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# Multi Parameter Physico-Chemical Analysis of Groundwater to be used for Drinking Purpose in Gorakhpur City

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**Abstract:** As we all know that water is the most precious compound found in nature. It covers about 71% of the earth surface. About 97.3% of water is contained in the great oceans that are saline and 2.14% is held in icecaps glaciers and in the poles, which are not useful. The remaining 0.56% are found on earth which are useful for general purpose. Out of which Groundwater is one of the purest form of water available on this earth. It has been estimated that approximately one third of the world's population use groundwater for drinking. This project is done in knowledge to get the analysis of various physico-chemical parameters such as pH, Turbidity, TDS, Total Alkalinity, Total Hardness, Chloride and Dissolved Oxygen of Gorakhpur city in view to ensure the groundwater to be fit for drinking purpose or not. About 20 samples were collected from India Mark-II Hand Pumps and Shallow Hand Pumps of various locations of Gorakhpur city and tested. After the analysis of various physico - chemical parameters of the samples collected, the groundwater found to be within permissible according to BIS 10500 – 2012.

**Keywords:** Physico – chemical, Ground water

## I. INTRODUCTION

As we all know that water is the most precious compound found in nature. It covers about 71% of the earth surface. About 97.3% of water is contained in the great oceans that are saline and 2.14% is held in icecaps glaciers and in the poles, which are not useful. The remaining 0.56% are found on earth which are useful for general purpose. Out of which Groundwater is one of the purest form of water available on this earth. It has been estimated that approximately one third of the world's population use groundwater for drinking.

The use of fresh water or we can say that the need of groundwater has been increased rapidly in the last few decades. Due to the increasing population, industrialization, urbanization, etc the need of fresh water or groundwater has been increasing tremendously. The groundwater has been polluted due to various pollutants from seepage pits, refuse dumping, landfilling, etc. Therefore the over-exploitation of groundwater has seriously affected its quantity and quality. Water quality is a term used to describe the physical, chemical and biological characteristics of water. Groundwater is mostly polluted in areas which are densely populated, highly industrialized, etc.

## II. STUDY AREA

Gorakhpur is situated 26°45' north latitude and 83 ° 24' east longitudes, in Tarai belt of river Rapti and Rohni. It is situated in the north-eastern part of the state of Uttar Pradesh in India, near the border with Nepal.

## III. SAMPLE LOCATION

The groundwater samples to be collected from places namely – MMMUT, Mohaddipur, Paidleganj, Kunraghat, Betiahata, DDUGU, Asuran Chowk, Ghasikatra, Buxipur, Railway Station, AIIMS, Khorabar, Nausad, Laldiggi, Surajkund, Gorakhnath, GIDA, Basharatpur, Hansupur and Ghantaghar. The groundwater samples to be collected from India Mark-II and shallow depth hand pumps of Gorakhpur city.

**IV. METHODOLOGY**

S. NO.	Parameter	Method used
1	Ph	Colorimetric Method
2	Turbidity	Digital Turbidity Meter
3	Total Dissolved Solids	Digital TDS Meter
4	Total Alkalinity	Titration(N/50 H <sub>2</sub> SO <sub>4</sub> )
5	Total Hardness	Titration (EDTA)
6	Chloride	Titration (AgNO <sub>3</sub> )
7	Dissolved Oxygen	Alsterberg modification of Winkler's method

Table- 1 Methods used for analysis

S.No.	Parameters	Unit	Acceptable Limit	Permissible limits
1	pH	-	6.5-8.5	No relaxation
2	Turbidity	NTU	1	5
3	Total Dissolved Solids	mg/l	500	2000
4	Total Alkalinity	mg/l	200	600
5	Total Hardness	mg/l	200	600
6	Chloride	mg/l	250	1000

Table-2 - Parameters of Water as per IS 10500:2012

**V. RESULTS AND DISCUSSION**

About 20 samples were collected from India Mark-II Hand Pumps and Shallow Hand Pumps of various locations of Gorakhpur city and tested and results are discussed below :

