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ASSESSMENT OF GROUNDWATER QUALITY INDEX USING GIS AT TIRUPATHI, INDIA

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Abstract - *Groundwater is the most important natural resource required for drinking to many people around the world, especially in rural areas. An attempt has been made in order to determine spatial distribution of groundwater quality parameters and to identify places with the best quality for drinking within the study area based on: an integrated analysis of physical-chemical parameters, use of Geographical Information System and Water Quality Index calculation. The physico-chemical results were compared to the standard guideline values as recommended by the Bureau of Indian standards for drinking and public health in order to have an overview of the present groundwater quality. According to the overall assessment of the basin, almost all the parameters analysed are above the desirable limits of standards. Using Geographic Information System, spatial distribution maps of physico-chemcial parameters and Water quality index have been created. The spatial analysis of ground water quality patterns of the study area shows that the Total Dissolved Solids values are similar throughout the sample station. The spatial distribution map of Total hardness shows that a majority of the groundwater samples are in the permissible limit only. The index was used to assess the suitability of groundwater from the study area for human consumption. From the index assessment, over 82% of the water samples fall within the "Poor", are unsuitable for drinking purposes.*

Key Words: *Ground water; Water Quality Parameters; Water Quality Index; Spatial Distribution; Geographic Information System*

1. INTRODUCTION

The availability of a water supply adequate in terms of both quantity and quality is essential to human existence. The demand for water has increased over the years and this has led to water scarcity in many parts of the world. The situation is aggravated by the problem of water pollution or contamination. India is heading towards a freshwater crisis mainly due to improper management of water resources and environmental degradation. This leads to lack of access to safe potable water supply to millions of people. This freshwater crisis is already evident in many parts of India, varying in scale and intensity depending mainly on the time of the year. According to WHO organization, about 80% of all the diseases in human beings are water borne. Further the groundwater, and the pollutants it may carry move with such a low velocity that it may take considerable time for the contaminants to move away from the source of pollution and also degradation in the groundwater quality may remain undetected for years. Once the groundwater is contaminated, its quality cannot be restored by arresting the pollutants from the source. It therefore becomes imperative to regularly monitor the quality of groundwater and to device ways and means to protect it. Water quality index is one of the most effective tools to communicate information on overall quality status of water to the concerned user community and policy makers. Thus, it becomes an important parameter for the assessment and management of groundwater. The purpose of the present study is to estimate the groundwater quality in the Tirupati and thematically represent it using Geographic Information System (GIS) for understanding of the present scenario at a glance.GIS can be used as a powerful tool for developing solutions for water resources problems for assessing water quality, determining water availability, preventing flooding, understanding the natural environment, and managing water resources on a local or regional scale.

1.1 Study Area

Tirupati is located on the Chittoor district of Andhra Pradesh, India. It is located at 13º 39'N & 79º 25'E. The average elevation is 162 meters. It has a population of about 4,59,985 as per 2011 census, India. This growth is because of recent inclusion of various villages into the municipal corporation area. The sex ratio of Tirupati city is 969 per 1000 males. Tirupati total geographical area is nearly 201 Sq.km and average rainfall is 1086 mm. Tirupati is famous for the richest temple Venkateswara Swami temple dedicated to Lord Venkateswara, located about 20 kilometres (12 mi) northwest of Tirupati in the Tirumala hills at an elevation of 853 metres (2,799 ft.). One of the most important pilgrimage centres in the World, the temple draws millions of pilgrims and is the busiest pilgrimage centre in the world. Tirupati City itself has several temples and is famous for its red wooden toys, copper and brass idols. Also, the city is a major economical and educational hub in the southern region of the state. Tirupati is

also the largest Metropolitan city in Rayalaseema and Southern Andhra Pradesh, and is the 4th largest city in terms of stand-alone city basis. People in this area majorly depend upon ground water for drinking and other purposes. For the past few years, Tirupati is facing a severe water scarcity due to rapid growth of population.

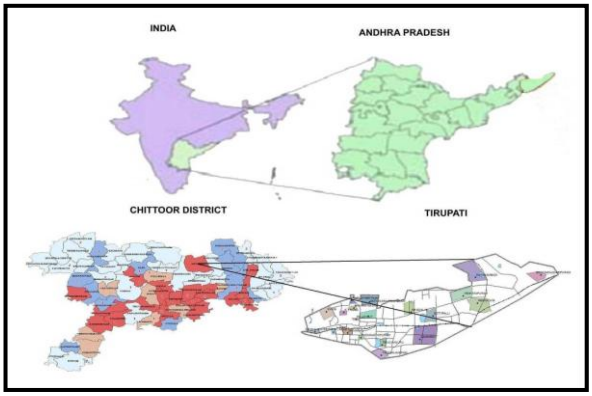


Fig -1: Location of the Study area

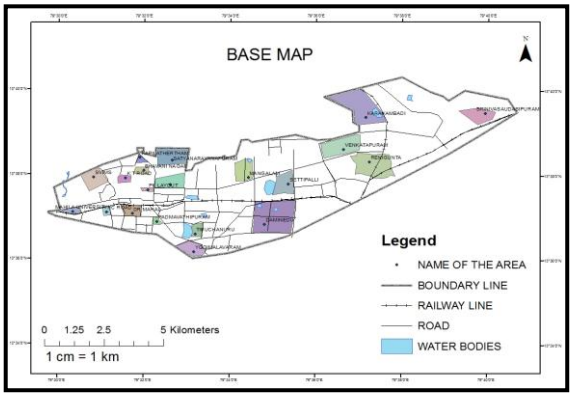


Fig -2: Base Map of the Study area

2. MATERIALS & METHODS

The ground water samples are collected manually from the bore wells which were approximately equally distributed all over Tirupati. The samples were analysed using standard procedures in the laboratory. The list of samples collected was given in Table. 1

