

# Spatial Variability of Ground Water Quality Parameters in Satna City Madhya Pradesh

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## **Abstract-**

The primary objective of this paper is to study the groundwater quality parameters in different locations. The availability of good quality water is an indispensable feature for preventing diseases and improving quality of life. The variations of the physicochemical properties of water samples directly influence the biotic communities and primary productivity of the water bodies at different areas of Satna. The samples were analyzed for their physical-chemical quality in order to identify the contamination problems and suggest appropriate solutions. From the present Research it was concluded that there are lots of variability of water characteristics and also it is found that there is a marginal spatial variation in water characteristics at different locations. While testing of water characteristic all the area of the respective sites it was suggested that major part of experiment were in desirable limit. These results are not effective for the health as well as for the supply of the water while Site No 1 Sohawal hand pump water needs to be treated first then it should be used for drinking purposes.

**Keywords:** *Ground water, water quality Parameter, Spatial variability*

## 1. INTRODUCTION

Water is one of the most abundant commodities in nature. Earth is called blue planet and most of its surface is covered under by water, however the means oceans, and only 3% of water is left which is used as fresh water and is required for agriculture, municipal and industrial purposes. Water is a vital resource for human survival. The Availability of good quality water is an indispensable feature for preventing diseases and improving quality of life. Water should be free from the various contaminations viz. Organic and Inorganic pollutants, Heavy metals, Pesticides etc. as well as all its parameter like pH, Electrical Conductivity, Calcium, Magnesium, Total Hardness, Carbonate, Bicarbonate, Chloride, Total Dissolved Solid, Alkalinity, Sodium Potassium, Nitrate, DO should be within a permissible limit .

## 2. LOCATION AND EXTENT

The study area is major part of the Satna city Madhya Pradesh in India. The total aerial extent of the study area is 187 km<sup>2</sup>. There are five major areas were selected for sampling collection. The groundwater quality analysis has been carried out for the water samples collected from the Hand Pump located in Sohawal, Sherganj ,Kothi Road

fact is that 97% of water is covered under saline water.

, Bharut Nagar Bus stand . In the present work attempts have been made to detect groundwater quality by using conventional methods available in PHE Department of Government of Madhya Pradesh at Satna [M.P]. The location map of the study area is shown in figure1



Figure 1: Location Map of the Study Area

Site No 1- Sohawal, Site No 2- Sherganj Site No 3- Kothi Road Site No 4- Bharut Nagar , Site No 5- Bus stand

### 3. MATERIAL AND METHODS

The present study was carried out for five different areas and five different sites, located in Satna City. In the present study the sampling was done during Day hours and all water samples were collected in the polyethylene bottles. The groundwater samples were collected during the post monsoon period i.e., Feb 2016 from the five Hand Pumps located in the study area. The quality analysis has been carried out for the parameters like pH, total alkalinity, electrical conductivity, total dissolved solids, total hardness, calcium hardness, magnesium hardness, nitrites, nitrates, sulphates, chlorides by following the standard methods prescribed as per IS: 10500-1994 Code. Environmental pollutants affect the aquatic ecosystem in a synergistic manner, which cannot be detected comprehensively by determination of selected physical-chemical parameters alone. Whereas, biological system can integrate all environmental variables over a long period two times of effects which can be easily measured and quantified. From the time of sample collection and to the time of actual analysis, many physical and chemical reactions would change the quality of water sample therefore to

minimize this change the sample were preserved soon after the collection.

The collected water samples were brought to the laboratory and relevant analysis was performed. pH was determined using pH meter, and similarly turbidity is measured by Turbidity meter. Alkalinity is measured by volumetric method; Hardness is determined by the EDTA method in alkaline condition etc.

| S. No | Characteristic         | Unit     | Desirable limits | Permissible limits |
|-------|------------------------|----------|------------------|--------------------|
| 1.    | Turbidity              | NTU      | 1.5              | 5.0                |
| 2.    | pH Value               | pH Scale | 6.5-8.5          | No relaxation      |
| 3.    | Total Hardness         | mg/l     | 200              | 600                |
| 4.    | Chlorides              | mg/l     | 250              | 1000               |
| 5.    | Alkalinity             | mg/l     | 200              | 600                |
| 6.    | Manganese              | mg/l     | 0.1              | 0.3                |
| 7.    | Sulphate               | mg/l     | 200              | 400                |
| 8.    | Calcium                | mg/l     | 75               | 200                |
| 9.    | Total Dissolved Solids | mg/l     | 500              | 2000               |
| 10.   | Iron                   | mg/l     | 0.3              | 0.5                |