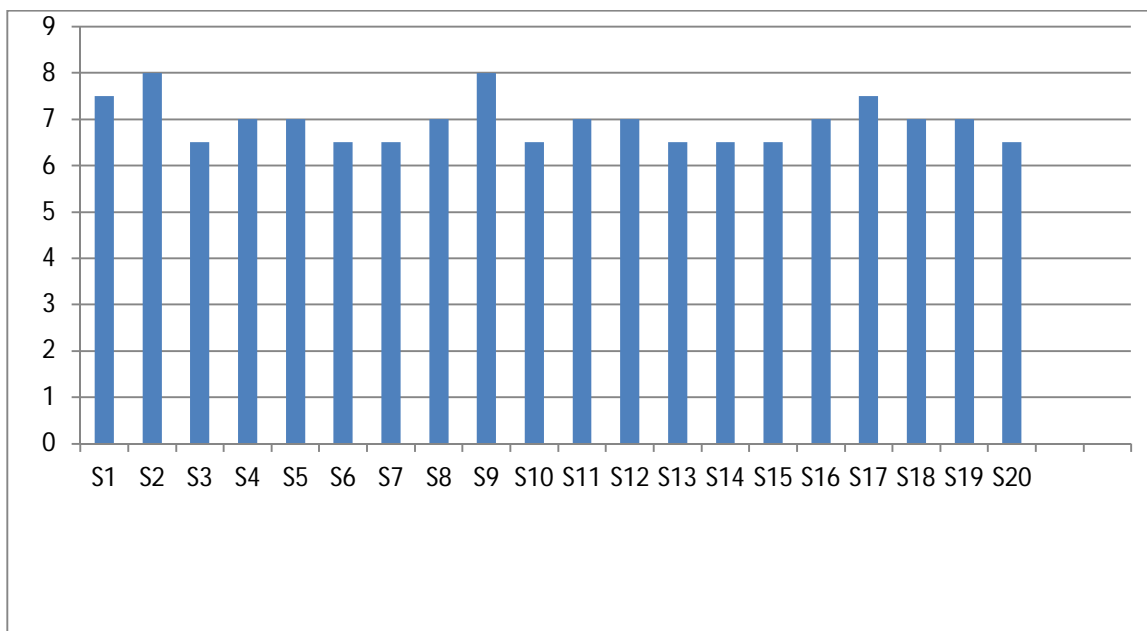


Fig. 1 – Sample Test Results for pH

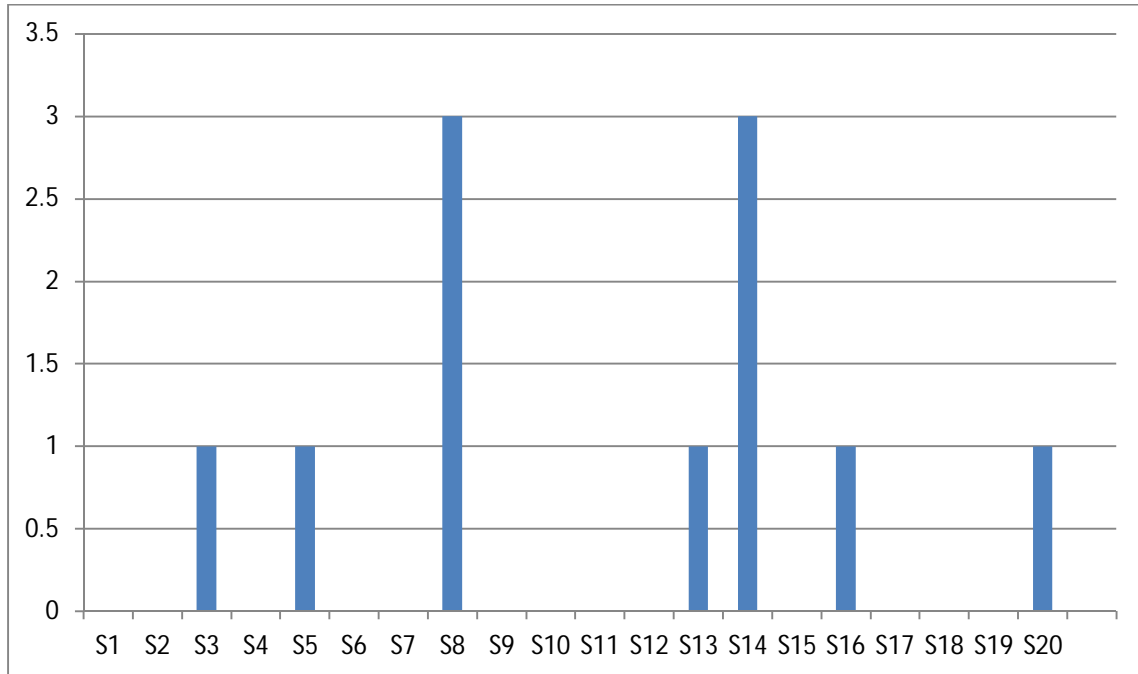


Fig. 2 – Sample Test Results for Turbidity

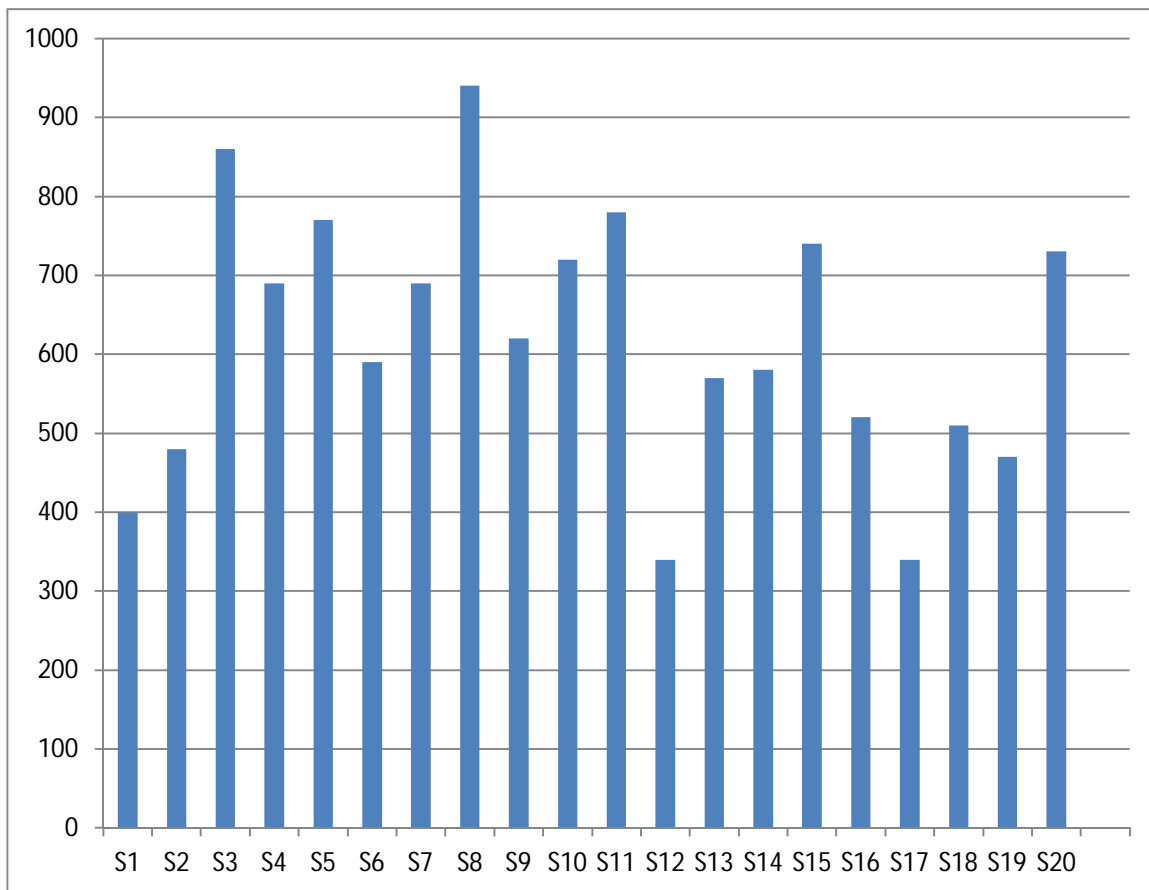


Fig. 3 – Sample Test Results for TDS

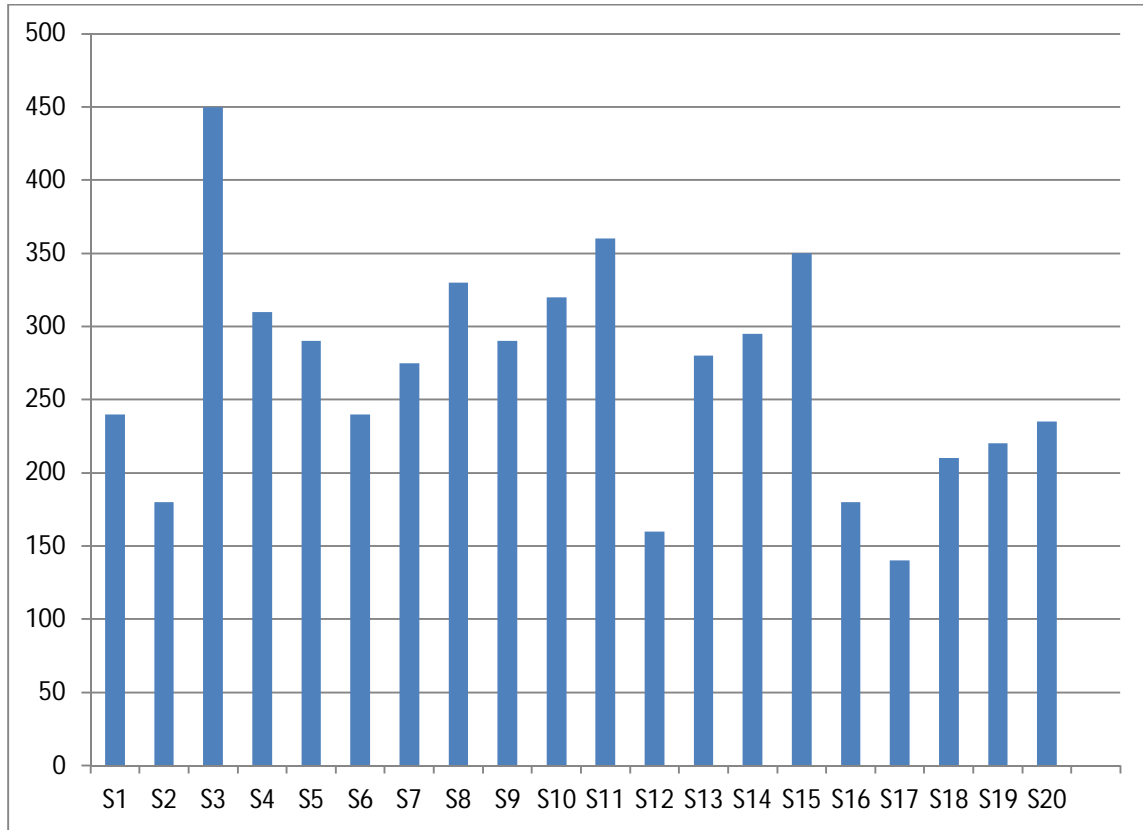


Fig. 4 – Sample Test Results for Total Alkalinity

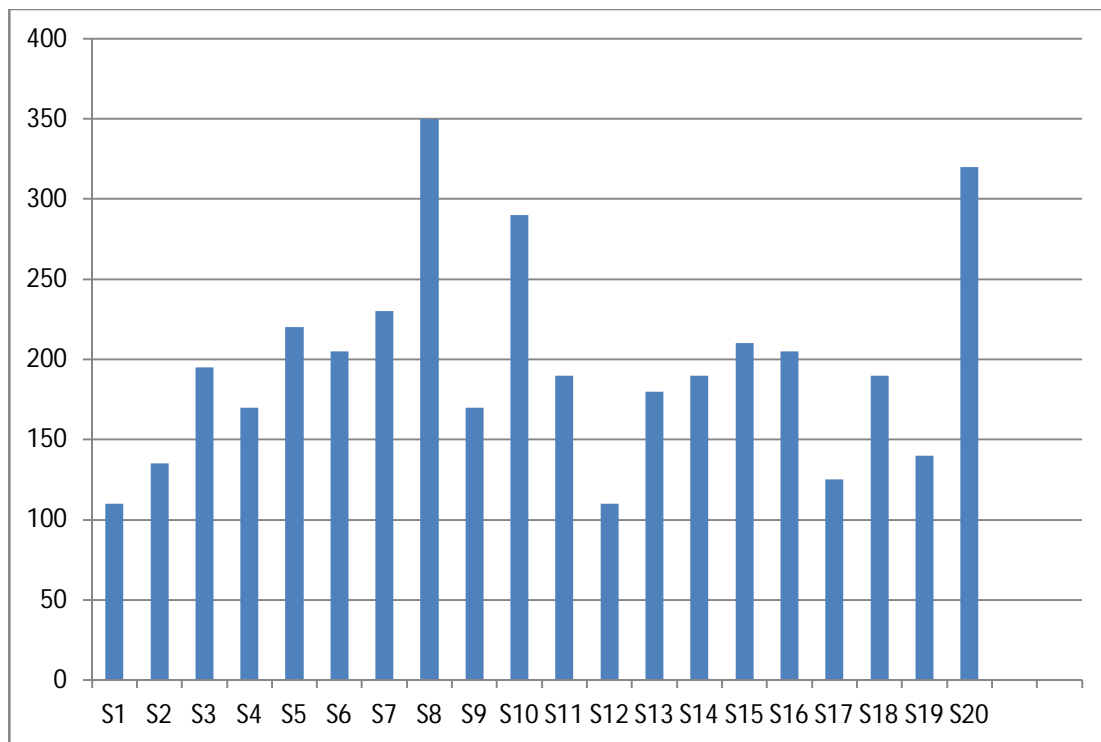


Fig. 5 – Sample Test Results for Total Hardness

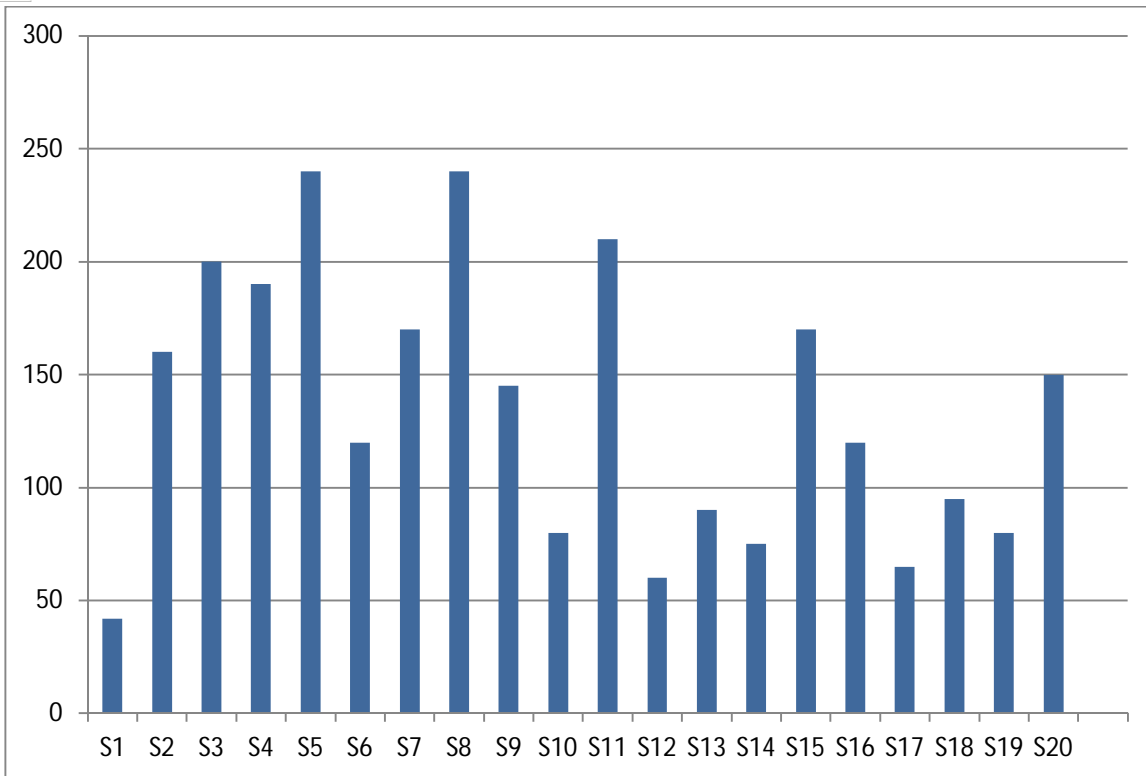


Fig. 6– Sample Test Results for Chloride

