SURFACE WATER QUALITY ANALYSIS OF VIKARABAD DISTRICT BY USING ARCGIS

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ABSTRACT

Geographical Information Technologies (GITs) is very useful in the collection, management, maintenance, manipulation and presentation of geographic data and or information. The use of these technologies is known to simplify decision making to a non technical level and to support the stakeholders in sustainable-oriented decision making. Recently, it has become clear that GIS, together with Global positioning systems (GPS), aerial photography, remote sensing techniques, and other spatially related tools for decision making, comprise a larger array of complementary tools that can be grouped together under the more comprehensive Global Positioning Systems.

For making the vector map of “Surface Water Chemical Composition Quality Analysis of Vikarabad District by using thematic layer map” first we learned some pre-requisite technical aspects like ARCGIS. After getting the image it was converted into vector data with required features as borders, Polygons and stream lines. The features were represented on the map with required data. After getting the DEM image from the opentopograpy it was converted into vector data with required features as borders, Polygons and stream lines. Finally all the features were represented with the thematic layer map and the map was showed with the legend and north arrow. The final results were explained with the remedies. All the features are represented on the map with labels and symbols and finally the analysis was done. The stream lines and water bodies was said to be water storage reservoir for the sake of irrigation or drinking water. The results founded were chemical compositions with lab testing values and the remedies were given for the sake of living being.

key words: *- dem, gis, gps.*

I. INTRODUCTION

Water:

Introduction: Water is one of the basic necessities of life. We require plenty of water every day for drinking, cooking and washing. It is necessary also for cleanliness of homes and hospitals.

Sources of drinking water: The chief sources of potable water are the surface water and ground water.

The ground water is drawn by deep tube-wells and water pumps. Water is supplied to the consumers through roadside taps and house connections. In rural areas, the supply of drinking water is hopelessly inadequate.

Causes for water crisis: India has built mega dams for irrigation, but her water management system has not received due attention. We are told that water crisis has touched millions people across several states.

The over-use of groundwater has pushed down the water level far deeper below. Arsenic contaminated water made the problem more grave.

Remedy: During the monsoon, many areas of India are flooded; causing widespread damage to life and property and this enormous quantity of water is allowed to flow down into the sea. Rain water harvesting can help in preservation of rain water, which can be used later for several purposes.

Water Pollution:

Water pollution has been an increasing problem over the last few years. Pollution itself is when a substance or energy is introduced into the soil, air, or water in a concentrate. Pollution comes in many forms; agricultural, urban runoff, industrial, sedimentary, animal wastes, and leeching from landfills/septic systems just to name a few. These pollutants are very detrimental to the environment. Whether they are alone or combined with another form of pollution they are very harmful. Over the last hundred years the problems with pollution have been increasing with time. This is due to both the increase in human population, and the increases in technology we have made as a society. If we plan on having our resources here for many years to come we are going to have to make some drastic changes in the way we treat the earth, and these changes will have to start with our pollutants.

Agricultural pollution is a very big contributor to water pollution. Problems we see with agriculture are applications of fertilizers, insecticides, and pesticides. We have made vast improvements in the types of chemicals we are using, as to how environmentally friendly they are. Yet even today the effects of these chemicals are very harsh, for instance:

"The annual total output of pesticides in the India is more than 2.5 billion pounds with 1500 active ingredients in some 45,000 products. Each year, approximately one billion pounds of pesticides containing more than 600 active ingredients, are applied to farms and gardens. Of this quantity, an estimated of 3.5 to 21 million pounds reach surface waters before degrading. (Rural Groundwater Contamination)

1.1. Types of Drinking Water Contaminants:

The Safe Drinking Water Act defines the term "contaminant" as meaning any physical, chemical, biological, or radiological substance or matter in water. Therefore, the law defines "contaminant" very broadly as being anything other than water molecules. Drinking water may reasonably be expected to contain at least small amounts of some contaminants. Some drinking water contaminants may be harmful if consumed at certain levels in drinking water while others may be harmless. The presence of contaminants does not necessarily indicate that the water poses a health risk.

