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Water Quality of River Ganga Year 2022 of Rohilkhand Region

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ABSTRACT
River water pollution due to industrial waste is one of the major concerns in most metropolitan cities these days. The following review article presents the findings of the work carried out by the various researchers on the effect of industrial pollution on the Ganga River. A systematic study was carried out to assess the water quality index of the Ganga from district Bijnor to Shahjahapur, Uttar Pradesh. Water samples were collected and analyzed for physical and chemical parameters like pH (at 25 °C), electric conductivity, TDS, turbidity, total hardness as CaCO3, calcium as Ca, alkalinity as CaCO3, chloride as C1, BOD (3 days at 27°C), COD (as O2), iron as Fe, Total Chromium (as Cr), Zinc (as Zn), Copper (as Cu), Manganese (as Mn), Cadmium (as Cd), Lead (as Pb), Arsenic (as As), Mercury (as Hg), Nickel (as Ni), and Antimony (as Sb). All the quality parameters were compared with the standard values of WHO and ISI. For the assessment of the water quality of the Ganga. These parameters are substituted into the quantitative value of each parameter that defines overall water quality for a definite location.

Keywords: pH, EC, TDS, Chromium, Manganese, BOD, COD, Hardness, Water Pollution, Industries.

I. INTRODUCTION

The river Ganga originates from the Gangotri glacier at Gomukh (30°36' N; 79° 04' E; altitude: 4100 m) in the district Uttar Kashi of Uttarakhand under the name of Bhagirathi [1]. This glacier is a group of many glaciers covering the main Gangotri Glacier (length: 30.20 km; width: 0.20–2.35 km; area: 86.32 km2) [2]. Another river, named the Alaknanda, originates from the Bhagirath-Kharak (30°49'N; 79017'E) and Satopanth (30°45'N; 79021'E) glaciers about 100 km south-east of Gaumukh. Both Bhagirathi and Alaknanda river receives several tributaries and flow separately for over 200 km before they merge at Devprayag in the lower Himalayas, where the combined river attains the name of Ganges. The river Ganges flows for about 64 km before descending to Rishikesh, which is situated at the foothills of the Himalayas, and further winding for 24 km arrives at Haridwar, where it diverts at Bhimgauda Barrage[3]. The length of the main channel from the source of the Gangotri glacier in India is about 2550 km. After flowing through the Shivalik hills, it enters in the plains of Haridwar. then it flows southwards, passing through the plains of Uttar Pradesh, from where the Ganga enters Rohtas in Bihar. From Bihar, it enters in West Bengal and starts flowing southwards. Nearly 40 kilometers below Farakka, it is divided into two streams. The left stream flows eastwards into Bangladesh, and the right stream, known as Bhagirathi, continues to flow south through West Bengal[4]. The Bhagirathi flowing west and south-west of Kolkata is popularly known as the Hooghly. After reaching Diamond Harbour, it conquers the southward direction and get split into two streams before reaching the Bay of Bengal [31]. From its origin at Gaumukh to the mouth at Sagar Island, where it discharges into the Bay of Bengal, the Ganges River traverses through a vast alluvial plain of Uttarakhand, Uttar Pradesh, Bihar, Jharkhand, and West Bengal states through big cities, covering a total distance of over 2715 km [5]. In India, the river Ganga passes along 29 class I cities, 23 class II cities, and approximately 50 towns, because of which different kinds of industrial wastes are discharged into the river ecosystem [6-7].

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Pic-Ganga RiverBijnor Bairaj.

Need / Justification / Rationale

To discuss how the Year 2022 ganga River water condition will affect living organisms and the natural environment.

Cleaning of the river Ganga is a continuous process, and the National Mission for Clean Ganga is implementing various projects for conservation and rejuvenation of the river Ganga and its tributaries.

Small contribution by analysis of surface and ground water of the ganga.

Proposed work Abstract:

My study focuses on the impact of various industries on groundwater and surface water that is used for domestic and agricultural purposes in Rohilkhand region 5 districts (District-Bijnor, J.P. Nagar (Amroha), Sambhal, Badaun, and Shahjahapur) in Uttar Pradesh, state of India, and part of the upper Ganges Plains. Water samples were collected from different locations, near big industrial areas, major industries, big religious places, crematorium places from the Ganga Riverbank, and at different depths of groundwater. The study indicates that water quality parameters near industrial effluents are normal in these districts. Only one location has some unpleasant results in terms of heavy metals. Only one heavy metal exceeds the permissible limits. The research work was started for 1-year 2022, that is, from February 2022 to December 2022. Three-season sampling was done, i.e., summer, winter, and rainy season in 2022.

Total 21 parameters were tested, which are: pH (at 25°C), electric conductivity, TDS, turbidity, total hardness as CaCO3, calcium as Ca, alkalinity as CaCO3, chloride as C1, BOD (3 days at 27°C), COD (as O2), iron as Fe, total chromium (as Cr), zinc (as Zn), copper (as Cu), manganese (as Mn), cadmium (as Cd), lead (as Pb), arsenic (as Hg), nickel (as Ni), and antimony (as Sb). Samples were collected from the Ganga River and borewells nearby in various types of locations in Rohilkhand region, Uttar Pradesh.

Aims & Objectives

- To assess the seasonal variation in the water quality of Ganga River through analysis of selected water quality parameters and to compare the results with the WHO standard.
- To explain and represent water pollution condition.
- Point out method and prospects of this major problem applied in the study area secure water for future.

Hypothesis Formulation

The work done with these hypotheses.

- Analysis of ganga water 2022.
- Water Pollution & related consequences for prevention method.

Study Area

The samples were taken from the 5 districts, 16 locations nearby, and the Ganga River for 3 seasons (summer, winter, and rainy). Samples were immediately transferred to a chemical laboratory with storage conditions according to IS 3025: Part-27 [Methods of sampling and testing (physical and chemical) for water and wastewater]. Part 1: Sampling. Sampling is done from the river stream, hand pump, and borewell, which are situated nearby industries and the Ganga River in the Rohilkhand region (District-Bijnor, J.P. Nagar (Amroha, Sambhal), Badaun, and Shahjahapur) in the Uttar Pradesh state of India, part of the upper Ganges plain.

Review of literature

Ganga is a major and important river in India that originates from Gangotri, Uttarakhand, in the Himalayas and runs through almost 52 densely populated cities and 48 towns to meet the Bay of Bengal.[8] This river has both emotional and spiritual value among Indians. The water of the Ganga carries religious sentiments and is considered the purest water that can wash off all the sins of human beings. It is one of the longest rivers in India and also the third-largest river in the world in terms of water discharged into the sea. Ganga plays an important role in the lives of Indian people, as the genetic basin is highly fertile and ideal for the cultivation of many crops. It also acts

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as an abode for some of the rarest species on the planet.[9] The river's water is used for irrigation, transportation, and fishing. Rishikesh is an important point because it is here that it first enters the plain terrain, and from here, the city pollution starts contaminating its water. The two rivers

Bhagirathi and Alaknanda join just before Rishikesh to form the Ganga. Unfortunately, the water of this holy river is getting polluted by increasing human activities, including dumping of sewage water, washing clothes, bathing animals, agriculture run-off water, and the release of effluents from industries. All these activities are responsible for dumping loads of organic and inorganic matter into the river daily, thus making the water highly polluted and unfit for drinking. [10–15]. However, the present study is carried out with the objective of assessing the water quality index of the Ganga water at its descendent point on the plains, where it is supposed to be least polluted. This study can be a benchmark for further studies on the water quality of the Ganga at different places upstream.[16-20]

Due to rapid industrialization, new technologies, in the form of industrial plants, get constructed in the riverside area. The advancement of industrialization has generated huge pressure and massive pollution in every sector of the environment.[17] River pollution is one such consequence of this rapid urbanization and industrialization [24–30]. Due to the rapid escalation of industries, there has been a rise in the amount of effluent being disposed of in water bodies. Industrial effluents and sewage entering water bodies are two of the prime sources of toxicity, which endangers aquatic biota and deteriorates water quality. The quality of water is a vital concern for mankind since it is directly linked to the healthy survival of living organisms [21–25].

The quality of water is degrading due to the establishment of a large number of industrial plants in riverine areas of Uttar Pradesh. The worst impacts are from the waste discharged from paper mills, textile mills, chemical plants, and sugar mills. All these industries contribute to the pollution of the Ganga River by dumping their untreated or partially treated waste.[26-28] Industrial wastes account for about 12% of the total volume of effluent reaching the river. Although of a relatively low proportion, they are a cause for major concern because they are mostly toxic and non-biodegradable [29-32]. Today freshwater resources are becoming scarcer and more polluted due to stress on water quality and quantity. At present, the Ganga River is slightly polluted. The quality of water is degrading due to the establishment of a large number of industrial plants in riverine areas of Uttar Pradesh.[33]

Plan and Procedure / Materials & Methods

Material: Methodology

Samples were collected as per standard procedures (IS 3025). At each sampling station, three water samples were collected. 21 parameters were studied using standard methods [12], and the results obtained were compared with the WHO and ISI standards.[13] All reagents were prepared using AR-grade chemicals, and distilled water was used throughout the analysis. A HANA conductivity metre and a digital HANA pH metre were used for the determination of electrical conductivity and pH, respectively. Other parameters were studied during the analysis.

