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Case studies on impact of pollution on environment using GIS and quality index tools
(Editorial Article)

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Abstract: Surface water is available in the form of catchments, ponds, rivers etc. catchment is a hydrological body which has the source of water through precipitation and the runoff from the nearby areas. Every drop of catchment normally enters either into the river or it may evaporate if the water is not being used, at most of the areas catchments are serving as potential water resource for drinking, agriculture and for various daily day to day activities. The hydrological behavior of Catchments near to the rivers is greatly influenced by the quality of river water as the contaminants enter in to the catchments either directly or through infiltration. In the present study catchments at every village near to the river basin of Krishna River were selected to assess the quality of water and its level of suitability for consumption. Entry of contaminated soils and sediments in to the water sources from the urban runoff decreases lake water quality and increases the cost of water purification .Maintenance of good water quality in the lakes is always most important criteria for promoting good irrigation standards and drinking facilities to the nearby people along with other benefits like recreation, fisheries etc. but all these benefits are questionable in the current scenario as the water in the lakes are being contaminated by industrial and municipal waste disposal practices along with agricultural runoff at certain rural connected areas. There should be a suitable management strategies for Protecting water bodies to promote ecological balance at study area, the present study has taken up at koritapadu lake falls under the limits of guntur municipal corporation, Andhra Pradesh. Unpredictable rapid increased growth of population with increased lifting of water from the deeper crusts of earth leads severe groundwater contamination and also non-repairable damage to soil structure and its stability. The extent and severalty of damage to the groundwater and the soil depends on the nature and the toxicity of the pollutants.Keywords: Catchments, Contaminate, Hydrological, River, Surface water , Sediment ,Groundwater, Soil, quarries, White cement, lakes

I INTRODUCTION

In the world scenario river banks are the significant potential resources behind the flourished civilization of human kind, however now a days they are getting disturbed due to rapid urbanization, increased and uncontrolled population along with unpredictable climatic conditions such as extended summer periods with reduced rainy seasons. Recognising and protecting catchments are the most important assignment to meet the continuous increase of water demand for human kind. Catchment is nothing but an area where the water enters either by rainfall or runoff then eventually flows back as single stream in to the nearby river basins or seas. In most of the areas catchments serves as source for drinking and also for agricultural to uplift the yield of agricultural productivity. As water resources are depleting gradually there is a pressure on effective management of catchments which can be done by taking measures such as reducing average runoff contamination in catchment areas, improving conditions for effective

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hydrological cycle through which major quantity of rainfall enters into the catchments along with maintenance of perfect equilibrium between the protecting and utilization of water resources for sustainable development of catchments at river basin.
There is a significant development in the fields of geospatial engineering for developing a model to obtain the information. on water resources by adopting overlaying techniques. GIS helps to access the information of entire catchment area and its quality of water more accurately than any other available technologies. By keeping this in view we have initiated this study for affective utilization and improved management of catchments by using geospatial engineering to uplift the hydrological characteristics with respect to its quality along the river banks. In this study six catchments from six villages in two mandalas very near to the Krishna River falls under the jurisdictions of guntur district andhra pradesh were identified to address the existed water quality scenario of catchments.

2. OBJECTIVES

1. To assess the quality of water in the catchments of study area and creation of GIS maps for water quality along with design of suitable strategies to promote sustainable environmental conditions along the river banks.
2. To determine the quality of lake water and sediments with suitable technologies and remediation techniques for improving the lake standards for promoting sustainable development at study area.
3. To determine the groundwater quality and its associated soil along with management plan [10] with respect o water quality and soil conditions

3. CASE STUDIES

Case study-I

Sampling locations

1. By considering the topographical conditions of the catchment we have identified eight sampling locations for collecting water samples by covering centre part at all the catchments nearby river zone in the study area.
2. Samples were collected in sterilized bottles.
3. All the samples were labelled with location names.

Water quality Analysis

1. Basic water quality influencing parameters like P^H, chlorides, Hardness, Total solids, and Total dissolved solids were examined
2. All the samples were analyzed by standard water quality analysis methods
3. The results were correlated with Surface water quality criteria for different uses (specified by CPCB, 1979 and the Bureau of Indian Standards, 1982) to understand the existed scenario of water quality in the catchment areas

Collection of Spatial data

1. The data of both PAN and LISS-III satellite were geometrically corrected with proper enhancement.
2. Cubic convolution re sampling technique and principle component methods were adopted to integrate LISS and PAN satellite data then projected with 1:50,000 scale in FCC.

