

# A Study on Ground Water Contamination in Gorakhpur City

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**Abstract**— This study was completed in Gorakhpur City to evaluate the some Groundwater contamination parameters of chose India Mark-II and Shallow depth hand pumps. An aggregate number of 16 water samples were tested for pH, Acridity, Alkalinity, Chloride, Total Hardness, Turbidity, TDS and MPN and the outcomes are analyzed for Gorakhpur City. It is uncovered that Total dissolved solids, Turbidity, Alkalinity and MPN surpassed in 25 percent of the examples taken from shallow depth hand pumps in Gorakhpur city. It is, hence, proposed to take up point by point water quality reviews and group mindfulness programs on water quality in the Gorakhpur City.

**Key words:** Physico-Chemical Parameter, India Mark-II Hand Pump, Shallow Depth Hand Pump, Ground water Quality

## I. INTRODUCTION

Groundwater is characterized as the water present in the immersed zone underneath the water table. Ground water is one of the Nation's most imperative characteristic assets. It gives around 40 percent of the Nation's open water supply. Likewise, more than 40 million individuals, including the greater part of the country populace, supply their own particular drinking water from household wells. Thus, ground water is an imperative wellspring of savoring water each state. Ground water is additionally the wellspring of a great part of the water utilized for watering system. It is the Nation's key store of fresh water and speaks to a significant part of the potential future water supply. Ground water is a noteworthy patron to stream in numerous streams and waterways and has an in number impact on waterway and wetland living spaces for plants and creatures. Gorakhpur is a city in the eastern piece of the condition of Uttar Pradesh in India, close to the outskirt with Nepal. It is the authoritative central command of Gorakhpur District and Gorakhpur Division and of Gorakhpur in a standout amongst the most vital urban areas of eastern Uttar Pradesh (U.P.) and the vital town in the transghagar plain. The name of the city has been doled out after the name of holy person Guru Gorakhpur of twelfth century. It is arranged at 26°45' north scope and 83°22' east longitude, in Taral belt and situated amidst region Gorakhpur at the interception of waterway Rapti and Rohni. The area of the city is imperative vital being found entirely close to Indo-Nepal Border and extremely very much joined by Railway. Streets and Airways from other parts of the Nation. Ground water can get to be polluted from characteristic sources or various sorts of human exercises. Private, metropolitan, business, modern, and farming exercises can all influence ground water quality. Contaminants may achieve ground water from exercises on the area surface, for example, discharges or spills from put away mechanical squanders; from sources underneath the area surface yet over the water table, for example, septic frameworks or releasing underground petroleum stockpiling frameworks; from structures

underneath the water table, for example, wells; or from polluted revive water.

## II. STUDY AREA

The study area is Gorakhpur City. Gorakhpur city is located 265 km last of the state capital Lucknow on National Highway- 28. It is situated near at the confluence of river Rohin and Rapti. The city is known for the Gorakhnath temple and the Gita Press and is the principal town of Eastern Uttar Pradesh having a population nearly 6, 71,048 lakhs.

## III. COLLECTION OF WATER SAMPLES

In the study, 16 Groundwater samples were collected from India Mark-II and Shallow depth hand pumps of Gorakhpur City from February 2015 to June 2015. Out of the 16 samples, 8 samples were collected from the Shallow depth hand pump and the other 8 samples were collected from India Mark-II. During sample collection, handling, and preservation, standard were followed.

## IV. SELECTION OF SAMPLING STATION

For the study of Groundwater contamination in the Gorakhpur City, 8 sampling stations were observed namely; Nausadh(S1), Transport Nagar (Mahewa Mandi)(S2), Rustampur(S3), Taramanda(S4), Railway station(S5), Golghar(S6), Betiahata(S7) and Kunraghat(S8). From each station 2 samples are taken. One sample has been taken from Shallow depth hand pump and second from the India mark-II.

## V. MATERIAL AND METHODS

The water samples were collected in 2 litre capacity of plastic bottles. The analytical methods which has been used for the testing of parameters are as follows: pH (Universal Method), Turbidity (Nephelometric Method), TDS(Digital Meter), Alkalinity, Acidity and Chloride by (Argentometric Method), Hardness by EDTA method and MPN(Multiple dilution tube method).