Test performed for water: A total of 21 tests were performed for water, including pH (at 25 °C), electric conductivity, TDS, turbidity, Total Hardness as CaCO3, Calcium as Ca, Alkalinity as CaCO3, Chloride as C1, BOD (3 days at 27°C), COD (as O2), Iron as Fe, Total Chromium (as Cr), Zinc (as Zn), Copper (as Cu), Manganese (as Mn), Cadmium (as Cd), Lead (as Pb), Arsenic (as As), Mercury (as Hg), Nickel (as Ni), and Antimony (as Sb).

Note: pH is done on site.

pH is defined as the negative logarithm of the hydrogen ion concentration. The pH of potable water should be between 6.5 and 8.5. There are many factors that affect the pH of the water, such as the presence of dissolved gases, salts, bases, and acids. In the present study, the pH was found to be 6.5 to 8.0, according to IS-10500-2012.

Alkalinity is the capacity of water to neutralise acids. The presence of bicarbonates, carbonates,

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and hydroxides causes alkalinity in the water. These salts in water are due to the dissolution of minerals from rocks, soils, plants, and microbial activities, as well as the discharge of industrial waste.[24] The alkalinity that was reported in the present study was also 125 mg/L in ganga water and more than 300 in borewell water at some places.

Electrical conductivity is the capacity of water to conduct electrical current. It is due to the presence of dissolved salts and minerals. The conductivity was found to be up to 150 µs/cm in Ganga water and higher in borewell samples.

Total hardness is an important property of water that prevents the lathering of water with the soap solution, and if it exceeds the tolerance limit, it may lead to serious illness. It causes serious damage to the products of industries and machinery if untreated water is used.[34] The main causes of hardness in water are the presence of bicarbonates, chlorides, and sulphates of calcium and magnesium. Total hardness was reported at <90 mg/L in ganga water and up to 200 to 280 in borewell water; according to IS 10500-2012, these are within permissible limits.

Calcium ions lead to hardness in the water. They are responsible for the formation of scales and sludge. The presence of calcium ions was found to be <50 mg/L according to IS 10500-2012; these are within permissible limits.

Total Dissolved Solids is an aggregate of all the dissolved solids present in the water. The amount of total dissolved solids was reported as <150 mg/L in ganga water and <450 mg/L in borewell water for all 16 locations, according to IS 10500-2012, which is within the safe limits.

BOD Biochemical oxygen demand (BOD) represents the amount of oxygen consumed by bacteria and other microorganisms while they decompose organic matter under aerobic (oxygen is present) conditions at a specified temperature.[35-37] The biological oxygen demand (BOD) test is based on a bioassay procedure to measure the amount of dissolved oxygen consumed by microorganisms while assimilating and oxidising organic matter under aerobic conditions. The standard test condition includes incubating the sample in an airtight bottle in the dark at a specified temperature for a specific time. BOD was reported as <5 mg/L in ganga water and borewell water for all 16 locations.

COD Chemical oxygen demand (COD) is the amount of dissolved oxygen that must be present in water to oxidise chemical organic materials, like petroleum. COD is used to gauge the short-term impact wastewater effluents will have on the oxygen levels of receiving waters.[38] Most of the organic matter is destroyed when boiled with a mixture of potassium dichromate and sulfuric acid, producing carbon dioxide and water. COD was reported as <8 mg/L in ganga water and borewell water for all 16 locations.

Heavy Metals The presence of lead, arsenic, mercury, copper, and other heavy metals in our drinking water could come as no surprise. That's because they exist in both natural deposits in the earth and originate from man-made sources. The difference between the two is that heavy metals that leach from natural deposits are very rarely found at levels that are considered harmful to human health.[39] Even when trace metals are leached out of soil and rocks by environmental conditions, it usually takes assistance from man, in the form of acid rain caused by pollution, to do so.[40-41] As you can probably guess, the man-made presence of these toxic species of metals in water is usually the result of industrial and power-generating processes. Heavy metals were reported. Below are the detection limits in ganga water and borewell water for all 16 locations.

Tools used:

The analytical test procedures, as suggested by the American Public Health Association (APHA 2012) & Bureau of India Standard wereused for sample analysis. Google GPS were used to tag the location of sampling points and the coordinates. The physio-chemical parameters of the analysed sample results were compared with the standards set by the Bureau of Indian standards IS:10500 (2012) and WHO (2011).

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Sample Location with Latitude & Longitudes:

District name	Location	Water Type	Latitude / Longitude	District name	Location	Water Type	Latitude / Longitude
1. Bijnor	Nangal Soti (Reference sample)	Ganga water	29.6761579, 78.1704095	2. Sambhal	Hari Baba bandh (Ganga Ghat)	Ganga water	29.6761579, 78.1704095
		Borewell water	29.6680708, 78.1909307			Borewell water	29.6680708, 78.1909307
		Handpump	29.6701370, 78.1792750			Handpump	29.6701370, 78.1792750
	Balawali Ganga Ghat	Ganga water	29.635394, 78.105916		Sikandarpur Khagi(Near big city Anoop Shahar	Ganga water	28.305942, 78.310196
		Borewell water	29.624765, 78.109899			Borewell water	28.305942, 78.310196
		Handpump	29.633888, 78.106025			Handpump	28.305942, 78.310196
	Rawli (Malan River & ganga junction)	Ganga water	29.434826, 78.061776		Band Gabgabas (Near Narora (Ganga Ghat))	Ganga water	28.193999, 78.403041
		Borewell water	29.450120, 78.075095			Borewell water	28.193999, 78.403041
		Handpump	29.450120, 78.075095			Handpump	28.193999, 78.403041
	Vidurkuti (Religious place)	Ganga water	29.284664, 78.104379		Shahjahanabad Sailab (near tata firtilizer, Rajghat (Ganga Ghat)	Ganga water	28.247296, 78.367926
		Borewell water	29.284664, 78.104379			Borewell water	28.247296, 78.367926
		Handpump	29.284664, 78.104379			Handpump	28.247296, 78.367926
	Bijnor Ganga Bairaj (mortuary and big city near by)	Ganga water	29.373498, 78.041466		Sankara (Ganga Ghat)	Ganga water	28.051693, 78.538993
		Borewell water	29.373498, 78.041466			Borewell water	28.051693, 78.538993
		Handpump	29.373498, 78.041466			Handpump	28.051693, 78.538993
4. J.P. Nagar (Amroha)	Kabirpur Ahatamali (Ganga Ghat)	Ganga water	28.759426, 78.157372	3. Badaun	Kachhla (Ganga Ghat)	Ganga water	27.929211, 78.857468
		Borewell water	28.759426, 78.157372			Borewell water	27.929211, 78.857468
		Handpump	28.759426, 78.157372			Handpump	27.929211, 78.857468
	Tigree (Ganga Ghat)	Ganga water	28.49'29.7"N 78.019'16.7''E		Kakora (Quadar ganj ganga ghat)	Ganga water	27.795468, 79.062942
		Borewell water	28.49'29.7"N 78.019'16.7''E			Borewell water	27.795468, 79.062942
		Handpump	28.49'29.7"N 78.019'16.7''E			Handpump	27.795468, 79.062942
	Hasanpur Sirsakala mustam (Ganga Ghat)	Ganga water	28.483694, 78.256591	5. Shahjahapur	Jalalabad (Dhaighat (Ganga Ghat))	Ganga water	27.575925, 79.478540
		Borewell water	28.483694, 78.256591			Borewell water	27.575925, 79.478540
		Handpump	28.483694, 78.256591			Handpump	27.575925, 79.478540

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Experimental work, Results year 2022 all three seasons& Discussion

	Locations			Nangal Soti (29.6761579, 78.1704095)								
	Seasons			Summer season			Rainy season			Winter Season		
S. No.	Parameter	Test methods	Unit	Ganga Water	Borewell	Handpump Water	Ganga Water	Borewell	Handpump Water	Ganga Water	Borewell	Handpump Water
1	pH (at 25	APHA .4500-H'		7	7.02	7.43	6.78	6.82	7.12	6.9	6.82	7.03
2	Electric	APHA .2510 B.	qS/C	193.2	491	722	209.37	486.58	547.53	199	475	530
3	TDS	Calculated by	mg/L	120.75	306.875	451.25	110	285	298	116	270	276
4	Turbidity	APHA, 2130 B.	NTU	<1.0	<1.0	<1.0	0.2	0.1	0.1	<1.0	<1.0	<1.0
5	Total	APHA, 2340C	mg/L	81.45	198	297	90.95	267.5	267.5	90.6	72.95	263.5
6	Calcium as	AP HA. 3500 Ca	mg/L	23.81	59.28	77.37	27.87	68.61	79.33	21.2	24.87	65.61
7	Alkalinity	APHA , 2320 B.	mg/L	80.8	252.5	363.6	87.87	235.87	208.12	73.6	81.87	229.87
8	Chloride	APHA. 4500-Cl	mg/L	2.38	9.5	14.25	14.57	58.27	9.71	3.27	21.57	65.27
9	BOD	IS:3025 (P-	mg/L	4.7	2.2	<2.0	4.9	1.1	0.9	3.8	<2.0	<2.0
10	COD (as	APHA, 5220 B	mg/L	25	8	4	40.8	4	4	9	<4.0	<4.0
11	Iron as Fe	IS 3025 (P-65)	mg/L	<0.01	<0.01	0.03	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
12	Total	IS 3025 (P-65)	mg/L	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
13	Zinc (as	IS 3025 (P-65)	mg/L	<0.01	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
14	Copper (as	IS 3025 (P-65)	mg/L	<0.002	<0.002	<0.002	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
15	Manganese	IS 3025 (P-65)	mg/L	<0.01	0.04	0.03	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06
16	Cadmium	IS 3025 (P-65)	mg/L	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
17	Lead (as	IS 3025 (P-65)	mg/L	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
18	Arsenic as	IS 3025 (P-65)	mg/L	0.013	0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
19	Mercury (	IS 3025 (P-65)	mg/L	<0.000	<0.0005	<0.0005	<0.000	<0.0005	<0.0005	<0.000	<0.0005	<0.0005
20	Nickel (as	IS 3025 (P-65)	mg/L	<0.002	<0.002	<0.002	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
21	Antimony	IS 3025 (P-65)	mg/L	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002

