CONFINED AQUIFERS AND SURFACE WATER QUALITY MEASUREMENTS OF NORTH EASTERN PART OF 23rd WARD, IRINJALAKUDA, TRISSUR DISTRICT, KERALA

A THESIS

Submitted by

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CERTIFICATE

This is to certify that the work embodied in the project entitled **"CONFINED AQUIFERS AND SURFACE WATER QUALITY MEASUREMENTS OF NORTH EASTERN PART OF 23rd WARD, IRINJALAKUDA, TRISSUR DISTRICT, KERALA"** has been carried out by **Ms. ABHIRAMI SAJAN K**, B.Sc. Student, Department of Geology & Environmental Science, Christ College Irinjalakuda (Autonomous), under my guidance and supervision.

Irinjalakuda
May 2022

Asst. Prof. Roshini P.P
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DECLARATION

I, **ABHIRAMI SAJAN K**, hereby declare that the B.Sc. project entitled **"CONFINED AQUIFERS AND SURFACE WATER QUALITY MEASUREMENTS OF NORTH EASTERN PART OF 23rd WARD, IRINJALAKUDA, TRISSUR DISTRICT, KERALA "** is an independent work carried out by me and it has not been submitted anywhere else for any other degree, diploma or title.

Irinjalakuda
May 2022

ABHIRAMI SAJAN K
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ABSTRACT

Quality of surface and ground water has a huge impact on everyday life of human beings. The objective of this study was to find out the quality of surface and ground water by recording and analysing various physical and biological parameters. The samples of water were acquired from various sources of both surface and ground water has been collected and appropriate tests were conducted. Tests for physical parameters like pH, NaCl & TDS concentration, Conductivity, Resistivity and biological parameters like Total Coliforms, Faecal Coliforms, E Coli were recorded. Systematic recording of location and attributes were carried out with the help of a GPS device. The combined effort of team members under the guidance of Asst. Prof Roshini P.P has resulted in the successful completion of the project.

ACKNOWLEDGEMENT

First and foremost, praises and thanks to the God, the Almighty, for his showers of blessings throughout my project work, to complete it successfully

I would like to express my deep and sincere gratitude to my project supervisor, **Mrs. Roshini P.P,** Assistant Professor, Department of Geology & Environmental Science, Christ College Autonomous Irinjalakuda, for giving me the opportunity, to do the project and providing invaluable guidance throughout this project. Her dynamism, vision, sincerity and motivation have deeply inspired me. It was a great privilege and honour to have worked and studied under her guidance. I am extremely grateful for her valuable support throughout this project. I would also like to thank her, for her friendship and empathy.

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ABHIRAMI SAJAN K
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CHAPTER-1

INTRODUCTION

1.1 GENERAL

Water is undoubtedly the most important natural resource on the planet. Water, the elixir of life, covers 71% of the Earth's surface. The total amount of water on a planet makes up the hydrosphere. Surface water and groundwater are two major components of the hydrosphere. They both strongly influence the quality of life of all organisms on the planet. Life on earth is simply impossible without water. The very first forms of life are believed to be originated in water. Water is the most versatile liquid in the world. Apart from sustaining life, water is also the invisible backbone of world economy. All agricultural and industrial framework needs water in one way or other. Increased population density and widespread industrialisation has forced us to look for more and more sources of usable water. The same factors mentioned above have also caused drastic increase in the pollution of available fresh water. As a consequence, ensuring the quality of water used has become a primary concern for the development of human civilization. Pollution by chemical and organic matter can adversely affect the quality of water sources. Using poor quality water can have huge impact on the health of general population by making them susceptible to diseases and subsequent health deterioration. Increased intensity of water use, discharge of untreated domestic and industrial wastes, excessive application of fertilisers and pesticides in agriculture, and accidental spills of harmful substances (including radioactive substances) have led to increasing pollution of many waterbodies. Natural geochemical conditions may cause increase in content of iron, fluoride, arsenic, strontium etc and salts in groundwater reducing the quality of water.