## VI. DATA COLLECTION

The water samples are collected from 8 stations from February 2015 to June 2015 and their parameters are tested for each month. The parameters data for Groundwater of both the hand pumps; Shallow depth hand India mark-II hand pump respectively in the Gorakhpur City determined for samples collected from various sampling stations during monitoring period i.e. from February-2015 to June-2015 are given in Table 3.1 to 3.16.

## VII. RESULTS AND DISCUSSION

The results and discussion of various parameters of the Groundwater sample of both type of hand pumps; Shallow

depth hand pump and India mark-II hand pump are discussed below:

**A. pH:**

pH variation Fig. s are shown in Fig. (a) and (b). pH is the major of the intensity of Acidity or Alkalinity and measures the concentration of hydrogen ion in the water. However, it does not major total acidity or alkalinity. pH is generally measured on a log scale an equal to negative logarithmic of hydrogen ion concentration. The pH of water sample in the entire investigation ranges from 6 at sample no.8 to 8 at sample no. 2,4, 6 and 7 including all sampling locations i.e. shallow depth hand pump and India mark-II hand pump . As per IS:10500 standard for drinking purpose the allowable limit of pH is 6.5 to 8.5 and the study indicates all the water samples are in safe limit and do not shows any health hazard.

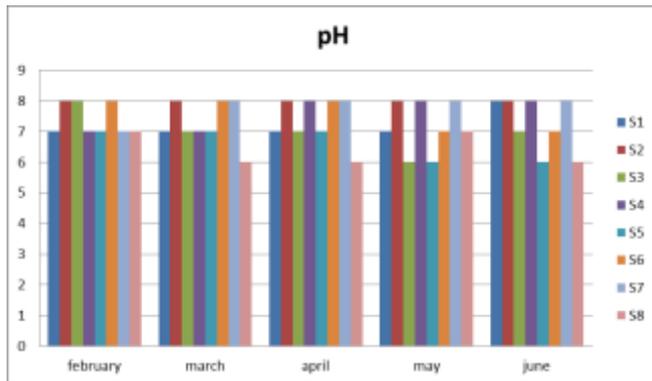


Fig. 1: Monthly variation of pH of Shallow depth hand pump

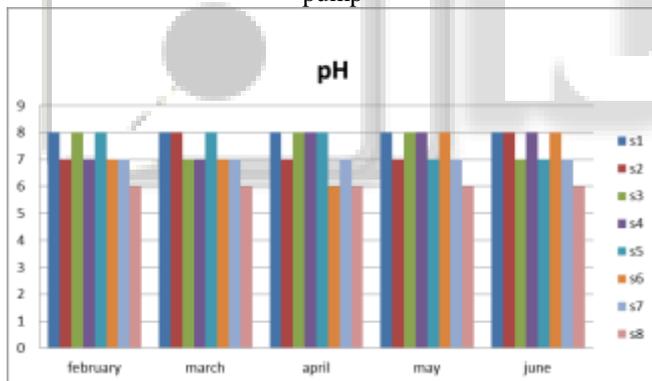


Fig. 2: Monthly variation of pH of India mark-II hand pump

**B. Total dissolved solids (TDS)**

The total dissolved solids measured for ground water in Gorakhpur city for various sampling location their monthly variation are mentioned in Fig. (c) and (d)

The minimum and maximum values of TDS are 229 at sampling location no 4 of India mark-II hand pump and 781 at sampling location no.2 of India mark-II hand pump respectively.

A comparison of TDS data with Indian standard code shows that A comparison of TDS data with Indian standard specifications for drinking water shows that TDS of shallow depth hand pump water and India mark-II hand pump water varies between 229 to 781 mg/l, does not satisfy the Indian standard of drinking water is at some stations as Prescribed by IS :10500-2012 which is 500 mg/l. In this study the groundwater of both the hand pump,

Shallow depth hand pumps and India mark-II hand pumps exceeds the permissible limits.