	Locations			Balawali (29.635394, 78.105916)								
	Seasons			Summer season			Rainy season			Winter Season		
S. No.	Parameter	Test methods	Unit	Ganga Water	Borewell Water	Handpump Water	Ganga Water	Borewell Water	Handpump Water	Ganga Water	Borewell Water	Handpump Water
1	pH (at 25 'C)	APHA .4500-H'B Electrometric Method		7.71	7.43	7.69	7.25	7.43	7.69	7.18	7.25	7.45
2	Electric conductivity	APHA .2510 B. Conductivity	qS/Cm	207	497	369	185	497	369	178	486	352
3	TDS	Calculated by conductivity	mg/L	129.375	310.625	230.625	111.25	310.625	230.625	136	296	246
4	Turbidity	APHA, 2130 B. Nephelometric Method	NTU	<1.0	<1.0	<1.0	0.3	0.1	0.1	3	<1.0	<1.0
5	Total Hardness as CaCO3	APHA, 2340C EDTA Titrimetric Method	mg/L	69.3	202.95	138.6	65.4	202.95	138.6	60.5	178.5	135.4
6	Calcium as Ca	AP HA. 3500 Ca B. EDTA Titrimetric	mg/L	24.53	39.68	41.66	20.2	39.68	41.66	18.5	36.5	38.5
7	Alkalinity as CaCO3	APHA , 2320 B. Titrimetric Method	mg/L	60.66	161.6	191.9	50.15	161.6	191.9	48.1	153.5	186.5
8	Chloride as Cl	APHA. 4500-Cl B. Argentometric Method	mg/L	30.88	11.88	7.13	42	11.88	7.13	39.5	18.5	16.5
9	BOD (3days @ 27°C)	IS:3025 (P-44):2003	mg/L	3.3	2.1	<2.0	4.9	2	2	5	<2.0	<2.0
10	COD (as O2)	APHA, 5220 B OpenReflux Method	mg/L	16	8	<4.0	12	4	4	12	5	5
11	Iron as Fe	IS 3025 (P-65) :2014(RA:2019)	mg/L	<0.01	<0.01	0.1	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
12	Total Chromium (as	IS 3025 (P-65) :2014(RA:2019)	mg/L	<0.002	<0.002	0.01	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
13	Zinc (as Zn)	IS 3025 (P-65) :2014(RA:2019)	mg/L	<0.01	<0.01	<0.002	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
14	Copper (as Cu)	IS 3025 (P-65) :2014(RA:2019)	mg/L	<0.002	<0.002	<0.002	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
15	Manganese (as Mn)	IS 3025 (P-65) :2014(RA:2019)	mg/L	<0.01	0.07	0.12	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06
16	Cadmium (as Cd)	IS 3025 (P-65) :2014(RA:2019)	mg/L	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
17	Lead (as Pb)	IS 3025 (P-65) :2014(RA:2019)	mg/L	0.006	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
18	Arsenic as As	IS 3025 (P-65) :2014(RA:2019)	mg/L	0.006	0.007	0.015	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
19	Mercury (as Hg)	IS 3025 (P-65) :2014(RA:2019)	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
20	Nickel (as N i)	IS 3025 (P-65) :2014(RA:2019)	mg/L	<0.002	<0.002	<0.002	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
21	Antimony (as Sb)	IS 3025 (P-65) :2014(RA:2019)	mg/L	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002

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	Locations			Rawali (Malan & Ganga Junction) (29.434826, 78.061776)								
	Seasons			Summer season			Rainy season			Winter Season		
S. No.	Parameter	Test methods	Unit	Ganga Water	Borewell Water	Handpump Water	Ganga Water	Borewell Water	Handpump Water	Ganga Water	Borewell Water	Handpump Water
1	pH (at 25 °C)	APHA .4500-H+ B Electrometric Method		8.05	7.8	7.55	7.75	7.8	7.55	6.75	6.8	7.35
2	Electric conductivity	APHA .2510 B. Conductivity meterMethod:201	qS/Cm	452	467	355	432	467	355	422	456	348
3	TDS	Calculated by conductivity	mg/L	282.5	291.875	221.875	256	291.875	221.875	238	276	205
4	Turbidity	APHA, 2130 B. Nephelometric Method	NTU	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
5	Total Hardness as CaCO3	APHA, 2340C EDTA Titrimetric Method	mg/L	188.1	163.35	148.5	188.1	163.35	148.5	180.1	136.35	131.5
6	Calcium as Ca	AP HA. 3500 Ca B. EDTA Titrimetric Method	mg/L	55.55	39.68	43.65	55.55	39.68	43.65	53.55	36.68	37.65
7	Alkalinity as CaCO3	APHA , 2320 B. Titrimetric Method	mg/L	222.2	202	166.7	222.2	202	166.7	220.2	198	154.7
8	Chloride as C1	APHA. 4500-Cl B. Argentometric Method	mg/L	9.5	16.63	11.88	9.5	16.63	11.88	6.5	22.63	17.88
9	BOD (3days @ 27°C)	IS:3025 (P-44):2003	mg/L	3.4	3.6	<2.0	3.4	3.6	0.9	2.4	2.6	<2.0
10	COD (as O2)	APHA . 5220 B OpenReflux Method	mg/L	16.8	16	<4.0	16.8	16	<4.0	20.8	17	<4.0
11	Iron as Fe	IS 3025 (P-65) :20 14(RA:2019)	mg/L	<1.0	0.07	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
12	Total Chromium (as Cr)	IS 3025 (P-65) :20 14(RA:2019)	mg/L	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
13	Zinc (as Zn)	IS 3025 (P-65) :20 14(RA:2019)	mg/L	<0.01	<0.01	0.4	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
14	Copper (as Cu)	IS 3025 (P-65) :20 14(RA:2019)	mg/L	<0.002	<0.002	<0.002	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
15	Manganese (as M n)	IS 3025 (P-65) :20 14(RA:2019)	mg/L	<0.01	0.2	0.13	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06
16	Cadmium (as Cd)	IS 3025 (P-65) :20 14(RA:2019)	mg/L	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
17	Lead (as Pb)	IS 3025 (P-65) :20 14(RA:2019)	mg/L	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
18	Arsenic as As	IS 3025 (P-65) :20 14(RA:2019)	mg/L	**0.065**	0.026	0.013	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
19	Mercury (as Hg)	IS 3025 (P-65) :20 14(RA:2019)	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
20	Nickel (as Ni)	IS 3025 (P-65) :20 14(RA:2019)	mg/L	<0.002	<0.002	<0.002	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
21	Antimony (as Sb)	IS 3025 (P-65) :20 14(RA:2019)	mg/L	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002

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	Locations			Vidurkuti (Relegious place) (29.284664, 78.104379)								
	Seasons			Summer season			Rainy season			Winter Season		
S. No.	Parameter	Test methods	Unit	Ganga Water	Borewel l Water	Handpum p Water	Ganga Water	Borewel l Water	Handpum p Water	Ganga Water	Borewel l Water	Handpum p Water
1	pH (at 25 °C)	APHA .4500-H⁺ B Electrometric Method		7.74	8.09	8.03	7.6	7.95	7.96	6.6	6.95	7.83
2	Electric conductivit y	APHA .2510 B. Conductivity meterMethod:201 7	qS/C m	197	322	240	146	302	226	136	291	209
3	TDS	Calculated by conductivity	mg/L	123.12 5	201.25	150	91.25	188.75	141.25	115	205	168
4	Turbidity	APHA, 2130 B. Nephelometric Method	NTU	<1.0	<1.0	<1.0	0.3	0.1	0.1	<1.0	<1.0	<1.0
5	Total Hardness as CaCO3	APHA, 2340C EDTA Titrimetric Method	mg/L	54.45	123.75	89.1	52.56	120.54	82.34	46.56	92.54	78.34
6	Calcium as Ca	AP HA. 3500 Ca B. EDTA Titrimetric Method	mg/L	21.82	35.71	25.79	20.58	32.56	23.54	18.58	29.56	19.54
7	Alkalinity as CaCO3	APHA , 2320 B. Titrimetric Method	mg/L	60.6	136.4	116.2	58.25	130.22	110.6	56.25	124.22	104.6
8	Chloride as C1	APHA. 4500-Cl B. Argentometric Method	mg/L	7.13	9.5	7.13	6.2	10.2	7.3	3.2	17.2	17.3
9	BOD (3days @ 27°C)	IS:3025 (P-44):2003	mg/L	13	2.4	0.9	6	2	0.9	7	<2.0	<2.0
10	COD (as O2)	APHA., 5220 B OpenRef1ux Method	mg/L	61	12	<4.0	14	10	<4.0	8	<4.0	<4.0
11	Iron as Fe	IS 3025 (P-65) :20 14(RA:2019)	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
12	Total Chromium (as Cr)	IS 3025 (P-65) :20 14(RA:2019)	mg/L	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
13	Zinc (as Zn)	IS 3025 (P-65) :20 14(RA:2019)	mg/L	<0.01	0.03	0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
14	Copper (as Cu)	IS 3025 (P-65) :20 14(RA:2019)	mg/L	<0.002	<0.002	<0.002	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
15	Manganese (as M n)	IS 3025 (P-65) :20 14(RA:2019)	mg/L	<0.01	<0.01	<0.01	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06
16	Cadmium (as Cd)	IS 3025 (P-65) :20 14(RA:2019)	mg/L	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002