Table 1. Desirable and permissible limit of Water Characteristic

**4. RESULTS AND DISCUSSION –**

| S No | Water Characteristic | Unit     | Site No 1 | Site No 2 | Site No 3 | Site No 4 | Site No 5 |
|------|----------------------|----------|-----------|-----------|-----------|-----------|-----------|
| 1.   | Turbidity            | NTU      | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       |
| 2.   | pH Value             | pH Scale | 7.94      | 8.3       | 8.1       | 8.56      | 7.32      |
| 3.   | Total Hardness       | mg/l     | 97.7      | 209       | 214       | 229       | 298       |
| 4.   | Chlorides            | mg/l     | 269       | 256       | 262       | 284       | 264       |
| 5.   | Alkalinity           | mg/l     | 216       | 215       | 273       | 286       | 289       |
| 6.   | Manganese            | mg/l     | 0.25      | 0.12      | 0.27      | 0.3       | 0.16      |
| 7.   | Sulphate             | mg/l     | 211       | 227       | 219       | 258       | 249       |
| 8.   | Calcium              | mg/l     | 76        | 76        | 79        | 88        | 82        |
| 9.   | TDS                  | mg/l     | 677       | 518       | 667       | 516       | 624       |
| 10.  | Iron                 | mg/l     | 0.32      | 0.4       | 0.29      | 0.42      | 0.32      |

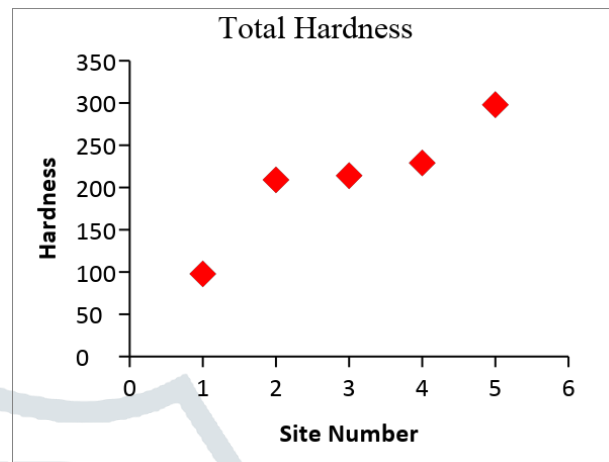


Fig. 2 Variation of Total Hardness with Sites

Table 2. Measured Reading in different Sites

In present work we have seen that the pH value is desirable in all five places and slightly higher in site no 4 having the maximum pH value may be required for further treatment for potable water as per the table no 1.

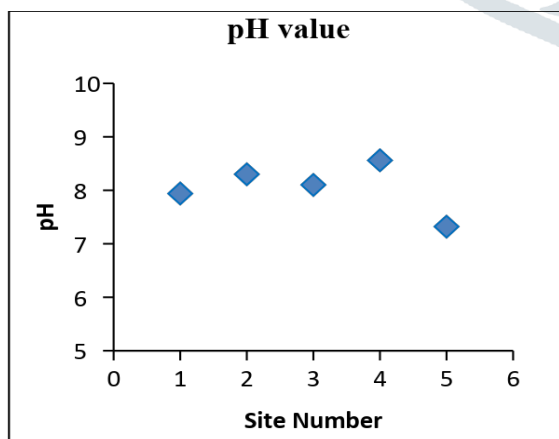


Fig. 1 Variation of pH with Sites

At site no 5 have obtained maximum value of the total Hardness as compared to other rest places, while site no 1 gives least value of hardness may be undesirable at this site, So need to increase water hardness for surrounding society usefulness.

