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Vellore Institute of Technology

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"Analyzing Groundwater Quality in Vellore District"

Water Resource Engineering (CLE2004)
Winter Semester 2021-22

A PROJECT REPORT

Submitted in partial fulfillment for the award of the degree of

Bachelor of Technology

In

CIVIL ENGINEERING

By

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DECLARATION BY THE CANDIDATE

We hereby declare that the project report entitled "Analyzing Groundwater Quality in Vellore District" submitted by us to Vellore Institute of Technology University, Vellore in partial fulfillment of the requirement for the award of the degree of Bachelor of Technology in Civil Engineering is a record of bonafide project work carried out by us under the guidance of Prof. Dr. Uma Shankar M. We further declare that the work reported in this project has not been submitted and will not be submitted, either in part or in full, for the award of any other degree or diploma in this institute or any other institute or university.

Signature of the Candidates:

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CERTIFICATE

This is to certify that the project report entitled “Analyzing Groundwater Quality inVellore District” submitted by Vibhav Verma - 20BCL0096 Bikalpa Gautam – 20BCL0135 Sai Pavan Kumar - 20BCL0124 Anwar Basha - 20BCL0085 Abhinav C - 20BCL0135 Chandan Yadav - 20BCL0133 Zhill Kurikkal - 20BCL0084, to Vellore Institute of Technology University, Vellore, in partial fulfillment of the requirement for the award of the degree of Bachelor of Technology in Civil Engineering is arecord of bona fide work carried out by them under my guidance. The projectfulfills the requirements as per the regulations of this Institute and in my opinionmeets the necessary standards for submission. The contents of this report havenot been submitted and will not be submitted either in part or in full, for the awardof any other degree or diploma and the same is certified.

Prof. Dr. Uma Shankar M

Project Guide

ACKNOWLEDGEMENT

We find immense pleasure in expressing our profound gratitude and thanks to our guide Prof. Dr. Uma Shankar m for his invaluable guidance, constant encouragement and keen interest in the progress and completion of this work. He has always been most willing to spend his valuable time for discussion. The discussions were always enjoyable as well as his comments have been extremely valuable. We learned a lot from the discussion. He has associated with us as a friend, philosopher and advisor. We would like to thank our HODs and Dean for providing all the infrastructure facilities to carry out our project successfully.

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Contents

Introduction

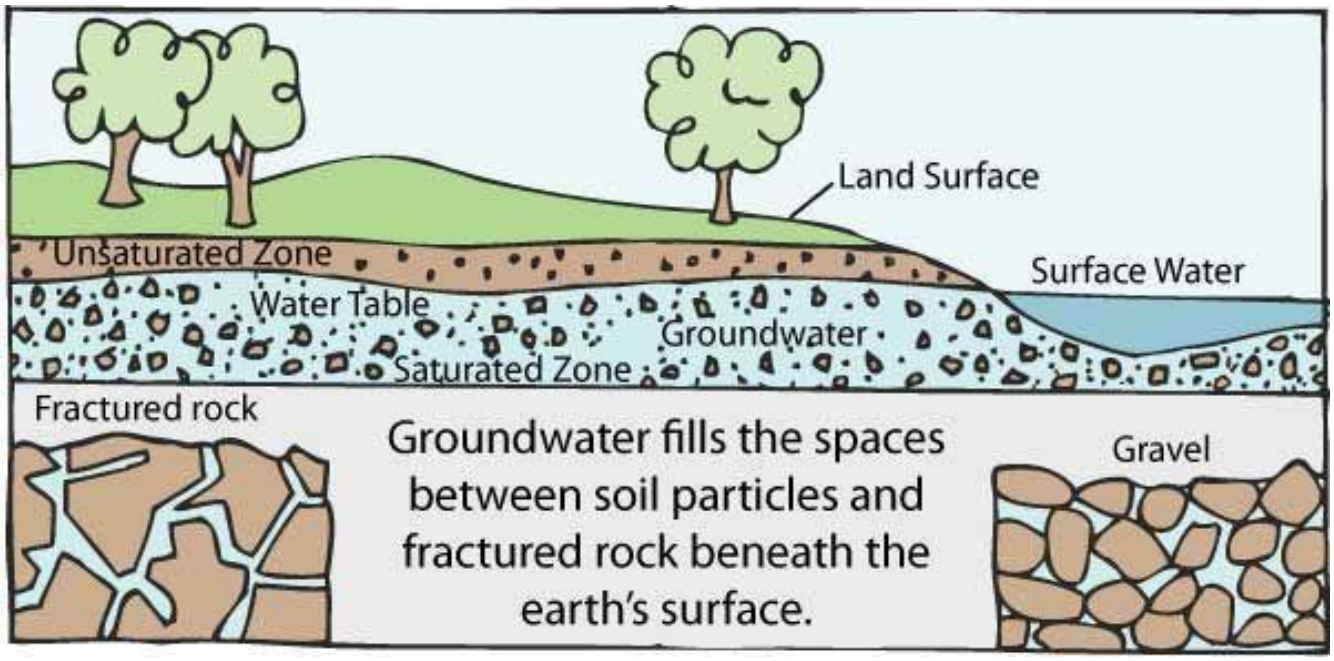
Groundwater is the water that gets collected under the earth's surface in a porous layer as a result of fluid infiltration through the soil profile.

It is found in saturated zones under the land surface.

Evaluating some of the parameters, quality of Groundwater can be estimated

The parameters include:

- Electrical Conductivity
- pH
- Total Dissolved Solids (TDS)
- Salinity
- Dissolved Oxygen (DO)
- Turbidity
- Total Suspended Solids (TSS)
- Chloride
- Depth to groundwater level



Literature Review

This Report covers studies related to groundwater quality at Vellore District. For 2010, 2011, 2012, 2013 and 2014, the water quality parameters were collected and interpreted with the help of MATLAB. Groundwater Quality is really helpful to know if the water is suitable for drinking purpose or not. Also, to check if it is suitable for irrigation purpose, it is necessary to know the groundwater quality.