Types of Water Pollution

1. Biological

Infectious Disease (pathogens)

Oxygen-Demanding Waste

2. Chemical

Nutrients (Fertilizers)

Toxic Inorganic Material

Persistent Organic Pollutants (POPs)

3. Physical

Sediments

Thermal Pollution

Solid Waste

The following are general categories of drinking water contaminants and examples of each:

Physical contaminants primarily impact the physical appearance or other physical properties of water. Examples of physical contaminants are sediment or organic material suspended in the water of lakes, rivers and streams from soil erosion.

Chemical contaminants are elements or compounds. These contaminants may be naturally occurring or man-made. Examples of chemical contaminants include nitrogen, bleach, salts, pesticides, metals, toxins produced by bacteria, and human or animal drugs.

Biological contaminants are organisms in water. They are also referred to as microbes or microbiological contaminants. Examples of biological or microbial contaminants include bacteria, viruses, protozoan, and parasites.

Radiological contaminants are chemical elements with an unbalanced number of protons and neutrons resulting in unstable atoms that can emit ionizing radiation. Examples of radiological contaminants include caesium, plutonium and uranium.

Water Use in the Future

As time goes on, more and more water users will compete for what remains the same finite supply. This implies increases in water efficiency and conservation and doing even more to restore its quality after use. Nor is conservation restricted to only the uses of water: energy conservation, a desirable goal in itself, also contributes to water conservation. The reason is that reduced energy consumption lessens the need for electric power generation, which outranks all other water uses many times.

Paying for the accumulated deterioration of water supply and sewerage systems, and making up for the years of indifference and neglect our water resources have suffered is very much a part of the challenge to conserve water for our own use and for that of future generations. But if we do not learn from our past mistakes now, we will add to an already large environmental mortgage.

We must learn to use only what we need, and need what we use. In the words of one conservation slogan: "Let's keep it on tap for the future."

Biological Contamination

The presence in the environment of living organisms or agents derived by viruses, bacteria, fungi, and mammal and bird antigens that can cause many health effects.

Biological Contamination:

Pathogens are the biggest threat to food safety.

There are 4 types of Pathogens that can contaminate food. They include:

Viruses

Bacteria

Parasites

Fungi

Chemical Contamination:

The phrase 'chemical contamination' is used to indicate situations where chemicals are either present where they shouldn’t be, or are at higher concentrations than they would naturally have occurred. Chemical contaminants can be found as organic and inorganic molecules in mass produced products used day to day by almost everybody. These include plastics, resins, pharmaceuticals, disinfectants, deodorants, detergents, petroleum products, road runoff, pesticides and biocides, along with the results of land fill and incineration.

The different types of Major parameters present in water are as follows

pH, Electrical conductivity, Carbonates, Bicarbonates, Sulphates, Magnesium

Fluorine, Chlorine, Calcium, Potassium, Total hardness, SAR, RSC

Electrical Conductivity

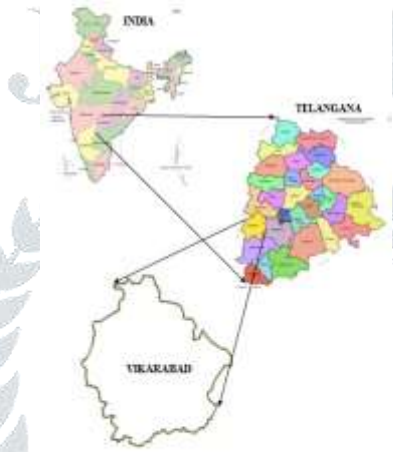
Electrical conductivity is a measure of the saltiness of the water and is measured on a scale from 0 to 50,000 us/cm. Electrical conductivity is measured in micro Siemens per centimetre (us/cm). Freshwater is usually between 0 and 1,500 us/cm and typical sea water has a conductivity value of about 50,000 us/cm. Low levels of salts are found naturally in waterways and are important for plants and animals to grow.

