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WATER QUALITY ASSESSMENT IN TERMS OF WATER QUALITY INDEX USING REMOTE SENSING AND GIS

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Abstract - *In the present study, anlaysis of Physio-chemical analysis & Water Quality Index of Water in Hyderabad, India. The samples of ground water were collected at various locations and analysis was done for Physio-chemical parameters for attribute data base generation. Then WQI of Water is found from the values of pH, hardness of Magnesium and Calcium, TDS, Chlorides, Sulphates, Nitrates, Carbonates, Bi-carbonates, TH. For six years Spatial Distribution Maps are generated for WQI for both pre and post monsoon periods from 2006 to 2011. The analysis of the physio-chemical properties and the WQI are helpful in the grouping of potable water samples into excellent, good, poor, very poor and unfit. The generated spatial distribution for WQI in the present study is useful for monitoring water resources.*

Key Words**: Physio-chemical parameters, Water Quality Index, Spatial distribution maps, Pre & Post Monsoon periods, Potable Water.**

1.INTRODUCTION

Water is the primary natural resources, which is necessary for different objectives such as Forestry, Agriculture, Urbanization and other day to day demands as required for human needs. The problem of water quality in and around urban areas is drawing interest for several years. The unscientific and unplanned urbanization and industrialization practices are getting a numerous problems which include the potable water quality. Hence there is a need for the analysis of water quality problem in urban areas. Since the changes in the climatic conditions, the annual rainfall is continuously reducing every year and also increasing runoff due to urbanization and industrialization. Such human activities may continuously result in the reduction of water bodies, adulterating the quality of ground water, contamination of potable water and different health hazards.

The main goal of WQI is to transform complicated water quality data in an informative way which is easy to understand and commonly used by the people. Basing on several factors, WQI can give a simple note on water quality. By this a particular idea is generated in public regarding the issues of water quality in a specific region. The Water Quality indices are the most effective ways to convey the information regarding quality of water to public/policy makers. It is also defined as an evaluation exhibiting the composite influence of different water quality factors over quality of water.

Based on various water quality factors, WQI gives a single number (grading) to know complete water quality in a location at a point of time.

2. STUDY AREA

The study area Hyderabad is situated between 17°20' & 17025' of the northern latitude and 78°25' & 780 35' of eastern longitude, 520mts above M.S.L covers in SOI toposheet nos 56k/6, 56k/7, 56k/10 and 56k/11. The Hyderabad city is located on Krishna basin. Musi River, the tributary of river Krishna, which passes through the city of Hyderabad and divides the city as north & south Hyderabad. The Hyderabad occupies an area of 217 sq km with density population of 14,497 per sq km. As per 2011 census The total population of district is 6,809,970. The study area map is shown in Fig 1

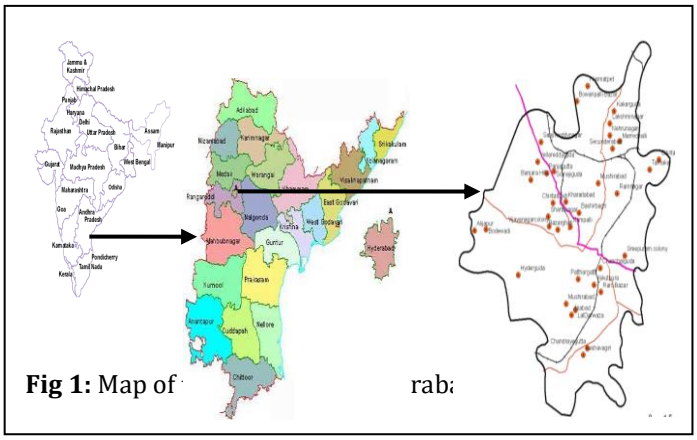

Fig 1: Map of rab

3. METHODOLOGY

The Water Quality Index was computed using Ten physicochemical parameters namely pH, hardness of Magnesium and Calcium, TDS, Chlorides, Sulphates, Nitrates, Carbonates, Bi-carbonates, TH.