This report presents all the values of groundwater parameters of Vellore District and findings are interpreted.

Objectives

Groundwater is a vital natural resource that supplies approximately 97 percent of all freshwater on the planet, excluding glaciers and ice caps.

- The major objective of this project is to analyze the water quality at Vellore District by collecting the datas and results from different sources and medias
- To find out if leakage from various sources has contaminated the groundwater in the Vellore district
- To collect qualitative data about water's physical, chemical, and biological parameters
- To study about the different kinds issues that can be seen due to the change in water quality of groundwater and find the realistic solution for the problems caused by the issues
- To conduct one experiment in the lab with the sample Groundwater from VIT or nearby locations to find out the water parameters like pH, turbidity, hardness, etc..

Study Area – Vellore District, Tamil Nadu

Vellore district is a beautiful place that lies between 12° 15’ to 13° 15’North latitudes and 78° 20’ to 79° 50’East longitudes in Tamil Nadu State. The average annual rainfall is 795mm, out of which Northeast monsoon contributes to 535mm and the Southwest monsoon contributed to 442mm

Ground Water Scenario at Vellore District

At Vellore District, Groundwater is found in the weathered zone under phreatic conditions and in the fractures under semi-confined conditions.

Depending on the topography, the thickness of the weathered zone varies from less than a meter to roughly 15 m in the area.

Groundwater Potential as on March 2011 (as per CGWB)	
Net Groundwater Availability (in MCM)	592.80
Existing Gross Groundwater draft for all users (in MCM)	621.44
Stage of Groundwater development (in %)	105%
Categorization of District	Over Exploited

Methodology

- Study the parameters used for determining the qualities of groundwater
- Collect the datas of water parameters(DO, TDS, TSS) of groundwater to know the quality of groundwater at Vellore district
- Collect a sample of water at VIT which is located in Vellore district and carry out the tests in lab to determine the water parameters such as pH, turbidity, hardness, electrical conductivity, TDS, TSS, etc...

(*Digital pH meter for pH*, *Jar test for turbidity*, *EDTA for hardness*, *Conductivity Cell for electrical conductivity*)

- Elaboration of the issues in the present condition of Groundwater at Vellore district

Study the ways on how we can improve the quality of groundwater

Causes: Reasons for finding the groundwater quality

- To check the suitability of water for
- Drinking Purpose
- Domestic Purpose
- Irrigation Purpose

Sampling and analysis

- Sampling was done by collecting the groundwater in different places of Vellore district. The groundwater was collected from different wells.
- Then the water quality parameters were studied
- The data for the quality parameters for groundwater were taken for the years 2010, 2011, 2012, 2013 and 2014
- Eight wells were selected for the study purpose
- The data were presented and studied with the help of a bar graph
- All the parameters except pH and Electrical Conductivity are expressed as mg/L. So, keeping parameters on X- axis and amount in mg/L as Y-axis, bar
  graph was drawn using MATLAB Code. For pH and Electrical Conductivity, separate graph was drawn.

Parameters used for determining the qualities of Groundwater

- Different parameters were studied for the determination of quality of groundwater at Vellore District
  The parameters are:

-NO_2 + NO_3

-Ca

-Mg

-Na

-K

-Cl

- Residual Solution Carbonate (RSC)

-Sodium Adsorption Ratio (SAR)