Type	**Electrical Conductivity (μS/cm)**
Pure water	0.05
Distilled water	1
Rain or Snow	2-100
Surface/Ground water	50-50000
Sea water	50000

II. METHODOLOGY

Area of Study:

Vikarabad district of the Indian state of Telangana, As of 2001 India census, Vikarabad had a population of 53,185.Area of this district is 1290.54sq.km. Males constitute 26,422 of the population and females 26,763. Vikarabad has an average literacy rate of 64%, higher than the national average of 59.5%: male literacy is 72%, and female literacy is 57%. In Vikarabad, 13% of the population is under 6 years of age.



Location Map

Flow chart

Procedure:

Attaching of toposheet or any data to the arc map:

ArcMap:

To Open ArcMap.Open ArcMap through Start button - all programs – ArcGIS- ArcMap. It opens the ArcMap window as shown below. Add the image using add (+) data tool which is located on the standard tool bar. Add data tool as shown below and go to the location of toposheet - Add - Yes - Ok. To add either raster or vector data we use the same tool as above. After adding the image it looks as shown below. The attached data is unreferenced so reference the data with existing coordinate points on the image and take the current location points as source.

Geo Referencing:

After adding the image do the geo referencing by using geo referencing tool bar. Now add Geo referencing toolbar, by right clicking on the screen. Create a note pad with coordinate points as source and destination save it. Now select view link table. Select the load tool – and select the notepad - open - it adds the points whichever we saved and select auto adjust it moves the image to the referenced location , to assign the coordinates select update geo referencing tool from geo referencing menu, now the referencing will be done. Do the same procedure for another image.

To assign the coordinate system - Open Arc Catalog - Select the image - right click - properties - In general - spatial reference - Edit - Geographic coordinate system - World - WGS 1984 - Ok - Ok. Now the toposheet will be referenced properly and updated

Flow Direction:

This tool takes a surface as input and outputs a raster showing the direction of flow out of each cell. If the Output drop raster option is chosen, an output raster is created showing a ratio of the maximum change in elevation from each cell along the direction of flow to the path length between centres of cells and is expressed in percentages. If the Force all edge cells to flow outward option is chosen, all cells at the edge of the surface raster will flow outward from the surface raster.

Flow Accumulation:

The Flow Accumulation tool calculates accumulated flow as the accumulated weight of all cells flowing into each down slope cell in the output raster. If no weight raster is provided, a weight of 1 is applied to each cell, and the value of cells in the output raster is the number of cells that flow into each cell.

In the graphic below, the top left image shows the direction of travel from each cell and the top right the number of cells that flow into each cell.

Conditional: The Conditional tools allow you to control the output values based on the conditions placed on the input values. The conditions that can be applied are of two types, those being either queries on the attributes or a condition based on the position of the conditional statement in a list.

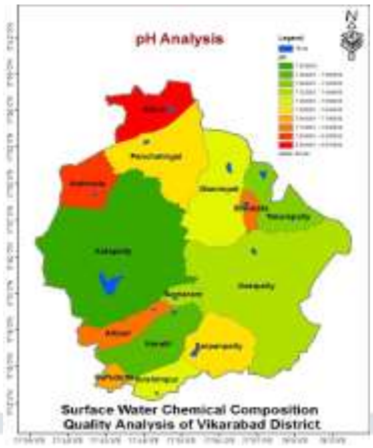
Stream Order:

Stream ordering is a method of assigning a numeric order to links in a stream network. This order is a method for identifying and classifying types of streams based on their numbers of tributaries. Some characteristics of streams can be inferred by simply knowing their order. For example, first-order streams are dominated by overland flow of water; they have no upstream concentrated flow. Because of this, they are most susceptible to non-point source pollution problems and can derive more benefit from wide riparian buffers than other areas of the watershed.

Water Basins:

The drainage basins are delineated within the analysis window by identifying ridge lines between basins. The input flow direction raster is analyzed to find all sets of connected cells that belong to the same drainage basin. The drainage basins are created by locating the pour points at the edges of the analysis window (where water would pour out of the raster), as well as sinks, then identifying the contributing area above each pour point. This results in a raster of drainage basins.

