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RESEARCH ARTICLE

A GIS Approach on Ground Water and Surface Water Investigation of in and around Wellingdon Lake, Tittakudi, Cuddalore District, Tamilnadu

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ABSTRACT

Irrigated agriculture is dependent on a sufficient water supply of utilizable quality. In the past water quality apprehensions had often been neglected because good quality water supplies had been plentiful and readily available. Wellingdon Lake is situated in Tittakudi taluk of Cuddalore district,Tamil Nadu. It is located 50 km east of Neyveli and south of Vellar River. The length of the lake is 1.5 km and width is 1 km. The lake is located in between the Cuddalore and Perambalur district. We have to collect 10 surface water samples from Wellingdon Lake and 5 ground water samples from adjoining area. We have to analyze the basic physico chemical Parameters of the both water samples. The analyzed water samples to find out different methods and also to be used in ARC GIS by spatially represented the chemical characters of the water samples.

Key Word: *Wellingdon Lake, Surface water and Ground water, Chemical character, ARC GIS.*

INTRODUCTION

Lakes are traditionally undervalued resources to human society but their uses include; drinking and municipal water supply, agricultural, irrigation, water navigation, commercial and recreational fisheries, boating and other aesthetics. Water is the second basic need for living things and it is the most precious resources among natural resources. Epics and scriptures have repeatedly highlighted the necessity of water for living. Some 6000 years ago, Kautilya wrote in Arthasatra, that water is the wealth of a nation. The renowned Tamil poet Thiruvalluvar told that a world without water cannot be imagined, also the old and new testaments emphasis the importance of water to live. Such prime resource should be abundant pure and safe, but it is now becoming scarce and impure, causing various diseases, with less nutrient value. Water crisis arises from: monsoon failure, deficit rainfall, enormous utilization in agricultural, industrial & domestic sector, rapid population growth, urbanization and change of life style, deforestation, water quality deterioration, failure in managing and conserving water sources (CGWB, 1989). The quality of water is of vital concern for mankind, since it is directly linked with human welfare. Poor quality of water adversely affects the plant growth and human health (Todd 1980, ISI 1983, WHO 1984, Hem 1991 and Karanth1997).

STUDY AREA

The geographical extent of the study area around 615.29 sq.km the study area is located between latitudes 110 22'03" to 110 36'29"N and longitudes 780 52' 42"to 780 18' 59" E in the Cuddalore district of Tamil Nadu state the region is Covered by the survey of India topographic 58/ m/3 58M/7 58I /14 and 58 I/15 (Fig 1).

MATERIALS AND METHODS

Water quality and hydrogeochemical characteristics require proper site selection for collection of water samples and appropriate method of analysis. Sampling sites were located

taking several factors into considerations like lithology, structure, geomorphology, river influence, industry, urban, agricultural activity and availability of wells. Sampling of groundwater has been carried out in the Tittakudi block during 2014. The sampling locations are shown in (Fig. 2).

The synoptic view of the methodology adopted for the present study is shown in the flow chart (Fig.3).The water samples were collected to broadly cover the study area. A total of 15 water samples were collected from bore wells and Lake surface water. (January 2014). Twolitre of water samples was collected in polyethelene bottle. Then it was sealed and brought to laboratory for analysis and stored properly 4^0C) before analysis.

RESULT AND DISCUSSION

Groundwater and surface samples were collected in space and time and analyzed for major ions using standard procedures. The chemical composition of the groundwater in and around Wellindon lake area were collected during January 2014 given in table 1.The total cations (TZ^+) and total anions (TZ^-) balance (Freeze and Cherry 1979) is considered to shows the charge balance error percentage. The error percentage in the samples of the present study ranges between ±1% to ±10%. Occurrence of errors in chemical analysis of groundwater is also due to the reagents employed, limitations of the methods and the instruments used presence of impurities in distilled water etc. The correlation coefficient between TZ^+ and TZ^- is around 0.6 to 0.9 TDS / EC ratio was ranging from 0.5 to 0.9. The role played by other ions than those considered here for the cations and anions charge balance is less significant. The Maximum, Minimum and average values in both samples are given in table 1. The groundwater in the study area is generally odorless and colorless in most of the places. The average temperature at the time of sampling varies from 25^0C to 31^0C.