-CO_3

-HCO_3

-F

-pH

-EC

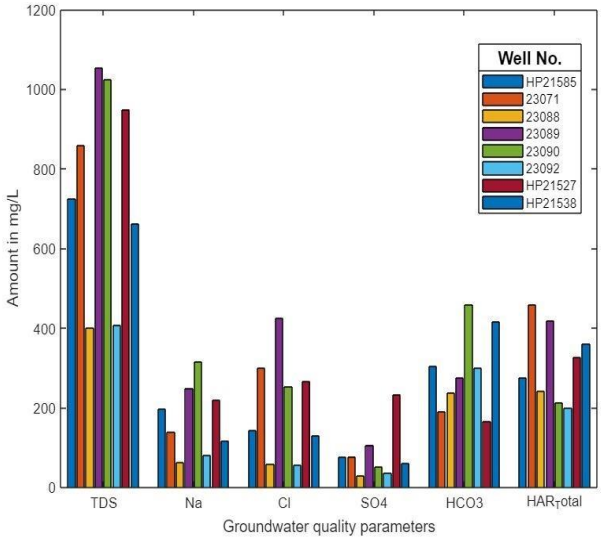
-Total Hardness

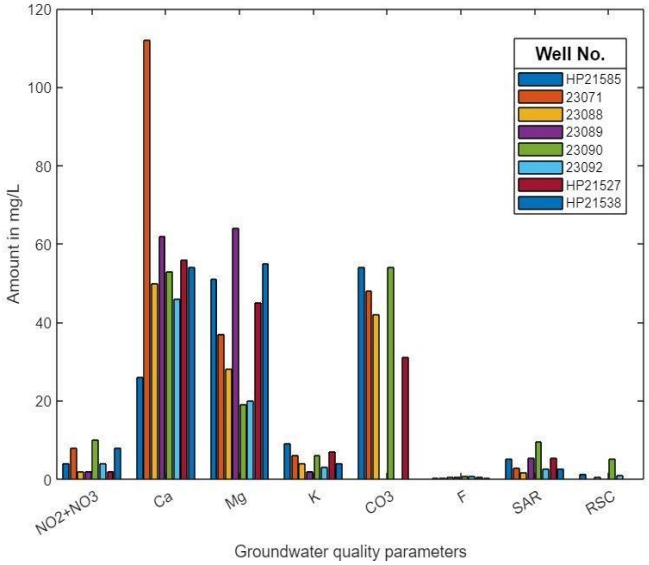
-SO_4

Findings

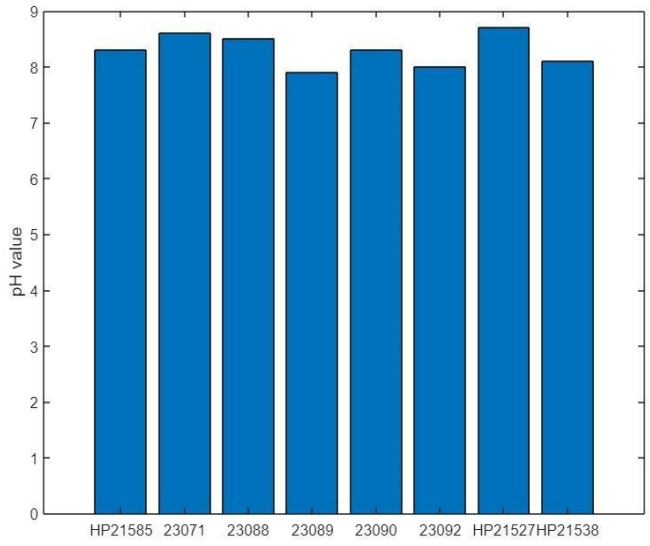
- Using MATLAB Code, we are able to present the datas in more convenient way
- The graphs obtained highlights the value of groundwater quality for different years

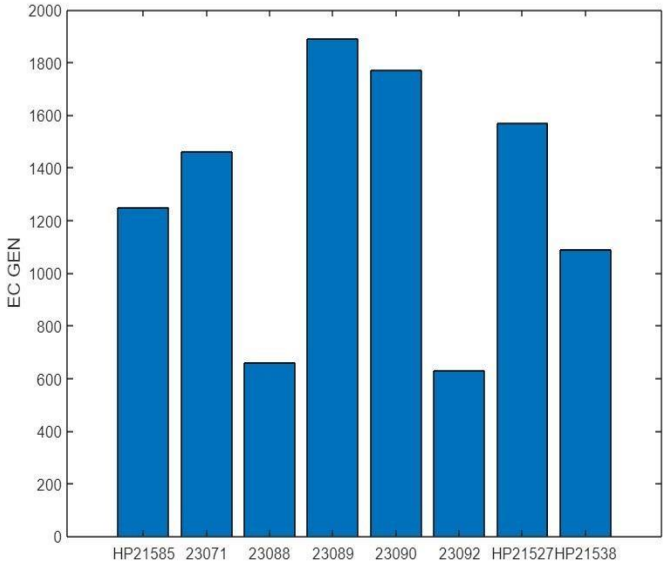
Water Quality parameters(X- Axis) vs Amount of quality



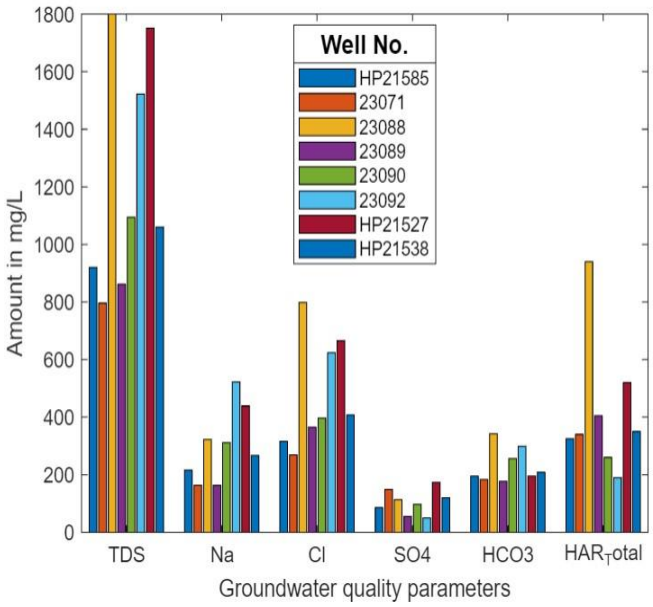


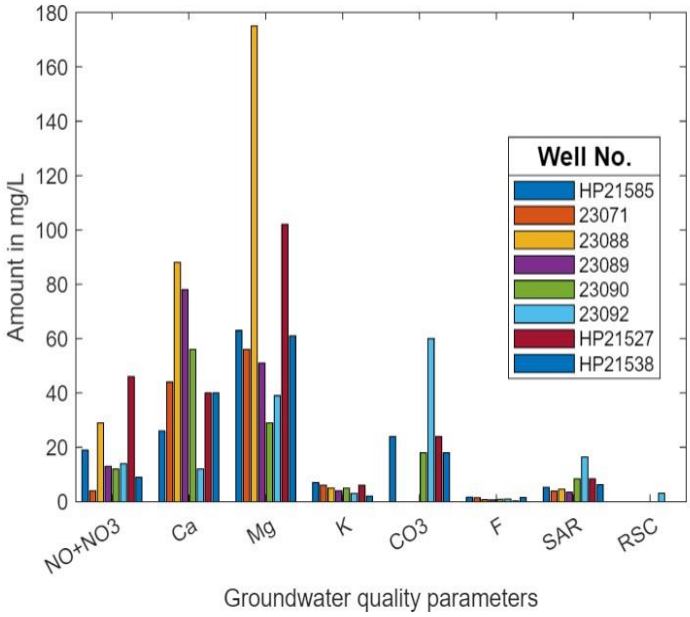
parameters(Y-Axis) for different wells for the year 2010