III. RESULTS AND DISCUSSIONS

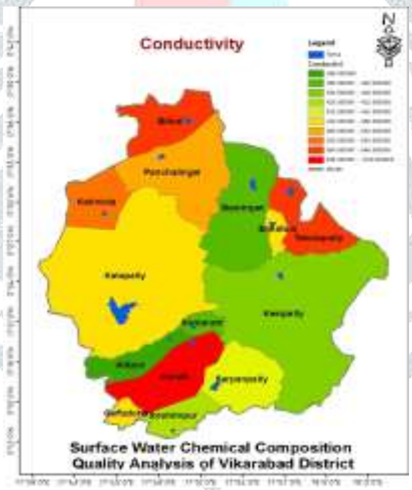


Drinking Water Limits As Per IS: 10500; 2012:

Desirable Limits: 6.5 – 8.5, Permissible: No relaxation.

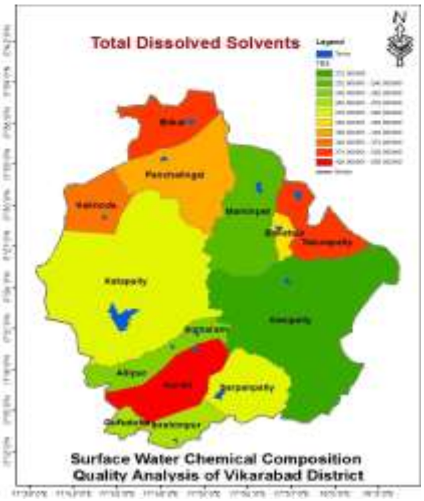
Effects: Low pH - corrosion, metallic taste, High pH – bitter/soda taste, deposits.

Treatment: Increase pH by soda ash, Decrease pH with white vinegar / citric acid.



Effects: Effects Water Quality and its aquatic life, and also affects dissolved oxygen solubility.

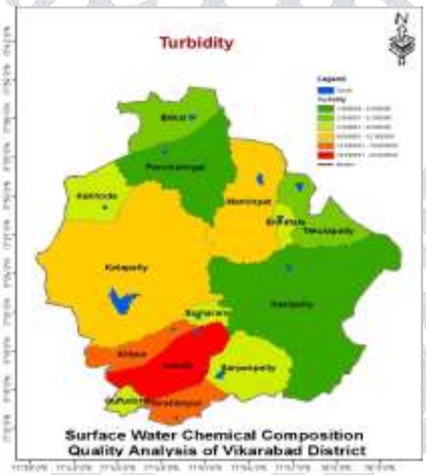
Treatment: No Treatment, We can only measure Conductivity.



Desirable Limits: 500 mg/l,Permissible Limits: 2000 mg/l,

Risks or effects: Hardness, scaly deposits, sediment, cloudy colored water, staining, salty or bitter taste, corrosion of pipes and fittings.

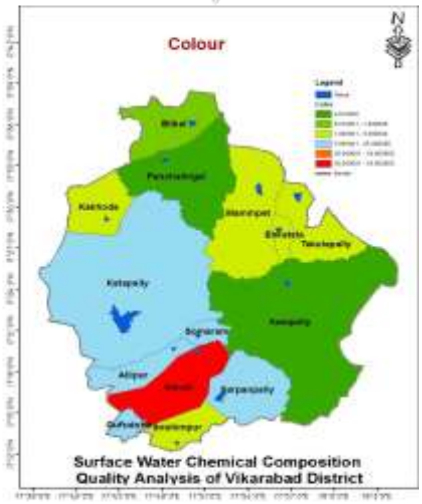
Treatment: Reverse Osmosis, Distillation, deionization by ion exchange.



Desirable Limits: 1 max, Permissible Limits: 5 max.

Effects: Makes Water cloudy and murky.

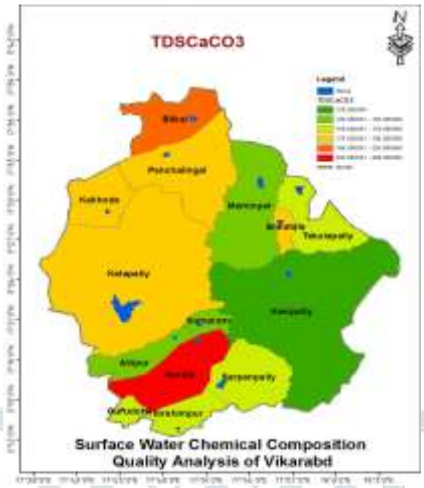
Treatment: Flocculation and Coagulation process.