Creation of spatial data base

1. Base map and settlements maps were prepared by applying visual image interpretation techniques.
2. Arc view and Arc info software's were used for scanning and maps digitization.
3. With the reference to field survey all the required corrections were done to produce final map.

Please refer last page of this article for all these figs and tables

Figure: 1 GIS map for the study area

Table 1: Water quality analysis at study area

Table 2: Average values of three months results

Figure 3: GIS map for catchment water quality in tadepalli Mandal

Figure 3: GIS map for catchment water quality in mangalagiri mandal

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Case study-II

Collection of Samples

Total eight locations were identified throughout the lake by covering all the possible corners of lake contamination including the centre part of the lake for both water and sediments collection. Samples were collected during the period of three months; all the samples were named with labels indicating date and location of the sample in lake.

Water quality Analysis

In the analysis part all the important water quality influencing parameters like Color, Turbidity, P^H, Conductivity, Total dissolved solids(TDS),Alkalinity, Total alkalinity, Total hardness, Calcium hardness, Magnesium hardness, Nitrite, Chlorides, Iron were analyzed with standard procedures and the values were tabulated, the final results were obtained with average of three months values during the study period.

Sediment analysis

The sediment analysis were carried by considering the possible contaminant sources and it has done mainly to identify the parameters like Color, P^H, Texture, Electrical conductivity, organic carbon, Available nitrogen, Available phosphorous, Available potassium, Available sulphur, Available zinc, Available iron, Available manganese, Available copper, and available boron in the lake sediments.

Please refer last page of this article for all these graph and tables

Table- 3: Lake Water quality analysis during the study period

Table- 4: sediment analysis of lake during the study period

Graph 1: Bar chart showing sediment analysis of lake during the study period

Case study-III

Collection of Samples

1. Twenty five sampling locations were identified in and around the study area by considering possible interference of limestone quarry [3] activities.

2. All the water samples were collected from underground bore wells.

Water quality Analysis

1. Water quality analysis [7] were carried out for the collected samples to find out the existed condition of groundwater

2. In the analysis of groundwater, the parameters of P^H, Colour, Turbidity, Magnesium, Calcium, Ferrous, Chlorine, Sulphur, Silica, Sodium, Potassium, ,fluorides, Biological Total alkalinity, Total hardness ,Oxygen Demand(BOD), Chemical Oxygen Demand (COD), Dissolved Oxygen (DO)

3. All the tests were carried out by standard test procedures [4] for three times during the study period of three months

4. Average values of all three months results[8]were correlated with IS 10500-2012 standards and considered as final values of various parameters of water quality.

Please refer last page of this article for this tables

Table- 5: Groundwater quality analysis during the study period

UNITS: Colour (c) – Hazen units , Turbidity(T) - NTU, Mg+ (mg/l), Ca(mg/l), Fe(mg/l), Cl (mg/l), Na(mg/l), K(mg/l), Ferrous(mg/l), Total Alkalinity – T.A (mg/l), Total Hardness – T.H (mg/l) BOD(mg/l), COD (mg/l), DO (mg/l)