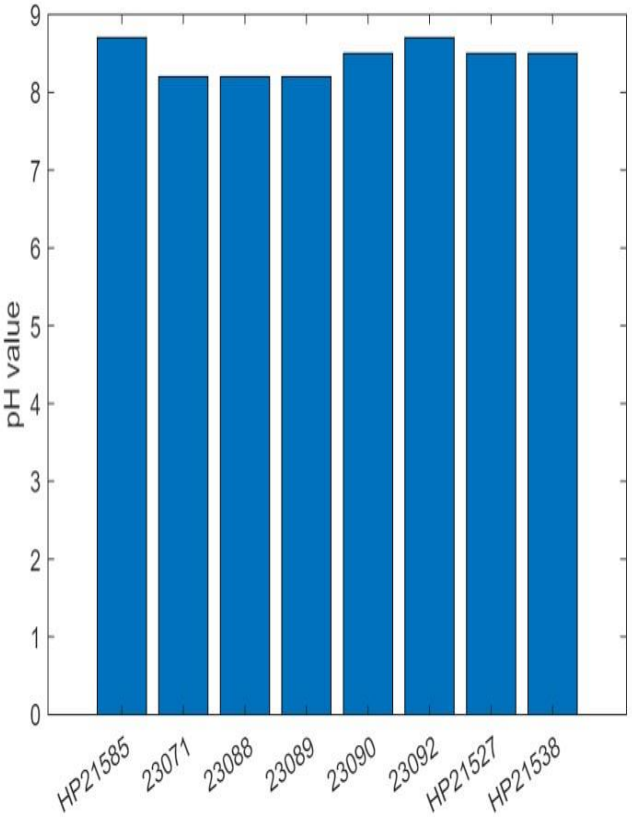


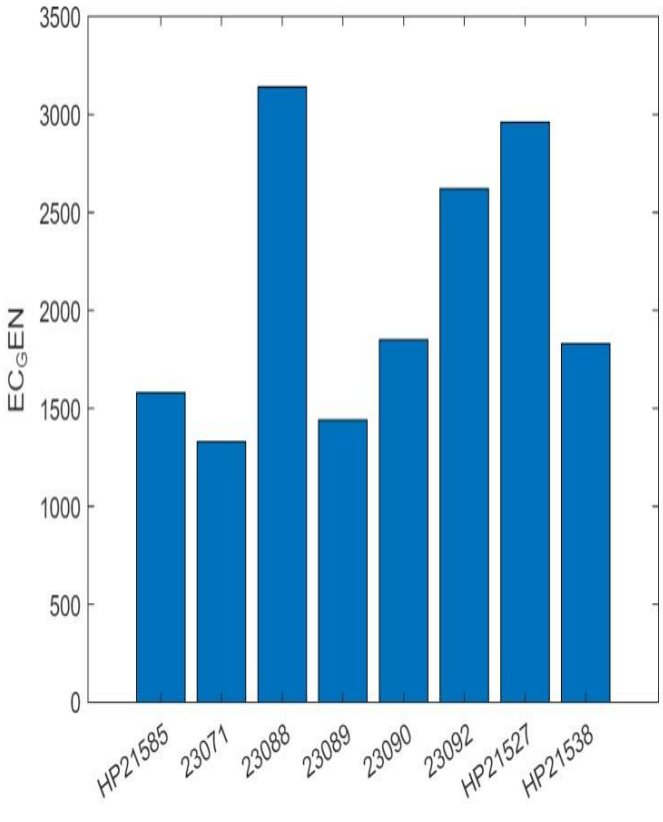


Water Quality parameters(Y- Axis) for different wells(X- Axis) for the year 2011

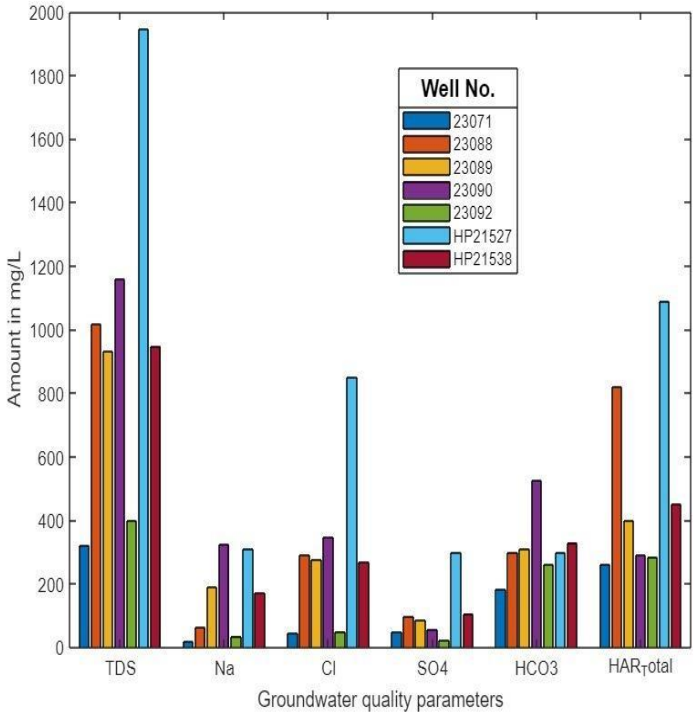