WQI is calculated by the method :

$Qni = (V_{actual} - V_{ideal}) / V_{standard} - V_{ideal}) * 100$

Where,

Q_{ni} = Quality rating of ith parameter for a total of n water quality parameters

V_{actual} = Value of water quality parameter obtained from laboratory analysis

$V_{standard}$ = Value of water quality parameter obtained from standard tables.

V_{ideal} for pH = 7 and zero for other parameters. (A.K. Srivastava and D.K. Sinha, IJEP, volume 14, No. 5, May 1994 and Mahuya Dasgupta Adak etal, IJEP, Volume 8, No. 3, 2001)

In order to calculate the suitability of potable water, a new indexing system called Water Quality Index has been found from WQR which is formulated as:

$$WQI = \text{Antilog} [\Sigma Wnn=1 \log 10\ qn]$$

Where,

$$Wn = K / Sn \text{ and}$$

$$K=1 / \Sigma nn=1\ 1/Si$$

$$K = \frac{1}{1/8.5+1/500+1/250+1/200+1/200+1/75+1/30+1/45+1/200+1/300} = 4.74$$

by substituting this K value in the equation

$$Wn = K/Si$$

4. RESULTS AND CONCLUSIONS

WQI of water is found from the values of pH, hardness of Magnesium and Calcium, TDS, Chlorides, Sulphates, Nitrates, Carbonates, Bi-carbonates, TH. For six years Spatial Distribution Maps are generated for WQI for both pre and post monsoon periods from 2006 to 2011. The analysis of the physio-chemical properties and the WQI are helpful in the grouping of potable water samples into excellent, good, poor, very poor and unfit.

Table -1: Water Quality Rating for Drinking Purposes

WQI	Water Quality Rating
0 – 25	Excellent
26 – 50	Good
51 – 75	Poor
76 – 100	Very Poor
>100	Unfit for Drinking

Table -2: The computed weightage factor

S.No.	Weightage Factor (W_n)	Standard	$W_n = K/S_n$
1	pH	8.5	0.5576
2	TDS	500	0.0094
3	Chlorides	250	0.0189
4	Carbonates	200	0.0237
5	Bicarbonates	200	0.0237
6	Calcium	75	0.0632
7	Magnesium	30	0.158
8	Nitrates	45	0.1053
9	Sulphates	200	0.0237
10	Total hardness	300	0.0158

Table -3: Water Quality Parameters, Their ICMR/WHO Standards, and Assigned Unit weights.

Sample No	Parameter	V_{actual}	V_{ideal}	$V_{standard}$	q_n	log q_n
1	pH	8	7	8.5	66.66666	1.823909
2	Chlorides	200	0	250	80	1.90309
3	Sulphates	62	0	200	31	1.491362
4	carbonates	0	0	200	0	0
5	bicarbonates	360	0	200	180	2.255273
6	Nitrates	14	0	45	31.11111	1.492916
7	TH	460	0	300	153.3333	2.185637
8	TDS	973	0	500	194.6	2.289143
9	Calcium	136	0	75	181.3333	2.258478
10	Magnesium	29	0	30	96.66666	1.985277

q_{ni} is computed for all the ten water quality parameters

Table –4: Estimated WQI values of pre and post monsoon for the year 2006

Area	2006 pre		2006 post	
	WQI	Water quality rating	WQI	Water quality rating
Gudi malkapur	33.11	Good	61.65	Poor
Kishan Bagh	60.25	Poor	67.06	Poor
Bhadurpura	36.03	Good	74.13	Poor
Charminar	38.09	Good	72.44	Poor
Langar House	60.11	Poor	52.48	Poor
Golconda	31.62	Good	38.09	Good
Koti	63.09	Poor	54.95	Poor
Himayatnagar	46.77	Good	60.25	Poor
Khairtabad	22.38	Excellent	52.48	Poor
Musheerabad	43.65	Good	56.23	Poor
Seethaphelmandi	57.54	Poor	66.03	Poor
Nampally	61.65	Poor	46.77	Good
Saidabad	38.09	Good	56.23	Poor
Shaikpet	33.11	Good	89.12	V.Poor
Falaknuma	38.01	Good	47.86	Good