CHAPTER-2

STUDY AREA

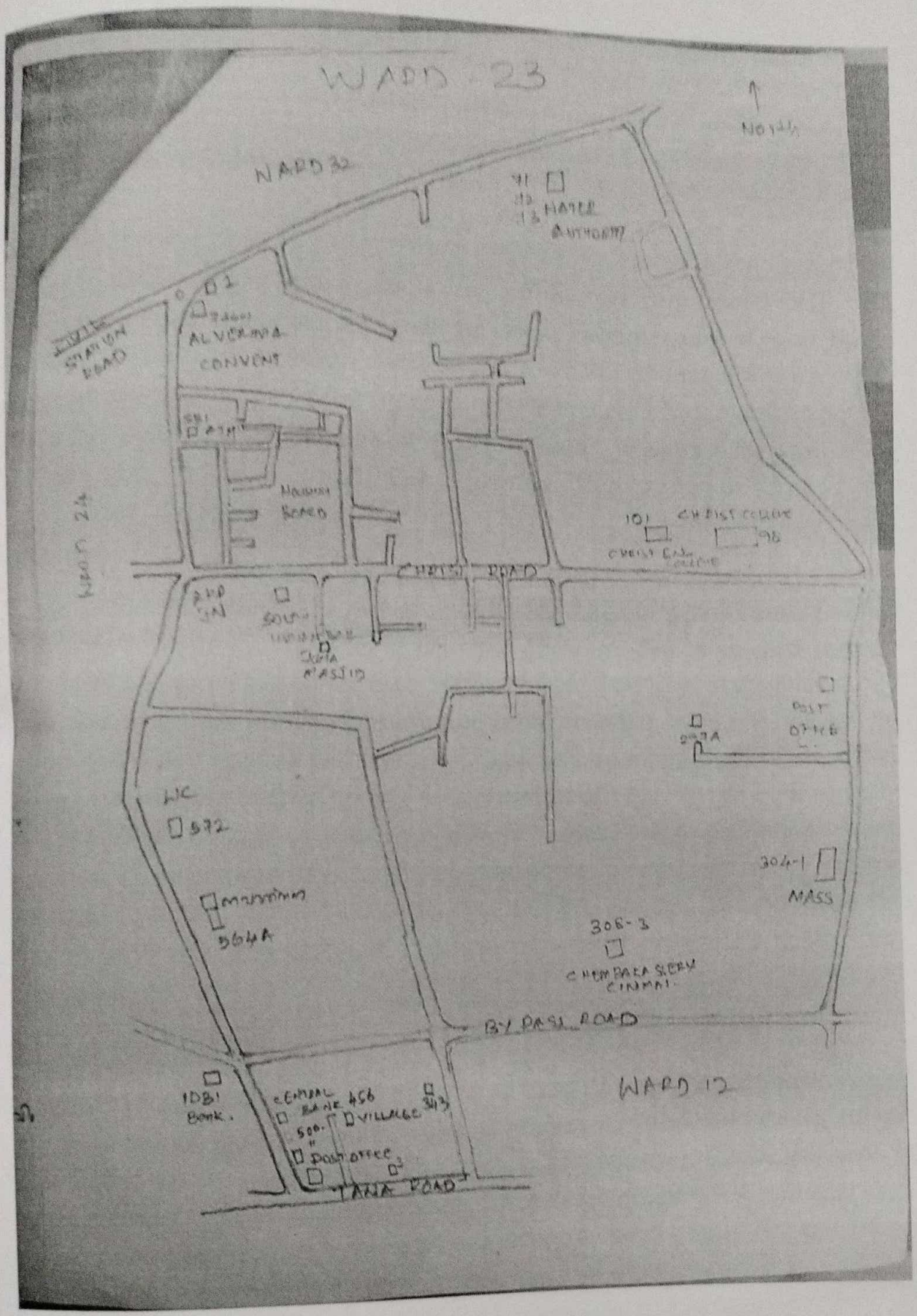
2.1 TOPOGRAPHY

The municipal town Irinjalakuda is situated in Mukundapuram taluk of Trissur district, Kerala, India. It is situated in 10.33°N longitude and 76.23°E latitude and covers an area of 11.24kilometresquares.It is governed by Porathissery Gram panchayat. The nearest town is Irinjalakuda, which is about 1 kilometre away from Irinjalakuda.