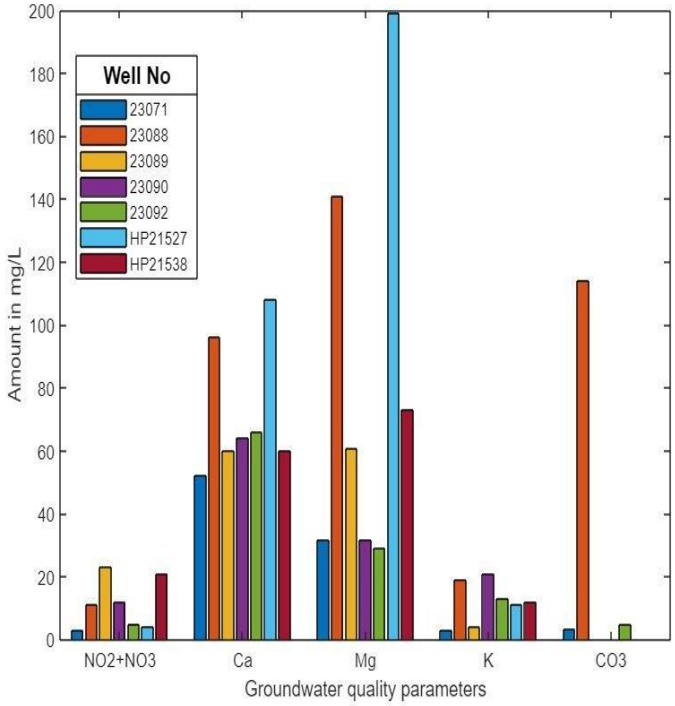


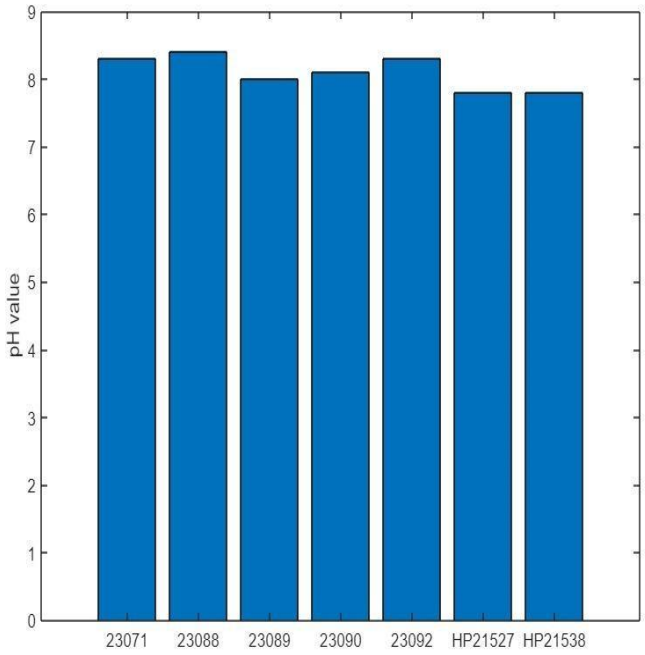


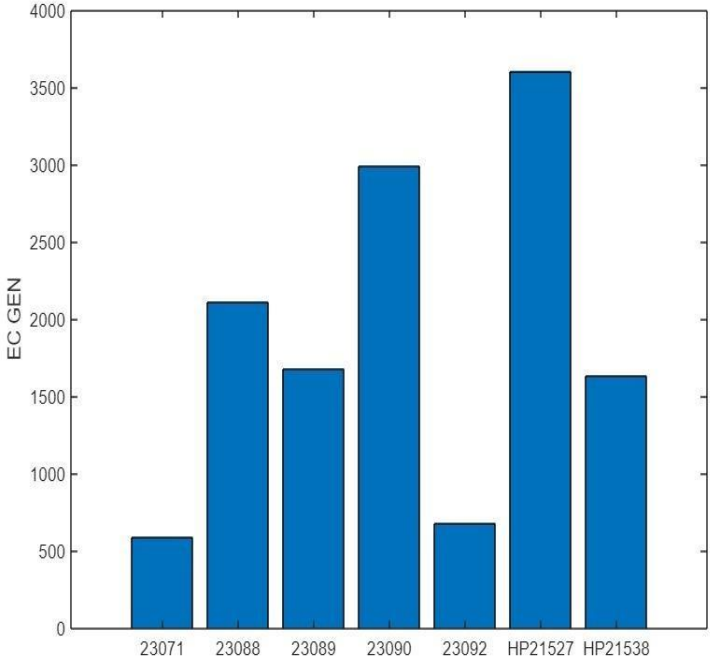


Water Quality parameters(X- Axis) vs Amount of quality parameters(Y-Axis) for different wells for the year 2012