Desirable Limits: 5 Hz, Permissible Limits: 15 Hz.

Risks or effects: Visible tint, acceptance decreases.

Treatment: Filtration, Distillation, Reverse osmosis, Ozonisation



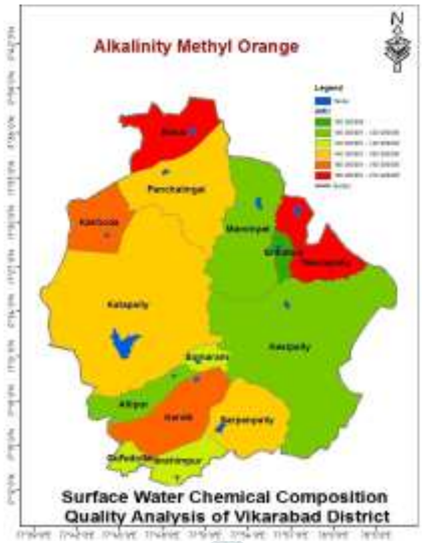
Desirable Limits: 200 max,Permissible Limits: 600 max.

Effects: Irritation on direct contact and drying of skin.

Treatment: Precipitation Softening and Warm lime softening

Effects: Improper Digestion, Metabolic abnormalities, Cardio Vascular Problems.

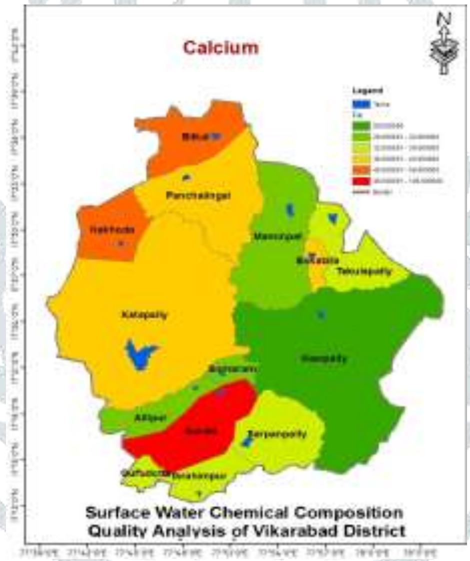
Treatment: Alkalinity Water Treatment Process.



Desirable Limits: 200 max, Permissible Limits: 600 max.

Effects: Improper Digestion, Metabolic abnormalities, Cardio Vascular Problems.

Treatment: Alkalinity Water Treatment Process.

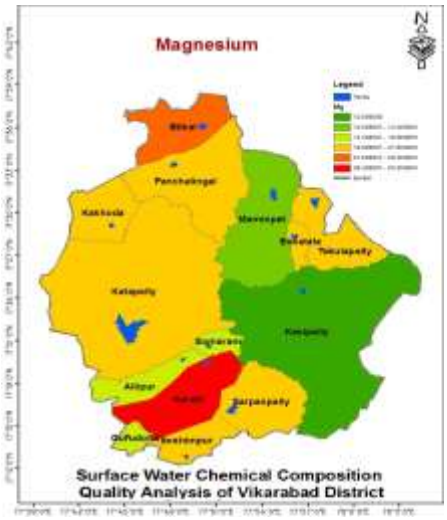


Poor lathering and deterioration of the quality of clothes; incrustation in pipes; scale formation.

Desirable Limits: 75 max, **Permissible Limits:** 200 max.

Effects: Increase bowel movements, Loosen Stools, Constipation.