The area have temperature hovers around 34°C and at night it feels like 26°C. In April Irinjalakuda gets 234.36mm of rain and approximately 15 rainy days in the month. Humidity is close to 76%. (World weather online)

2.2 GEOLOGY OF THE AREA

Study area at Irinjalakuda is underlain by Archean gneisses and crystalline schists, above which laterites and tertiary formations are observed. Main soil type here is laterite soil. Main geomorphic feature near Irinjalakuda is Karuvannur river basin. Irinjalakuda at its eastern margin is surrounded by Muriyad wetlands. The hard rock and laterite aquifers constitute major aquifer system of the area. The laterites are highly porous and due to this the aquifer gets recharged fully by the initial few rains itself. Subsequent rains contribute little to the aquifer system and escapes as rejected recharge. Due to this high porosity the stored water escapes as sub surface run off from the elevated areas and slopes once the rain recedes. The laterite forms highly potential aquifers along topographic lows and valleys. Depth of dug wells in these formations generally ranges from 5.00 to 25.62 metres. In hardrock aquifers along the weathered portion, the groundwater occurs under water table conditions and mainly controlled by geologic and geomorphic features. The weathered rocks form potential aquifers. Groundwater occurs under semi confined to confined conditions in the fractured portions of the crystalline rocks.



Map of ward number 23

CHAPTER-3

PARAMETERS

2.1 PHYSICAL PARAMETERS

2.1.1pH

pH is a measure of how acidic/basic water is. The range goes from 0 to 14, with 7 being neutral. pHs of less than 7 indicate acidity, whereas a pH of greater than 7 indicates a base. pH is really a measure of the relative amount of free hydrogen and hydroxyl ions in the water. pH of bore hole and pondwater varies from 6 – 8. To 2-3 , indicate contamination of acidic water. A water with a pH > 8.5 indicate that the water is hard. Consequences of pH change in borewell and pond water. Hard water does not pose a health risk, but can cause aesthetic problems.

These problems include: Formation of a precipitate on piping causing water pressures and interior diameter of piping to decrease. Causes an alkali taste to the water and can make coffee taste bitter; The ideal pH level of alkaline ionized water for long-term human consumption is between 8.5 and 9.5 When low pH water come into contact with certain chemicals and metals, this often makes them more poisonous than normal. Heavy metals can accumulate on the gills of fish, reducing their chance of survival. How to increase pH of water(borewell and pond). A corrosion-resistant chemical feed pump injects soda ash or sodium hydroxide solution into the water to raise the pH. The solution should be fed directly into the well or pond to protect the well casing and pump from corrosion.

2.1.2CONDUCTIVITY

Conductivity refers to the ability of water to conduct electricity and functions as an indicator of dissolved ionic solid concentration and salinity. Dissolved ionisable solids are compounds such as salts of calcium, magnesium, and sodium that can impact the hardness and alkalinity of a water supply.1 Water with high conductivity does not necessarily pose a risk to human health, But can cause harm in industrial system and agriculture.

Sources :

It can caused by natural sources like minerals, rocks and anthropogenic activities of industry and run off iron roads. Natural sources are mostly harmless as it does not exceed recommended limits.

Regulations :

The limit for drinking water conductivity is 2500 micro-Siemens per centimetre (μS/cm).