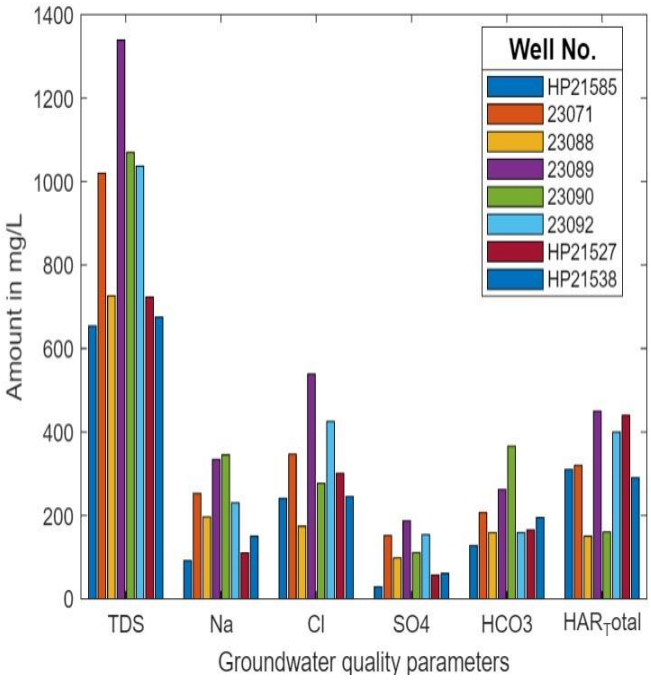


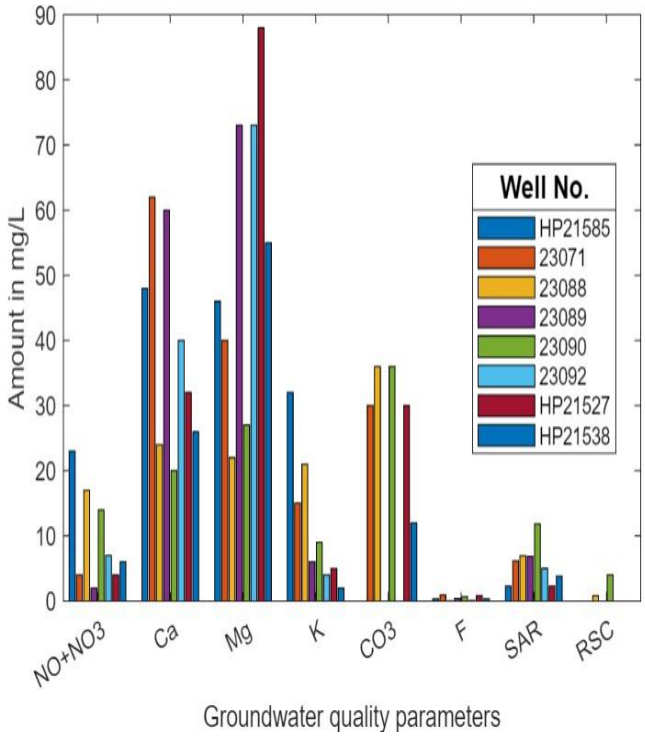


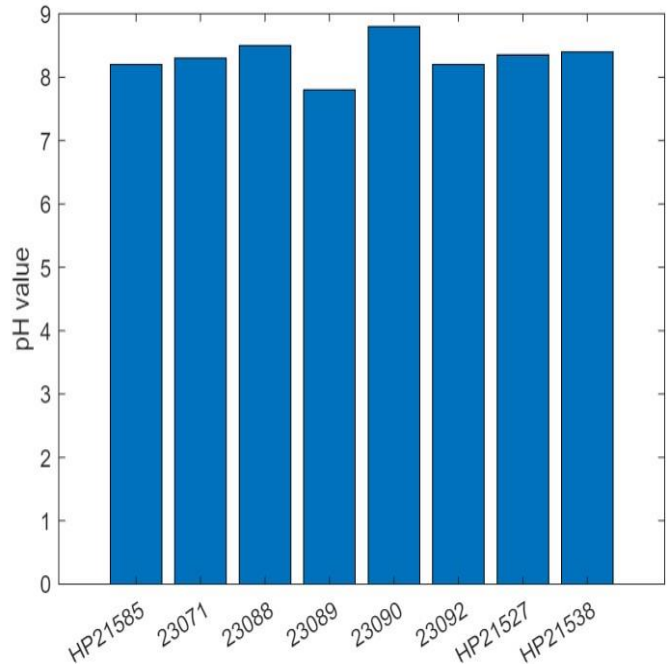


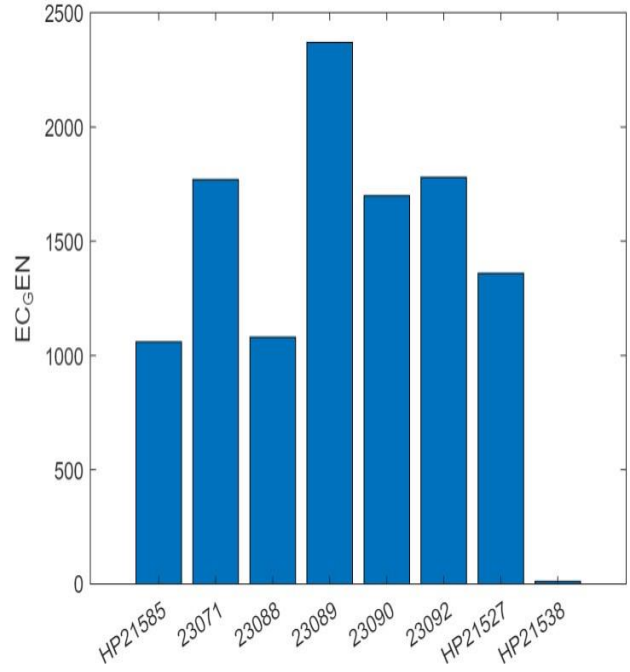


Water Quality parameters(X- Axis) vs Amount of quality parameters(Y-Axis) for different wells for the year 2013