Please refer last page of this article for all this graph

Graph 2: Graphical representation of groundwater quality at study area

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4. CONCLUSIONS

- The quality of catchment water is always in dynamic stage as it is influenced by quality of water flow from the rivers and the nature of contaminants enters into it through runoff.
- Catchments must be maintain and monitored regularly to avoid the runoff contamination nearby coastal belts.
- Geospatial engineering plays vital role in decision making for policy makers to promote environmental sustainable conditions by integrating water quality data of various seasons with spatial data base for making maps to be used as future reference in and around the study area
- The P^H of the water and the sediment samples shows that the lake is alkaline condition.
- The acceptable limit of Turbidity is up to 1%, the result for the water samples collected gives the average of 0.8 %, which is within the acceptable limit
- Total dissolved solids (TDS) up to 500mg/L is acceptable, In the present study TDS is crossed the permissible levels and it is noted as 680mg/l
- The acceptable limit total alkalinity in water is 200 mg/L but we had the average value of 280 mg/L
- Hardness of water is acceptable up to 300mg/L. The average value of hardness in the present study is notes as 280 mg/L
- Calcium in water is acceptable about 75mg/L, in the present study it is 95 mg/L.
- The presence of magnesium is permissible up to 30mg/L, we got it is 35mg/L
- The presence of fluoride is acceptable up to 1mg/L, 0.8mg/L.
- In the sediment samples ait is noted that available nitrogen and phosphorous is in excess limit and it leads to the eutrophication of the lake
- The remaining parameters are within the permissible limits
- Careful monitoring and periodical assessment of lake parameters must be done to avoid the contamination of the lake
- Proper guidelines must be framed on discharge of effluents and sewage in to the lakes.
- Strict punishment must be imposed on the people who ever releasing untreated wastes in to the water bodies.
- Natural fertilizers must be encouraged for agricultural practices to avoid the entry of chemicals into the lakes through agricultural runoff
- Proper management strategies must be framed to avoid lake contamination by human activities in and around the lake area to maintain the aquatic ecological balance.
- The P^H of the water samples were within the permissible levels as per IS 10500-2012 water quality standards
- The acceptable limit of Turbidity is up to 1%, the turbidity of all the locations were crossed their permissible levels
- The acceptable limit of magnesium (Mg+) in water is 30 mg/L. all the location were within the permissible levels except at L.No- 19
- The Calcium (Ca) in the water samples of L.No:9 and 10 crossed the permissible levels remaining all are within the acceptable limits of 75mg/l as per IS10500-2012 water quality standards.
- Iron (Fe) in the water samples of L.No: 2, 3, 4, 9 crossed acceptable level of 5mg/l. where as in the remaining locations it was within the acceptable limits.
- Chlorine (Cl) in the water samples of L.No: 6, 16, 20, 24 crossed acceptable level of 250mg/l. where as in the remaining locations it was within the acceptable limits.
- The presence of fluoride (F), Total alkalinity and Total hardness at all the locations in the study area were within the acceptable limits.

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Figure: 1 GIS map for the study area

