

# Comprehensive Study of Groundwater Contamination and Its Depletion- A Case Study

Rishabh Kansara<sup>1</sup> Labdhi Sheth<sup>2</sup> Vikas Bhavsar<sup>3</sup>

<sup>1</sup>PG Student <sup>2,3</sup>Professor

<sup>1,2,3</sup>Department of Civil Engineering

<sup>1,2,3</sup>LDRP Institute of Technology and Research, Gandhinagar, Gujarat-382015, India

**Abstract**— Groundwater is the water under the surface of the earth in soil pore spaces and the cracking of rock creation. An aquifer is the unit of rock or an unconsolidated deposit when it can proceed able to be used a quantity of water. Different samples and data of ground water level and its water quality data were collected from the Daskroi taluka of Ahmedabad district of Gujarat state, India. And identify suitable remedies for groundwater conservation and recharging, reuse groundwater for the future generation. To analyze the groundwater, water quality data and check out the different physicochemical parameters like pH, DO, TDS, Alkalinity, Acidity, Fluoride, Hardness, Chloride, Calcium, Nitrate which the aim of the research project.

**Keywords:** Groundwater, Water Quality, Physico-Chemical Parameters

## I. INTRODUCTION

Groundwater is the science of the incident, delivered, and movement of water below the surface of the earth. It is a pure and renewable source and it provides fresh water to complete the requirement of our daily different purposes. Groundwater can come from rainfall. Rainfall penetrates under the ground surface into the soil area. When the area of soil becomes saturated, water spreads downward side. Due to irregular rain the level of groundwater decreases day by day, also moisture content of the soil has been decreasing. And then the different chemicals, gasoline oil, different pollutants, fertilizers, pesticides are mix and contamination in ground water, after their cause becomes unsafe for use.

## II. OBJECTIVES OF THE STUDY

The aim of the research project is to understand what causes groundwater to diminish and become polluted.

Collect the data of before monsoon and after monsoon of ground water level data & water quality data from Daskroi Taluka. And tested parameters have been compared to the Indian Standard.

## III. LITRATURE REVIEW

In the year 2009, Matthew Rodell, Isabella Velicogna & James S.Famiglietti have studied on, 'Satellite Based Estimates of Groundwater Depletion in India' In this study storage-change observations from the NASA Gravity Recovery and Climate Experiment satellites and simulated soil-water variations from a data integrating hydrological modelling system which shows groundwater depletion. Here they used 73 monthly GRACE gravity solutions.

In the year 2012, Olumuyiwa I. Ojo, Fred A.O. Otieno and George M. Ochieng have studied on, 'Groundwater: Characteristics, qualities, pollutions and treatments-An overview.' This study mainly focus on the quality and treatment of groundwater. For achieving their

objectives they use different physical process have done like, Aeration, Coagulation, Flocculation, Sedimentation, Disinfection which all are convection methods. This low cost treatment process through easily improving the quality of water and reducing the water borne disease.

In the year 2012, D M Banerjee, A Mukherjee, S K Acharyya have studied on, 'Contemporary Groundwater Pollution Studies in India' Fluoride and arsenic have caused surface water and groundwater in parts of Indian Peninsula, Ganga-Brahmaputra Alluvial and Delta Plains. Total 5729 samples in 192 blocks spread across 23 districts were tested. Using Arsenator field tests kits, UV Spectrophotometry and Atomic Absorption Spectrometry through arsenic parameter was tested.

In the year 2013, Gursimran Singh, Dapinder Deep Singh, Prof. S.K Sharma have studied on, 'Effect of Polluted Surface Water on Groundwater: A Case Study of Budha Nullah.' Effect of Polluted surface water on groundwater has check in this paper. There are mainly analyse physicochemical and biological parameters, examine heavy metal in the surface and groundwater samples and examine heavy metals in the soil samples.

In the year 2016, Mohd Saleem, Athar Hussain and Gauhar Mahmood. Saleem et al. have studied on, 'Analysis of groundwater quality using water quality index: A Case study of greater Noida (Region), Uttar Pradesh (U.P), India.' The objectives of this study are to analyse the underground water quality of Greater Noida region by water quality index. In this study 90% water samples were found good quality and only 10% water samples falls under moderately poor category. The water quality index ranges from 16.49 to 64.65.

In the year 2017, Adnan Khan and Yusra Rehman have studied on 'Groundwater quality assessment using water quality index (WQI) in Liaquatabad Town, Karachi, Pakistan.' The groundwater samples is taken through boring wells from various sites of study area. Value of Ca, Na, Cl, and HCO<sub>3</sub> is reported in 85, 33, 40 and 70% wells respectively, which is the corresponding WHO guideline for drinking purpose. Groundwater is not suitable for drinking purpose after calculation of WQI.