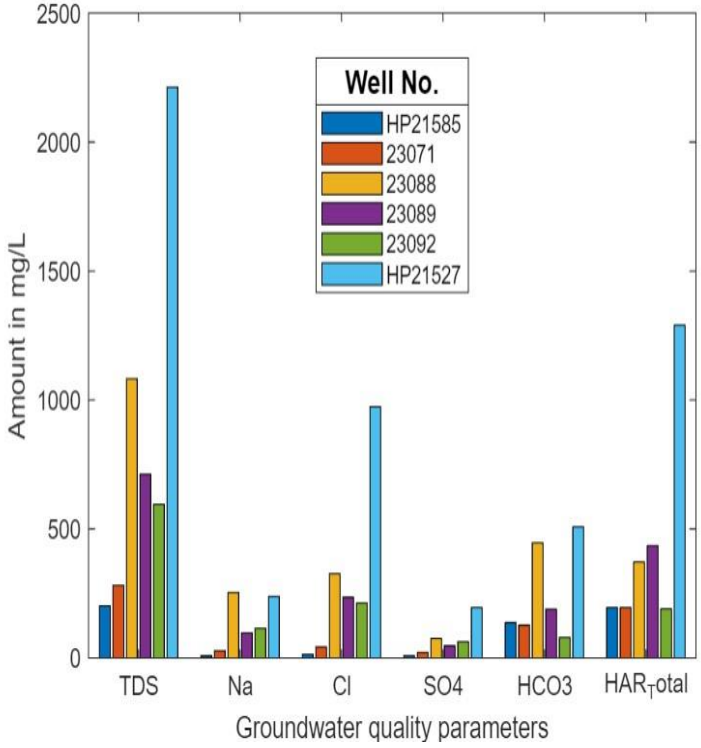


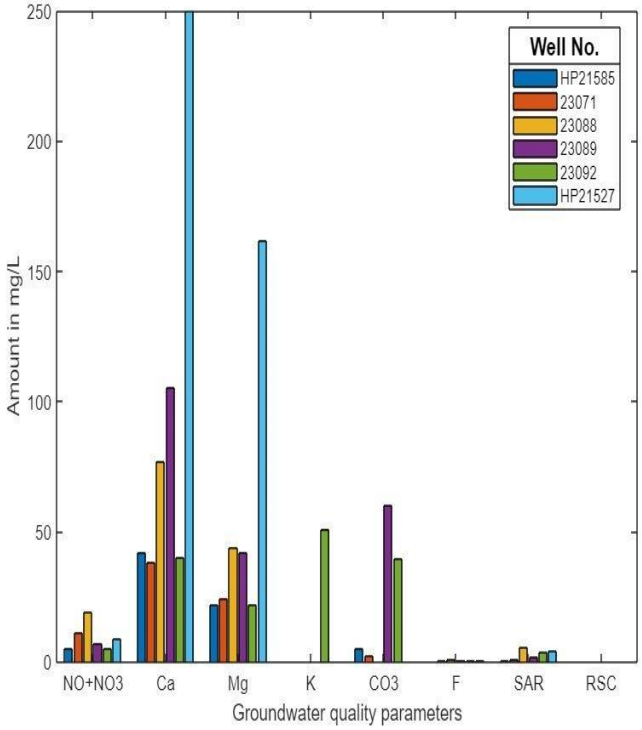


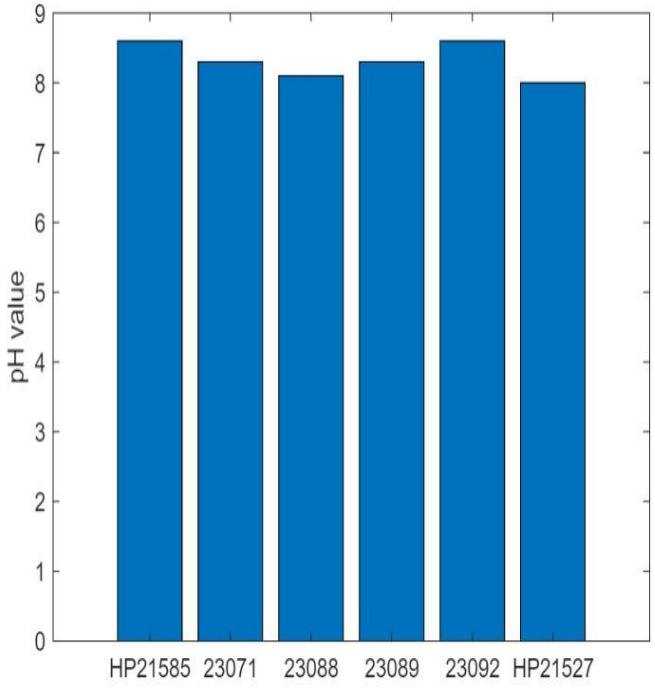


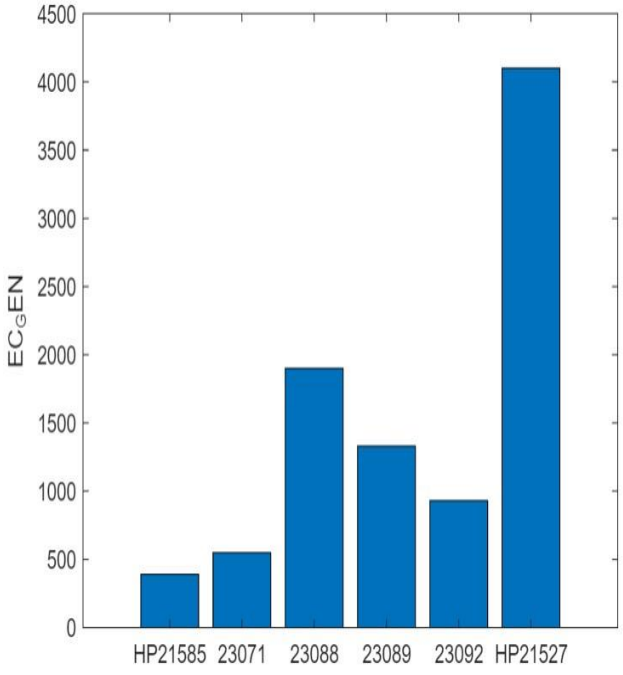


Water Quality parameters(X- Axis) vs Amount of quality parameters(Y-Axis) for different wells for the year 2014









Results and Discussions

- Water Quality parameter values were studied and were represented in a bar graph for convenience
- The use of groundwater is mainly for drinking, domestic and irrigation purpose
- So, we will check if the groundwater from different wells is suitable for drinking purpose and irrigation purpose or not

Standards for drinking water quality

pH	6.5 – 9.5
Electrical Conductance	1400
Total Dissolved Solids	600
Sodium	200
Potassium	75
Calcium	100
Magnesium	150
Chloride	250
Carbonate	-
Bicarbonate	300
Sulphate	250
Nitrate	50