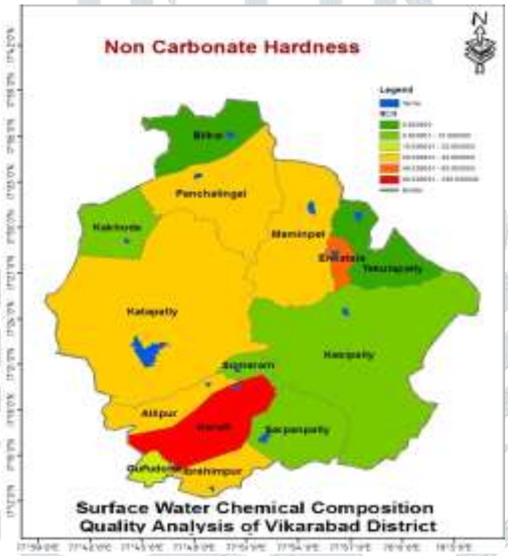
Treatment: Water Softening Process.



Desirable Limits: 30 max, Permissible Limits: 100 max

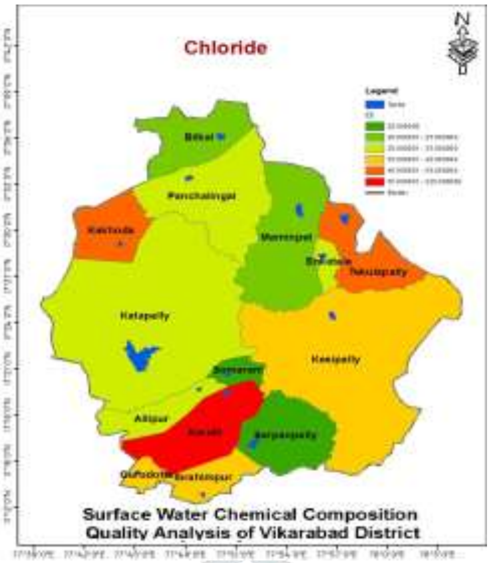
Effects: No Health Effects.

Treatment: No treatment is needed.



Effects: Does not Produce Lather.

Treatment: No Treatment.



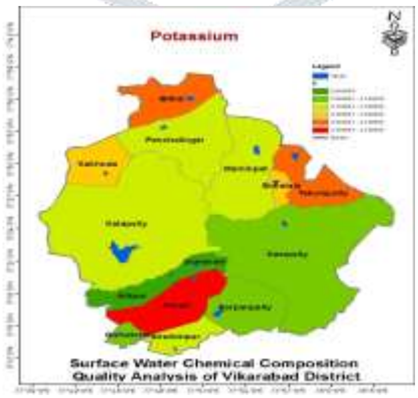
Desirable: 250 mg/l,**Permissible:** 1000 mg/l.

Risks or Effects: High blood pressure, salty taste, corroded pipes, fixtures and appliances, blackening and pitting of stainless steel.

Treatment: Reverse Osmosis, Distillation, Activated Carbon

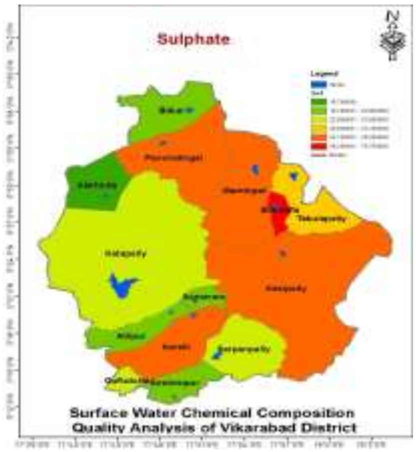
Effects: Increases the blood pressure and Leads to heart problems.

Treatment: Reverse Osmosis Process and Distillation Process.



Effects: No Health Effects.

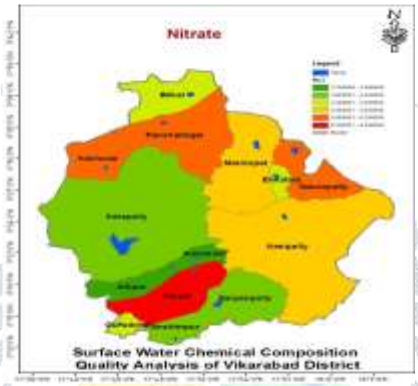
Treatment: No treatment is needed



Desirable: 200 mg/l, **Permissible:** 400 mg/l.

Risks or effects: Bitter, medicinal taste, scaly deposits, corrosion, laxative effects, "rotten-egg" odor from hydrogen sulfide gas formation.