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17	Lead (as Pb)	IS 3025 (P-65) :20 14(RA:2019)	mg/L	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
18	Arsenic as As	IS 3025 (P-65) :20 14(RA:2019)	mg/L	0.009	0.009	<0.0005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
19	Mercury (as Hg)	IS 3025 (P-65) :20 14(RA:2019)	mg/L	<0.000 5	<0.0005	<0.0005	<0.000 5	<0.0005	<0.0005	<0.000 5	<0.0005	<0.0005
20	Nickel (as Ni)	IS 3025 (P-65) :20 14(RA:2019)	mg/L	<0.002	<0.002	<0.002	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
21	Antimony (as Sb)	IS 3025 (P-65) :20 14(RA:2019)	mg/L	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002

	Locations			Bijnor Ganga bairaj (29.373498, 78.041466)								
	Seasons			Summer season			Rainy season			Winter Season		
S. No.	Parameter	Test methods	Unit	Ganga Water	Borewell Water	Handpump Water	Ganga Water	Borewell Water	Handpump Water	Ganga Water	Borewell Water	Handpump Water
1	pH (at 25 °C)	APHA .4500-H+ B Electrometric Method		7.88	7.8	7.49	7.18	7.13	6.93	6.18	6.13	6.82
2	Electric conductivity	APHA .2510 B. Conductivity meterMethod:2017	qS/Cm	182	358	309	189.24	421.94	358.79	179	411	343
3	TDS	Calculated by conductivity	mg/L	113.75	223.75	193.125	108	228	205	106	210	196
4	Turbidity	APHA, 2130 B. Nephelometric Method	NTU	<1.0	<1.0	<1.0	0.3	0.3	0.5	4	3	6
5	Total Hardness as CaCO3	APHA, 2340C EDTA Titrimetric Method	mg/L	59.4	84.15	118.8	80.25	139.1	165.85	72.25	109.1	160.85
6	Calcium as Ca	AP HA. 3500 Ca B. EDTA Titrimetric Method	mg/L	17.86	19.84	29.76	21.44	38.59	55.75	19.44	35.59	52.75
7	Alkalinity as CaCO3	APHA , 2320 B. Titrimetric Method	mg/L	65.7	181.8	136.4	74	194.25	161.87	72	184.25	155.87
8	Chloride as C1	APHA. 4500-Cl B. Argentometric Method	mg/L	7.13	9.5	9.5	7.28	9.71	7.28	6.28	16.71	19.28
9	BOD (3days @ 27°C)	IS:3025 (P-44):2003	mg/L	8.13	<2.0	<2.0	1.3	0.8	0.7	6	<2.0	<2.0
10	COD (as O2)	APHA, 5220 B OpenReflux Method	mg/L	8	<4.0	4	4	4	4	8	5	5
11	Iron as Fe	IS 3025 (P-65) :20 14(RA:2019)	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

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12	Total Chromium (as Cr)	IS 3025 (P-65) :20 14(RA:2019)	mg/L	<0.00 2	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
13	Zinc (as Zn)	IS 3025 (P-65) :20 14(RA:2019)	mg/L	<0.01	<0.002	0.55	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
14	Copper (as Cu)	IS 3025 (P-65) :20 14(RA:2019)	mg/L	<0.00 2	<0.002	<0.002	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
15	Manganese (as M n)	IS 3025 (P-65) :20 14(RA:2019)	mg/L	<0.01	<0.01	<0.01	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06
16	Cadmium (as Cd)	IS 3025 (P-65) :20 14(RA:2019)	mg/L	<0.00 2	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
17	Lead (as Pb)	IS 3025 (P-65) :20 14(RA:2019)	mg/L	<0.00 2	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
18	Arsenic as As	IS 3025 (P-65) :20 14(RA:2019)	mg/L	0.008	<0.005	**0.076**	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
19	Mercury (as Hg)	IS 3025 (P-65) :20 14(RA:2019)	mg/L	<0.00 5	<0.005	<0.005	<0.000 5	<0.0005	<0.0005	<0.000 5	<0.0005	<0.0005
20	Nickel (as N i)	IS 3025 (P-65) :20 14(RA:2019)	mg/L	<0.00 2	<0.002	<0.002	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
21	Antimony (as Sb)	IS 3025 (P-65) :20 14(RA:2019)	mg/L	<0.00 2	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002

	Locations			**Tigri (28.49'29.7"N 78.019'16.7''E)**								
Seasons				**Summer season**			**Rainy season**			**Winter Season**		
S. No.	**Parameter**	**Test methods**	**Unit**	**Ganga Water**	**Borewell Water**	**Handpump Water**	**Ganga Water**	**Borewell Water**	**Handpump Water**	**Ganga Water**	**Borewell Water**	**Handpump Water**
1	pH (at 25 'C)	APHA .4500-H' B Electrometric Method		7.23	7.46	7.54	7.1	7.26	7.12	6.8	6.26	7.03
2	Electric conductivity	APHA .2510 B. Conductivity meterMethod: 2017	qS/Cm	200	514	523	178	450	488	168	439	461
3	TDS	Calculated by conductivity	mg/L	125	321.25	326.875	111.25	281.25	305	116	290	346

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4	Turbidity	APHA, 2130 B. Nephelometric Method	NTU	<1.0	<1.0	<1.0	0.3	0.2	0.1	11	6	4
5	Total Hardness as CaCO3	APHA, 2340C EDTA Titrimetric Method	mg/L	74.75	231.66	161.37	80.25	139.1	165.85	72.25	113.1	161.85
6	Calcium as Ca	AP HA. 3500 Ca B. EDTA Titrimetric Method	mg/L	22.82	60.11	34.12	21.44	38.59	55.75	19.44	35.59	52.75
7	Alkalinity as CaCO3	APHA , 2320 B. Titrimetric Method	mg/L	80.8	166.7	232.3	74	194.25	161.87	72	188.25	155.87
8	Chloride as C1	APHA. 4500-Cl B. Argentometric Method	mg/L	7.13	11.88	14.25	7.28	9.71	7.28	4.28	19.71	21.28
9	BOD (3days @ 27°C)	IS:3025 (P-44):2003	mg/L	<2.0	8	<2.0	4.9	8	1	5.9	<2.0	<2.0
10	COD (as O2)	APHA . 5220 B OpenRef1ux Method	mg/L	<4.0	16	<4.0	4	10	4	8	<4.0	<4.0
11	Iron as Fe	IS 3025 (P-65) :20 14(RA:2019)	mg/L	<0.01	0.02	0.27	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
12	Total Chromium (as Cr)	IS 3025 (P-65) :20 14(RA:2019)	mg/L	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
13	Zinc (as Zn)	IS 3025 (P-65) :20 14(RA:2019)	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
14	Copper (as Cu)	IS 3025 (P-65) :20 14(RA:2019)	mg/L	<0.002	<0.002	<0.002	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

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15	Manganese (as Mn)	IS 3025 (P-65) :20 14(RA:2019)	mg/L	<0.01	0.3	0.22	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06
16	Cadmium (as Cd)	IS 3025 (P-65) :20 14(RA:2019)	mg/L	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
17	Lead (as Pb)	IS 3025 (P-65) :20 14(RA:2019)	mg/L	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
18	Arsenic as As	IS 3025 (P-65) :20 14(RA:2019)	mg/L	0.006	0.017	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
19	Mercury (as Hg)	IS 3025 (P-65) :20 14(RA:2019)	mg/L	<0.005	<0.005	<0.005	<0.005	<0.0005	<0.0005	<0.005	<0.0005	<0.0005
20	Nickel (as N i)	IS 3025 (P-65) :20 14(RA:2019)	mg/L	<0.002	<0.002	<0.002	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
21	Antimony (as Sb)	IS 3025 (P-65) :20 14(RA:2019)	mg/L	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002

	Locations			**Kabirpur Ahatamali (Ganga Ghat) (28.759426, 78.157372)**								
	Seasons			**Summer season**			**Rainy season**			**Winter Season**		
S. No.	**Parameter**	**Test methods**	**Unit**	**Ganga Water**	**Borewell Water**	**Handpump Water**	**Ganga Water**	**Borewell Water**	**Handpump Water**	**Ganga Water**	**Borewell Water**	**Handpump Water**
1	pH (at 25 'C)	APHA .4500-H‘ B Electrometric Method		6.8	7.83	7.44	6.7	7.26	7.12	6.9	6.26	7.02
2	Electric conductivity	APHA .2510 B. Conductivity meterMethod: 2017	qS/Cm	191	420	523	178	178	488	168	190	461

