International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 06 Issue: 05 | May 2019 www.irjet.net p-ISSN: 2395-0072

Pollution Assessment of Water Bodies in Muvattupuzha Muncipality after Flood (2018) using GIS

Mr. Rasim Navas[1], Fasina Fackrudheen[2], Haja T.B[2], Mohammed Shafeer P.M[2], Nehas Nazar[2]

[1]Assistant Professor, Dept. of Civil Engineering, Ilahia College of Engineering and Technology, Kerala, India
[2]B-Tech Student, Dept. of Civil Engineering, Ilahia College of Engineering and Technology, Kerala, India

---

Abstract - *Management of water quality is very important as demand is increases day by day. Water is the most important source for living things on earth which is threatened on its quality and quantity. Ph, DO, COD, E coli, Turbidity, Alkalinity, Chloride and Hardness are basic water quality parameters. Management of water quality in Muvattupuzha municipality after flood (2018) is important as it is the source of drinking, domestic uses and irrigation. Deterioration of water quality receives more attention to mapping the current situation of water quality parameter provides the better management of resources. Water samples collected from various resources located in Muvattupuzha during dry period, whereas when entire town under great water stress. Interpolation methods facilitate to estimate values for unknown point and create a continuous dataset to study the spatial distribution. The IDW and Spline tools are deterministic interpolation method and Kriging are based on a statistical model. Kriging is the best fit method of interpolation was used with the help of Geographic Information System (GIS) software Arc GIS 10.4 to visualize the spatial distribution of above water quality parameters. This study has shown that Kriging interpolation and statistical analysis perform better mapping of water parameter. The water quality index (WQI) is a single number that expresses the quality of water by integrating the water quality variables. This Paper also deals with the assessment of ground water quality in and around Muvattupuzha Municipality, Kerala State Of India.*

Key Words: **water quality index, geographic positioning system, geographic information system, physio - chemical parameters, kriging interpolation, Weighted Aritmetic Index Method**

1. INTRODUCTION

Water is the most precious gift of nature, the most crucial for sustaining life and is required in almost all the activities of man for drinking and municipal use, irrigation to meet the needs of growing food, industries, power generation, navigation, and recreation. Hence the conservation, optimum utilization and management of resources for the betterme the economic status of the country become paramount. Water quality index provides a single number that expresses

overall water quality at a certain location and time, based on several water quality parameters. The objective of water quality index is to turn complex water quality data into information that is understandable and usable for common man. A single number is not enough to describe the water quality: there are many other water quality parameters that are not included in the index. However, a water quality index based on some very important parameters can provide a simple indicator of water quality. In general, water quality indices incorporate data from multiple water quality parameters into a mathematical equation that rates the health of a water body with number. The main aim of our project is to prepare the water quality map of water bodies in Muvattupuzha municipality.

1.1Water Quality Mapping Using GIS

Mapping the water quality parameters using the decision support system like GIS, can be useful for taking quick decisions as graphical representation would be easy to facilitate policy makers in taking a decision. A Spatial Decision Support System (SDSS) is a computer based system designed to assist the decision system. Typically, such a system will include spatial data relevant to the decision, analytical tools to process the data in ways meaningful for decision makers, and output or display functions. Geographic Information System (GIS) is an information system that is specially designed for handling spatial (or geographical) data. GIS has the advantage of handling attribute data in conjunction with spatial features, which was totally impossible with manual cartographic analysis. It combines a set of interrelated software components that create, edit, manipulate , analyse and display data both in text and graphic forms.

1.2 Water Quality Analysis

Water quality index provides a single number that expresses overall water quality at a certain location and time, based on several water quality parameters. The objective of water quality index is to turn complex water quality data into information that is understandable and usable for common man. A single number is not enough to describe the water quality: there are many other water quality parameters that are not included in the index. However, a water quality index based on some very important parameters can provide a simple indicator of water quality.

2. STUDY AREA

For the present study, Muvattupuzha municipality of Ernakulum district was selected. It is located at a latitude of 9° 58′ 47.46″ n, and longitude of 76° 34′ 25.72″ e and is in the foothills of the western ghats and covers an area of 13.18

km ^{2} . Ten different sampling points were selected in the study area. The locations were chosen keeping in mind that all the areas of Muvattupuzha can be covered properly.