Table – 1: Sampling location with Source points

S.NO	SAMPLING LOCATION	HABITAT	SOURCE
1	BHAVANI NAGAR	RESIDENTIAL AREA	BORE
2	T.K STREET	RESIDENTIAL AREA	BORE
3	K.T ROAD	RESIDENTIAL AREA	BORE
4	SRI PADMAVATHI MAHILA UNIVERSITY	EDUCATIONAL AREA	BORE
5	SETTI PALLI	INDUSTRIAL AREA	BORE
6	D.R MAHAL	RESIDENTIAL AREA	BORE
7	P.K LAYOUT	RESIDENTIAL AREA	BORE
8	R.C ROAD	RESIDENTIAL AREA	BORE
9	YOGIMALLAVARAM	RESIDENTIAL AREA	BORE
10	DAMENIDU	RESIDENTIAL AREA	HAND PUMP
11	TIRUCHANURU	RESIDENTIAL AREA	HAND PUMP
12	PADMAVATHIPURAM	RESIDENTIAL AREA	BORE
13	KORLAGUNTA	RESIDENTIAL AREA	BORE
14	S.I.V.M.S	HOSPITAL AREA	BORE
15	KARAKAMBADI	INDUSTRIAL AREA	HAND PUMP
16	SATYANARAYANAPURAM	RESIDENTIAL AREA	BORE
17	MANGALAM	INDUSTRIAL AREA	BORE
18	VENKATAPURAM	INDUSTRIAL AREA	WELL
19	SRINIVASAPURAM	INDUSTRIAL AREA	BORE

20	RENIGUNTA	INDUSTRIAL AREA	BORE

The Parameters, which are analysed during water analysis, Ph, Temperature, Total alkalinity, TDS, EC, Total hardness ,Calcium, Magnesium, Chloride, Iron, Fluoride, Nitrate, Sodium, Potassium, Sulphate, Phosphate.

2.1 Determination of Water Quality Index

The WQI has been calculated to evaluate the suitability of groundwater quality of the study area for drinking purposes. The WHO (2004) standards for drinking purposes have been considered for the calculation of WQI. For the calculation of WQI, Nine parameters such as: pH, TDS, Total Hardness, Calcium, Magnesium, Sulphates, Chlorides, Fluorides, Nitrates have been used. To compute WQI four steps are followed.

2.1.1 First Step: Each of 9 parameters has been assigned a weight (wi) according to its relative importance in the overall quality of water for drinking purposes. The maximum weight of 5 has been assigned to parameters such as nitrate due to their major importance in water quality assessment (Srinivasamoorthy et al., 2008). Other parameters like calcium, magnesium, sodium and potassium were assigned a weight between 1 and 5 depending on their importance in the overall quality of water for drinking purposes.

2.1.2 **Second Step:** The relative weight (Wi) is computed using a weighted arithmetic index method given below (Brown et al., 1972; Horton, 1965; Tiwari and Manzoor, 1988) in the following steps.

$$W_i = \frac{w_i}{\sum_{i=1}^{n} w_i}$$

Where, Wi is the relative weight, wi is the weight of each parameter and n is the number of parameter.

2.1.3 **Third Step:** A quality rating scale (Qi) for each parameter is assigned by dividing its concentration in each water sample by its respective standard according to the guidelines of WHO (2004) and then multiplied by 100.

$$\mathbf{Qi = (Ci / Si) \times 100}$$

Where Qi is the quality rating, Ci is the concentration of each chemical parameter in each water sample in mg/L and Si is the WHO drinking water standard for each chemical parameter in mg/L according to the guidelines of WHO (2004)

2.1.4 **Fourth Step:** The SIi is first determined for each chemical parameter, which is then used to determine the WQI as per the following equation:

$$\mathbf{SIi = Wi \times Qi}$$

Where SIi is the sub index of ith parameter and Qi is the rating based on concentration of ith parameter.

The overall water quality index (WQI) was calculated by adding together each sub index values of each groundwater samples as follows:

$$\mathbf{WQI = \Sigma SIi}$$

The Weightage values obtained by the above method were given in the Table 2.