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3	TDS	Calculated by conductivity	mg/L	119.375	262.5	326.875	111.25	110.2	305	105	124	318
4	Turbidity	APHA, 2130 B. Nephelometric Method	NTU	<1.0	<1.0	<1.0	0.3	0.1	0.1	6	5	3
5	Total Hardness as CaCO3	APHA, 2340C EDTA Titrimetric Method	mg/L	71.78	142.07	229.68	68.2	138.6	220.5	60.2	108.6	216.5
6	Calcium as Ca	AP HA. 3500 Ca B. EDTA Titrimetric Method	mg/L	25.39	32.54	49.2	20.6	30.5	50.3	18.6	27.5	47.3
7	Alkalinity as CaCO3	APHA , 2320 B. Titrimetric Method	mg/L	75.8	247.5	171.7	73	225.3	160.3	72	219.3	154.3
8	Chloride as C1	APHA. 4500-Cl B. Argentometric Method	mg/L	7.13	7.13	9.5	6.2	8.4	7.24	3.2	18.4	17.24
9	BOD (3days @ 27°C)	IS:3025 (P-44):2003	mg/L	<2.0	<2.0	2.9	1	1	1	6	<2.0	<2.0
10	COD (as O2)	APHA . 5220 B OpenRef1ux Method	mg/L	<4.0	<4.0	25	4	4	4	8	5	5
11	Iron as Fe	IS 3025 (P-65) :20 14(RA:2019)	mg/L	<0.01	<0.01	0.04	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
12	Total Chromium (as Cr)	IS 3025 (P-65) :20 14(RA:2019)	mg/L	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
13	Zinc (as Zn)	IS 3025 (P-65) :20 14(RA:2019)	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

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14	Copper (as Cu)	IS 3025 (P-65) :20 14(RA:2019)	mg/ L	<0.00 2	<0.00 2	<0.002	<0.01	<0.01	<0. 01	<0.0 1	<0.01	<0.01
15	Mangane se (as M n)	IS 3025 (P-65) :20 14(RA:2019)	mg/ L	<0.01	0.03	0.04	<0.06	<0.06	<0. 06	<0.0 6	<0.06	<0.06
16	Cadmiu m (as Cd)	IS 3025 (P-65) :20 14(RA:2019)	mg/ L	<0.00 2	<0.00 2	<0.002	<0.00 2	<0.00 2	<0. 002	<0.0 02	<0.00 2	<0.00 2
17	Lead (as Pb)	IS 3025 (P-65) :20 14(RA:2019)	mg/ L	<0.00 2	<0.00 2	<0.002	<0.00 2	<0.00 2	<0. 002	<0.0 02	<0.00 2	<0.00 2
18	Arsenic as As	IS 3025 (P-65) :20 14(RA:2019)	mg/ L	0.008	<0.00 5	<0.005	<0.00 5	<0.00 5	<0. 005	<0.0 05	<0.00 5	<0.00 5
19	Mercury (as Hg)	IS 3025 (P-65) :20 14(RA:2019)	mg/ L	<0.00 5	<0.00 5	<0.005	<0.00 05	<0.00 05	<0. 000 5	<0.0 005	<0.00 05	<0.00 05
20	Nickel (as N i)	IS 3025 (P-65) :20 14(RA:2019)	mg/ L	<0.00 2	<0.00 2	<0.002	<0.00 5	<0.00 5	<0. 005	<0.0 05	<0.00 5	<0.00 5
21	Antimon y (as Sb)	IS 3025 (P-65) :20 14(RA:2019)	mg/ L	<0.00 2	<0.00 2	<0.002	<0.00 2	<0.00 2	<0. 002	<0.0 02	<0.00 2	<0.00 2

	Locations			**Hasanpur Sirsakala mustam (Ganga Ghat) (28.483694, 78.256591)**								
Seasons				**Summer season**			**Rainy season**			**Winter Season**		
S. No.	**Paramet er**	**Test methods**	**Unit**	**Gan ga Wat er**	**Borew ell Water**	**Hand pump Wate r**	**Gang a Water**	**Borew ell Water**	**Handpu mp Water**	**Ga nga Wa ter**	**Bor ewel l Wat**	**Hand pump Wate r**
1	pH (at 25 'C)	APHA .4500-H‘ B Electrometric Method		7.46	7.48	7.56	6.75	6.95	7.1	5.75	5.95	6.45
2	Electric conducti vity	APHA .2510 B. Conductivity meterMethod:	qS/C m	366	590	446	188.34	474.78	400.2	190	463	383
3	TDS	Calculated by conductivity	mg/ L	228. 75	368.75	278.7 5	117.71 25	296.73 75	250.125	128	278	246

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4	Turbidity	APHA, 2130 B. Nephelometric Method	NTU	1.2	<1.0	<1.0	0.2	0.1	0.1	7	4	3
5	Total Hardness as CaCO3	APHA, 2340C EDTA Titrimetric Method	mg/L	104.3	248	174	85.6	181.9	150	75.6	153.9	146
6	Calcium as Ca	AP HA. 3500 Ca B. EDTA Titrimetric Method	mg/L	26.5	42.3	38.4	25.73	40.74	37.5	23.73	37.74	34.5
7	Alkalinity as CaCO3	APHA , 2320 B. Titrimetric Method	mg/L	101.5	312	155.4	74	219.72	125.6	72	215.72	118.6
8	Chloride as C1	APHA. 4500-Cl B. Argentometric Method	mg/L	16.9	24.4	10.8	7.28	12.14	8.2	4.28	19.14	18.2
9	BOD (3days @ 27°C)	IS:3025 (P-44):2003	mg/L	<2.0	<2.0	<2.0	0.9	1.3	1	<2.0	<2.0	<2.0
10	COD (as O2)	APHA . 5220 B OpenRef1ux Method	mg/L	<4.0	<4.0	<4.0	4.08	4.08	4.08	8	5	5
11	Iron as Fe	IS 3025 (P-65) :20 14(RA:2019)	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
12	Total Chromium (as Cr)	IS 3025 (P-65) :20 14(RA:2019)	mg/L	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
13	Zinc (as Zn)	IS 3025 (P-65) :20 14(RA:2019)	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
14	Copper (as Cu)	IS 3025 (P-65) :20 14(RA:2019)	mg/L	<0.002	<0.002	<0.002	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
15	Manganese (as M n)	IS 3025 (P-65) :20 14(RA:2019)	mg/L	<0.01	0.04	**0.48**	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06
16	Cadmium (as Cd)	IS 3025 (P-65) :20 14(RA:2019)	mg/L	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
17	Lead (as Pb)	IS 3025 (P-65) :20 14(RA:2019)	mg/L	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
18	Arsenic as As	IS 3025 (P-65) :20 14(RA:2019)	mg/L	<0.005	0.013	**0.141**	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
19	Mercury (as Hg)	IS 3025 (P-65) :20 14(RA:2019)	mg/L	<0.005	<0.005	<0.005	<0.0005	<0.0005	<0.0005	<0.0005	<0.005	<0.0005
20	Nickel (as N i)	IS 3025 (P-65) :20 14(RA:2019)	mg/L	<0.002	<0.002	<0.002	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005

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21	Antimony (as Sb)	IS 3025 (P-65) :20 14(RA:2019)	mg/L	0.0047	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002

S. No.	Locations			Haribaba Bandh (29.6761579, 78.1704095)								
	Seasons			Summer season			Rainy season			Winter Season		
	Parameter	Test methods	Unit	Ganga Water	Borewell Water	Handpump Water	Ganga Water	Borewell Water	Hand pump Water	Ganga Water	Borewell W	Handpump Wat
1	pH (at 25 'C)	APHA .4500-H‘ B Electrometric Method		7.44	7.54	7.46	7.25	7.35	7.2	7.18	7.25	6.85
2	Electric conductivity	APHA .2510 B. Conductivity meterMethod:	qS/Cm	198	456	656	160	420	624	150	411	606
3	TDS	Calculated by conductivity	mg/L	123.75	285	410	100	262.5	390	196	253	362
4	Turbidity	APHA, 2130 B. Nephelometric Method	NTU	<1.0	<1.0	<1.0	0.2	0.1	0.1	<1.0	<1.0	<1.0
5	Total Hardness as CaCO3	APHA, 2340C EDTA Titrimetric Method	mg/L	76.73	222.26	323.73	65.2	202.6	289.6	57.2	170.6	282.6
6	Calcium as Ca	AP HA. 3500 Ca B. EDTA Titrimetric Method	mg/L	22.42	65.47	83.72	20.5	54.6	68.6	18.5	51.6	65.6
7	Alkalinity as CaCO3	APHA , 2320 B. Titrimetric Method	mg/L	50.5	247.5	338.4	42.3	205.6	289.5	40.3	196.6	283.5
8	Chloride as C1	APHA. 4500-Cl B. Argentometric Method	mg/L	4.75	7.13	11.88	4.05	6.2	10.8	1.05	13.2	17.8
9	BOD (3days @ 27°C)	IS:3025 (P-44):2003	mg/L	1.3	<2.0	1.2	2	1	1	2.6	<2.0	<2.0
1	COD (as O2)	APHA . 5220 B OpenRef1ux Method	mg/L	8	<4.0	8	4	4	4	8	5	5
1	Iron as Fe	IS 3025 (P-65) :20 14(RA:2019)	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
1	Total Chromium (as Cr)	IS 3025 (P-65) :20 14(RA:2019)	mg/L	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
1	Zinc (as Zn)	IS 3025 (P-65) :20 14(RA:2019)	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