Fig -1.Study Area

Sampling locations

30 samples were collected from water bodies from locations in Muvattupuzha muncipality. The latitude and longitude of the area was also determined using google maps.

Table 1.GPS co-ordinates of Sampling Locations

No	Station name	Latitude	Longitude
1	Kakkadashery	9.9972527	76.5989237
2	Kakkadashery	9.9972201	76.5987561
3	Kakkadashery	9.9972032	76.5985375
4	Perumattam	9.996524	76.5956863
5	Perumattam	9.9965798	76.5955109
6	Perumattam	9.9967984	76.5952846
7	Perumattam	9.992539	76.5986323
8	Perumattam	9.9925271	76.5987215
9	Perumattam	9.9924175	76.5969519
10	Kizhakekara	9.9925116	76.5969244
11	Kizhakekara	9.9839589	76.5887393
12	Kizhakekara	9.9838585	76.5887189
13	Kizhakekara	9.9836921	76.5888486
14	Chalikadav	9.9840847	76.5888436
15	Kaliyar river basin	9.9853639	76.5883498
16	Thodupuzha river Basin	9.9926839	76.590969
17	Latha theatre	9.9712925	76.59358
18	Chalikadav	9.9796755	76.5828844
19	Market	9.9908038	76.5903752
20	Triveni sangamam	9.9883228	76.5863113
21	Nedumchalil	9.9855121	76.583381
22	Market	9.9885262	76.577878
23	Market	9.9913021	76.5882093
24	Market	9.9915042	76.5881281
25	Muvattupuzha river basin	9.9911031	76.5878978
26	Arakuzha	9.9857816	76.5805539
27	Kecherippady	9.9756707	76.5871132
28	Kecherippady	9.9936725	76.5825357
29	Kecherippady	9.9924505	76.5795766
30	Kecherippady	9.9945115	76.5831121

3. WATER QUALITY INDEX

The water samples were analyzed for different physio-chemical parameters and were compared with the values of various quality standards such as world health organization (who), bureau of Indian standards (bis) and indian council for medical research. Turbidity, DO, hardness , pH, alkalinity and chloride are the various water quality parameters analysed. Water Quality Index (WQI) was calculated by using the Weighted Arithmetic Index method. In this model, different water quality components are multiplied by a weighting factor and are then aggregated using simple arithmetic mean. The overall WQi was calculated by aggregating the quality rating with the unit weight linearly by using the following equation.

$WQI = \sum W_n Q_n / \sum W_n$

Q_n = quality rating, W_n= relative weight

$Q_n=100[(v_n-v_{io})/ (s_n-v_{io})]$

q_n=quality rating for the nth water quality parameter,v_n=observed value of the nth parameter s_n=standard permissible value of nth parameter v_{io}=ideal value of nth parameter in pure water. All the ideal values (v_{io}) are taken as zero for drinking water except for ph=7 and dissolved oxygen=14.6mg/l.

$W_n=k/s_n$

Where , W_n= unit weight of nth parameter s_n=standard value for the nth parameter. K=constant of proportionality and is given as (kalavathy et al., 2011) $k=1/[1/v_{s1}+1/v_{s2}+...+1/v_{sn}]$.

Table 2. Water Quality Status

Class	WQI	Water Quality Status
I	<50	Excellent
II	50-100	Good
III	100-200	Poor
IV	200-300	Very Poor
V	>300	Unsuitable For Drinking

4. GIS ANALYSIS

GPS technology prove to be very useful for enhancing the spatial accuracy of the data integrated in the GIS. We utilized ArcGIS software in our study area. The water quality data thus obtained forms of the non-spatial database. It is stored in excel format and linked with the spatial data by join option in ArcMap..

