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Original Article

Comparative Analysis of Water Quality Parameters of Poondi Reservoir with Drinking Water Quality Standards for Sustainable Development

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Abstract *- The study of a field water sample data collection in poondi reservoir water to mean dissolved oxygen, TDS, pH, TSS, BOD, and COD. The laboratory tested them according to standard parameters described and compared by the Water Quality Standards Bureau of Indian Standards (BIS). In experimental research, a comparison between reservoir water quality parameters was collected for 24 separate sampling stations (12 in Group 1 and 12 in Group 2). The water quality of the poondi reservoir in Tiruvallur district was studied to examine the stability of reservoir water for industrial human usage and agriculture purposes. The beta qualities are 0.05 and 0.2, and G-power is 0.8, respectively, 95% confidence level. Evaluating reservoir water and drinking water standards for which N = 4 samples were taken from each. Drinking water standards for standard parameters compared with the reservoir's water quality have been measured at 7.6, 979, 47, 45, and 320. Within limits of water quality standards, collected water samples in reservoirs in 12 places around the poondi reservoir region. Reservoir water mean value is not equal to the drinking water in Novel treatment. The study mainly focuses on water quality parameters in reservoir water, human use and drinking water sources.*

Keywords *- Poondi reservoir water, Novel treatment, Parameter, Unpolluted water, Drinking water standard, WQI in poondi reservoir.*

1. Introduction

Poondi reservoir is one of the major reservoirs in Tamilnadu. Mainly the reservoir water is affected by environmental pollution caused due to both natural and human-made factors and human activities like washing clothes and utensils, swimming, bathing and discharge of domestic and industrial waste like fishing, so that the water quality of the lake changes hence it is needed to use analyze the water quality contamination parameters Novel treatment in poondi reservoir, considering the use of poondi reservoir water, and its contamination by human and industrial activities (Gopinath et al. 2020).

Environmental parameters on water quality and the water contamination of poondi reservoir built in 1944 in thiruvallur district in Tamilnadu, poondi reservoir water volume is 3,231 million cubic feet on the water quality index WQI in poondi reservoir.(Felix, Prabu, and Upadhyay, 2020).

Based on other characteristics like pH and dissolved oxygen, the WQI was calculated. (DO), nitrogen (NO3-N), turbidity, total coliform, E-coli, TSS, TDS, BOD, COD and Hardness. One of the most popular tests for water quality is pH. pH measures the potential activity of hydrogen ions (H+) in the water but also reveals how acidic the water is. (Chapman 1996). Nitrate and nitrite are nitrogen and oxygen-soluble molecules. (Munn 2018)

Turbidity is caused by the particles dissolved in water, which results in cloudy wastewater. Coliform bacteria in the water are caused by a failure in a closed system and equipment failure. It may spot in soil, leaves, insects, animals, sewage or enter Unpolluted Water into any environment. Novel treatment. E-coli and t-test is a type of facial coliform bacteria present in animals and humans (Mitra 2013)(Felix, Prabu, and Upadhyay 2020).

Table 1. No. of reviewers in the literature on physico-chemical assessment

S.No	Title of the research article/ thesis	Authors
1	Analysis of groundwater – A review	Devendra Dohare Shriram Deshpandey Atulkotiya
2	Monitoring for groundwater quality assessment- current constraints and strategies	P J Chitton S S D Foster
3	Groundwater quality assessment – Assessment of Anekaltaluk, Bangalore urban districts, India	K C Prakash R K Somasekhar
4	Assessing groundwater quality using GIS	Insaf Babiker
5	Changing paradigms in groundwater ecology- from the living fossils to the new groundwater ecology	Colin S Reynolds
6	India groundwater governance – case study	Hector Garduno et al.,
7	Groundwater peer review	National Groundwater Association
8	A Review of regional groundwater flood modeling	Yangixao Zhou
9	A review of groundwater quality issue in Jharkhand due to fluoride	Neeta Kumari et al.
10	Review of water pollution control in China	Tingyao Gao et al.,
11	The challenge of documenting water quality benefits of conversation practices: a review of USDA	M D Torner M A loke
12	Water quality standards Review	IDNR

The articles related to this research paper in Google Scholar for the previous five years, 183 published 165 articles are based on the water contamination in the poondi reservoir. Among all this research has been developed to analyze the water contamination in WQI in the poondi reservoir. It determines (Wintgens et al. 2015) the basis of various parameters like turbidity, total coliform, E-coli, and PH determines the suitability of water for different uses(Ismael et al. 2021). Poondi reservoir's average PH value was 8.14 and stayed alkaline; observed values were within the BIS (Ullhas 2017) acceptance range. Poondi reservoir water is classified as hard to hard water (Sinha Ray 2018). The extensive knowledge and research experience of our team has produced papers of the highest caliber(Prabakaran et al. 2022; Sakthivadivel et al. 2022; Ramesh et al. 2022; Vellaiyan, Muralidharan, and Devarajan 2022; Vivekanandan et al. 2022).