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1	Copper (as Cu)	IS 3025 (P-65) :20 14(RA:2019)	mg/ L	<0.0 02	<0.00 2	<0.002	<0.01	<0.01	<0.01	<0.01	<0. 01	<0.0 1
1	Manganese (as M n)	IS 3025 (P-65) :20 14(RA:2019)	mg/ L	<0.0 1	<0.01	0.098	<0.06	<0.06	<0.06	<0.06	<0. 06	<0.0 6
1	Cadmium (as Cd)	IS 3025 (P-65) :20 14(RA:2019)	mg/ L	<0.0 02	<0.00 2	<0.002	<0.00 2	<0.00 2	<0.002	<0.00 2	<0. 00 2	<0.0 02
1	Lead (as Pb)	IS 3025 (P-65) :20 14(RA:2019)	mg/ L	<0.0 02	<0.00 2	<0.002	<0.00 2	<0.00 2	<0.002	<0.00 2	<0. 00 2	<0.0 02
1	Arsenic as As	IS 3025 (P-65) :20 14(RA:2019)	mg/ L	0.00 7	0.04	0.025	<0.00 5	<0.00 5	<0.005	<0.00 5	<0. 00 5	<0.0 05
1	Mercury (as Hg)	IS 3025 (P-65) :20 14(RA:2019)	mg/ L	<0.0 05	<0.00 5	<0.005	<0.00 05	<0.00 05	<0.000 5	<0.00 05	<0. 00 05	<0.0 005
2	Nickel (as N i)	IS 3025 (P-65) :20 14(RA:2019)	mg/ L	<0.0 02	<0.00 2	<0.002	<0.00 5	<0.00 5	<0.005	<0.00 5	<0. 00 5	<0.0 05
2	Antimony (as Sb)	IS 3025 (P-65) :20 14(RA:2019)	mg/ L	<0.0 02	<0.00 2	<0.002	<0.00 2	<0.00 2	<0.002	<0.00 2	<0. 00 2	<0.0 02

	Locations			**Sikandarpur Khagi(Near big city Anoop Shahar (28.305942, 78.310196)**								
	Seasons			**Summer season**			**Rainy season**			**Winter Season**		
S. No.	**Parameter**	**Test methods**	**Unit**	**Ganga Water**	**Borewell Water**	**Handpump Water**	**Ganga Water**	**Borewell Water**	**Handpump Water**	**Ganga Water**	**Borewell Water**	**Hand pump Water**
1	pH (at 25 'C)	APHA .4500-H‘ B Electrometric Method		7.75	7.54	7.46	6.95	7.05	7.2	6.4	7.19	6.88
2	Electric conductivity	APHA .2510 B. Conductivity meterMethod:	qS/Cm	206	456	656	186	420	630	176	409	613
3	TDS	Calculated by conductivity	mg/ L	128.75	285	410	116.25	262.5	393.75	210	250	370
4	Turbidity	APHA, 2130 B. Nephelometric Method	NTU	<1.0	<1.0	<1.0	0.2	0.1	0.1	10	6	3
5	Total Hardness as CaCO3	APHA, 2340C EDTA Titrimetric Method	mg/ L	74.25	222.26	323.73	70.5	205.6	300.8	62.5	182.6	296.8
6	Calcium as Ca	AP HA. 3500 Ca B. EDTA Titrimetric Method	mg/ L	22.82	64.47	83.72	17.6	60.7	75.9	15.6	182.6	296.8

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7	Alkalinity as CaCO3	APHA , 2320 B. Titrimetric Method	mg/L	75.8	247.5	338.4	70.8	225.6	329.8	68.8	219.6	323.8
8	Chloride as C1	APHA. 4500-Cl B. Argentometric Method	mg/L	4.75	7.13	11.88	4.25	6.57	9.8	1.25	16.57	19.8
9	BOD (3days @ 27°C)	IS:3025 (P-44):2003	mg/L	2.4	<2.0	<2.0	2	1	1	3	<2.0	<2.0
10	COD (as O2)	APHA . 5220 B OpenRef1ux Method	mg/L	20	<4.0	8	4	4	4	8	5	5
11	Iron as Fe	IS 3025 (P-65) :20 14(RA:2019)	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
12	Total Chromium (as Cr)	IS 3025 (P-65) :20 14(RA:2019)	mg/L	0.03	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
13	Zinc (as Zn)	IS 3025 (P-65) :20 14(RA:2019)	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
14	Copper (as Cu)	IS 3025 (P-65) :20 14(RA:2019)	mg/L	<0.002	<0.002	<0.002	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
15	Manganese (as Mn)	IS 3025 (P-65) :20 14(RA:2019)	mg/L	<0.01	<0.01	0.098	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06
16	Cadmium (as Cd)	IS 3025 (P-65) :20 14(RA:2019)	mg/L	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
17	Lead (as Pb)	IS 3025 (P-65) :20 14(RA:2019)	mg/L	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
18	Arsenic as As	IS 3025 (P-65) :20 14(RA:2019)	mg/L	0.008	0.041	0.023	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
19	Mercury (as Hg)	IS 3025 (P-65) :20 14(RA:2019)	mg/L	<0.005	<0.005	<0.005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
20	Nickel (as N i)	IS 3025 (P-65) :20 14(RA:2019)	mg/L	<0.002	<0.002	<0.002	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
21	Antimony (as Sb)	IS 3025 (P-65) :20 14(RA:2019)	mg/L	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002

	Locations	**Band Gabgabas (Near Narora (Ganga Ghat)) (28.193999, 78.403041)**		
	Seasons	**Summer season**	**Rainy season**	**Winter Season**

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S. No.	Parameter	Test methods	Unit	Ganga Water	Borewell Water	Handpump Water	Ganga Water	Borewell Water	Handpump Water	Ganga Water	Borewell Water	Handpump Wate
1	pH (at 25 'C)	APHA .4500-H' B Electrometric Method		7.52	7.42	7.98	7.05	7.15	7.58	6.5	6.85	7.35
2	Electric conductivity	APHA .2510 B. Conductivity meterMethod:	qS/Cm	345	312	412	225	286	388	215	275	361
3	TDS	Calculated by conductivity	mg/L	215.625	195	257.5	140.625	178.75	242.5	136	163	236
4	Turbidity	APHA, 2130 B. Nephelometric Method	NTU	1.3	<1.0	<1.0	1.4	0.1	0.1	<1.0	<1.0	<1.0
5	Total Hardness as CaCO3	APHA, 2340C EDTA Titrimetric Method	mg/L	92.3	172	168	88.6	160.5	152.3	80.4	132.4	147.2
6	Calcium as Ca	AP HA. 3500 Ca B. EDTA Titrimetric Method	mg/L	24.58	48.9	45.2	20.58	38.6	37.6	18.52	35.6	34.6
7	Alkalinity as CaCO3	APHA , 2320 B. Titrimetric Method	mg/L	96.3	156	250	80.6	144	224.6	78.6	136	218.6
8	Chloride as C1	APHA. 4500-Cl B. Argentometric Method	mg/L	10.5	11.2	12.6	9.6	10.2	10.5	6.6	17.2	19.5
9	BOD (3days @ 27°C)	IS:3025 (P-44):2003	mg/L	<2.0	<2.0	<2.0	1.6	1	1	4	<2.0	<2.0
10	COD (as O2)	APHA . 5220 B OpenRef1ux Method	mg/L	<4.0	<4.0	<4.0	4	4	4	8	6	6
11	Iron as Fe	IS 3025 (P-65) :20 14(RA:2019)	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
12	Total Chromium (as Cr)	IS 3025 (P-65) :20 14(RA:2019)	mg/L	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
13	Zinc (as Zn)	IS 3025 (P-65) :20 14(RA:2019)	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
14	Copper (as Cu)	IS 3025 (P-65) :20 14(RA:2019)	mg/L	<0.002	<0.002	<0.002	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
15	Manganese (as Mn)	IS 3025 (P-65) :20 14(RA:2019)	mg/L	<0.01	<0.01	**0.44**	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06
16	Cadmium (as Cd)	IS 3025 (P-65) :20 14(RA:2019)	mg/L	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002

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17	Lead (as Pb)	IS 3025 (P-65) :20 14(RA:2019)	mg/ L	<0.00 2	<0.00 2	<0.002	<0.00 2	<0.00 2	<0.00 2	<0. 002	<0.00 2	<0.00 2
18	Arsenic as As	IS 3025 (P-65) :20 14(RA:2019)	mg/ L	<0.00 5	0.011	**0.134**	<0.00 5	<0.00 5	<0.00 5	<0. 005	<0.00 5	<0.00 5
19	Mercury (as Hg)	IS 3025 (P-65) :20 14(RA:2019)	mg/ L	<0.00 5	<0.00 5	<0.005	<0.00 05	<0.00 05	<0.00 05	<0. 000 5	<0.00 05	<0.00 05
20	Nickel (as N i)	IS 3025 (P-65) :20 14(RA:2019)	mg/ L	<0.00 2	<0.00 2	<0.002	<0.00 5	<0.00 5	<0.00 5	<0. 005	<0.00 5	<0.00 5
21	Antimon y (as Sb)	IS 3025 (P-65) :20 14(RA:2019)	mg/ L	0.003	<0.00 2	<0.002	<0.00 2	<0.00 2	<0.00 2	<0. 002	<0.00 2	<0.00 2