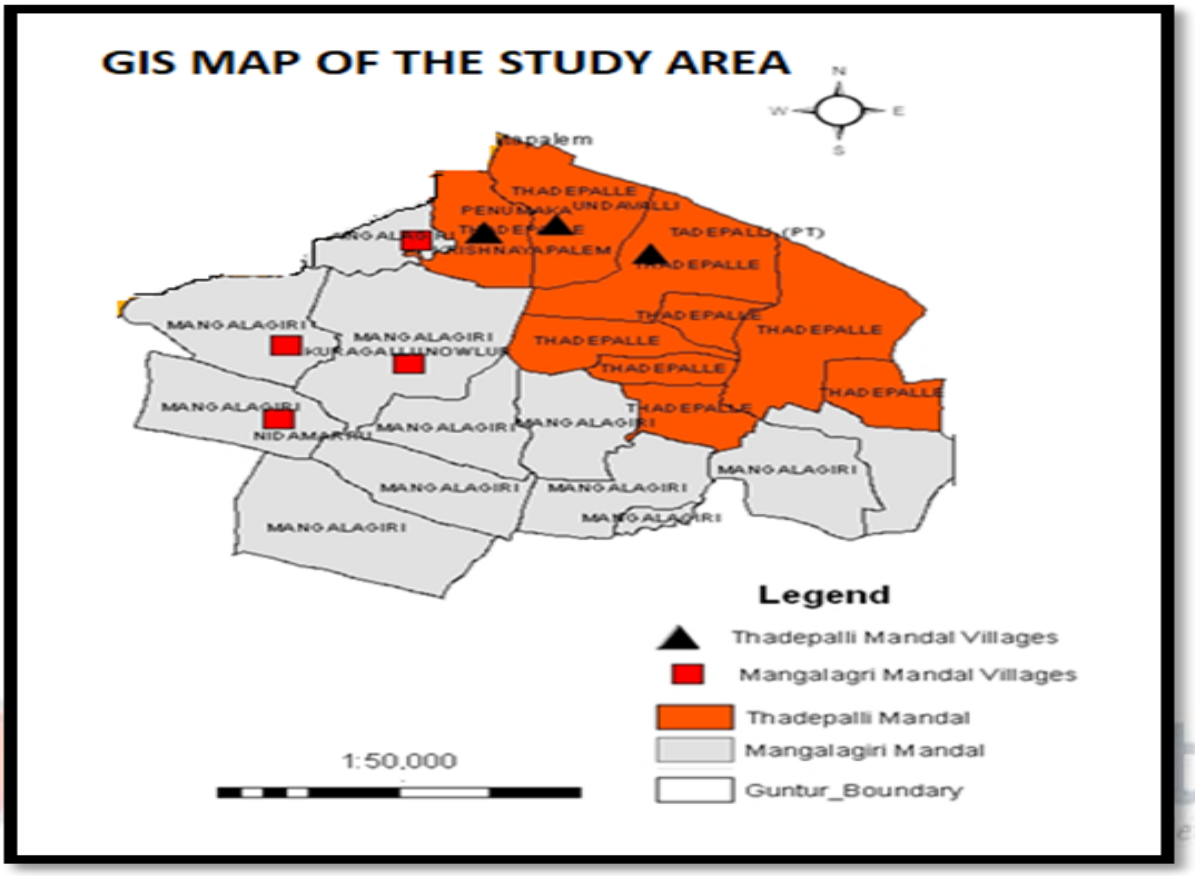

Table 1: Water quality analysis at study area

VILLAGE NAME	P^H			CHLORIDES			HARDNESS			TOTAL SOLIDS			TOTAL DISSOLVED SOLIDS		
	DEC	JAN	FEB	DEC	JAN	FEB	DEC	JAN	FEB	DEC	JAN	FEB	DEC	JAN	FEB
UNDAVALLI	7.1	7.2	7.2	235	240	226	264	276	291	384	378	365	378	365	354
PENUMAKA	7.4	7.4	7.8	241	231	228	284	286	274	376	361	356	369	345	345
KR PALEM	7.1	7.6	7.4	244	250	236	291	291	282	371	384	382	354	372	365
NIDAMARRU	7	7.8	7.6	235	240	250	256	265	276	382	385	391	369	381	369
KURAGALLU	7.6	7.6	7.8	234	239	234	271	285	284	362	354	372	354	344	358
NAVVULURU	7.5	7.4	7.5	245	238	240	282	286	298	365	382	362	358	372	349

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Table 2: Average values of three months results

VILLAGE NAME	P^H	CHLORIDES	HARDNESS	TOTAL SOLIDS	TOTAL DISSOLVED SOLIDS
UNDAVALLI	7.1	233	277	375	365
PENUMAKA	7.5	233	281	364	353
KR PALEM	7.3	243	288	379	363
NIDAMARRU	7.4	241	265	386	373
KURAGALLU	7.6	235	280	362	352
NAVVULURU	7.4	241	288	369	359