2.1.3NaCl

Nacl or common salt made up of strong sodium ion bonded to negetive chloride ions.it is dissolved in water as positive Na ion is attracted by negative portion of water molecule and negative chloride ions is attracted by positive part of water molecule. Sodium and chloride occur naturally in groundwater, but levels can increase from water softeners, natural salt deposits, sewage and fertilizers. Salt can also be dissolved in freshwater sources near coastal areas due to excess use of ground water by pumping for households and agricultural uses, this process is called 'Saltwater intrusion'. Although Nacl in water is harmless in low level,high levels of nacl can damage plants and cause unpleasant taste in drinking water. While there is no drinking water standard for sodium, state and federal agencies recommend sodium levels in water not exceed 20 milligrams per liter (mg/L) for people on very low sodium diets and 270 mg/L for people on moderately restricted sodium diets. Most of the salt we consume comes from food.(Source:https://www.health.ny.gov/environmental/water/drinking/salt_drinkingwater.htm#:~:text=While%20there%20is%20no%20drinking,we%20consume%20comes%20from%20food.)

2.1.4Resistivity

The water ability to resist electrical current is resistivity. Dissolved salt in water depends resistivity in water. If the concentration of dissolved salt is high, the water has high resistivity. Ohm is the unit of measurement. Cleaner water has high resistivity. The ohms law states that current passes through two separate points of a conductor is proportional to the voltage across the two points. If salt dissolves in the water, there is the formation of free ions.To find dissolved salts or contaminants in the water sample resistivity meter is important. In the collected borewell water samples the resistivity is between 1-4 kilo ohm. Surface water has comparatively high resistivity varies 1-10 kiloohm.

2.1.5TOTAL DISSOLVED SOLIDS (TDS)

TDS id defined as the total measurement of substances, both organic and inorganic present in a liquid in molecular or ionized form. TDS is the main contaminant present in water and it can't be neglected through named filtration process. It is explained in terms of parts per million (ppm) and can be measured using a digital meter.

Usually, the amount of organic matter present in water is small. The inorganic matter that are common in water are calcium, potassium, sodium etc. these can be mixed with water through natural or man-made sources. When water percolates through soil, it dissolves the minerals present in its path. Some dissolves solids like arsenic and fluoride are danger even in trace amount. so there is a permissible quantity for each dissolved solid in water TDS standers uses the WHO standards as the basis and India follows the standards set by Berean of Indian standards.

TDS chart for drinking water.

TDS level (ppm)	Result
50-150	Excellent for drinking
150-250	good
250-300	fair
300-500	poor
>1200	unacceptable

2.2BIOLOGICAL PARAMETERS

2.2.1COLIFORM BACTERIA

Total coliforms are a group of bacteria commonly found in the environment, for example in soil or vegetation, as well as the intestines of mammals, including humans. Total coliform bacteria are not likely to cause illness, but their resence indicates that your water supply may be vulnerable to contamination by more

harmful microorganisms. Escherichia coli (E.coli) is the only member of the total coliform group of bacteria that is found only in the intestines of mammals, including humans. The presence of E.coli in water indicates recent fecal contamination and may indicate the possible presence of disease-causing pathogens, such as bacteria, viruses, and parasites. Although most strains of E.coli bacteria are harmless, certain strains, such as E.coli 0157:H7, may cause illness.

Total coliforms and E.coli are used as indicators to measure the degree of pollution and sanitary quality of well water, because testing for all known pathogens is a complicated and expensive process. The main source of pathogens in drinking water is through recent contamination from human or animal waste, from

- Improperly treated septic and sewage discharges
- Leaching of animal manure
- Stormwater runoff
- Domestic animals or wildlife

During and after precipitation, bacteria and other harmful microorganisms from any of these sources may be washed into rivers, lakes, or groundwater. Poor well construction or poor maintenance can increase the risk of groundwater contamination. (Source: New Nouveau Brunswick)

CHAPTER -4

METHODOLOGY

4.1GENERAL PROCEDURE

Borewell samples, collected from 10 locations and pond samples collected from 7 locations of ward 23 of Porathissery Grama Panchayath. The samples collected in polyethene bottles of 1 litre capacity. Sampling was carried out without adding any preservativies in rinsed bottles directly for avoiding any contamination. The pond samples are brought to the laboratory for check biological parameters like total coliforms, fecal coliform and E coli using the test method APHA 9222B.