	Locations			**Shahjahanabad Sailab (near tata firtilizer, Rajghat (Ganga Ghat) (28.247296, 78.367926)**								
Seasons				**Summer season**			**Rainy season**			**Winter Season**		
S. No.	**Parameter**	**Test methods**	**Unit**	**Ganga Water**	**Borewell Water**	**Hand pump Water**	**Ganga Water**	**Borewell Water**	**Hand pump Water**	**Ganga W**	**Borewell Wat**	**Hand pump Water**
1	pH (at 25 'C)	APHA .4500-H‘ B Electrometric Method		7.46	7.47	7.71	7.16	7.19	7.8	6.16	6.19	7.2
2	Electric conductivity	APHA .2510 B. Conductivity meterMethod:	qS/Cm	199	253	499	201.67	497.39	450	191	484	433
3	TDS	Calculated by conductivity	mg/ L	124.375	158.125	311.875	123	287	281.25	116	263	270
4	Turbidity	APHA, 2130 B. Nephelometric Method	NTU	<1.0	<1.0	<1.0	0.4	0.2	0.1	<1.0	<1.0	<1.0
5	Total Hardness as CaCO3	APHA, 2340C EDTA Titrimetric Method	mg/ L	78.21	163.35	215.82	123	287	225.6	115	260	221.6
6	Calcium as Ca	AP HA. 3500 Ca B. EDTA Titrimetric Method	mg/ L	23.81	33.13	52.97	25.73	53.6	68.5	23.73	50.6	64.5
7	Alkalinity as CaCO3	APHA , 2320 B. Titrimetric Method	mg/ L	80.8	131.3	298	74	245.12	345.8	72	239.12	339.8
8	Chloride as C1	APHA. 4500-Cl B. Argentometric Method	mg/ L	4.75	7.13	16.63	16.99	16.99	20.6	13.99	23.99	27.6
9	BOD (3days @ 27°C)	IS:3025 (P-44):2003	mg/ L	<2.0	<2.0	<2.0	1.6	1	1	2.6	<2.0	<2.0

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10	COD (as O2)	APHA . 5220 B OpenRef1ux Method	mg/L	<4.0	<4.0	<4.0	4.08	4	4	8.08	5	5
11	Iron as Fe	IS 3025 (P-65) :20 14(RA:2019)	mg/L	<0.01	<0.01	0.04	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
12	Total Chromium (as Cr)	IS 3025 (P-65) :20 14(RA:2019)	mg/L	0.005	<0.002	0.005	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
13	Zinc (as Zn)	IS 3025 (P-65) :20 14(RA:2019)	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
14	Copper (as Cu)	IS 3025 (P-65) :20 14(RA:2019)	mg/L	<0.002	<0.002	<0.002	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
15	Manganese (as Mn)	IS 3025 (P-65) :20 14(RA:2019)	mg/L	<0.01	<0.01	<0.01	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06
16	Cadmium (as Cd)	IS 3025 (P-65) :20 14(RA:2019)	mg/L	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
17	Lead (as Pb)	IS 3025 (P-65) :20 14(RA:2019)	mg/L	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
18	Arsenic as As	IS 3025 (P-65) :20 14(RA:2019)	mg/L	0.007	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
19	Mercury (as Hg)	IS 3025 (P-65) :20 14(RA:2019)	mg/L	<0.005	<0.005	<0.005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
20	Nickel (as N i)	IS 3025 (P-65) :20 14(RA:2019)	mg/L	<0.002	<0.002	<0.002	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
21	Antimony (as Sb)	IS 3025 (P-65) :20 14(RA:2019)	mg/L	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002

	Locations			**Sankara Ganga ghat (28.051693, 78.538993)**								
Seasons				**Summer season**			**Rainy season**			**Winter Season**		
S. No.	**Parameter**	**Test methods**	**Unit**	**Ganga Water**	**Borewell Water**	**Hand pump Water**	**Ganga Water**	**Borewell Water**	**Hand pump Wate**	**Ganga Water**	**Borewell Wat**	**Hand pump Water**
1	pH (at 25 'C)	APHA .4500-H' B Electrometric Method		7.35	7.33	8.14	6.79	7.06	7.85	6.48	6.7	7.78
2	Electric conductivity	APHA .2510 B. Conductivity meterMethod:	qS/Cm	312	1616	399	213.31	1526	358	203	1210	150

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3	TDS	Calculated by conductivity	mg/L	195	1010	249.375	118	953.75	223.75	136	750	450
4	Turbidity	APHA, 2130 B. Nephelometric Method	NTU	1.6	<1.0	<1.0	0.3	0.1	0.1	<1.0	3	5
5	Total Hardness as CaCO3	APHA, 2340C EDTA Titrimetric Method	mg/L	106.3	319.05	158.4	64.2	310.6	160.2	64.2	310.6	160.2
6	Calcium as Ca	AP HA. 3500 Ca B. EDTA Titrimetric Method	mg/L	20.3	37	35.71	21.44	40.2	41.2	19.44	38.2	35.2
7	Alkalinity as CaCO3	APHA , 2320 B. Titrimetric Method	mg/L	108.6	453.65	184.62	97.12	460.2	190.5	95.12	454.2	184.5
8	Chloride as C1	APHA. 4500-Cl B. Argentometric Method	mg/L	14.6	101.35	9.42	13.25	98.6	10.5	10.25	105.6	17.5
9	BOD (3days @ 27°C)	IS:3025 (P-44):2003	mg/L	<2.0	<2.0	<2.0	5	1	1	6	<2.0	<2.0
10	COD (as O2)	APHA . 5220 B Open Ref1ux Method	mg/L	<4.0	<4.0	<4.0	32..64	4	4	18	<4.0	<4.0
11	Iron as Fe	IS 3025 (P-65) :20 14(RA:2019)	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
12	Total Chromium (as Cr)	IS 3025 (P-65) :20 14(RA:2019)	mg/L	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
13	Zinc (as Zn)	IS 3025 (P-65) :20 14(RA:2019)	mg/L	<0.01	0.11	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
14	Copper (as Cu)	IS 3025 (P-65) :20 14(RA:2019)	mg/L	<0.002	<0.002	<0.002	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
15	Manganese (as Mn)	IS 3025 (P-65) :20 14(RA:2019)	mg/L	<0.01	0.24	0.18	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06
16	Cadmium (as Cd)	IS 3025 (P-65) :20 14(RA:2019)	mg/L	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
17	Lead (as Pb)	IS 3025 (P-65) :20 14(RA:2019)	mg/L	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
18	Arsenic as As	IS 3025 (P-65) :20 14(RA:2019)	mg/L	0.008	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
19	Mercury (as Hg)	IS 3025 (P-65) :20 14(RA:2019)	mg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.0005

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20	Nickel (as N i)	IS 3025 (P-65) :20 14(RA:2019)	mg/ L	<0.0 02	<0.002	<0.002	<0.00 5	<0.00 5	<0.00 5	<0.0 05	<0.0 05	<0.005
21	Antimon y (as Sb)	IS 3025 (P-65) :20 14(RA:2019)	mg/ L	<0.0 02	<0.002	<0.002	<0.00 2	<0.00 2	<0.00 2	<0.0 02	<0.0 02	<0.002

	Locations			**Kachhla Ganga ghat (27.929211, 78.857468)**								
Seasons				**Summer season**			**Rainy season**			**Winter Season**		
S. No.	**Parameter**	**Test methods**	**Unit**	**Ganga Water**	**Borewell Water**	**Handpump Water**	**Ganga Water**	**Borewell Water**	**Hand pump Water**	**Ganga Water**	**Borewell Wa**	**Hand pump Water**
1	pH (at 25 'C)	APHA .4500-H‘ B Electrometric Method		7.84	7.42	7.84	7.15	7.5	7.68	6.15	6.5	7.55
2	Electric conductivity	APHA .2510 B. Conductivity meterMethod:	qS/Cm	479	566	487	385	528	490	375	517	473
3	TDS	Calculated by conductivity	mg/ L	299.375	353.75	304.375	240.625	330	306.25	231	318	290
4	Turbidity	APHA, 2130 B. Nephelometric Method	NTU	1.2	<1.0	<1.0	1.5	0.1	0.1	7	4	4
5	Total Hardness as CaCO3	APHA, 2340C EDTA Titrimetric Method	mg/ L	89.1	196.8	158.4	70.5	180.6	170.6	72.5	152.6	166.6
6	Calcium as Ca	AP HA. 3500 Ca B. EDTA Titrimetric Method	mg/ L	25.79	68.2	65.47	22.6	58.2	63.2	20.6	55.2	60.2
7	Alkalinity as CaCO3	APHA , 2320 B. Titrimetric Method	mg/ L	105.5	242	258.47	105.5	242	258.47	103.5	236	252.47
8	Chloride as C1	APHA. 4500-Cl B. Argentometric Method	mg/ L	9.42	16.5	14.14	9.42	16.5	14.14	6.42	23.5	24.14
9	BOD (3days @ 27°C)	IS:3025 (P-44):2003	mg/ L	<2.0	<2.0	<2.0	2	1	1	3	<2.0	<2.0
10	COD (as O2)	APHA . 5220 B Open Ref1ux Method	mg/ L	16	<4.0	<4.0	6.8	4	4	10.8	5	5
11	Iron as Fe	IS 3025 (P-65) :20 14(RA:2019)	mg/ L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
12	Total Chromium (as Cr)	IS 3025 (P-65) :20 14(RA:2019)	mg/ L	<0.002	<0.01	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002