Figure 3: GIS map for catchment water quality in tadepalli mandal

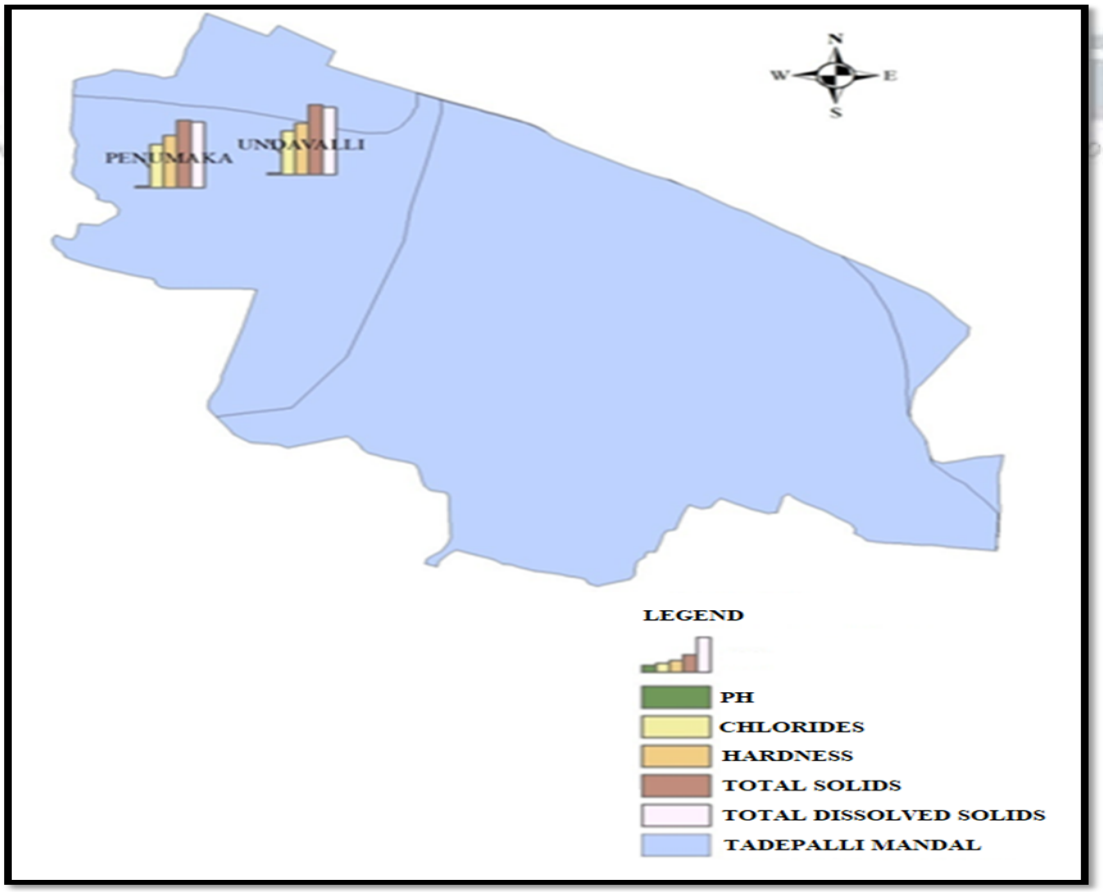

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Figure 3: GIS map for catchment water quality in mangalagiri mandal