Table -2: Water Quality Parameter, Their BIS Standards, and Weightages

PARAMETER	STANDARD(Si)	WEIGHTAGE(Wn)
P_H	8.5	**4**
TDS	500	**2**
Chloride (mg\l)	250	**3**
Total hardness (mg\l)	300	**2**
Total alkalinity (mg\l)	200	**3**
Iron (mg\l)	0.3	**1**
Fluoride (mg\l)	1	**2**
Nitrate (mg\l)	45	**3**
Calcium (mg\l)	75	**3**
Magnesium (mg\l)	30	**2**
Electrical conductivity (µs/cm)	2000	**2**

Sodium (mg\l)	200	**2**
Potassium	12	**1**
Sulphate(mg\l)	200	**2**

Based on the above WQI values, the ground water quality is rated as excellent, good, poor, very poor, and unfit for human consumption (Table 3)

Table – 3 : Water Quality Index Categories

WATER QUALITY INDEX	DESCRIPTION
0-50	Excellent
50-100	Good
101-200	Poor
201-300	Very Poor
>300	Unfit for drinking (UFD)

2.2 Creation of Database

The study is carried out with the help of two major components: toposheet and field data. The toposheet collected from the SOI demarcating all areas were scanned and digitized to generate a digital output forming a spatial database. Field work was conducted and groundwater samples were collected with the help of the map. These samples were tested using standard procedures in the laboratory and the results were tabulated in an excel worksheet. The Water Quality Index for each sample was calculated. The water quality data thus obtained forms the attribute database for the present study. The data base table consisting of average values of the parameters determined and the calculated values of the water quality index are given in the Table. 3.

2.3 Generation of Maps

The spatial and attribute database generated were integrated for the generation of the spatial distribution maps of all water quality parameters along with the Water Quality Index map. The water quality data (attribute) is linked to the sampling location (spatial) i.e. Tirupati maps showing spatial distribution were prepared using Arc Map 10.1software.

3. RESULTS AND DISCUSSIONS

3.1 Groundwater Quality Variation

The variations of the physicochemical characteristics along with WQI of the ground water in the different parts of Tirupati were presented through bar chart 1. The quality of ground water varies from place to place. It depends up on both the surface and subsurface characteristics. Presence of landfills, open dump, usage of fertilizers, disposal of industrial wastes, etc., changes the quality of ground water. Even at the same location, from seasons to seasons the quality of ground water varies. The variations of water quality were
discussed below.

Table – 4: Different parameter values

SAMPLE STATIONS	Ph	TDS Mg/l	T ºC	T.A Mg/l	T.H Mg/l	Ca Mg/l	Mg Mg/l	Cl Mg/l	E c (µS/cm)	SO4 Mg/l	P Mg/l	K Mg/l	Na Mg/l	NO3 Mg/l	F Mg/l	Fe mg/l
S1	7.6	180	30	180	210	260	133.65	309.75	1540	250	189.78	1.56	6.44	45	1.8	0.02
S2	7.5	189	29	200	215	224	111.78	177	1850	250	99.88	3.9	2.76	50	2	0.02
S3	7.77	199	29	240	200	150	66.82	132.75	1720	200	199.77	2.34	5.75	35	1.9	0.01
S4	7.95	123	30	150	200	360	194.4	309.75	2350	300	159.81	2.73	5.29	50	0.9	0.01
S5	7.85	145	31	210	190	140	85.05	309.75	2650	370	99.88	12.87	23	30	1.5	0.01
S6	7.86	178	30	210	180	400	218.7	354	3660	280	99.88	23.79	8.04	45	2	0.03
S7	7.29	198	30	180	200	90	30.37	177	1760	450	119.86	8.58	5.06	20	0.7	0.01
S8	7.7	178	30	140	190	330	176.17	354	2360	270	199.77	7.02	3.68	25	0.9	0.01
S9	7.9	197	29	220	210	340	85.05	265.5	2600	250	119.86	11.3	32.2	40	1.8	0.01
S10	8.08	145	29	150	198	40	24.3	398.25	2650	320	149.82	3.9	0	30	0.9	0.03
S11	7.5	178	30	160	190	210	103.27	354	2900	250	99.88	3.12	13.6	20	0.6	0.01
S12	8.12	145	29	180	200	46	24.3	88.5	1910	260	129.85	22.22	22.1	45	1.5	0.02
S13	7.76	134	29	160	215	340	182.25	486.75	3160	300	169.8	12.48	11.5	30	1.8	0.03
S14	7.1	187	30	170	210	204	99.63	177	1270	400	199.77	4.29	1.84	35	0.8	0.02
S15	7.68	198	29	200	170	140	60.75	177	3130	400	139.84	5.46	17	45	1	0.03
S16	7.7	156	29	160	215	240	121.5	177	1580	200	179.79	10.53	3.68	25	0.8	0.02
S17	7.1	187	30	150	180	300	157.95	265.5	3040	250	99.88	0.97	6.44	10	0.8	0.01
S18	8.04	189	29	190	190	180	85.05	177	1700	270	149.82	21.45	5.52	20	0.9	0.03
S19	7.6	156	31	200	180	200	97.2	265.5	2440	300	149.82	14.43	16.1	15	0.7	0.02
S20	7.95	189	29	170	180	80	24.3	531	4190	350	159.81	3.12	0	40	0.9	0.02

3.1.1 PH

The permissible limit of PH in drinking water is within 6.5-8.5 according to bureau of Indian standards (BIS). The value of PH in all categories of water is within the permissible range. The value of PH in groundwater samples of the study area ranges between 7.1-8.12. Measurement of pH in one of the most important and frequently used tests, as every phase of water and wastewater treatment and waste quality management is pH dependent. Maximum at S12 and minimum at S14and S17

3.1.2 Electrical Conductivity

Electrical conductivity is the ability of water to allow electric current Through it and is expressed in micro mhos per centimeter (μ mhos/cm). Conductivity value of fresh waters is in the range of 5 to 500 μmhos/cm. Maximum value of 4190μ mhos/cm was observed at S_{20} while minimum value was 1270μ mhos/cm at S_{14}

3.1.3. Total Alkalinity

The values of alkalinity at stations were found in the range of 140-240mg/l. The alkalinity values for all seasons fluctuate from 30-40mg/l. The value shows that there is very little fluctuation in alkalinity in the area. Maximum at S_3 240 mg/l and minimum at S_8 140 mg/l.