Table – 5: Estimated WQI values of pre and post monsoon for the year 2007

Area	2007 pre		2007 post	
	WQI	Water quality rating	WQI	Water quality rating
Gudi malkapur	43.65	**Good**	63.09	Poor
Kishan Bagh	53.07	Poor	64.56	Poor
Bhadurpura	44.66	Good	60.26	Poor
Charminar	48.97	Good	54.95	Poor
Langar House	53.07	Poor	66.06	Poor
Golconda	38.01	Good	43.65	Good
Koti	5.49	Excellent	29.51	Good
Himayatnagar	36.03	Good	46.77	Good
Khairtabad	38.09	Good	51.28	Poor
Musheerabad	54.95	Poor	48.97	Good
Seethaphelmandi	39.81	Good	52.48	Poor
Nampally	43.65	Good	53.07	Poor
Saidabad	27.54	Good	53.07	Poor
Shaikpet	32.35	Good	70.79	Poor
Falaknuma	27.54	Good	35.48	Good

Table –6: Estimated WQI values of pre and post monsoon for the year 2008

Area	2008 pre		2008 post	
	WQI	Water quality rating	WQI	Water quality rating
Gudi malkapur	28.84	Good	57.54	Poor
Kishan Bagh	63.09	Poor	79.43	V.Poor
Bhadurpura	35.48	Good	61.65	Poor
Charminar	54.95	Poor	70.79	Poor
Langar House	46.77	Good	38.01	Good
Golconda	31.62	Good	43.65	Good
Koti	46.77	Good	67.06	Poor
Himayatnagar	34.67	Good	41.68	Good
Khairtabad	34.67	Good	44.66	Good
Musheerabad	38.09	Good	43.65	Good
Seethaphelmandi	51.28	Poor	44.66	Good
Nampally	95.49	V.Poor	79.43	V.Poor
Saidabad	79.43	V.Poor	72.44	Poor
Shaikpet	91.02	V.Poor	81.28	V.Poor
Falaknuma	34.67	Good	51.28	Poor

Table –7: Estimated WQI values of pre and post monsoon for the year 2009

Area	2009 pre		2009 post	
	WQI	Water quality rating	WQI	Water quality rating
Gudi malkapur	66.06	Poor	91.02	V.Poor
Kishan Bagh	64.56	Poor	93.32	V.Poor
Bhadurpura	29.51	Good	79.43	V.Poor
Charminar	56.23	Poor	79.43	V.Poor
Langar House	30.09	Good	45.07	Good
Golconda	30.09	Good	83.17	V.Poor
Koti	33.88	Good	33.11	Good
Himayatnagar	29.51	Good	46.77	Good
Khairtabad	33.11	Good	36.03	Good
Musheerabad	32.35	Good	43.65	Good
Seethaphelmandi	66.06	Poor	75.85	V.Poor
Nampally	97.72	V.Poor	109.64	Unfit for Drinking
Saidabad	79.43	V.Poor	97.72	V.Poor
Shaikpet	63.09	Poor	67.06	Poor
Falaknuma	36.03	Good	52.48	Poor

Table –8: Estimated WQI values of pre and post monsoon for the year 2010

Area	2010 pre		2010 post	
	WQI	Water quality rating	WQI	Water quality rating
Gudi malkapur	60.25	Poor	36.03	Good
Kishan Bagh	67.06	Poor	63.09	Poor
Bhadurpura	61.65	Poor	85.11	V.Poor
Charminar	43.65	Good	75.85	V.Poor
Langar House	69.18	Poor	40.73	Good
Golconda	54.95	Poor	38.01	Good
Koti	41.68	Good	38.09	Good
Himayatnagar	38.09	Good	44.66	Good
Khairtabad	38.09	Good	42.65	Good
Musheerabad	63.09	Poor	43.65	Good
Seethaphelmandi	66.06	Poor	52.48	Poor
Nampally	63.09	Poor	77.62	V.Poor
Saidabad	72.44	Poor	18.62	Excellent
Shaikpet	68.18	Poor	38.01	Good
Falaknuma	54.95	Poor	48.97	Good