Fig.1: Study area map

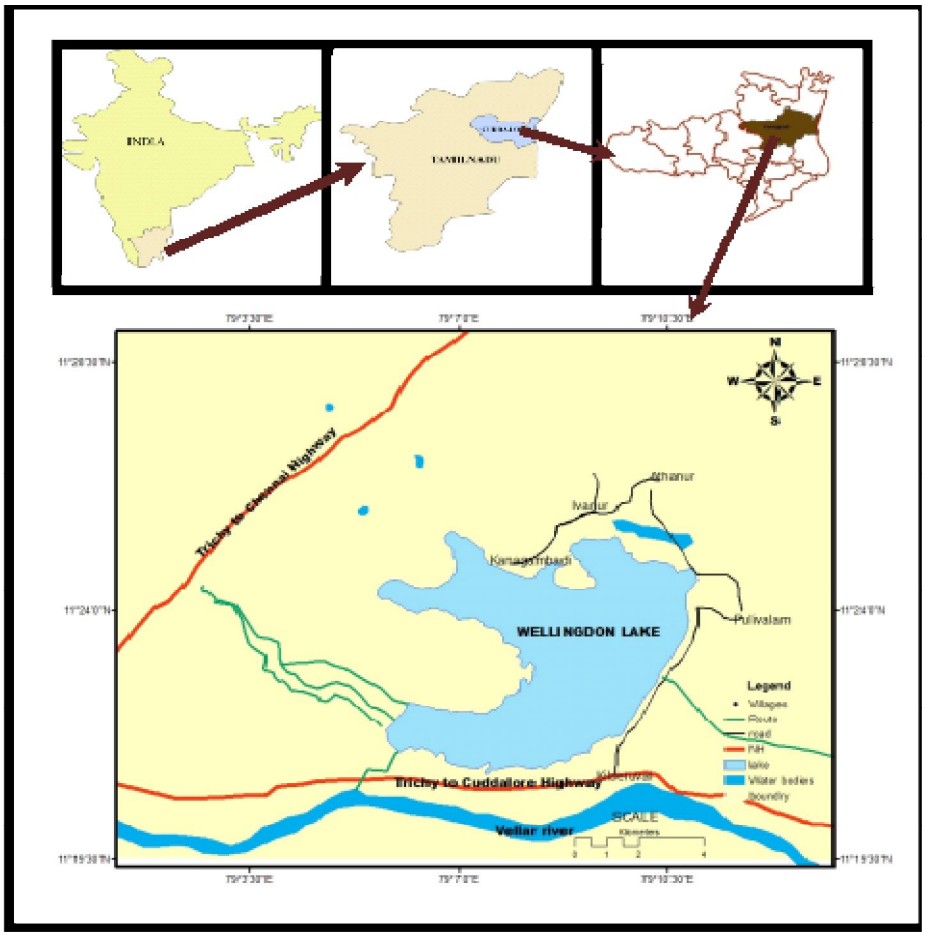

Fig. 2: Loction map of the study area

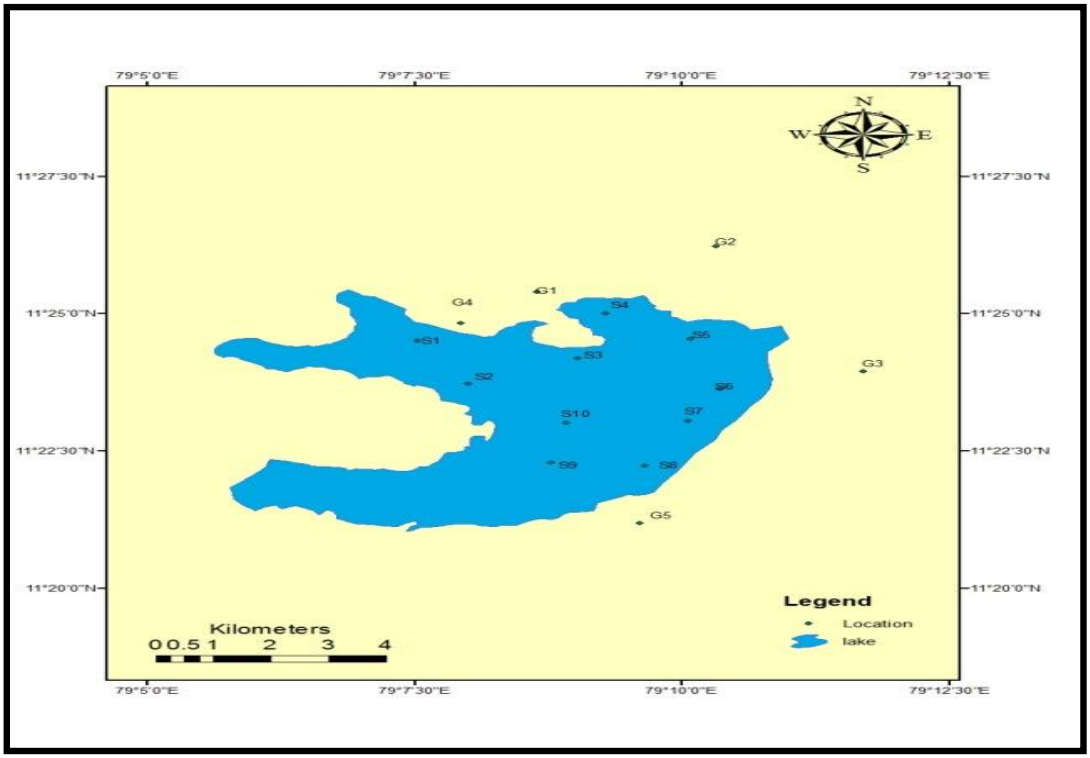

Fig.3: Flow chart of methodology