3.1.4. Total Hardness

Hardness is frequently used as an assessment of the quality of water supplies. The hardness of a water is governed by the content of calcium and magnesium salts (temporary hardness), largely combined with bicarbonate and carbonate and with sulphates, chlorides, and other an ions of mineral acids (permanent hardness) maximum at S_{13}, S_2 215mg/l and minimum at S_6, S_{19} & S_{20} 180 mg/l.

3.1.5 Iron

High levels of iron are attributed to the dominating literatic soil. Iron in drinking water may be present as geological sources, industrial wastes and domestic discharges and also from mining products. Excess amount of iron i.e., more than 10mg/l causes rapid increase in respiration, pulse rate and coagulation of blood vessels. The concentration of iron in all water samples of the study area ranges from 0.01-0.03 mg/l. Maximum at S_6, S_{10}, S_{13} & S_{18} 0.03 mg/l and minimum at $S_3, S_4, S_5, S_7, S_8, S_9, S_{11}$ & S_{17} 0.01 mg/l.

3.1.6 Fluoride

The fluoride concentrations were found to be in the range of 0.6-2.0 mg/l in ground water, fluoride concentrations vary with the type of rock that the water flows through but do not usually exceed 10mg/l. Presence of large quantities fluoride is associated with dental and skeletal fluorosis and inadequate amounts with dental caries. Maximum at S_6 2 mg/l and minimum at S_{11} 0.6 mg/l.

3.1.7 Nitrate

The nitrite concentration in the study area ranges from 10-50 mg/l. The permissible limit of nitrate is 45mg/l. Nitrates generally occur in trace quantities in surface waters but may attain high levels in ground waters. It can be toxic to certain aquatic organisms even at concentrations of 100mg/l. In excessive limits, it contributes to the illness known as methenogobinemia in infants. Maximum at S_2 & S_4 50 mg/l and minimum at S_{17} 10 mg/l.

3.1.8 Calcium

The maximum permissible and allowable concentration of calcium in drinking water in study area ranges between 2-20 mg/l. Calcium is a major constituent of various types of rocks. Calcium is a cause for hardness in water and incrustation in boilers. Calcium is an essential constituent of human being. The low content of calcium in drinking water may cause rickets and defective teeth. It is essential for nervous system, cardiac function and coagulation of blood. Maximum at S_6 400 mg/l and minimum at S_{10} 0 mg/l.

3.1.9 Chloride

The chloride concentration in the study area ranges from 2.5-15 mg/l. The permissible limit of chlorides is 250mg/l. High chloride content may harm metallic pipes and structures as well as growing plants. Chlorides in excess imparts the salty

taste to water and people are not accustomed to high chloride are subjected to laxative effect. The chloride values for all the seasons fluctuate from 481-507mg/l. Maximum at S_{20} 531 mg/l and minimum at $S_2, S_7, S_{14}, S_{15}, S_{16}$ & S_{18} 177 mg/l.

3.2.0 Magnesium

The maximum permissible limit of calcium hardness is 30mg/l. The concentration of magnesium in the study area 2-14.5 mg/l. chemical softening, reverse osmosis, electro dialysis, or ion exchange reduces the magnesium and associated hardness to acceptable levels. Maximum at S_6 218.7 mg/l and minimum at S_{10} & S_{20} 24.3 mg/l.

3.2.1 Sodium

The concentrations of sodium in the study area ranges between 0.08-1.4 mg/l in all samples person afflicted with certain diseases require low sodium concentration. Maximum at S_9 32.19 mg/l and minimum at S_{10} & S_{20} 0 mg/l.

3.2.2 Potassium

It ranks seventh among the elements in order of abundance yet its concentration in most drinking waters seldom reaches 20mg/l. However the concentrations of potassium were analysed from 0.01-0.61 mg/l. for all the samples. Maximum at S_6 23.79 mg/l and minimum at S_1 1.56 mg/l.

3.2.3 Sulphate

The major physiological effects resulting from the ingestion of large quantities of sulphate are catharsis, dehydration and gastrointestinal irritation. Sulphate may also contribute to the corrosion of distribution systems. The sulphate concentrations were found to be in the range of 200-450 mg/l. Maximum at S_7 450 mg/l and minimum at S_3 200 mg/l.