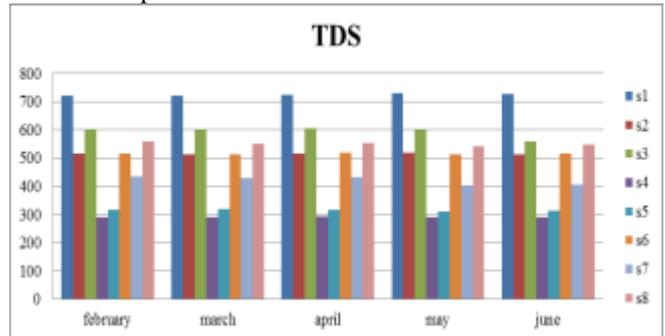


Fig. 3: Monthly variation of TDS of shallow depth hand pump

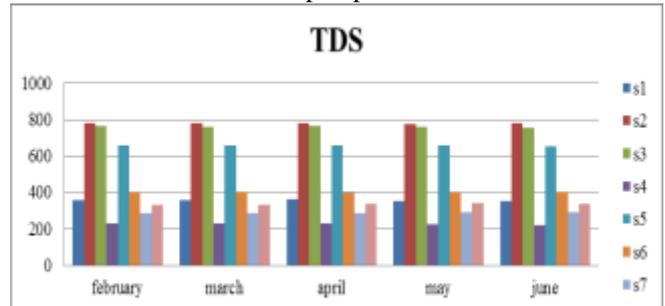


Fig. 4: Monthly variation of TDS of India mark-II hand pump

**C. Turbidity**

Turbidity were measured by using Nephelo-turbidity meter and their monthly variation are mentioned in Fig. (e) and (f).

The minimum and maximum values of the turbidity are 1 and 15 at sampling location no.2 of shallow depth hand pump. A comparison with IS code shows that sampling station no. 2 of shallow depth hand pump does not satisfy the permissible limits.

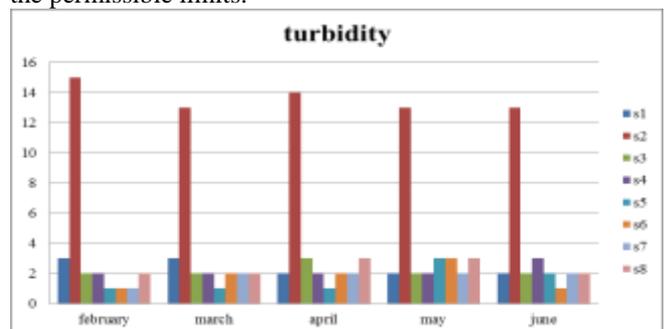


Fig. 5: Monthly variation of Turbidity of Shallow depth hand pump

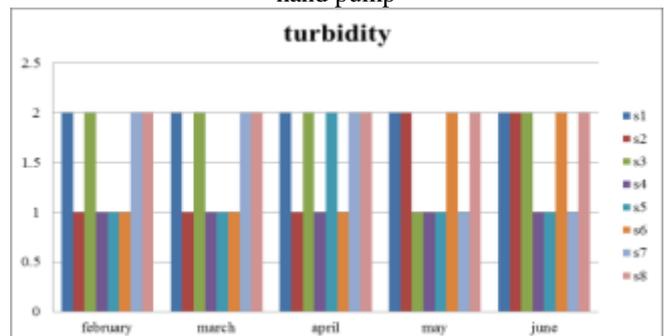


Fig. 6: Monthly variation of Turbidity of India mark-II hand pump

**D. Total Hardness**

The data of hardness of ground water monthly variation are shown in Fig. (g) and (h). On comparison with Indian standard code only station no 2 of shallow depth hand pump does not satisfy the limit and remaining all the sampling stations water are in safe limit.