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13	Zinc (as Zn)	IS 3025 (P-65) :20 14(RA:2019)	mg/ L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0. 01	<0.01
14	Copper (as Cu)	IS 3025 (P-65) :20 14(RA:2019)	mg/ L	<0.00 2	<0.002	<0.002	<0.01	<0.01	<0.01	<0.01	<0. 01	<0.01
15	Mangane se (as M n)	IS 3025 (P-65) :20 14(RA:2019)	mg/ L	<0.01	0.046	**0.51**	<0.06	<0.06	<0.06	<0.0 6	<0. 06	<0.06
16	Cadmiu m (as Cd)	IS 3025 (P-65) :20 14(RA:2019)	mg/ L	<0.00 2	<0.002	<0.002	<0.00 2	<0.002	<0.002	<0.0 02	<0. 002	<0.00 2
17	Lead (as Pb)	IS 3025 (P-65) :20 14(RA:2019)	mg/ L	<0.00 2	<0.002	<0.002	<0.00 2	<0.002	<0.002	<0.0 02	<0. 002	<0.00 2
18	Arsenic as As	IS 3025 (P-65) :20 14(RA:2019)	mg/ L	<0.00 5	0.015	**0.147**	<0.00 5	<0.005	<0.005	<0.0 05	<0. 005	<0.00 5
19	Mercury (as Hg)	IS 3025 (P-65) :20 14(RA:2019)	mg/ L	<0.00 5	<0.005	<0.005	<0.00 05	<0.000 5	<0.000 5	<0.0 005	<0. 000 5	<0.00 05
20	Nickel (as N i)	IS 3025 (P-65) :20 14(RA:2019)	mg/ L	<0.00 2	<0.002	<0.002	<0.00 5	<0.005	<0.005	<0.0 05	<0. 005	<0.00 5
21	Antimon y (as Sb)	IS 3025 (P-65) :20 14(RA:2019)	mg/ L	0.004	<0.002	<0.002	<0.00 2	<0.002	<0.002	<0.0 02	<0. 002	<0.00 2

	Locations			**Kakora Ganga ghat (27.795468, 79.062942)**								
	Seasons			**Summer season**			**Rainy season**			**Winter Season**		
S. No.	**Paramet er**	**Test methods**	**Unit**	**Gang a Wate r**	**Borew ell Water**	**Hand pum p Wate**	**Gang a Wate r**	**Borew ell Water**	**Hand pum p Wate**	**Gang a Wate r**	**Bore well Wat er**	**Hand pump Wate r**
1	pH (at 25 'C)	APHA .4500-H‘ B Electrometric Method		7.69	7.77	7.66	7.22	7.58	7.5	6.48	6.58	7.3
2	Electric conducti vity	APHA .2510 B. Conductivity meterMethod:	qS/C m	235	635	559	198	556	520	188	545	503
3	TDS	Calculated by conductivity	mg/ L	146.8 75	396.87 5	349.3 75	123.7 5	347.5	325	118	332	310
4	Turbidit y	APHA, 2130 B. Nephelometri c Method	NTU	1.5	<1.0	<1.0	1.6	0.1	0.1	10	6	4
5	Total Hardness as CaCO3	APHA, 2340C EDTA Titrimetric Method	mg/ L	113.8 5	207.9	267.3	98.6	184..2	258.6	90.6	152. 2	254.6

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6	Calcium as Ca	AP HA. 3500 Ca B. EDTA Titrimetric Method	mg/L	25.79	51.58	59.52	23.2	50.6	52.3	21.2	47.6	48.3
7	Alkalinity as CaCO3	APHA , 2320 B. Titrimetric Method	mg/L	100.23	211	274.3	75.6	198.6	250.3	73.6	190.6	244.3
8	Chloride as C1	APHA. 4500-Cl B. Argentometric Method	mg/L	7.07	9.42	9.42	6.27	0.66	8.42	3.27	10.66	18.42
9	BOD (3days @ 27°C)	IS:3025 (P-44):2003	mg/L	<2.0	<2.0	<2.0	1.8	1	1	2.8	<2.0	<2.0
10	COD (as O2)	APHA . 5220 B OpenRef1ux Method	mg/L	12	<4.0	<4.0	4	4	4	8	<4.0	<4.0
11	Iron as Fe	IS 3025 (P-65) :20 14(RA:2019)	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
12	Total Chromium (as Cr)	IS 3025 (P-65) :20 14(RA:2019)	mg/L	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
13	Zinc (as Zn)	IS 3025 (P-65) :20 14(RA:2019)	mg/L	<0.01	<0.002	0.077	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
14	Copper (as Cu)	IS 3025 (P-65) :20 14(RA:2019)	mg/L	<0.002	<0.002	<0.002	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
15	Manganese (as M n)	IS 3025 (P-65) :20 14(RA:2019)	mg/L	<0.01	0.034	<0.01	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06
16	Cadmium (as Cd)	IS 3025 (P-65) :20 14(RA:2019)	mg/L	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
17	Lead (as Pb)	IS 3025 (P-65) :20 14(RA:2019)	mg/L	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
18	Arsenic as As	IS 3025 (P-65) :20 14(RA:2019)	mg/L	0.008	0.026	0.007	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
19	Mercury (as Hg)	IS 3025 (P-65) :20 14(RA:2019)	mg/L	<0.005	<0.005	<0.005	<0.00005	<0.0005	<0.00005	<0.00005	<0.0005	<0.00005
20	Nickel (as N i)	IS 3025 (P-65) :20 14(RA:2019)	mg/L	<0.002	<0.002	<0.002	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
21	Antimony (as Sb)	IS 3025 (P-65) :20 14(RA:2019)	mg/L	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002

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	Locations	Jalalabad dhai ghat (27.575925, 79.478540)									
Seasons				Summer season			Rainy season			Winter Season		
S. No.	Parameter	Test methods	Unit	Ganga Water	Borewell Water	Handpump Water	Ganga Water	Borewell Water	Hand pump Water	Ganga Water	Borewell Water	Handpump Wat
1	pH (at 25 'C)	APHA .4500-H‘ B Electrometric Method		7.66	8.34	7.78	7.15	7.86	7.42	6.15	6.86	7.28
2	Electric conductivity	APHA .2510 B. Conductivity meterMethod:	qS/Cm	239	539	445	202	516	420	192	505	403
3	TDS	Calculated by conductivity	mg/L	149.375	336.875	278.125	126.25	322.5	262.5	118	305	236
4	Turbidity	APHA, 2130 B. Nephelometric Method	NTU	1.1	<1.0	<1.0	1.2	0.1	0.1	<1.0	<1.0	<1.0
5	Total Hardness as CaCO3	APHA, 2340C EDTA Titrimetric Method	mg/L	94.05	247.5	188.1	90.02	250.5	200.5	82.02	222.5	196.5
6	Calcium as Ca	AP HA. 3500 Ca B. EDTA Titrimetric Method	mg/L	25.79	65.47	55.55	20.5	65.5	58.6	18.5	62.5	55.6
7	Alkalinity as CaCO3	APHA , 2320 B. Titrimetric Method	mg/L	84.04	305.95	211	75.2	288.2	202.5	73.2	282.2	196.5
8	Chloride as C1	APHA. 4500-Cl B. Argentometric Method	mg/L	9.42	9.42	9.42	7.2	10.2	10.6	7.2	10.2	10.6
9	BOD (3days @ 27°C)	IS:3025 (P-44):2003	mg/L	<2.0	<2.0	<2.0	2.2	1	1	3.2	<2.0	<2.0
10	COD (as O2)	APHA . 5220 B OpenRef1ux Method	mg/L	12	<4.0	<4.0	6.8	4	4	10.8	5	5
11	Iron as Fe	IS 3025 (P-65) :20 14(RA:2019)	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
12	Total Chromium (as Cr)	IS 3025 (P-65) :20 14(RA:2019)	mg/L	<0.002	<0.01	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
13	Zinc (as Zn)	IS 3025 (P-65) :20 14(RA:2019)	mg/L	<0.01	<0.002	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
14	Copper (as Cu)	IS 3025 (P-65) :20 14(RA:2019)	mg/L	<0.002	<0.002	<0.002	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

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15	Manganese (as Mn)	IS 3025 (P-65) :20 14(RA:2019)	mg/L	<0.01	0.046	0.33	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06
16	Cadmium (as Cd)	IS 3025 (P-65) :20 14(RA:2019)	mg/L	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
17	Lead (as Pb)	IS 3025 (P-65) :20 14(RA:2019)	mg/L	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
18	Arsenic as As	IS 3025 (P-65) :20 14(RA:2019)	mg/L	0.009	0.014	0.048	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
19	Mercury (as Hg)	IS 3025 (P-65) :20 14(RA:2019)	mg/L	<0.005	<0.005	<0.005	<0.0005	<0.0005	<0.0005	<0.005	<0.005	<0.005
20	Nickel (as N i)	IS 3025 (P-65) :20 14(RA:2019)	mg/L	<0.002	<0.002	<0.002	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
21	Antimony (as Sb)	IS 3025 (P-65) :20 14(RA:2019)	mg/L	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002

*****BLQ (LOQ 0.002) = < 0.002, BLQ (LOQ 0.0005) = < 0.0005, BLQ (LOQ 0.01) = < 0.01, BLQ (LOQ 1.00) = <1.0, BLQ (LOQ 0.005) = <0.005, BLQ (LOQ 0.06) = <0.06

II. RESULTS & CONCLUSION:

The above study is indicating that, water quality quiet ok,at Nangal Soti location where it is considered Reference sample &least polluted. As per test results of rest 15 locations water quality is not bad. If we talk about ganga river, the water of ganga is not recommended for drinking purpose without treated. The study suggests that the water at almost its source is not fit for direct drinking by humans. The Research is based on the effect of human activity like industries, that might be releasing heavy metals into the Ganga River and supporting rivers of Ganga, big religious places & crematorium places of Ganga riverbank, which contribute the water pollution on high level. The study is indicating that water quality of nearby industries and major human activities area is slightly disturbed. Surface & Ground water both are contaminated on ver low level. 1 heavy metals exceed the permissible limits at 1 location. COD & BOD also detect low level at various locations. Testing has been done & ensure that consumption of ganga water for irrigation water is safe, but for human beings consumption it should be treated before use for drink & cooking. The conclusion of this research is due to Industrialization & other human activities, drinking water quality is decreasing day by day and there is a need to proper treatment of water and some prevention method to control water pollution and manage to supply safe drinking water for human beings and other living beings.

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