The pond and borewell samples were brought to measure the physical parameters. The measurement was done by Eutect instrument cyber scan no. PCD650. This includes a digital screen device with function and waterproof electric connected to it. We are measuring the Ph value, conductivity, TDS, NaCl and resistivity using the device. The procedure is as follows.

1. A beaker is washed well and rinsed twice using the sample that needs to measured. Take 150ml of the sample in beaker.
2. Clean the waterproof electronic using distilled water and soak it in the sample with completely sinking and be careful not to Touch them at the bottom.
3. Press F3 button and measuring of one parameter occurs (eg-pH)
4. Record the value when it shows stable in the screen.
5. Again, press F3 to check parameter and continue till all results are found. After the completion using one sample, the beaker is rinsed again carefully using the next sample for measuring. The waterproof electrodes using the next sample for measuring. The waterproof electrodes must be washed well with distilled water. Repeat the process for all the samples.

Figure 1

Figure 2

Figure 3

Figure4

Figure 5

Figure 6

Figure 1 – 6 :Sample Collection

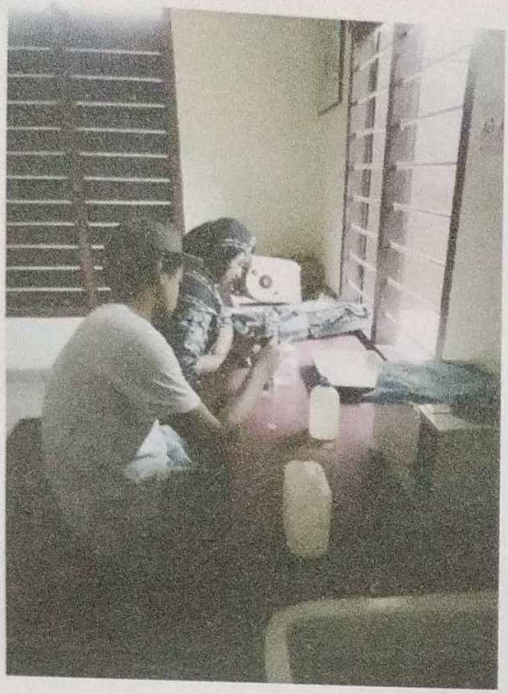


Figure 7

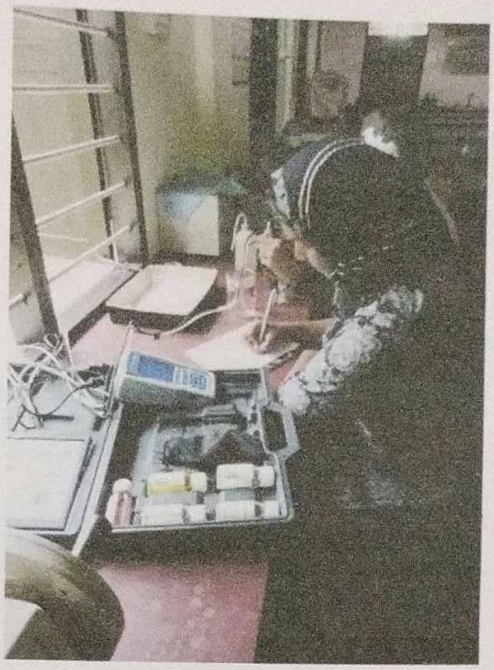


Figure 8

Figure 7 – 8 :Measurement of Physical Parameters

CHAPTER-5

DATA TABLE

5.1 TABLE:1

PARAMETER	WHO STANDARD (2011)
PH	7
Nacl(mg/l)	20mg/l
TDS(mg/l)	300mg/l
Resistivity(°C)	25°C
Conductivity(µS/cm)	2500 µS/cm

