Map of study area

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Biographies

Shweta Rai has done M.Sc Remote Sensing and GIS from The Global Open University of Nagaland Dimapur and pursuing Ph.D. in Remote Sensing and GIS from Mahatma Gandhi Chitrakoot Gramodaya University,Chitakoot ('A' grade University accredited by NAAC) and working as Senior Research Fellow in M.P Council of Science and Technology Bhopal. Shweta Rai may be reached at
shwetagis009@gmail.com