To describe water quality, physical, chemical, and biological elements are used(Majumder and Kale 2021). The water's physical and chemical characteristics are the most crucial components for long-term water collection (Mvss 2019). Reservoir water has been the subject of a number of various water quality rules. This Drinking Water Standard research examines the water quality parameters of bore poondi reservoir waters in a few regions not covered in the prior research and identifies future research needs (Krishnan et al. 2020). The study's objective is to use physicochemical parameters to assess the water quality in the poondi reservoir(Bobrowsky, 2013)(Matheswaran et al., 2022; Sundar et al., n.d.; Tharanikumar, Mohan, and Anbuchezhiyan 2022).

2. Literature Review

The blue planet- the earth is vulnerable to environmental concerns such as climate change, global warming, air pollution, urban sprawl, acid rain, water pollution, waste disposal and ozone depletion(Owolabi and Belle, 2023). The major concern among all the aforesaid was water.

Table 2. Comparing reservoir water and standard drinking water for analyzing the water quality. The reservoir water quality pH, TDS, TSS, BOD, COD is 7.6, 976, 47, 45, 320, and the drinking water standard of pH, TDS, TSS, BOD, COD is 7, 2000,100, 5, 200

Test Cases	QUALITY OF WATER									
	Reservoir Water					Standard drinking water				
	pH	TDS	TSS	BOD	COD	pH	TDS	TSS	BOD	COD
Sample 1	7.6	976	47	45	320	7	2000	100	5	200
Sample 2	7.8	979	51	42	200	7	2000	100	5	200
Sample 3	7.45	973	49	49	210	7	2000	100	5	200
Sample 4	7.63	975	47	70	240	7	2000	100	5	200
Test Results	7.5	979	49	46	240	7	2000	100	5	200

The distribution of surface water is as follows: freshwater, 3%; saline water, 97%; in the available fresh water, 30.1% falls in groundwater and the remaining 68.7% in ice caps and glaciers. Globally, scientists and health advisors are concerned with health issues due to the consumption of unsafe water(Owolabi and Belle, 2023).

Globally it was found that most of the surface waters, groundwater and reservoir water are being contaminated and made unsuitable for human consumption(Darling et al., 2023). In some areas throughout the world, the concentration of toxic metals, organic pollutants and other minor pollutants is alarming. This made scientists worldwide perform physico-chemical and biological analyses of different water sources available to assess their quality and suitability for human consumption. Urbanization, industrialization, human activities, anthropogenic activities, seepage and sewage contamination, are some of the reasons for poor water quality throughout the world(Liu et al., 2023).

Jay P. Graham reviewed the impacts of pit latrines on groundwater quality. A review of groundwater status, challenges, and research needs in Kathmandu, Nepal, was presented by Pradhang-a comprehensive study of water contamination and its health consequences in China(Wang et al., 2023). Gorde elaborately presented a review of water quality assessment parameters in his research article.

No. of reviews are available in the literature on physico-chemical assessment, metal ion analysis of water samples in various regions of the globe, and WQI of different regions are summarized in Table 1.

3. Materials and Methods

This experiment was conducted in the civil engineering department of the Saveetha School of Engineering at the Saveetha Institute of Medical and Technological Sciences in Chennai, Tamil Nadu. This experiment measures the 2 groups of quality standards the poondi reservoir control group and the experimental group at the poondi reservoir region. With a total sample size of 40, there were 20 samples in each group. Both PH, turbidity, acidity, alkalinity, Dissolved Oxygen (DO), electrical conductivity, and E. coli are factors taken into account while conducting an examination. The samples are stored with reagents to prevent them from altering the water's properties while being tested. 20 water samples were gathered close to the poondi reservoir. Poondi reservoir water is often colourless, acidic, and in an unpolluted environment. To determine if reservoir water is appropriate for use in industrial, household, and human-made aspects, the water quality in the poondi reservoir was investigated(Aryal, 2022).