3.2.4 Phosphate

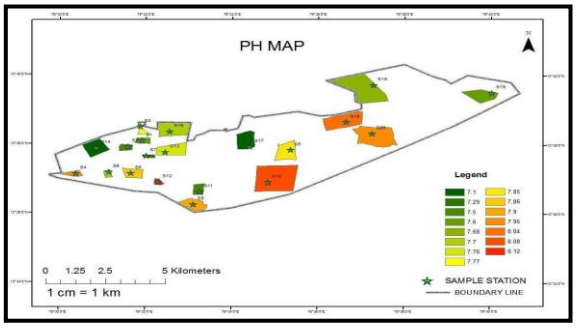
The levels of phosphate in ground water from all parts of sample stations are found to be in the range of 100-200 mg/l. High concentration of phosphate might be due to use of detergents for washing of clothes and utensil activities by the villagers around most or the dug wells. Maximum S_3 199.77 mg/l at and minimum at S_2, S_5, S_6, S_{11} & S_{17} 99.88 mg/l.

3.2.5 TDS

Concentration of dissolved solids in groundwater decides its applicability for drinking, irrigation or industrial purposes. Concentration of dissolved matter in water is given by the weight of the material on evaporation of water to dryness up to a temperature of 180ºC. The values are expressed in mg/l. Major constituents of TDS include Bicarbonates (HCO^3-), Sulphates (SO_4^{2-}) and Chlorides (Cl^-) of Calcium, Magnesium, Sodium and Silica. Groundwater containing more than 1000 mg/l of total dissolved solids is generally referred as brackish water. In the study area, TDS in groundwater ranges from 199 to 123 mg/l. Maximum at S_3 199 mg/l and minimum at S_4 123 mg/l.

3.2.6 Temperature

The temperature of the sample is taken when the sample is collected using the standard thermometer. The average temperature of the ground water in Tirupati is around 30ºc. The temperature at the sampling stations, S_2, S_3, S_9, S_{10}, S_{12}, S_{13}, S_{15}, S_{16}, S_{18}, S_{20} is 29ºc and at S_5, S_{19} is 31ºc and remaining stations it is 30ºc.


PH MAP
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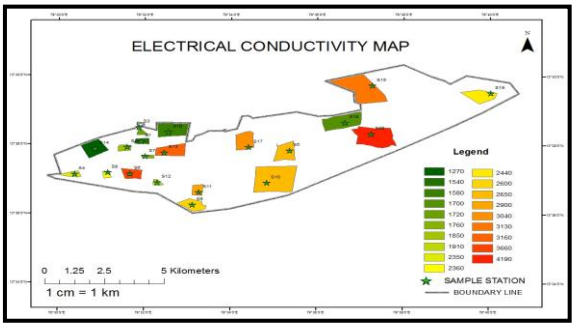
SAMPLE STATION
BOUNDARY LINE


ELECTRICAL CONDUCTIVITY MAP
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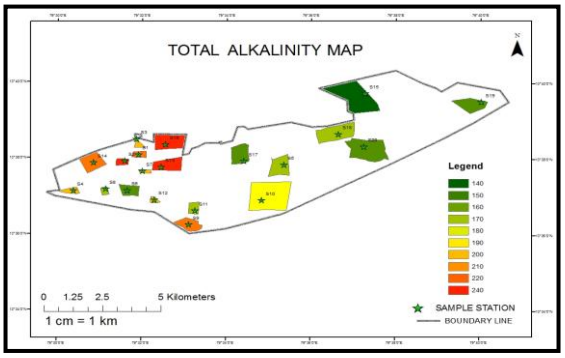
SAMPLE STATION
BOUNDARY LINE


TOTAL ALKALINITY MAP
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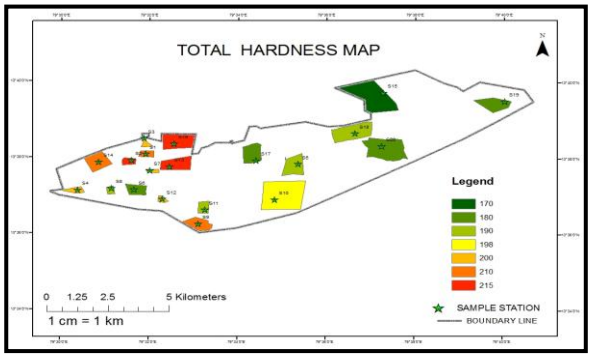
SAMPLE STATION
BOUNDARY LINE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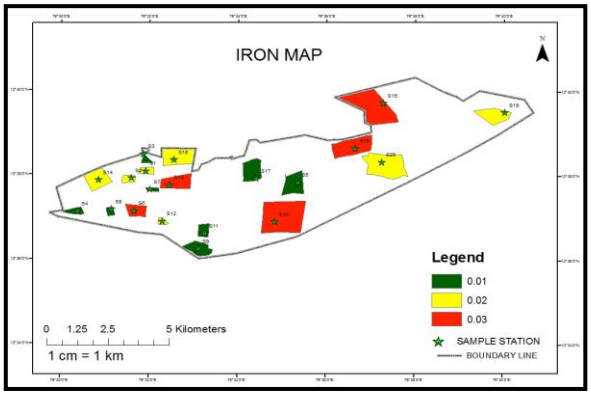
IRON MAP
Legend
0.01
0.02
0.03
0 1.25 2.5 5 Kilometers
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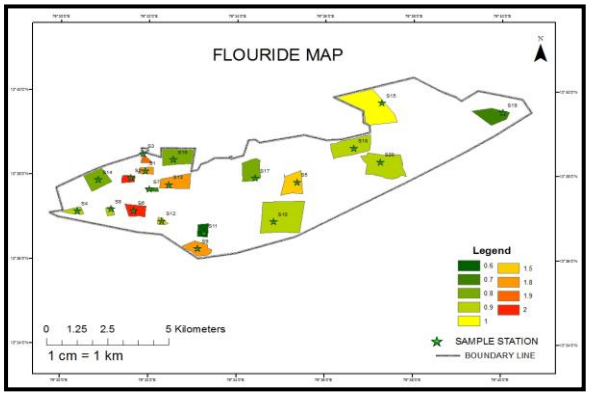
SAMPLE STATION
BOUNDARY LINE