Standards for irrigation water quality

pH	4.0-8.6
Total Dissolved Solids	2500mg/l
Electrical Conductivity	2250 s/cmμ
Calcium	450mg/l
Chloride	250mg/l
Sulphate	200mg/l
Potassium	100mg/l
Sodium	250mg/l

Suitability for Drinking

- We are following WHO standards to check if the water is suitable for drinking purpose or not
- pH: The value of pH for every wells lies between 8.0–8.6. Recommended pH levels for drinking water is 6.5-9.5
- Electrical Conductance: The value of electrical Conductance lies between

  390 to 4100s/cmμ. The recommended value of EC is 1400s/cmμ
- Total Dissolved Solids(TDS): The value of TDS ranges between 202-

  2213mg/L. The recommended value ranges from 200-2000mg/L
- Sodium(Na): The value of Sodium lies between 8-253mg/L. Standard value of sodium content in drinking water is around 200mg/L.
- Potassium(K): The value of Potassium content is ranging from 0.1-51mg/L. The standard amount for potassium in drinking water is around 75mg/L.
- Calcium: The content of Calcium present in sample lies between 38-250mg/L. The recommended standard is 100mg/L.

- Magnesium: The amount of Magnesium present in per litre of sample ranges between 21.87-161.595 mg/L. The recommended standard is 150mg/L.

- Chloride: Chloride quantity ranges from 43mg/L to 851mg/L. The recommended standard is 250mg/L.

- Carbonate: The amount of carbonate present in sample lies between 0-60mg/L

- Bicarbonate: The content of Bicarbonate present in sample lies between 181.4962-329.4mg/L. The recommended standard is 300mg/L.

- Sulphate: The value of sulphate content of the wells ranges from 23508 mg/L. The recommended standard is 250mg/L.

- Total Hardness: The value of Total Hardness ranges from 1501290mg/L. The recommended standard is 500mg/L.

Suitability for Irrigation

- We are following International standards to check if the water is suitable for Irrigation purpose or not
- pH: The value of pH for every wells lies between 8.0–8.6. Recommended pH levels for Irrigation water is 4-8.6
- Electrical Conductance: The value of electrical Conductance lies between 390 to 4100s/cmμ. The recommended value of EC is 2250s/cmμ
- Total Dissolved Solids(TDS): The value of TDS ranges between 202-2213mg/L. The recommended value should be below 2500mg/L
- Sodium(Na): The value of Sodium lies between 8-253mg/L. Standard value of sodium content in Irrigation water is around 250mg/L.
- Potassium(K): The value of Potassium content is ranging from 0.1-51mg/L. The standard amount for potassium in Irrigation water is around 100mg/L.
- Calcium: The content of Calcium present in sample lies between 38-250mg/L. The recommended standard is 450mg/L.
- Chloride: Chloride quantity ranges from 43mg/L to 851mg/L. The recommended standard is 250mg/L.

- Sulphate: The value of sulphate content of the wells ranges from 23-508 mg/L. The recommended standard is 200mg/L.

- Total Hardness: The value of Total Hardness ranges from 150-1290mg/L. The recommended standard is 300mg/L.

Issues with Groundwater Quality In Vellore District

Vellore is effected with the Occurance of flouride in ground water. And other 7 districts of Tamilnadu are also effected with flouride in ground water.

Sodium Adsorption Ratio (SAR), values range from 2.4 to 19.6. With regard to irrigation Suitability based on specific electrical conductance and SAR it is observed that the Ground water in the phreatic zone may cause high to very high salinity hazard and Medium to very high alkali hazard when used for irrigation. Proper soil management Strategies are to be adopted in the major part of the district while using ground water for Irrigation

The pollution from tanneries has caused irrevocable deterioration of quality of ground Water and soil in vast areas. There is an urgent need to arrest/prevent further deterioration of ground water and soil quality through a comprehensive plan. Providing common Effluent treatment plant (CETP) and adoption of environment friendly technologies for Tanning and safe disposal of waste in the area.

Ways to increase Groundwater Quality

The quality is concerned it can be improved by examining the causes of water pollution and curbing them by proper techniques…. Such as providing the state of the art treatment plant to the industrial units. The need based use of agrochemicals in the crops which percolates in the soil deeper zone joining the aquifer and pollute the soil water.

Waste disposal:

- Properly dispose of all waste
- Ensure proper waste water discharge connections; if possible, eliminate floor drains
- Properly use and maintain on-site septic systems
- Plug and cover waste dumpsters

Hazardous materials:

- Safely store, handle, and use chemicals and fuels
- Monitor underground fuel and chemical tanks; if possible, replace above ground
- Contain storage and loading areas
- Reduce or substitute use of chemicals

Storm water:

- Keep chemicals and waste safe from rain
- Isolate drains from storage and loading areas
- Use deicing salt and pesticides sparingly

Other good management practices:

- Conduct an environmental audit
- Develop a pollution prevention plan
- Regularly inspect high risk areas
- Devise an emergency response plan

At home also we have to take some precautions they are:-

- Properly dispose of all waste; don’t dump chemicals down drains or on the ground
- Test underground fuel oil tanks for leaks; if possible, replace them above ground
- Safely store all chemicals and fuels
- Minimize the use of chemicals; always use according to directions
- Have on-site septic systems pumped and inspected every five years
- Examine on-site wells and surrounding land areas; test wells as often as pollution risk demand.
- Finally We All Must Support Protection Legislation And Programs.

Conclusion:

Groundwater quality of vellore district was found out and suitability for drinking purpose and irrigation purpose was checked using the standard values. Also, using MATLAB, a graph was made for different water quality parameter values for different years.

Fluoride content was found to be higher than the standard value. For different wells, the water quality parameters have different values.

References

- Irrigation water Iraqi standards | Download Table (researchgate.net)
- Guidelines and standards for quality of drinking water | Download Table (researchgate.net)
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