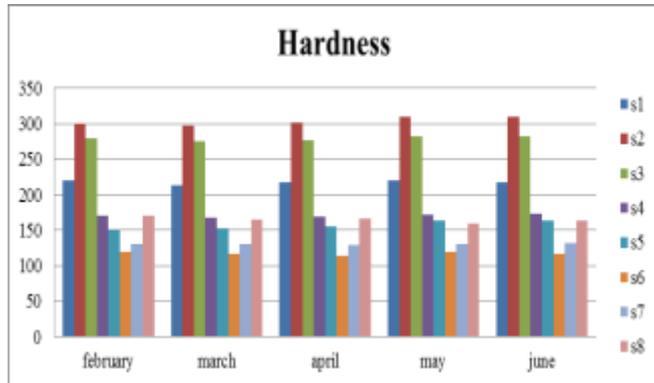


Fig. 7: Monthly variation of Hardness of Shallow depth hand pump

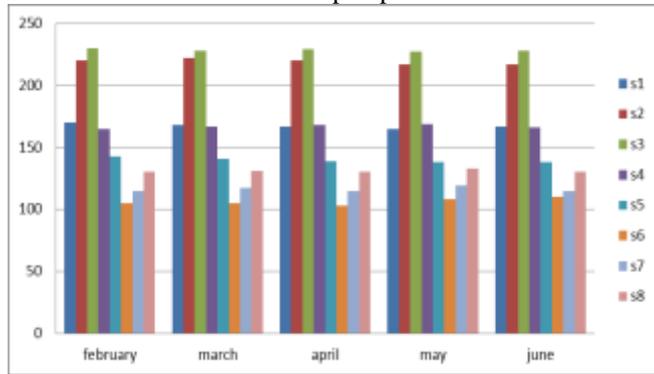


Fig. 8: Monthly variation of Hardness of India mark-II hand pump

**E. Acidity**

Acidity is caused by the presence of mineral acids, free carbon dioxide, sulphates of iron and aluminium, etc in water. The acidity in natural waters is primarily due to dissolved carbon dioxide. The monthly variation are mentioned in Fig. (i) and Fig. (j). The minimum and maximum values of acidity found are 50 at station no 1 of India mark-II hand pump and 183 at station no.2. As per IS code it is clarified that the ground water of these sampling locations are not in safe limit.

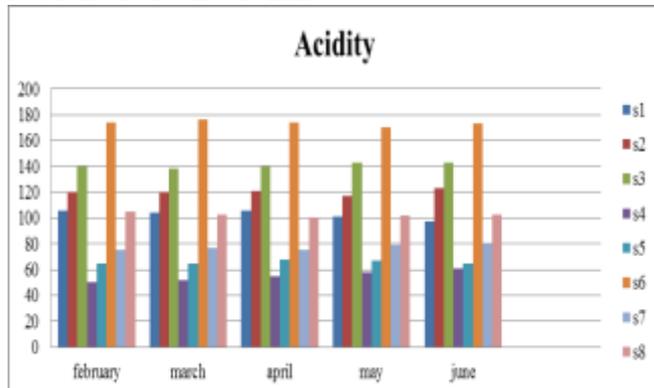


Fig. 9: Monthly variation of Acidity of Shallow depth hand pump

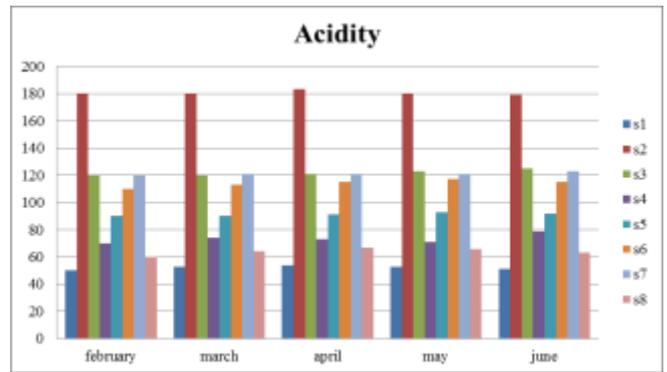


Fig. 10: Monthly variation of Acidity of India Mark-II hand pump

**F. Alkalinity**

By testing the pH value of water we can easily find that water is alkaline or acidic. Generally speaking the alkalinity is caused by the presence of bicarbonates of calcium and magnesium or by the carbonates or hydroxide of sodium, potassium, calcium and magnesium. Alkalinity caused by bicarbonates is called carbonate alkalinity; and that caused by hydroxide is called hydroxide alkalinity or caustic alkalinity. The monthly variation are mentioned in Fig. (k) and (l). As per IS code the permissible value for alkalinity is 250. A comparison with IS code shows that station no. 7 of shallow depth hand pump is affected.