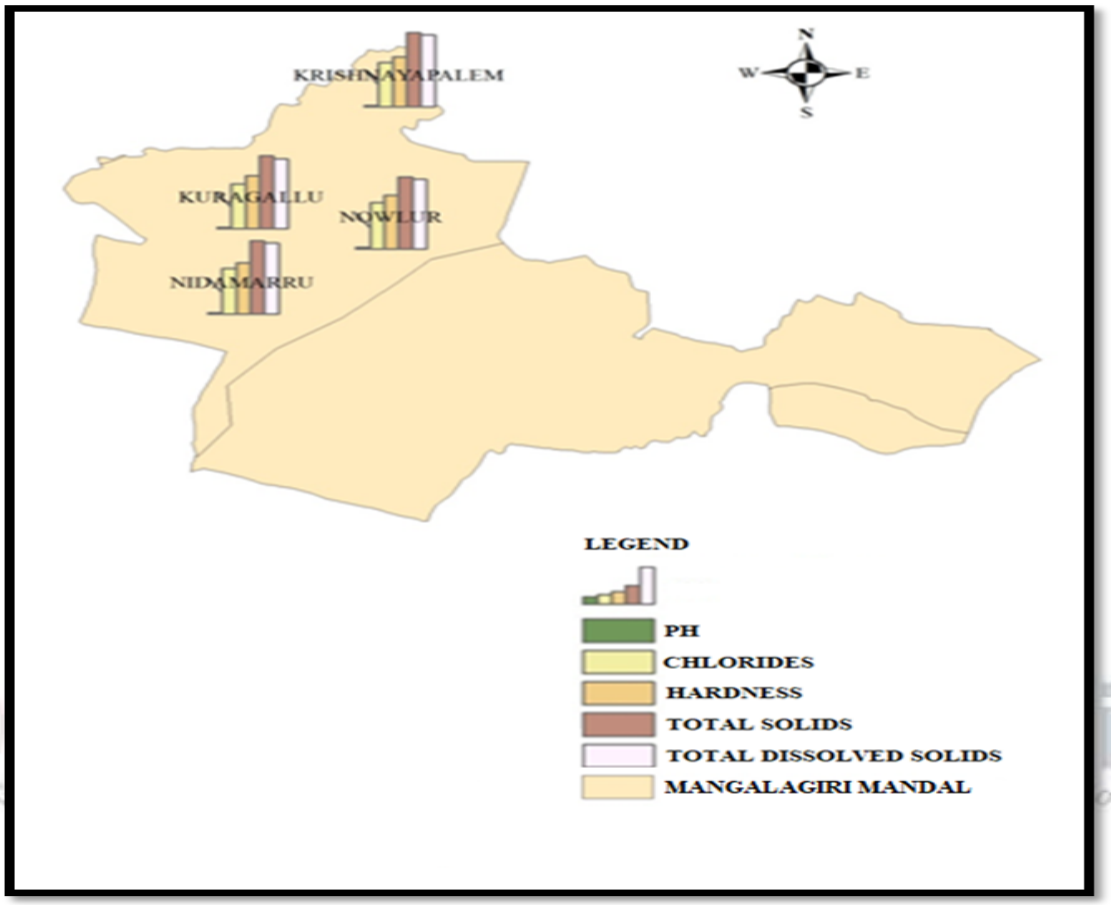

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Table- 4: sediment analysis of lake during the study period

S.No	Parameter	Location1	Location 2	Location 3	Location 4	Location 5	Location 6	Location 7	Location 8
1	Colour	Light brown	Light brown	Light brown	Light brown	Light brown	Light brown	Light brown	Light brown
2	Texture	Hard	soft	Hard	soft	Hard	Hard	Hard	Soft
3	P^H	7.9	7.8	8.1	7.89	7.65	8.2	8.1	8.25
4	EC	1.3	1.24	1.39	1.16	0.9	1.27	1.2	1.5
5	Organic carbon	0.4	0.3	0.2	0.3	0.31	0.11	0.28	0.39
6	Available nitrogen	289	315	250	245	236	248	185	160
7	Available phosphorus	18	12	6	4	2.8	2.4	9	14
8	Available potassium	222	418	578	645	680	574	530	540
9	Available sulphur	8	5	4	8	5	9	9	9
10	Available zinc	0.589	0.826	1.4	0.564	0.485	0.425	0.854	0.645
11	Available iron	22.64	44.12	34.56	18.26	11.84	5.648	28.24	22.64
12	Available manganese	12.52	18.56	14.25	14.26	9.65	5.82	9.24	10.56
13	Available copper	0.7	1.32	0.92	0.97	0.613	0.913	2.014	1.564
14	AvailableBoran	408	1056	1078	0.8	89	1.2	2.8	2.64

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Graph 1: Bar chart showing sediment analysis of lake during the study period

