

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

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### 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 sqkm 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 24°50' N latitude and 80° 50'00'' E to 81° 01' 2' E longitude (figure 1). The area covered in Survey of India Toposheets 63H/2 and 63H/3. Major part of the area is in Satna. 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)

#### Fig 1: Location Map of Study Area Groundwater Quality Parameters:

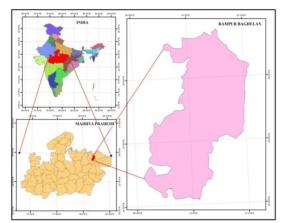


 Table 1.1: Water quality parameters considered for the study

S.No	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				

#### pН

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

Alkanlity is a chemical measurement of water ability to neutralize acids. Large amount of alkalinity imparts bitter taste in water.

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Village name	Type of Source	рН	Total Hardness (as CaCo3) mg/l	Chlorides (as Cl) mg/l	Village name	Type of Source	рН
		Pre	Post	Pre	Post	Pre	Post

Aber         Deep         7.5         7.5         344         340         29         29           Andharwar         Deep         7.5         7.5         7.5         340         348         28         29           Asarar         Deep         7.5         7.5         388         380         27         26           Badhaiya         Deep         7.5         7.5         320         316         32         31           Bairiha         Deep         7.5         7.5         320         316         32         31           Bakiya         Deep         7.5         7.5         248         300         32         34           Beada         Deep         7.5         440         388         31         31           Baihon         Deep         7.5         440         388         31         31           Beda         Deep         7.5         7.5         280         292         -         31           Chadahi         Deep         7.5         7.5         280         280         33         33           Chadahi         Deep         7.5         7.5         292         266         27         27		-			1			
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Tubewell	Saraya		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         7.4         6         400         255         38         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         7.4         6         400         255         38         33	Semara		8	7	440	388	33	33
Tubewell         T.5         7.5         332         388         26         33           Sonaura         Deep Tubewell         7.5         7.5         216         312         -         30           Tikuri         Deep Tubewell         6.5         7.5         216         312         -         30           Bhatgawan         Hand         7.4         6         400         255         38         33	Sijabata		7.5	7.5	228	240	21	20
Sonaura         Deep Tubewell         7.5         7.5         332         388         26         33           Tikuri         Deep Tubewell         6.5         7.5         216         312         -         30           Bhatgawan         Hand         7.4         6         400         255         38         33	Sijanata		1.5	1.5	328	240	51	29
Tikuri         Deep Tubewell         6.5         7.5         216         312         -         30           Bhatgawan         Hand         7.4         6         400         255         38         33	Sonaura	Deep	7.5	7.5	332	388	26	33
Tubewell         400         255         38         33					<u> </u>		ļ	
Bhatgawan Hand 7.4 6 400 255 38 33	Tikuri		6.5	7.5	216	312	-	30
	Bhatgawan		7.4	6	400	255	38	33
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Table-1.2:	Physicochemi	cal charact	eristics of	ground
water samp	oles of the stud	ly 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 34 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 lo-



cations 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 premonsoon 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.

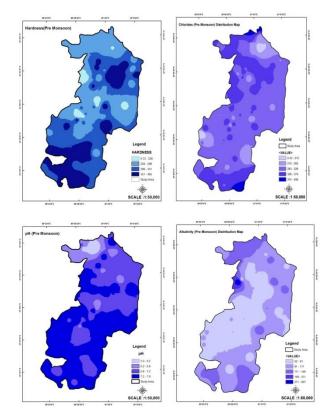
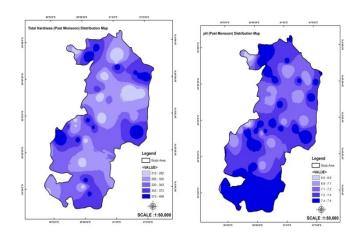


Fig1.1: Water Quality map of pre monsoon





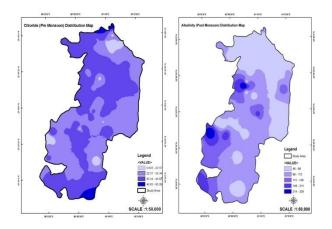


Fig1.2: Water Quality map of post monsoon

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

Table 1.3: Water Quality of Study Area in pre monsoon

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 pota- ble 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 203 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 207.31 sqkm. The land with this category covers a part of 34 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.(Fig 1.3)

 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	207.31
5	Class V	Non Potable in pre monsoon and Permissible in Post Mon- soon	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	874.00		

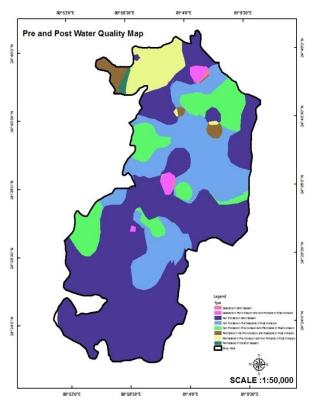


Fig1.3: Groundwater Quality Map of study area

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