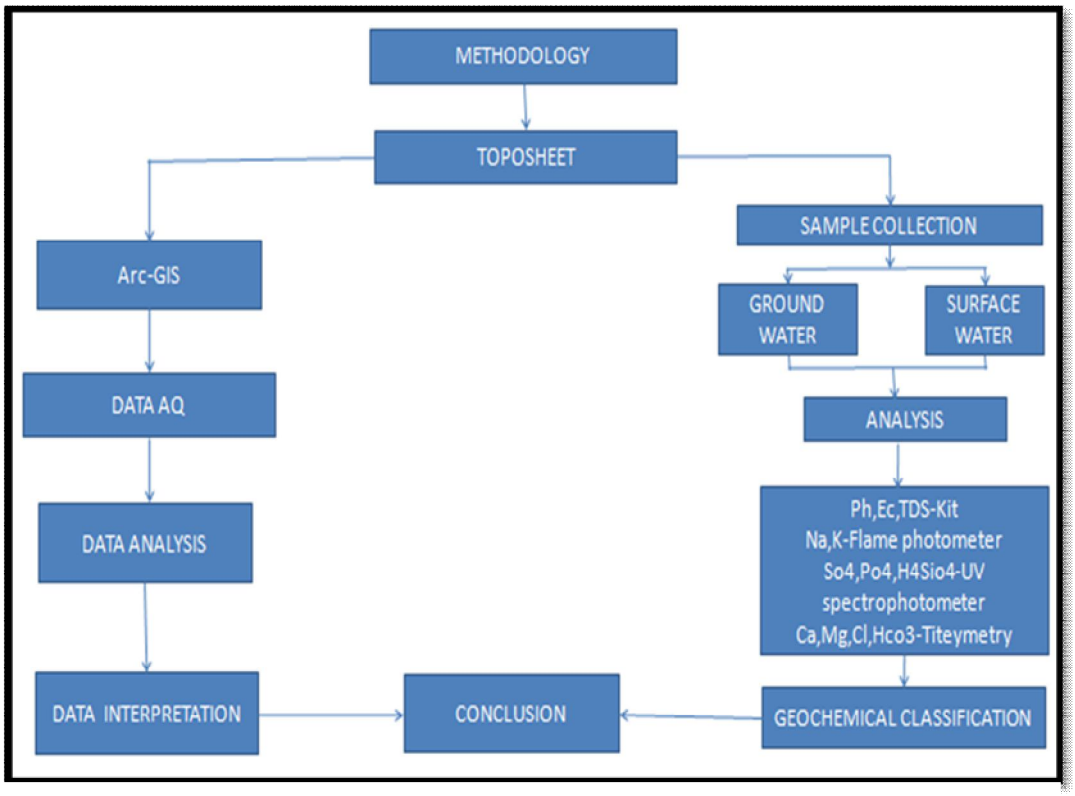

Fig.4: Spatialm distribution of surface and ground waterv sample concentration in and around of Wellingdon lake