SAMPLE NO	BORE WELL NO	LOCATION NAME	LATITUDE	LONGITUDE	ELEVATION (M)	PHYSICAL PARAMETER					DEPTH (Ft)
						PH	Nacl (ppm)	TDS (ppm)	RESISTIVITY	CONDUCTIVITY	
1	1	Madhusoothanan,Kolothuparambil(H)	N10°21'394"	E76°12'607"	15	6.2	72.92	140.2	3.546	147.8	100
2	2	Muraleedharan,Nadakal(H)	N10°21'408"	E76°12'559"	19	6.22	128.5	255.5	1.96	269.5	135
3	3	Reshma Sinop,Adhwetham(H)	N10°21'406"	E76°12'547"	22	6.5	138.8	277	1.808	291.5	100
4	4	Sunandha, Kakkam(H)	N10°21'397"	E76°12'597"	19	6.63	91.21	178.7	2.794	188.5	125
5	5	July Baiju,Layas nest	N10°21'589"	E76°12'397"	19	6.78	73.86	142.3	3.516	149.5	300
6	6	Stanly,Poyara(H)	N10°21'304"	E76°12'517"	19	6.67	106.2	209.1	2.388	220.3	100
7	7	Rathamani Rajan,kottarath(H)	N10°21'396"	E76°12'550	23	6.28	134.1	267	1.877	281.71	150
8	8	PV Manoharan	N10°21'411"	E76°12'540"	25	6.51	142.6	284.3	1.768	299.4	175
9	9	Antony PO, pulikkal(H)	N10°21'532"	E76°92'659"	29	6.78	73.06	140.2	3.571	147.4	200
10	10	Biju,Vadakkan(H)	N10°21'531"	E76°12'648"	32	6.62	87.15	169.9	2.948	179.1	200

SAMPLE NO	POND NO	LOCATION NAME	LATITUDE	LONGITUDE	PHYSICAL PARAMETER					BIOLOGICAL PARAMETER		
					PH	NACL (ppm)	TDS (ppm)	RESISTIVITY	CONDUCTIVITY	TOTAL COLIFORMS,MPN100ML	FECAL COLIFORMS, MPN/100ML	E COLI
1	1	AKP	N10°35'57909"	E76°20'99809"	6.83	76.72	145.3	3.4	152.3	>1600	Absent	Absent
2	2	Rossy Sister Convent	N10°35'76092"	E76°20'94559"	6.64	30.49	46.67	10.59	48.75	900	>1600	present
3	3	Ambedkar Road	N10°35'30746"	E76°21'00074"	6.03	87.28	169.7	2.939	178.4	>1600	350	present
4	4	Anganavady	N10°35'8483"	E76°21'0721"	5.62	34.29	55.55	8.963	58.26	>1600	>1600	present
5	5	Mass	N10°34'8226"	E76°21'3516"	5.78	138	272.9	1.83	287.9	>1600	>1600	present
6	6	Chapel	N10°21'10.8"	E76°12'43.8"	6.24	59.67	110.9	4.49	116.8	>1600	>1600	present
7	7	Engineering college	N10°35'65264"	E76°21'22068"	6.15	59.75	110.9	4.5	116.8	>1600	>1600	present

CHAPTER-6

6.1 CONCLUSION

From the observation it may be concluded that the parameters like conductivity, TDS and resistivity are within the permissible limits prescribed by WHO but salinity and pH values were exceeding the limits. The samples collected from pond shows almost same trend in salinity and pH. The samples have pH less than 7 which indicate the water is slightly acidic and have salinity ranges from 30-70 ppm which means it is higher than the permissible limit. Also the borewell samples show almost same trend in pH and saline content. The samples have pH less than 7 indicate that also the borewell water is slightly acidic and while compare to pond samples salinity is more in bore well samples it ranges from 70-120 ppm. When consider about biological parameters only one pond sample have absence of coli bacteria others have its amount ranges from >1600 MPN/ml.From the results we can sumup that the samples contains slightly acidic nature and high saline content.

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