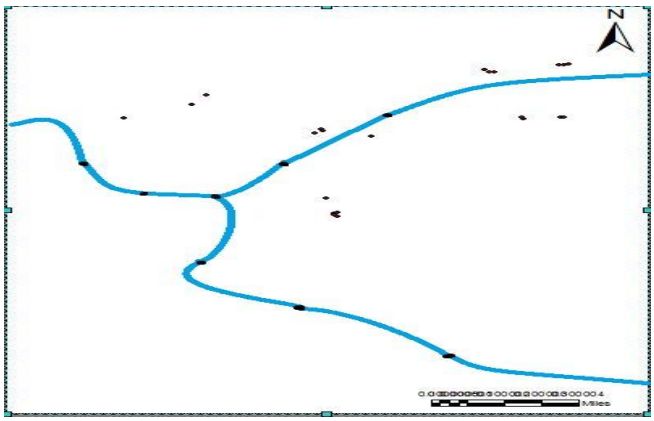

Fig-2 .Study area Location Map

The spatial and non-spatial database formed are integrated for the generation of spatial distribution of maps of the water quality parameter .For spatial interpolation Kriging, Co-kriging approach in GIS has been used in the present study to delineate the local distribution of ground water pollutants. The spatial variation of parameters was plotted using method of kriging.

5. RESULTS AND DISCUSSIONS

Various physical and chemical characteristics of the water was tested. The physical parameters include pH and colour. The chemical parameters include alkalinity, turbidity, DO, chlorides, TDS.

Table 3.Tests results of samples

no	pH	DO	Hardness	Alkalinity	Cl-	Turbidity
1	6.6	65	5	38	11.5	0
2	6.2	56	1.2	36	6.5	0
3	7.5	107	2.2	34	11.5	1
4	8.1	83	3.2	28	16.5	1
5	7.7	87	2.8	30	14	2
6	8.2	106	4.4	30	34.5	2
7	7.9	87	6.2	35	4.5	1
8	7.7	121	4.2	27	32.5	3
9	8.2	110	5	32	40.5	3
10	8.1	114	9.4	28	83	3
11	7.4	97	1.8	48	12.5	3
12	8	77	3.6	26	7.5	2
13	7.5	113	1.4	36	19.5	3
14	7	84	1.2	29	21	2
15	7.2	99	1.4	24	16	2
16	8.1	91	1.6	28	7	3
17	7.4	94	1.8	24	5.5	4
18	7.3	83	2.7	28	6	3
19	6.7	89	2.6	28	18.5	3
20	6.7	92	2.6	30	4	4
21	6.3	83	2.6	48	8	3
22	7.5	93	7	28	15	2
23	6.5	105	7	27	23	2
24	7.6	110	2.2	24	7.5	3
25	6.6	97	6.8	68	20.5	3
26	7	82	2	30	7	4
27	6.8	81	1.6	22	7	3
28	6.7	89	4.6	52	20.5	3
29	6.4	105	3.6	28	9	4
30	6.1	104	12.2	54	12.5	4

The test results showed that the levels of pH, DO, chloride, hardness, alkalinity, turbidity are within the permissible limits.

Table 4.Water Quality Index of Samples

No	Station name	WQI	Remarks
1	Kakkadashery	26.89	Excellent
2	Kakkadashery	27.8	Excellent
3	Kakkadashery	10.21	Excellent
4	Perumattam	22.7	Excellent
5	Perumattam	20.2	Excellent
6	Perumattam	17.42	Excellent
7	Perumattam	30	Excellent
8	Perumattam	15.29	Excellent
9	Perumattam	15.28	Excellent
10	Kizhakekara	15.07	Excellent
11	Kizhakekara	15.38	Excellent
12	Kizhakekara	17.8	Excellent
13	Kizhakekara	15.35	Excellent
14	Chalikadav	18	Excellent
15	Kaliyar river basin	17.3	Excellent
16	Thodupuzha river basin	60.66	Good
17	Latha theatre	70.24	Good
18	Chalikadav	62.4	Good
19	Market	15.78	Excellent
20	Triveni sangamam	66	Good
21	Nedumchalil	88.08	Good
22	Market	53	Good
23	Market	18.21	Excellent
24	Market	15.857	Excellent
25	Muvattupuzha river basin	53.42	Good
26	Arakuzha	52	Good
27	Kecherippady	65.71	Good
28	Kecherippady	58.42	Good
29	Kecherippady	80	Good
30	Kecherippady	87	Good