In the year 2018, Niloy Parvez, Afifa Sultana Pritul have studied on, 'Analysis of Ground Water Quality: A Case Study in the Savar (Akraim) Area' In this paper, studied the various physiological, chemical, and biological parameters defined as Turbidity, pH, DO, Arsenic, TDS, TSS, TS from a specific area using CCME method. Approximately 62.5 percent is suitable for human consumption within the specific area. Total 40 samples were testing.

According to the different research papers, it has been found due to insufficient groundwater conservation, it is polluting and its levels are constantly decreasing. Besides, the water level is decreasing due to proper planning and management. Provide proper treatment for reducing water

pollution and using modern conservation techniques for increasing the quantity and level of groundwater.

#### IV. STUDY AREA PROFILE



Fig. 1: Location of Daskroi

The study area was located at Daskroi, Ahmadabad which is 23.033, and 72.460 latitude and longitudinal. Total area of Daskroi is 501.23 sq.km. There are total 54 villages in Daskroi Taluka.

There are 58.4% urban area and 41.965% rural area present. Farmers are used the Fatewadi canal water for irrigation, cultivating of different crops. Using bore well through drinking facility has been completed.

#### V. METHODOLOGY

##### A. Sample Data Collection:

The study area was distributed in fifteen site station where village area, Industrial area and agriculture area is there. The groundwater samples were collected for physico-chemical parameter analysis from fifteen site station of Dakroi taluka.

For collecting of sample use 500 ml of bottle deep into the water and gathering water sample. Each and every time for taking a sample repeated the same process.

After taking the sample cover the bottles with using paper for protected from sunlight and give this bottle for testing the values of different para meters. Also labeling on the bottles.



Fig. 2: Sampling Site Image

Sample Id	Sampling Code	Sampling Point
1	G1	Bareja
2	G2	Rakhiyal
3	G3	Vasana(Barriage)
4	G4	Scout Bhavan

5	G5	Vatva-1
6	G6	Vatva-2
7	G7	Vatva-3
8	G8	Lambha-I
9	G9	Lambha-II
10	G10	Mahijada
11	G11	Kamod
12	G12	Badarabad
13	G13	Kasindra
14	G14	Paldi Kankaj
15	G15	Gamdi

Table 1: Sampling Sites with Sampling Code in Details

#### VI. GROUNDWATER QUALITY

Taking each date of collection, location, etc. and each sample collected in a plastic bottle and give a unique number. Here, take the sample by grab or catch sample method. PH meter and paper, Do meter, TDS meter and other digital instruments through check the parameters easily. Also various chemicals and equipment through analysis the sample. Various physicochemical parameters have been studied as under:

##### A. pH:

PH is an intensity of the acidic or basic character of a sample at a given temperature which is indicated by pH of hydrogen ion activity. The pH below 7.0 show acidic nature and above 7.0 show alkaline nature. The range of pH for drinking water 6.5 to 8.5. PH will be measured by pH metre, pH scale, pH paper etc. and I have used pH paper and pH meter for pH measured.

##### B. TDS:

The organic particles an inorganic particle present in dissolved form. Size of these particles varies from  $10^{-3}\mu\text{m}$  to  $10^{-5}\mu\text{m}$ . TDS metre will be used for the testing of my sample1. For measuring the correct value of total dissolved solids of drinking water there are temperature is the important part.

##### C. DO:

A DO sampler is a metal tube about 10 cm diameter and 30 cm length. DO is checked instantly check when collect the sample because after not correctly value. Here, used DO meter for check my sample. In the drinking water there are high level of DO is required.

##### D. Acidity:

It is the capacity of substances to neutralize hydroxyl ions  $\text{OH}^-$  (basics). It is due to presence of minerals and dissolution of carbon dioxide. Acidity is measured in mg/l. as  $\text{CaCO}_3$ .

##### E. Alkalinity:

The alkalinity of water is a measure of its capacity to neutralise water. In alkalinity the major portion is hydroxide, carbonate, and bicarbonate. It is measured in mg/l as  $\text{CaCO}_3$ .

##### F. Chloride:

Chlorides are mainly due to the intrusion of sea water, brine, industrial wastes and domestic wastes into the water supply source. Chlorides are generally present in the water in the

form of calcium chloride, sodium chloride and magnesium chloride.

**G. Fluoride:**

There are in water sources contain natural fluorides. Fluorides are mainly associated with some sedimentary and fluoride bearing rocks. In a fluoride concentration of approx. 1 mg/L in drinking water effectively reduces dental caries without any harmful effect on health.

**H. Nitrate:**

The intensity of the colour directly proportional to the concentration of Nitrite present in water.