Water samples from the poondi reservoir were collected from two sampling stations from September to October. Water samples were collected bimonthly, and physic-chemical parameters such as alkalinity, sulphate, pH, DO, BOD, COD, hardness, TDS, and TSS were examined according to the protocol. The World Health Organization's recommended reservoir quality standard was used to determine the WQI (Ponsadailakshmi et al., 2018).

The drinking water samples were collected to test physic-chemical parameters, and pH, DO, BOD, COD, alkalinity, hardness, sulfate, TDS, and TSS were examined according to the protocol. Drinking water quality was determined by the WQI (Ponsadailakshmi et al. 2018; Slavik and Uhl 2009).The physical-chemical parameters were tested using instruments, namely a pH meter, a dissolved oxygen meter, a bottle or an incubation bottle (BOD) meter, Chemical Oxygen Demand(COD) test tube used in water Analysis, Alkalinity was measured using pH levels, water hardness test, photometric test, TDS meter tester(Cotruvo 2018).

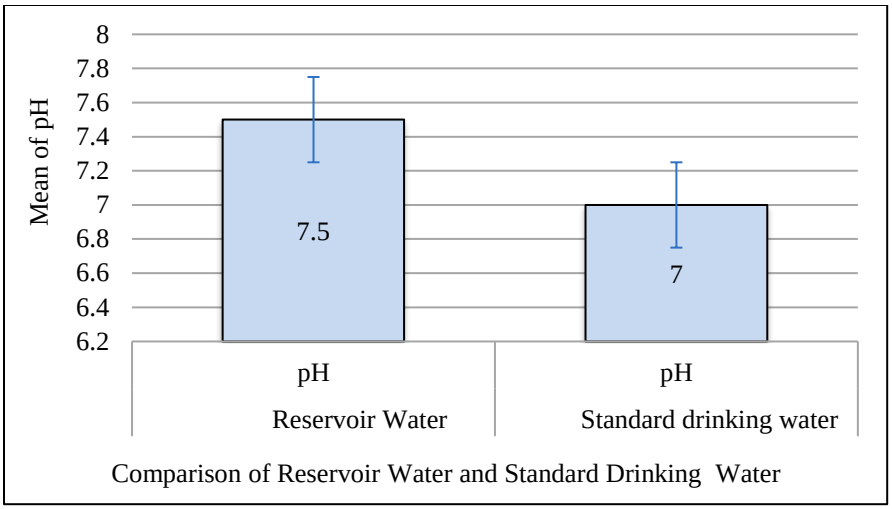

Fig. 1 The standard pH value of water is 7, and the reservoir water sample pH is 7.6; when compared to drinking water, reservoir water pH is high, so it is used for drinking purposes

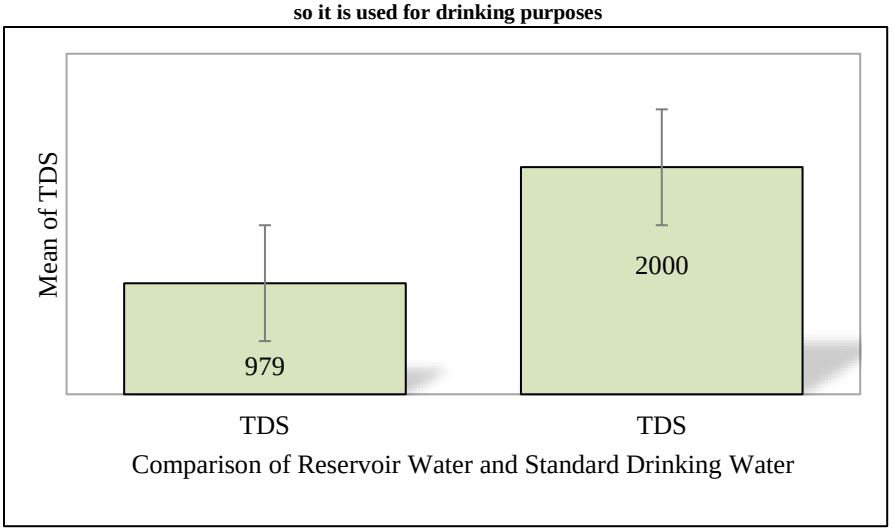

Fig. 2 The standard TDS value of water is 2000, and the reservoir water sample pH is 979; compared to drinking water, reservoir water TDS is high, so it is used for drinking purposes