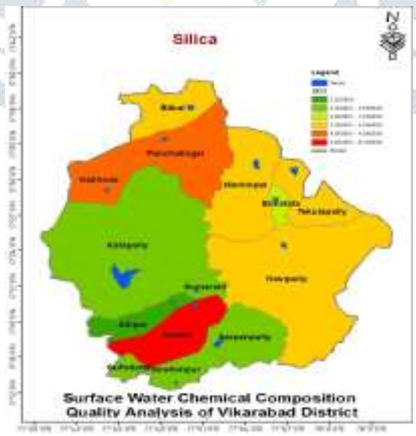
Treatment: Ion Exchange, Distillation, Reverse Osmosis.



Desirable: 45 mg/l, **Permissible:** No Relaxation.

Risks or effects: Methemoglobinemia or blue baby disease in infants.

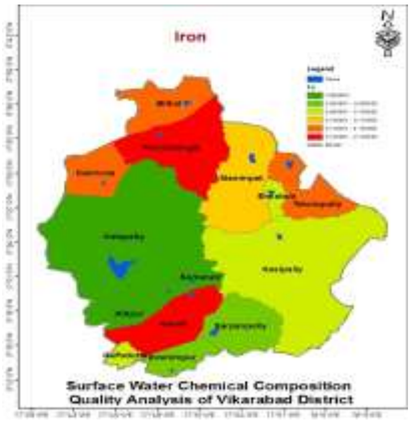
Treatment: Ion Exchange, Distillation, Reverse Osmosis.



Desirable Limits: 05 max, Permissible Limits: No Relaxation.

Effects: Alzheimer's disease and associated disorder on high intake cognitive impartment on low intake.

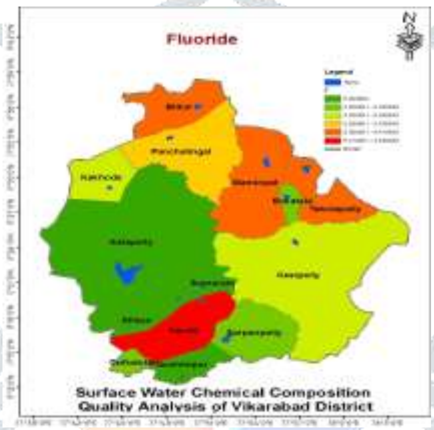
Treatment: Ion Exchange Method, Reverse Osmosis Process, Lime softening.



Desirable Limit: 0.3 mg/l, Permissible limit: No Relaxation.

Risks or effects: Brackish color, rusty sediment, bitter or metallic taste, brown green stains, iron bacteria, discolored beverages.

Treatment: Oxidizing Filter, Green-sand Mechanical Filter.



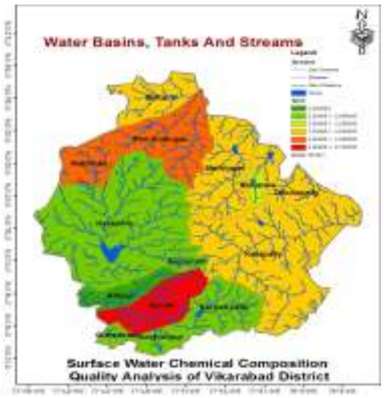
Desirable: 1.0 mg/l, **Permissible:** 1.5 mg/l.

Risks or effects: Brownish discoloration of teeth, bone damage.

Treatment: Activated Alumina, Distillation, Reverse Osmosis, Ion Exchange

Drainage System Maps

The above map shows the drainage network with water tanks, which indicates the flow direction and source of water collection.



The above map shows the drainage network with water tanks and water basins which indicates the flow direction and source of water collection to the water basins.