FLOURIDE MAP
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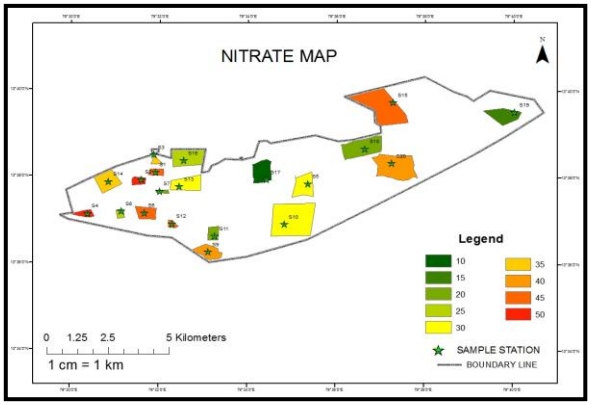
SAMPLE STATION
BOUNDARY LINE


NITRATE MAP
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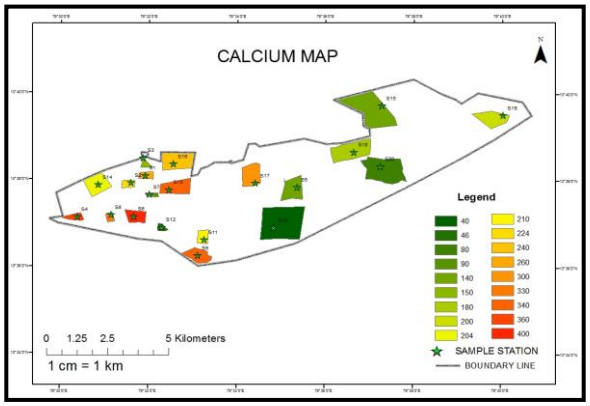
BOUNDARY LINE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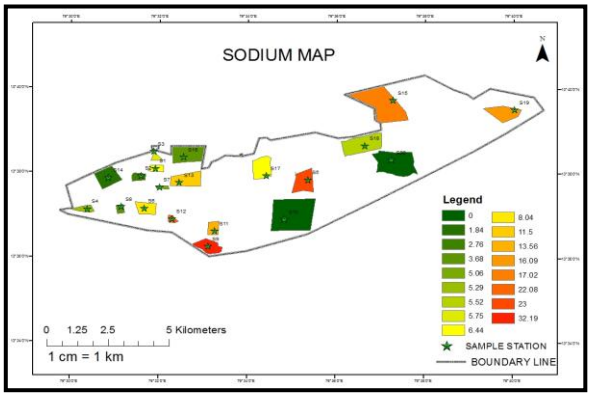
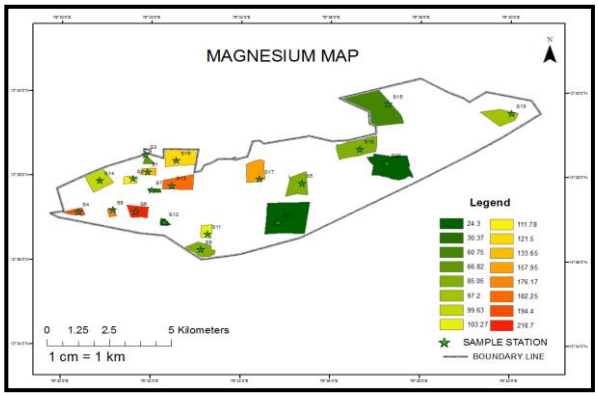
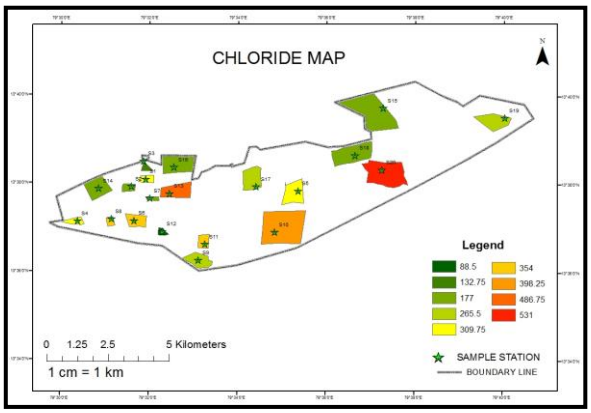
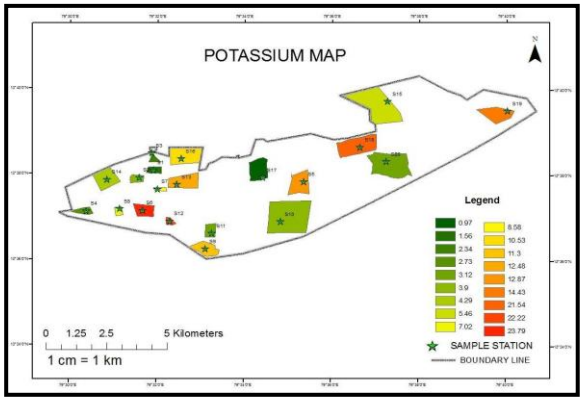
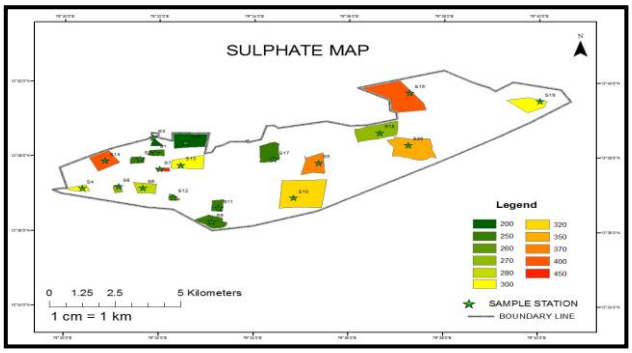
BOUNDARY LINE