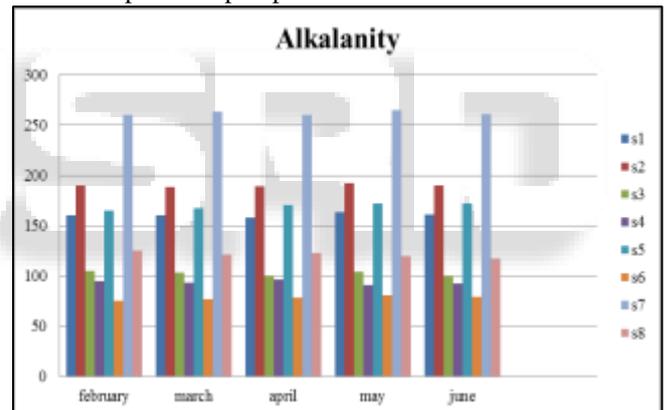


Fig. 11: Monthly variation of Alkalinity of Shallow depth hand pump

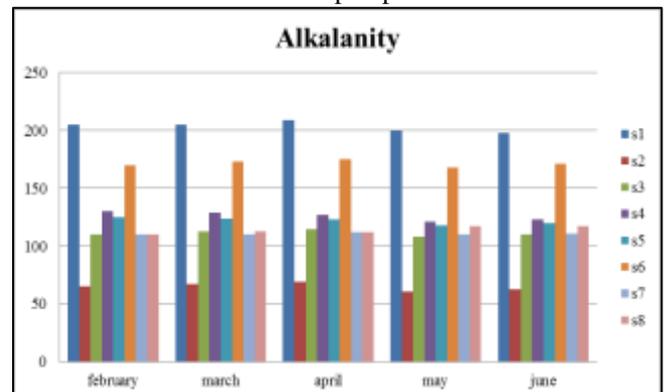


Fig. 12: Monthly variation of India mark-II hand pump

**G. Chloride**

Chloride are generally present in water in the form of sodium chloride (common salt) and may be due to leaching of marine sedimentary deposits, pollution from sea water, brine or industrial and domestic wastes, etc. Their

concentrations above 250mg/l produce a noticeable salty taste in drinking water and are thus objectionable. The monthly variation is mentioned in Fig. (m) and (n). There is no evidence that chloride constitute any human health hazards for this reason, chloride are generally limited 250mg/l in supply intended for public used in many area of the world The permissible limit of chloride is set 250mg/l) as per IS standard Chloride concentration in Gorakhpur city region varied from 29 to 233, including both the sampling source; Shallow depth hand pump and India mark-II hand pump. All the sampling location and all the water sample are found to be in the safe limit.