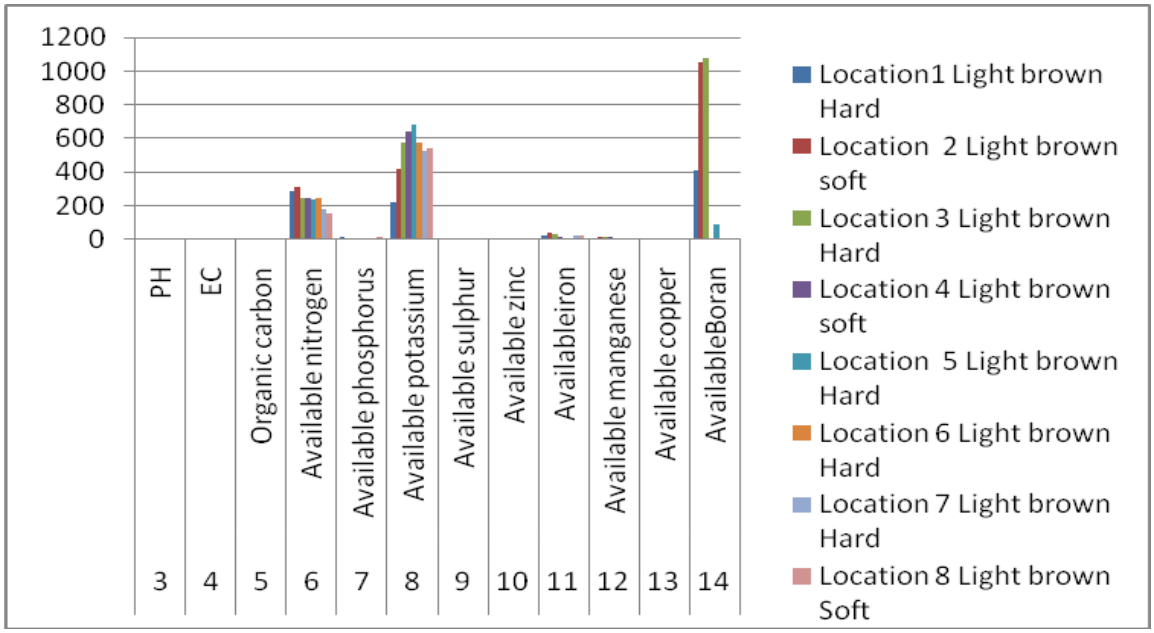

Table- 5: Groundwater quality analysis during the study period

L.NO	LOCATION	P^H	C	T	Mg+	Ca+	Fe+	Cl	Na+	K	F	T.A	T.H	BOD	COD	DO
1	Bhavani nagar	7.2	8	5	25	62.8	0.2	226	64	4.8	0.5	192	142	4.6	7.5	3.6
2	Indiramma colony	7.2	5	5	19	55.2	0.4	231	54	2.8	0.4	186	124	4.8	7.4	3.6
3	Bellamkonda donka	7.5	4	5	15	54.6	0.6	223	124	8.2	0.2	145	124	4.2	5.6	4.8
4	Chandraih street	6.4	5	3	26	562	0.5	208	68	10.4	0.4	160	165	3.5	8.9	4.4
5	Lenin nagar	7.5	9	5	19	74.2	0.1	220	152	9.8	0.4	124	152	41	6.2	3.4
6	Ambedkar nagar	6.8	6	4	24	58.4	0.2	255	134	6.6	0.6	184	125	4.6	7.5	3
7	M.Office area	7.8	5	5	18	74.5	0.2	240	112	1.8	0.9	184	154	4.1	8.9	2.4
8	Chinachala donka	7.5	6	3	22	66.4	0.2	233	84	14.6	0.4	185	186	4.2	8.9	2.4
9	Sundaraiah colony	7.1	8	5	20	78.4	0.8	222	120	2.4	0.5	194	186	3.6	6.5	2.6
10	Vasavi nagar	7.2	6	4	24	82.6	0.3	246	125	52	0.5	146	128	4.6	7.8	3.9

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11	S.pillutla	6.8	5	5	28	75.4	0.2	234	78	9.4	0.8	165	146	4.6	7.8	3.6
12	Rasool pet	7.2	8	6	25	64.2	0.4	245	82	7.6	0.4	186	124	3.4	6.8	3.4
13	Srinivasa colony	7.5	6	4	24	66.4	0.3	211	78	6.4	0.8	195	135	4.2	6.4	3.6
14	Gangamma temple	7.6	8	5	28	68.4	0.2	246	108	4.2	0.6	198	136	4.6	8.4	2.8
15	Kummari palem	7.6	4	6	26	65.8	0.2	255	136	8.6	0.4	186	145	3.8	5.8	3.2
16	Balakuter area	7.1	9	4	30	74.2	0.2	225	98	9.8	0.8	188	124	4.2	9.6	2.8
17	PWD Colony	7.4	6	5	19	66.4	0.2	210	76	7.2	0.6	184	185	4.8	8.5	3.2
18	Janapadu road	6.6	8	6	29	69.5	0.1	213	75	8.4	0.4	156	166	3.2	7.4	2.4
19	Yarramvari street	7.4	6	4	34	68.4	0.3	225	104	7.6	0.4	198	134	3.9	8.9	2.5
20	Station area	7.5	8	6	18	65.8	0.1	252	182	3.1	0.2	142	124	4.5	8.1	3.4
21	Nemili Reddy street	7.5	8	5	18	62.4	0.1	225	95	9.6	0.6	182	112	4.9	6.9	3.4
22	SBI road area	7.8	6	6	28	69.5	0.1	236	86	6.5	0.5	125	194	4.6	6.8	2.8
23	Maruthi nagar	7.4	6	6	19	64.5	0.2	246	96	5.6	0.9	156	168	4.2	6.4	4.1
24	Gandhi nagar	7.8	6	3	24	78.4	0.1	256	84	4.6	0.9	138	145	4.8	8.6	3.2
25	Bali bazaar	7.2	8	6	26	75.6	0.1	241	54	5.4	0.6	146	126	4.5	6.1	3.4

UNITS: Colour (c) – Hazen units , Turbidity(T) - NTU, Mg+ (mg/l), Ca(mg/l), Fe(mg/l), Cl (mg/l), Na(mg/l), K(mg/l), Ferrous(mg/l), Total Alkalinity –T.A (mg/l), Total Hardness – T.H (mg/l) BOD(mg/l), COD (mg/l), DO (mg/l)