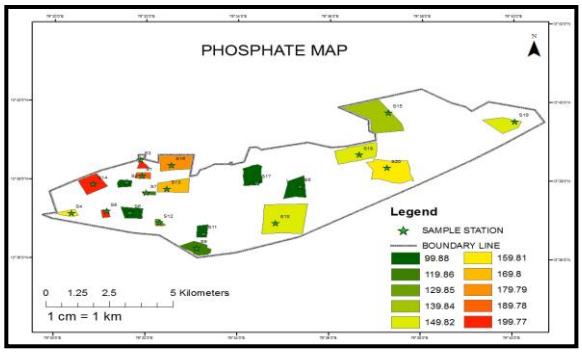


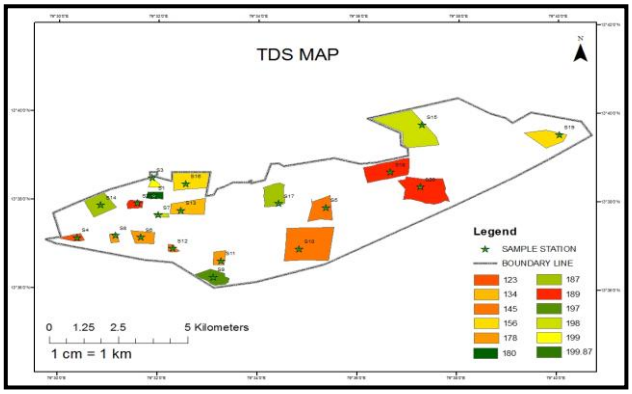












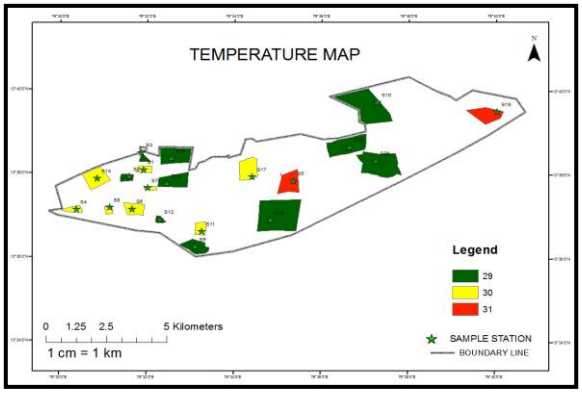


Fig -3: Map showing 16 Parameters values for the sample station

3.2. WATER QUALITY INDEX

The water quality index (WQI) of major areas in Tirupati was found to be good and poor. The WQI in areas that groundwater in Bhavani nagar, T.K Street, K.T Road, Sri Padmavathi mahila university, Setti palli,D.RMahal,R.Croad,Yogimallavaram,Tiruchanuru,Korlagunta,S.I.V.M.S,Karakambadi,Satyanarayanapuram,Mangalam,Venkatapuram,Srinivaspuram,Renigunta was found to be unsuitable for drinking purposes. Whereas the water quality index in areas like Padmavathipuram, Damenidu, P. k layout was found to be good. The main reasons we have observed are open dumping of solid wastes, misused ponds, use of fertilizers, etc., The map showing the variation of the WQI in the sample station areas with bar chart.