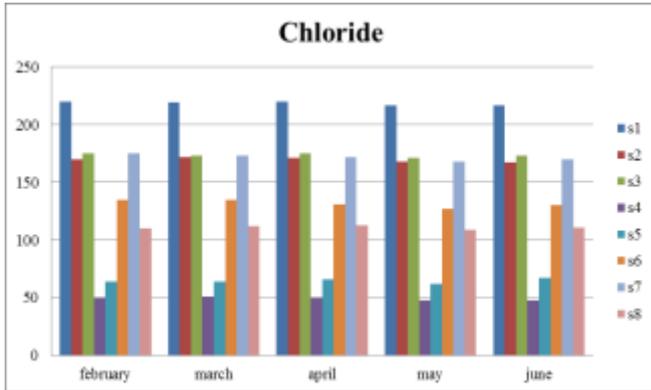


Fig. 13: Monthly variation of Chloride of Shallow depth hand pump

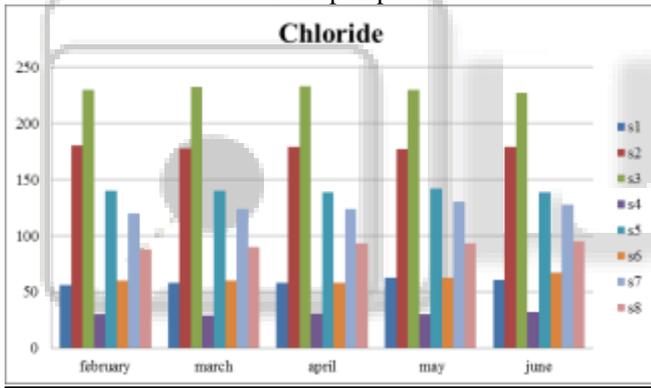


Fig. 14: Monthly variation of Chloride of India mark-II hand pump

#### Most probable number

The statistical methods which are used to determine the bacterial density that has the maximum probability with the given set of constants, which represents nothing but most probable number of coliforms, called MPN or MPN index. The monthly variation are mentioned in Fig. (o) and (p). As per the requirements of the Water Quality Criteria prescribed by Central Pollution Control Board waters M.P.N. of total coliform /100 ml should be 50 or less for Class-A waters, 500 or less for Class-B waters and 5000 or less for Class-C waters.

A comparison with Indian standard code shows that sampling waters no 4 and 5 are characterized as class A water and all other remaining water samples are characterized as class B water.

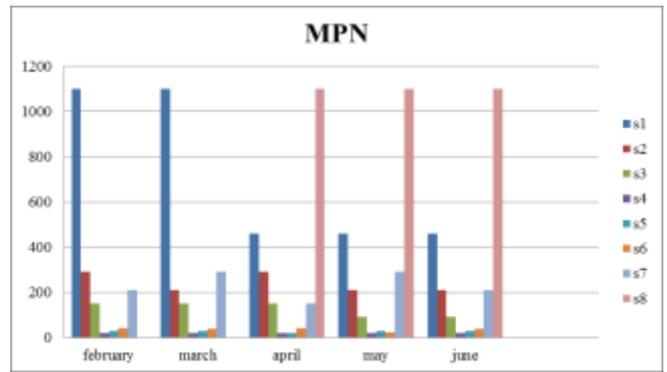


Fig. 15: Monthly variation of MPN of Shallow depth hand pump

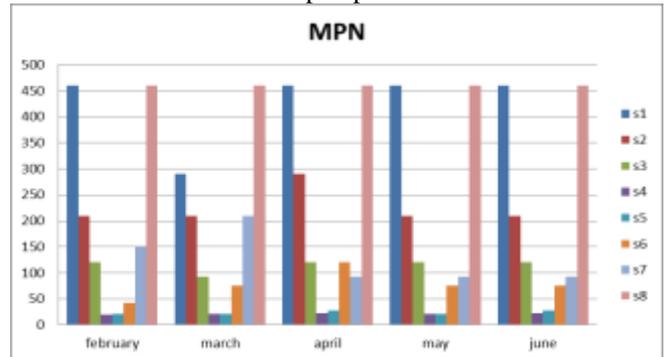


Fig. 16: Monthly variation of MPN of India mark-II hand pump

#### VIII. CONCLUSION

Groundwater is extensively used for water supply in urban and peri-urban areas of Gorakhpur city. The present study incorporates the assessment of ground water contamination in Gorakhpur city and also the quality of groundwater in the Gorakhpur city. This study is carried out for the determination of ground water contamination data at eight sampling locations in the Gorakhpur city and is carried out for various physico-chemical parameters (pH, TDS, Turbidity, Acidity, Alkalinity, Chloride, Hardness, MPN) and during February, March, April, May and June of 2015. The present study is based on the results of the ground water contamination in the Gorakhpur city for selected parameters and exhibits that some shallow depth hand pumps and also India mark-II hand pumps are affected by high extent of total dissolved solids, turbidity, alkalinity and MPN in Gorakhpur city. This necessitates a detailed water quality survey in Gorakhpur city. Also, there is a need to educate and convince people to avoid using shallow depth hand pumps on one hand and providing the access to safe drinking water through India Mark-II hand pump or piped water supply in near future on the other hand. Such community awareness programmes need to be taken up in peri-urban areas as well as urban areas.

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