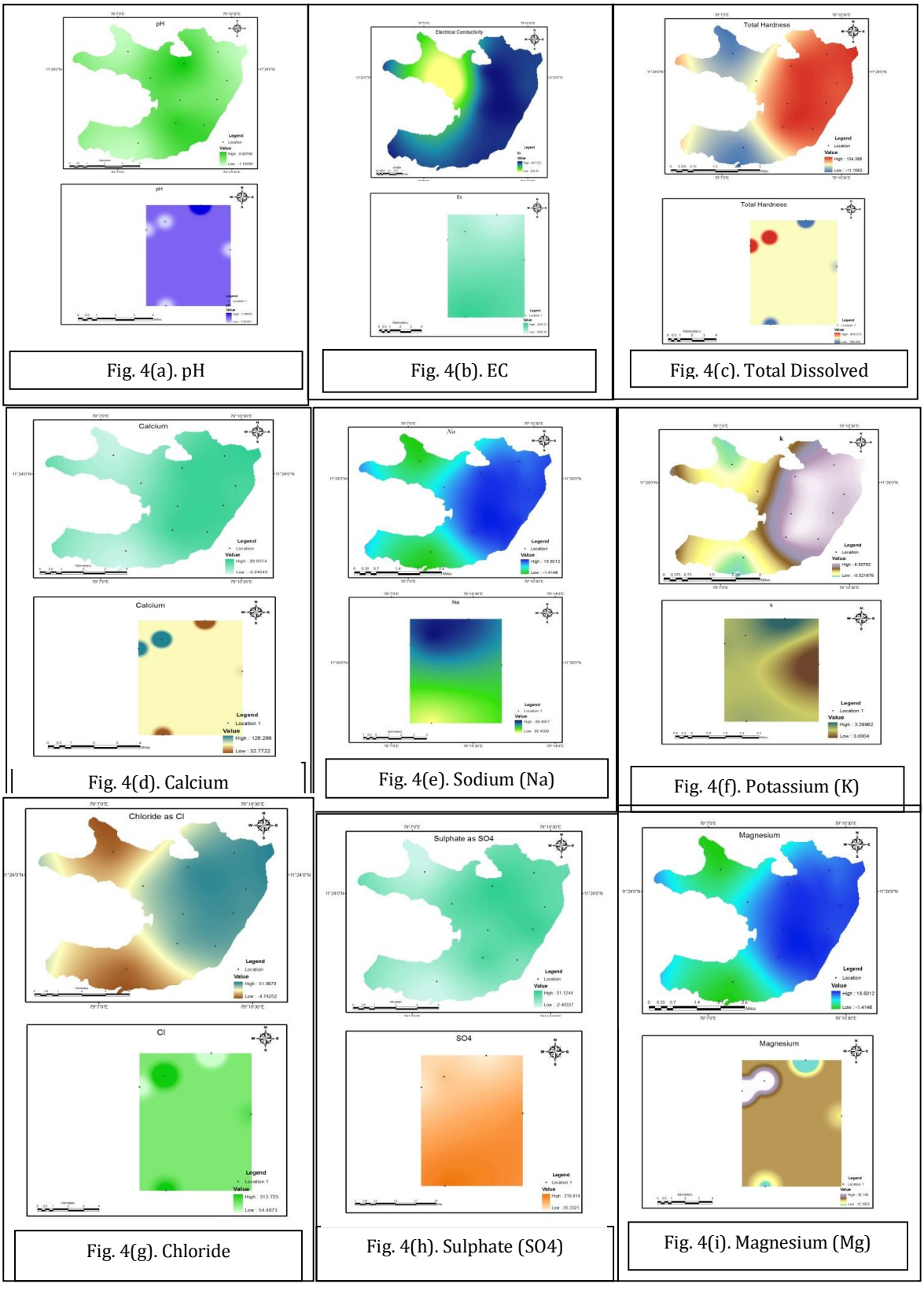

Fig. 4(a). pH

Fig. 4(b). EC

Fig. 4(c). Total Dissolved

Fig. 4(d). Calcium

Fig. 4(e). Sodium (Na)

Fig. 4(f). Potassium (K)

Fig. 4(g). Chloride

Fig. 4(h). Sulphate (SO4)

Fig. 4(i). Magnesium (Mg)

Table 1: Physico chemical parameter of the Ground and Surface water sample of Wellingdon lake and around area (mg/l) except EC and pH (EC in us/cm)