Table –9: Estimated WQI values of pre and post monsoon for the year 2011

Area	2011 pre		2011 post	
	WQI	Water quality rating	WQI	Water quality rating
Gudi malkapur	33.11	Good	64.56	Poor
Kishan Bagh	95.49	V.Poor	69.18	Poor
Bhadurpura	69.18	Poor	83.17	V.Poor
Charminar	37.15	Good	61.65	Poor
Langar House	33.88	Good	56.23	Poor
Golconda	38.09	Good	64.56	Poor
Koti	57.54	Poor	61.65	Poor
Himayatnagar	35.48	Good	34.67	Good
Khairtabad	33.88	Good	40.73	Good
Musheerabad	41.68	Good	38.01	Good
Seethaphelmandi	43.65	Good	34.67	Good
Nampally	47.86	Good	39.81	Good
Saidabad	43.65	Good	60.25	Poor
Shaikpet	38.09	Good	50.11	Good
Falaknuma	79.43	V.Poor	70.79	Poor

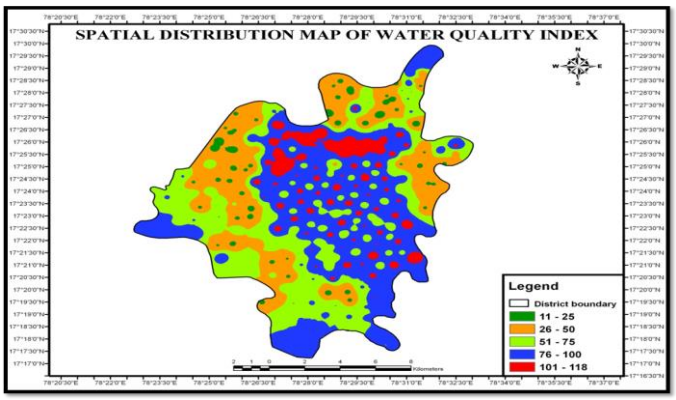

Fig 2: Spatial Distribution Map of Water Quality Index

REFERENCES

[1] Abdel-Aziz Ismail Kashef, ground water Engineering, Mc Graw Hill International Editions, 1986.

[2] Anjaneyulu Y., (Editor Prof.P.Narasimha Rao), "Introduction to Environmental Science", BS Publications, Hyderabad, (First reprint 2005)

[3] Reddy M., Text Book of Anji RS and GIS, Second edition, B.S Publications, Hyderabad, 2001.

[4] APHA, AWWA, WPCF, Standard Methods for the Examination of Water and Wastewater, 16th edition, American Public Health Association, New York, 1985.

[5] Mahuya Das Gupta Adak, K.M Purohit and Jayita Datta, Assessment of drinking water quality of river Brahmani, Journal of environment and Pollution, Vol.8, No.3, 2001, pp. 285-291.

[6] Srivastava A.K. Mishra D.K. Sarika Tripathi and Priti singh , "Calculation of water quality Index considering important physicochemical parameters", Nature Environment and pollution Technology", 2000, 16 , pp 315-319.

[7] Tiwari T.N and M. Mishra, 1995, IJEP, Vol.5, No.4, pp. 276-279.

[8] Rao, A. L. India's water wealth. Its assessment, uses and projections. Published by Orient Longman Limited, 1975.

[9] David Keith Todd, Ground Water Hydrology, John Wiley and Sons, 1980.

[10] Chand S and Dara S.S, "A Textbook of environmental chemistry and pollution control", S.Chand & Co Ltd., New Delhi, India, 1997.