As per the standard water characteristic all selected sites gives desirable result of Chloride and Alkalinity, there is no need of any chloride and alkalinity treatment. Both the water parameters are under desirable result. All nearby area can directly use as potable water of the sites

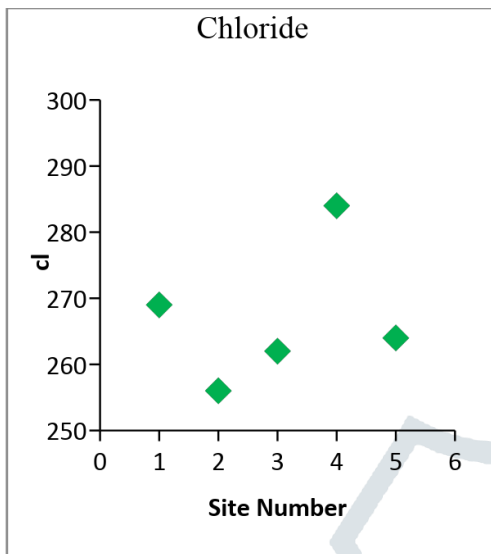


Fig. 3 Variation of Chloride with Sites

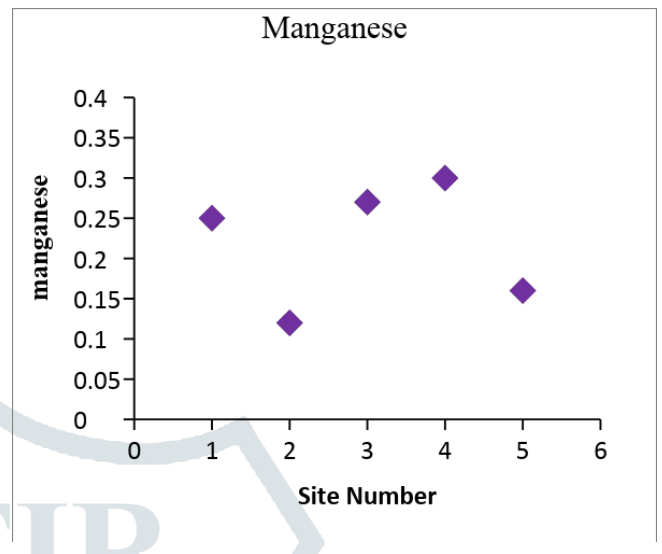


Fig. 5 Variation of Manganese with Sites

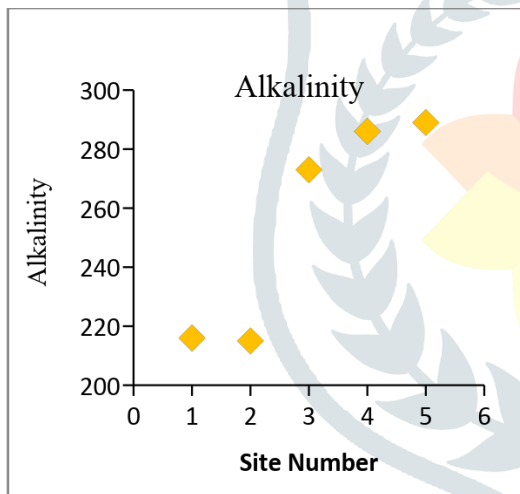


Fig. 4. Variation of Alkalinity with Sites

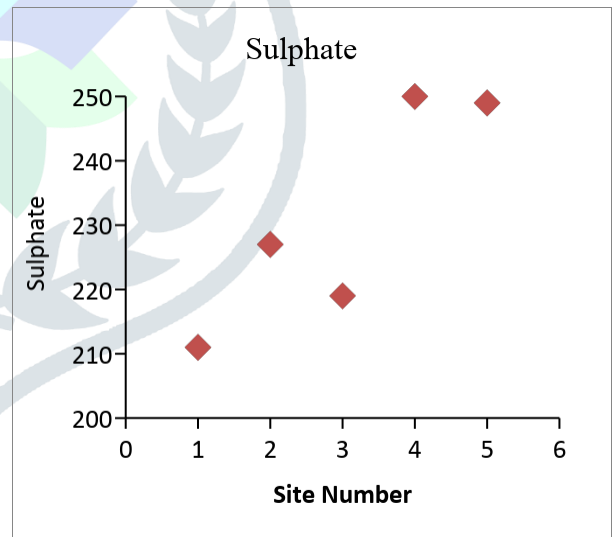


Fig. 6 Variation of Sulphate with Sites

Manganese contents presents in all the sites are in desirable limit; site no 4 and 2 gives maximum and minimum value of manganese respectively.

Sulphate amount presents in the all the water samples also found under desirable criteria, so no need of further treatment of all the places for sulphate regarding issue. Calcium in sampling sites. There is no requirement of any kind of treatment in calcium related problems. In present study the Total Dissolved Solids presents in water sample varies from 500 to 650 mg/l. These all results are in within the desirable limit, therefore no need of any kind of further removal of dissolved solids.