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Graph 2: Graphical representation of groundwater quality at study area

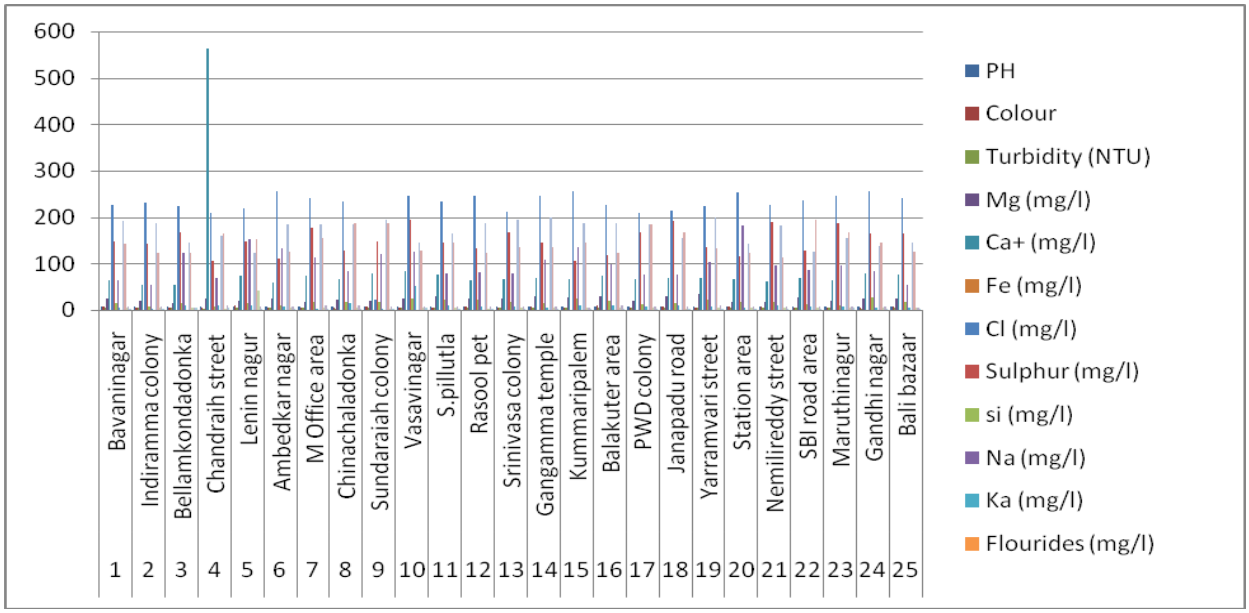

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Table- 3: Lake Water quality analysis during the study period

S.No	Parameter	Location 1	Location 2	Location 3	Location 4	Location 5	Location 6	Location 7	Location 8
1	Colour (Hazen units)	Colour less	Colour less	Colour less	Colour less	Colour less	Colour less	Colour less	Colour less
2	Turbidity in NTU's	0.5	0.6	0.8	0.8	0.5	0.6	0.7	0.8
3	Odour	Unobjectionable	unobjectionable	Unobjectionable	Unobjectionable	Unobjectionable	Unobjectionable	Unobjectionable	Unobjectionable
4	PH	7.5	7.65	7.85	6.56	8.15	6.5	8.28	8.56
5	Conductivity (micro mhos/cm)	630	480	520	640	520	580	440	510
6	TDS (mg/L)	640	520	460	680	525	630	440	490
7	Alkalinity (as caco3)	Nil	5	Nil	Nil	5	Nil	Nil	Nil
8	Total alkalinity	125	225	245	250	245	285	250	530
9	Total hardness	120	210	160	180	160	210	140	280
10	Calcium hardness (as caco3)	60	80	60	60	80	90	80	60
11	Magnesium	40	60	45	55	65	120	130	80

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	hardness (as caco3)								
12	Calcium (as ca)	32	20	52	30	95	50	24	75
13	Magnesium (as mg)	10	20	20	30	20	15	35	25
14	Ammonical nitrogen	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
15	Nitrite (as N)	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
16	Chloride (as cl)	75	80	65	110	60	50	60	200
17	Fluoride as (F)	0.8	0.8	0.6	0.4	0.3	0.5	8	0.8
18	Iron as (Fe)	Nil	Nil	Nil	Nil	Nil	0.5	Nil	0.4