Sam.No	pH	EC	TDS	Ca	Mg	Na	K	Cl	F	SO4	PO4	NH3	NO2	NO3	TH
GW1	7.41	1908	1336	127	83	96.4	3.2	315	0.4	108	0.03	6.3	0.01	6	662
GW2	7.43	1329	930	109	91	85.1	3.2	141	0.6	31	0.18	1.41	0.18	10	650
GW3	6.68	1964	1375	81	56	87.3	3	212	1	174	0	4.18	1.09	10	437
GW4	7.41	2460	1722	62	48	82.9	3.2	255	1	226	0.18	0.94	0.03	12	355
GW5	7.69	938	657	32	19	90.6	3.3	53	1.2	24	0.04	0.16	0.02	12	162
Max	7.69	2460.00	1722.00	127.00	91.00	96.40	3.30	315.00	1.20	226.00	0.18	6.30	1.09	12.00	662.00
Min	6.68	938.00	657.00	32.00	19.00	82.90	3.00	53.00	0.40	24.00	0.00	0.16	0.01	6.00	162.00
Average	7.32	1719.80	1204.00	82.20	59.40	88.46	3.18	195.20	0.84	112.60	0.09	2.60	0.27	10.00	453.20
SW1	8.37	465	326	28	13	87.8	3.1	48	1.2	16	0.13	0.29	0.05	6	126
SW2	8.61	461	323	25	14	85.9	3.4	48	0.6	16	0.08	0.35	0.06	6	122
SW3	8	483	338	27	14	89.5	3.2	48	0.6	20	0.09	0.18	0.05	6	126
SW4	8.6	464	325	26	15	91.4	3.1	44	0.6	15	0.08	0.22	0.01	6	126
SW5	8.77	225	158	10	9	84.6	3.2	32	0.6	15	0.02	0.61	0.06	2	61
SW6	8.57	470	329	26	15	85.9	3.2	44	0.8	11	0.09	2.14	0.06	6	126
SW7	8.77	454	318	27	14	86.1	3.2	40	0.6	17	0.11	2.45	0.06	6	126
SW8	8.55	474	332	27	14	93	3.1	48	0.6	21	0.1	2.41	0.06	6	126
SW9	8.46	473	331	27	15	81	3.2	44	0.6	19	0.07	2.31	0.05	6	130
SW10	8.49	459	321	28	14	85.8	3.1	44	0.6	21	0.1	2.48	0.06	6	125
Max	8.77	483.00	338.00	28.00	15.00	93.00	3.40	48.00	1.20	21.00	0.13	2.48	0.06	6.00	130.00
Min	8.00	225.00	158.00	10.00	9.00	81.00	3.10	32.00	0.60	11.00	0.02	0.18	0.01	2.00	61.00
Average	8.52	442.80	310.10	25.10	13.70	87.10	3.18	44.00	0.68	17.10	0.09	1.34	0.05	5.60	119.40

GIS APPROACH FOR SPATIAL ANALYSIS

The chemical quantity have been analysed for different quality parameters over the entire surface area of Lake Wellingdon. The profiles of spatial variation for each resource are discussed below in terms of their relation with each other and their Change in concentration over space. The distance between observation points were calculated by exported sampling

points map in shape file format into Arc view and interpolated by the krigging analysis option (Vijayakumar *et al.* 2013). By the application of GIS (Arc view) software, the spatial distribution of parameters has presented in Fig. 4 (a to i). The figures depict amount of spatial variation in all parameters. It is obviously noticed that most of the parameters have higher concentration at the south western part as the result of shallow part of the water body which receives higher amount of sediment input and effluent water from Neyveli mine activities that can be trap most of ions on the particles (CM Laluraj and Gobinath 2006) .The EC values show the regular trend over the entire lake excess for those shallow locations. The values range from 362 to 61800 µs/cm near the Kalliankuppam area and a little bit increase to around the middle of the lake. It can be seen that the points near to shoreline and in south shows higher value, which are closed to river inputs.

The spatial distribution based on pH concentration value of ground water samples were highly found in East region and also surface water fall in North and east region of wellingdon lake, Electrical conductivity concentration value of ground water samples were highly found in south region and also surface water fall in east region, Total Hardness concentration value of ground water samples were highly found in north region and also surface water fall in east region. The graphically distributed the Calcium, Magnesium concentration value of ground water samples were highly found in North region and also surface water fall in east region of wellingdon lake. Chloride concentration value of ground water samples were highly found in North and South region and also surface water fall in east region, Sulphate concentration value of ground water samples were highly found in south region and also surface water fall in North and east region of wellingdon lake. The surface water and Ground water concentration may be increased as a source of anthropogenic activities from the river input was primary and agricultural land activities also secondary polluted activity source.

CONCLUSION

The ground water and surface water of in and around of Wellingdon lake generally found in acidic nature with an EC values are more than 100 µS0/cm. The TDS was higher concentration in groundwater samples 657 to 1722 with an average of 1204 and surface water 657 to 928.43 with an average 1325.93 were higher in ground water In general high concentration of ground water of the weathering zone and reveals that longer rock contact time. Most of the concentration was permissible limit except EC, TDS, Cl. In compared to the ISI and WHO standard limitation surface water mostly good for irrigation purposes and ground water may be good for drinking purpose some of locations.

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