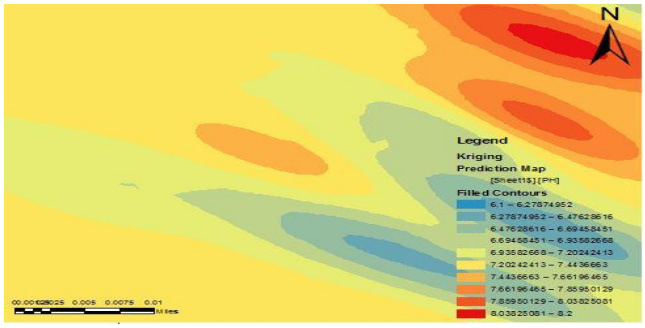

Fig -3.Results of pH in GIS

Fig-4. Results of chloride in GIS

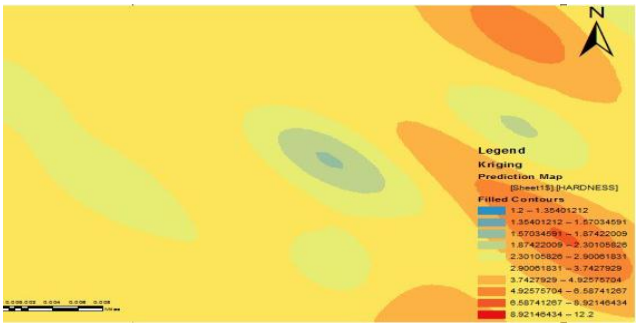

Fig-5. Results of Hardness in GIS

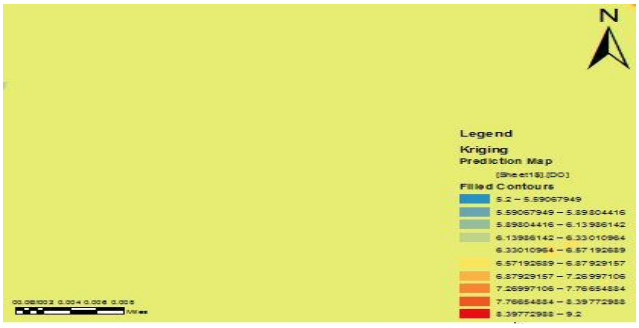

Fig-6. Results of DO in GIS

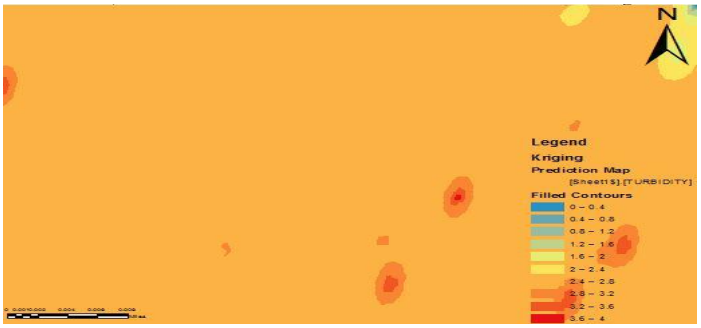

Fig-7. Results of turbidity in GIS

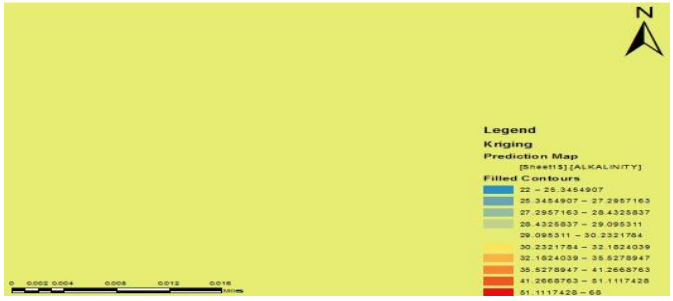

Fig-8. Results of Alkalinity in GIS

6. CONCLUSION

The pH, DO, chloride, hardness, alkalinity, turbidity are within the permissible limits. The variation in the values of water quality parameters shows in the thematic maps the various legends.The samples are shows good and excellent quality status in terms of water quality index after flood,2018. It indicated that the water quality parameters of water samples are satisfying the standards prescribed by IS 10500:2012. This study demonstrates that the use of GIS could provide useful information for water quality assessment.

REFERENCES

[1] IS 10500: 2012

[2] Jency Nadayi-*Studies on ground water quality in and around, Muvattupuzha Muncipality Kerala, India* International Journal of Engineering Science Invention(IJESI),2018.ISSN:2319-6734,ISSN:2319-6726.

[3] Dr.C.Nagamani, Physico-chemical analysis of water samples, International Journal of Scientific & Engineering Research, vol. 6, Jan. 2015, pp2149–2155