Results :

Area of Sample Collection	Sarpanpally	Somaram	Erkatala	Ibrahimpur	Katapally
	1	2	3	4	5
pH at 25°C	7.64	7.41	7.84	7.55	7.2
Conductivity at 25°C	442	394	464	432	468
Total Dissolved Solids	288	262	308	278	290
Turbidity	8.96	7.2	9.6	16.8	12.8
Color	10	10	5	5	10
Total Hardness $CaCO_3$	170	150	180	170	180
Alkalinity – Phenolphthalein	Nil	Nil	Nil	Nil	Nil
Alkalinity – Methyl Orange	160	140	100	130	150
Calcium Ca	36	32	40	36	40
Magnesium Mg	19.2	16.8	19.2	19.2	19.2
Non – Carbonate Hardness	10	10	80	40	30
Chloride Cl	20	20	35	40	35
Sodium Na	20	18.4	20	17.5	21.2
Potsium K	2.1	2	2.5	2.3	2.3
Sulphate SO_4	24.3	21	70.7	21.3	25.6
Nitrate NO_3	4	3.8	5	4.1	4.4
Silica SiO_2	2.8	2.6	3.2	2.8	2.7
Iron Fe	0.08	0.06	0.1	0.08	0.06
Fluoride F	0.3	0.2	0.3	0.2	0.2

Area of Sample Collection	Kerelli	Allipur	Bilkal	Gurudotta	Kakhoda
	6	7	8	9	10
pH at 25°C	7.26	7.81	8.67	7.74	8.2
Conductivity at 25°C	1102	386	614	462	564
Total Dissolved Solids	658	256	436	278	374
Turbidity	49.8	18.6	53	8.6	7.9
Color	40	20	1	10	5
Total Hardness $CaCO_3$	480	150	230	160	190
Alkalinity – Phenolphthalein	Nil	Nil	30	Nil	Nil
Alkalinity – Methyl Orange	180	120	210	140	180
Calcium Ca	100	32	48	36	44
Magnesium Mg	55.2	16.8	26.4	16.8	19.2
Non – Carbonate Hardness	300	30	Nil	20	10
Chloride Cl	225	30	25	40	50
Sodium Na	28.1	17	31.3	29.2	38.4
Potsium K	3.1	2	2.7	2.1	2.5
Sulphate SO_4	37.9	22.8	21.9	25.1	19.7
Nitrate NO_3	8.5	3.7	5	4.7	6.3
Silica SiO_2	6.7	2.2	3.6	2.8	4.8
Iron Fe	0.14	0.06	0.12	0.1	0.12
Fluoride F	0.5	0.2	0.4	0.3	0.36

Area of Sample Collection	Maminpet	Tekulapally	Kesipally	Panchalingal
	11	12	13	14
pH at 25°C	7.58	7.32	7.46	7.64
Conductivity at 25°C	390	646	428	502
Total Dissolved Solids	246	410	232	346
Turbidity	11.6	4.6	2.9	1.8
Color	5	5	<01	<01
Total Hardness $CaCO_3$	140	170	120	190
Alkalinity – Phenolphthalein	Nil	Nil	Nil	Nil
Alkalinity – Methyl Orange	110	200	110	160
Calcium Ca	32	36	28	40
Magnesium Mg	14.4	19.2	12	21.6
Non – Carbonate Hardness	30	Nil	10	30
Chloride Cl	25	55	40	30
Sodium Na	21.6	66.2	39.8	24.4
Potsium K	2.3	2.7	2.1	2.3
Sulphate SO_4	38.2	33.1	36.1	36.7
Nitrate NO_3	5.6	6.3	5.6	6
Silica SiO_2	3.9	4	3.8	4.4
Iron Fe	0.11	0.12	0.1	0.13
Fluoride F	0.4	0.41	0.36	0.38

IV. CONCLUSION

From the above results that the Geographical Information Technology was very useful in the collection, management, maintenance, manipulation and presentation of geographic data and or information. The use of these technologies is known to simplify decision making to a non-technical level.

For making the vector map of "Surface Water Chemical Composition Quality Analysis of Vikarabad by thematic layer" first we learned some pre-requisite technical aspects like ARCGIS. After getting the DEM image from the open topography, it was converted into vector data with required features as contours and stream lines. All the features are represented on the map with labels and symbols and finally the analysis was done. Theses stream lines and water bodies was said to be water storage reservoir for the sake of irrigation or drinking water.

The results founded were chemical composition values. These values are almost within the desirable limits, so we can use for the drinking purpose and also for irrigation purposes etc

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