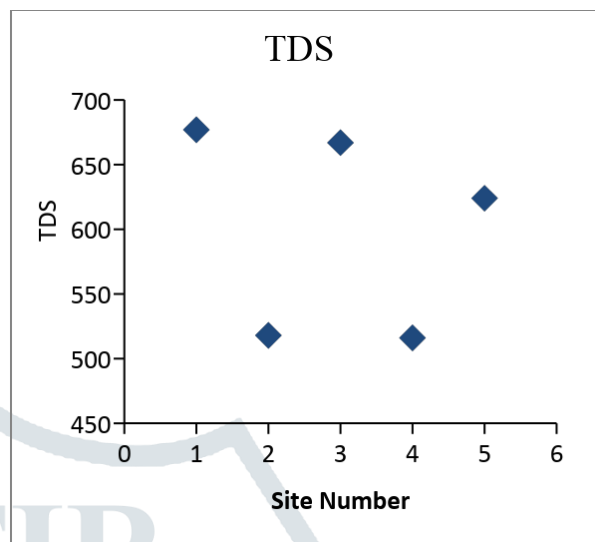


Fig. 8 Variation of TDS with Sites

The desirable limit requirement of calcium varies from 75 mg/l to 200mg/l. In present work it was seen that there no issues found related to

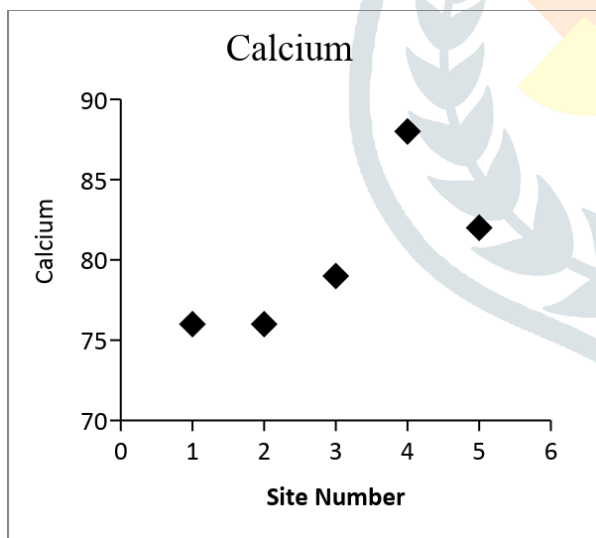


Fig. 7 Variation of Calcium with Sites

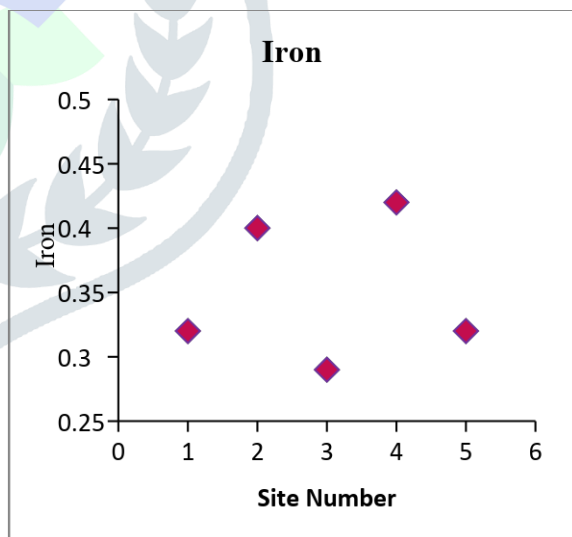


Fig. 9 Variation of Iron with Sites

The desirable and permissible limit requirement of Iron varies from 0.3 mg/l to 0.5 mg/l. from the plot it's clear that all sampling sites gives

desirable while site no 4 and 3 gives maximum and minimum value of Iron presents in the water sample.

#### CONCLUSION-

From the present research it was concluded that there are lots of variability of water characteristics and there is a marginal spatial variation in water characteristics at different locations. From the present study following conclusion may be drawn-

- Most of the water characteristic shows the desirable result.
- Instead of small aerial extension there is lots of spatial variability of water characteristic.
- Spatial variation of water characteristic shows the marginal result.
- It was concluded that there were no turbid water found in all selected sites.
- In spite of desirable result there is wide variation of water characteristic.
- Hardness and Iron gives least value at site No. 1 and 3 respectively.
- pH value shows slightly higher in site no 4 may not be used for potable water.

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