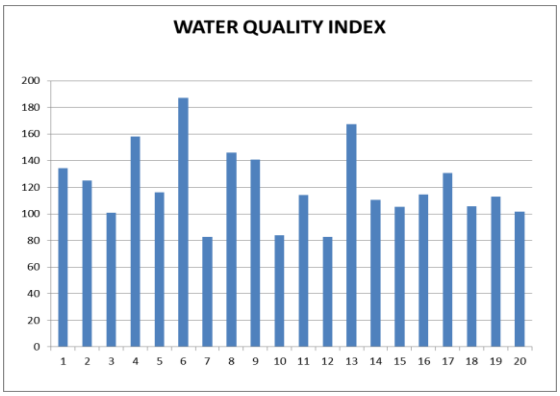


Chart -1: Bar chart for the WQI

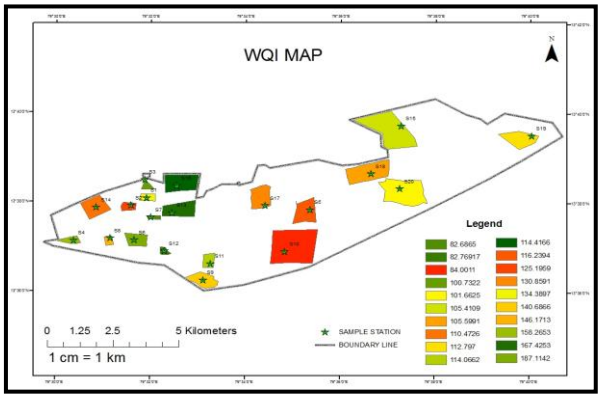


Fig – 4: The values of WQI for the samples

Table 6 Representing the WQI for the following sample station

SAMPLE STATIONS	SAMPLE STATION	WQI
1	BHAVANI NAGAR	134.3897
2	T.K STREET	125.1959
3	K.T ROAD	100.7322
4	SRI PADMAVATHI MAHILA UNIVERSITY	158.2653
5	SETTI PALLI	116.2394
6	D.R MAHAL	187.1142
7	P.K LAYOUT	82.6865
8	R.C ROAD	146.1713
9	YOGIMALLAVARAM	140.6866
10	DAMENIDU	84.0011
11	TIRUCHANURU	114.0662
12	PADMAVATHIPURAM	82.76917
13	KORLAGUNTA	167.4253
14	S.I.V.M.S	110.4726
15	KARAKAMBADI	105.4109
16	SATYANARAYANAPURAM	114.4166
17	MANGALAM	130.8591
18	VENKATAPURAM	105.5991
19	SRINIVASAPURAM	112.797
20	RENIGUNTA	101.6625

4. CONCLUSION

The present work reveals whether the water is suitable or unsuitable for drinking purposes in the area. The major conclusions drawn from the study were given below. It is observed that the areas like Bhavani nagar, T.K Street, K.T Road, Sri Padmavathi mahila university, Settipalli,D.R. Mahal, R.C road, Yogmallavaram, Tiruchanuru,
Korlagunta, S.I.V.M.S, Karakambadi, Satyanarayanapuram, Mangalam, Venkatapuram, Srinivaspuram,Renigunta had water quality which is poor for drinking. Necessary measures are to be taken to supply safe drinking water to the people living in the villages.
It is observed that the fluoride concentration is high in the area, D.R Mahal, Bhavani nagar, T. k Street, k.t road, Settipalli, Yogimallavaram, Padmavathipuram, Korlagunta. In other areas it is found to be within desired limits.Renigunta, Srinivaspuram, Mangalam, korlagunta, Tiruchanuru, Damenidu, Yogimallavaram, R.C Road, D.R Mahal , settipalli, Sri Padmavathi Mahila university, Bhavani nagar was found to be affected by the high chloride concentration whereas the other areas found to be having chloride concentration with in permissible limits.Alkalinity was found to be high in the areas like K.T road, settipalli, D.r Mahal, Yogimallavaram.Total hardness was found to be high in Bhavani nagar, T.K.Street, Yogimallavaram, Satyanarayanapuram, Korlagunta, S.I.V.M.S to be high Whereas the other areas found to be having hardness with in permissible limits. Total dissolved salts were within in the permissible limit for all areas ph was found to be within the permissible limit in all the areas, Highest Ph can be seen at Padmavathipuram which is 8.12.Iron also found be within the permissible limit in all the areas. Potassium was found to be high in the areas like settipalli, D.R Mahal, Padmavathipuram, korlagunta, Venkatapuram, Srinivaspuram, remaining areas was within the permissible limit. Sodium was found to be within in the permissible limit for all areas. Calcium was found to be high in all areas Except Damenidu, Padmavathipuram. Nitrate was found to be high in the areas like T.K Street, and Sri Padmavathi Mahila University, remaining areas are all lies in the permissible limit. Electrical conductivity Sri Padmavathi mahila university, Settipalli, D.R Mahal, R.C Road, Yogimallavaram, Damenidu, Tiruchanuru, korlagunta, Karkambadi, Mangalam, Srinivaspuram, Renigunta was found to be high. Sulphur was found to be high except in K.T Road, Satyanarayanapuram. Magnesium was found to be high except in Renigunta, Padmavathipuram, Damenidu. As WQI is more than 100 for Bhavani nagar, T.K Street, K.T Road, Sri Padmavathi mahila university, Setti palli, D.R Mahal, R.C road, Yogimallavaram,Tiruchanuru,Korlagunta,S.I.V.M.S,Karakambadi,Satyanarayanapuram,Mangalam,Venkatapuram,Srinivaspuram ,Renigunta, water in these areas are poor for drinking. The final output has been given in the thematic representation of ground water quality. The analysis suggests that the groundwater of the area needs some degree of treatment before consumption. The study helps us to understand the quality of the water as well as to develop suitable management practices to protect the ground water resources. WQI is less than 100 in only three areas Padmavathipuram, Damenidu, P. k layout which doesn't require further treatment and hence it can be consumed directly.

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