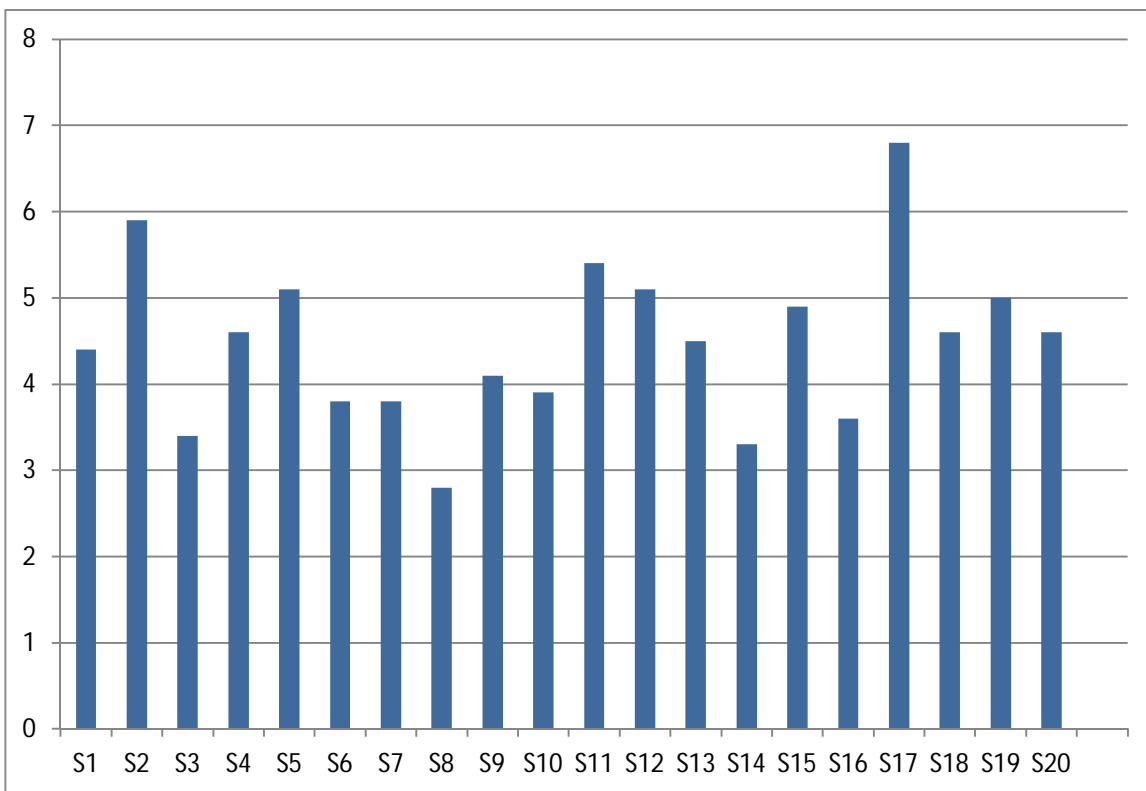


Fig. 7 – Sample Test Results for Dissolved Oxygen

Sl. No.	Sample Code	Area	Location	Hand Pump Type	pH	Turbidity (NTU)	Total Dissolved Solids (mg/l)	Total Alkalinity (mg/l)	Total Hardness (mg/l)	Chloride (mg/l)	Dissolved Oxygen (mg/l)
1	S1	MMMUT	Gate -1 Near Temple	India Mark-II	7.5	0	400	240	110	42	4.4
2	S2	Mohaddipur	Near Luxmi Bakers	India Mark-II	8.0	0	480	180	135	160	5.9
3	S3	Paidleganj	Near Mahaveer Marbles	Shallow	6.5	1	860	450	195	200	3.4
4	S4	Kunraghat	Near Kamakshi Store	Shallow	7.0	0	690	310	170	190	4.6