**I. Calcium:**

Calcium is naturally present in water. It may dissolve from rocks such as limestone, marble, calcite, dolomite, gypsum,

fluorite and apatite. Calcium is a determinant of water hardness, because it can be found in water as Ca<sup>2+</sup> ions. Calcium also gives water a better taste.

**J. Hardness:**

Hardness of water may be defined as the soap destroying property of water. The hardness may be of two types: Temporary Hardness and Permanent Hardness.

**VII. RESULT AND DISCUSSION**

The drinking water quality parameters of various villages of Daskroi taluka. Industrial wastewaters are the main source of surface and ground water contamination. The Physicochemical parameters of water around the industrial site obtained from the analyses are presented in the Table.

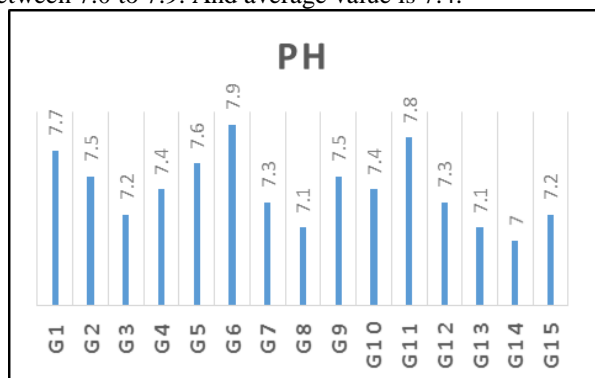
No.	pH	TDS mg/l	DO	Total Acidity mg/l	Total Alkalinity mg/l	Chloride mg/l	Fluoride mg/l	Nitrate mg/l	Calcium mg/l	Hardness mg/l
G1	7.7	2810	2.1	480	590	310	2.0	40	220	620
G2	7.5	1530	1.6	450	560	195	1.5	20	195	585
G3	7.2	1210	2.2	410	490	210	0.5	10	145	560
G4	7.4	1030	2.3	490	520	255	1.0	30	175	595
G5	7.6	1440	1.7	430	500	225	1.5	10	150	550
G6	7.9	1850	1.9	470	580	265	3.0	50	185	610
G7	7.3	1120	1.5	400	550	245	2.0	20	170	575
G8	7.1	1360	1.0	370	510	220	0.5	40	140	545
G9	7.5	1000	1.3	350	480	280	1.5	30	125	520
G10	7.4	1250	1.8	390	450	215	1.0	20	160	500
G11	7.8	1630	2.0	420	510	275	1.5	50	200	580
G12	7.3	2240	1.6	360	400	250	0.5	40	180	535
G13	7.1	2950	1.8	310	470	270	2.0	20	155	570
G14	7.0	1500	1.0	300	430	190	1.0	10	120	515
G15	7.2	2110	1.9	380	390	230	0.5	30	135	590
Min	7.0	1000	1.0	300	390	190	0.5	10	120	500
Max	7.9	2950	2.3	490	590	310	2.0	50	220	620
Avg.	7.4	1669.66	1.7	400.67	495.33	242.33	1.3	28	175	565

Table 2: Physicochemical Characterizations of Groundwater Samples

Detail information of the tested parameters are:

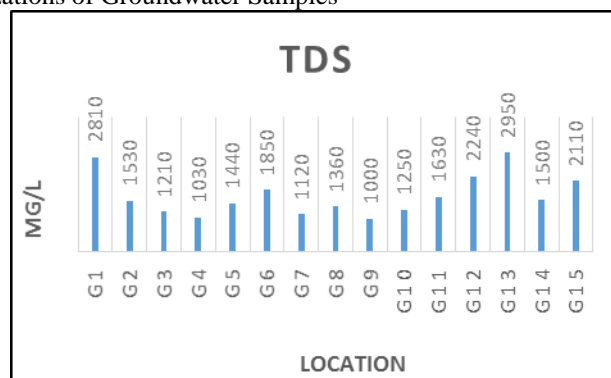
**A. pH:**

Due to chemical and biological reactions through pH value will be higher and easily mixed up. The value of pH is between 7.0 to 7.9. And average value is 7.4.



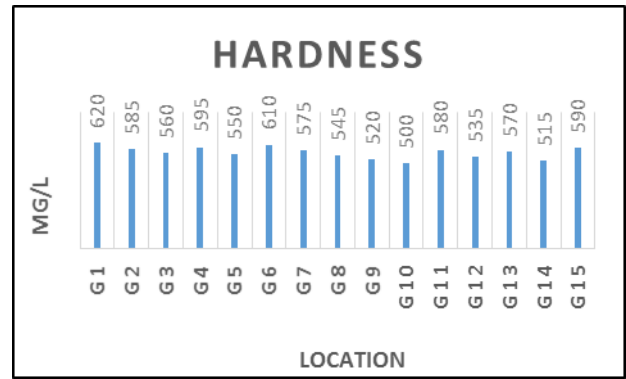
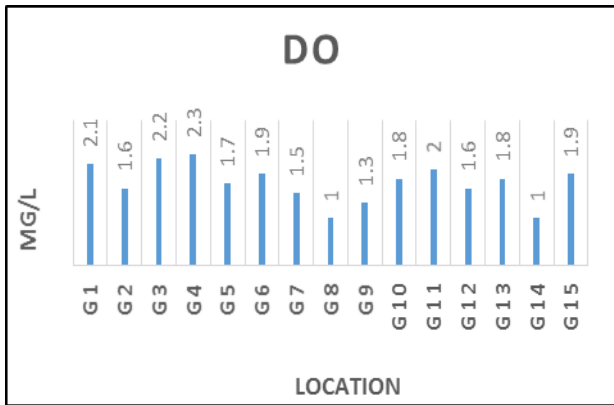
**B. TDS:**

TDS concentration beyond 500 mg/L. The value of TDS between 1000 to 2950 mg/l and average value is 1669.66 mg/l.



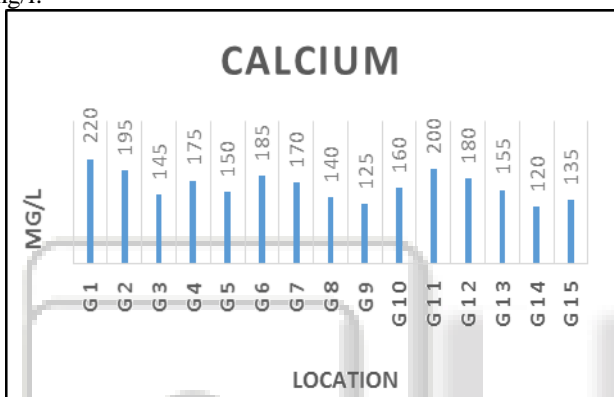
**C. DO:**

The amount of oxygen water can hold depends upon temperature, pressure, and salinity. Range of DO concentration is 2 mg/l. The amount of DO often determines the number and types of organisms living in that body of water. The value of DO between 1.0 to 2.3 mg/l and average value is 1.7 mg/l.



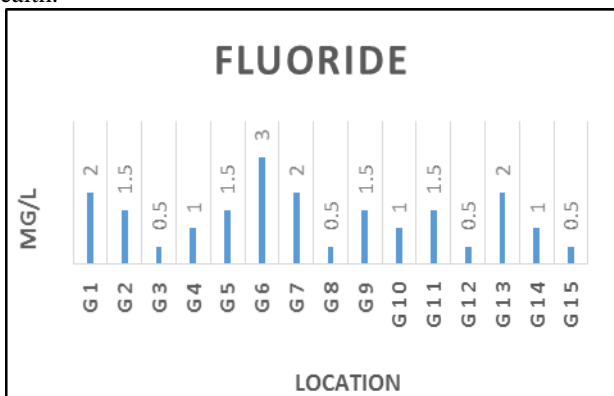
**D. Calcium:**

Calcium concentration beyond 200 mg/l. The value of calcium between 120 to 220 mg/l and average value is 175 mg/l.



**E. Fluoride:**

The groundwater sample of Fluoride varied from 0.5 to 2.0 mg/l. The average value of is 1.3 mg/l. The main sources of fluoride in groundwater are different fluoride bearing rocks. A Fluoride concentration of approximately 1 mg/l in drinking water effectively reduces without any harmful effect on health.



**F. Hardness:**

The hardness is mainly due the Ca, Mg and Eutrophication. The water containing excess hardness is utensils when used for cooking and consume more soap during washing of clothes. The value between 500 to 620 mg/l and average value is 565 mg/l.

**VIII. CONCLUSION**

- 1) Overall, the study has shown that the groundwater depletion and contamination. Therefore from the analysis it is showed that all the tested parameters of groundwater sample were contaminated (TDS, Hardness, Fluoride, Chloride, Nitrate, etc.) due to presence of some incongruities (pH, Calcium, Acidity, Alkalinity, DO, etc.) the tested parameters in a specific sample the quality to use as drinking water and irrigation.
- 2) All the values in some cases were lower than the maximum allowable limits, due to the depletion and contamination of groundwater.
- 3) Groundwater contain higher concentration of many physicochemical parameters. The used of this groundwater for drinking purposes reduces above all impurities with help of RO (Reverse Osmosis) and Water purification systems.
- 4) iv)Increasing the groundwater with help of pond, recharging of well interconnecting river, barrage, check dam, canals, percolating well, and recharge of bore.
- 5) To increase ground water level by artificial recharge methods and treat the groundwater which is the aim of the study.

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