5	S5	Betiahata	Near Maa Ambey Provision Store	India Mark-II	7.0	1	770	290	220	240	5.1
6	S6	DDUGU	University Chauraha Near Pant Park	Shallow	6.5	0	590	240	205	120	3.8
7	S7	Asuran Chowk	Asuran Chowk	India Mark-II	6.5	0	690	275	230	170	3.8
8	S8	Ghasikatra	Near Temple	India Mark-II	7.0	3	940	330	350	240	2.8
9	S9	Buxipur	Near Kotwali Thana	India Mark-II	8.0	0	620	290	170	145	4.1
10	S10	Railway Station	Gorakhpur Station Near Reserve Police Line	India Mark-II	6.5	0	720	320	290	80	3.9
11	S11	AIIMS	Near Railway Line	Shallow	7.0	0	780	360	190	210	5.4
12	S12	Khorabar	Near St. Joseph's School	India Mark-II	7.0	0	340	160	110	60	5.1
13	S13	Nausad	Nausad Chowk	Shallow	6.5	1	570	280	180	90	4.5
14	S14	Laldiggi	Near Laldiggi Park (Bandha)	India Mark-II	6.5	3	580	295	190	75	3.3
15	S15	Surajkund	Near Surajkund Flyover	Shallow	6.5	0	740	350	210	170	4.9
16	S16	Gorakhnath	Beside Temple Road	India Mark-II	7.0	1	520	180	205	120	3.6
17	S17	GIDA	Near Little Flower School	Shallow	7.5	0	340	140	125	65	6.8
18	S18	Basharatpur	Basharatpur Chowk	India Mark-II	7.0	0	510	210	190	95	4.6
19	S19	Hansupur	Hansupur Chowk	Shallow	7.0	0	470	220	140	80	5.0
20	S20	Ghantaghar	Halsiganj Road	Shallow	6.5	1	730	235	320	150	4.6

Table-3 Result of Groundwater quality assessment of Gorakhpur city

## VI. CONCLUSION

About 20 samples were collected from India Mark-II Hand Pumps and Shallow Hand Pumps of various locations of Gorakhpur city and tested. Although the water samples tested were within the permissible limit but still some samples were not fit for drinking purpose as the water samples of some areas say Ghasikatra (S8), Laldiggi (S14) and Gorakhnath (S16) were yellowish in color. The samples namely Ghasikatra (S8), Laldiggi (S14) and Gorakhnath (S16) were highly turbid. The samples namely Ghasikatra (S8), Laldiggi (S14) and Gorakhnath (S16) were aesthetically not good for drinking purpose as they show color and turbidity in it. Overall the work done for the analysis of groundwater in Gorakhpur city were found to be within permissible according to BIS 10500 – 2012.

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