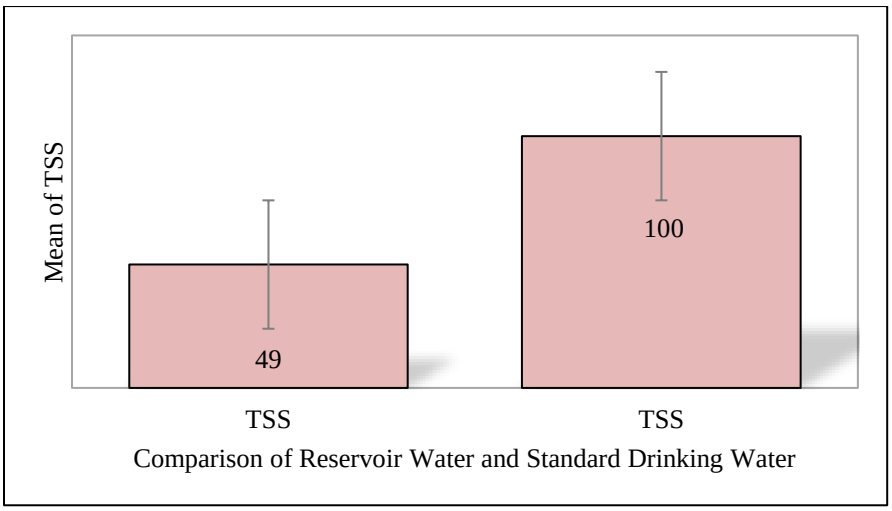

Fig. 3 The standard TSS value of water is 100, and the reservoir water sample pH is 49; when compared to drinking water, reservoir water TSS is high, so it is used for drinking purposes

Table 3. The statistical calculation such as reservoir water, standard deviation and standard median for reservoir water and standard drinking water.The water quality parameter used in the test. The mean quality of water of reservoir water of pH, TDS, TSS, BOD, Hardness 7.6, 976, 47, 45, 220. and standard drinking water quality for pH, TDS, TSS, BOD, Hardness 7, 2000, 100, 5 and 200

Group		N	Mean	Standard Deviation	Standard Error Mean
pH	Reservoir water	5	7.5960	0.13539	0.06055
	Standard drinking water	5	7.0000	0.00000	0.00000
BOD	Reservoir water	5	976.4000	2.60768	1.16619
	Standard drinking water	5	2000.0000	0.00000	0.00000
TDS	Reservoir water	5	48.6000	1.67332	0.74833
	Standard drinking water	5	100.0000	0.00000	0.00000
TSS	Reservoir water	5	50.4000	11.23833	5.02593
	Standard drinking water	5	5.0000	0.00000	0.00000
COD	Reservoir water	5	242.0000	47.11688	21.07131
	Standard drinking water	5	200.0000	0.00000	0.00000

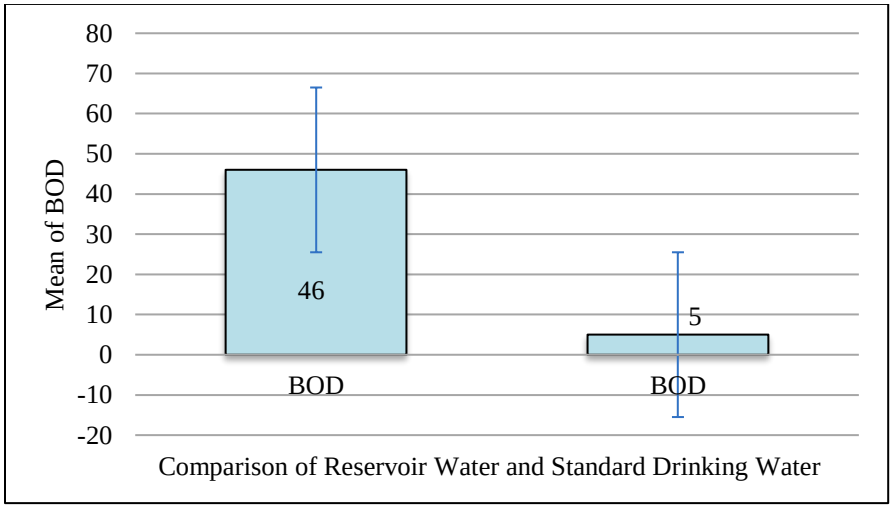

Fig. 4 The standard BOD value of water is 5, and the reservoir water sample pH is 46; when compared to drinking water, reservoir water BOD is high, so it is used for drinking purposes

Rapid industrialisation, extensive road transportation, overpopulation, and water disposal have significantly impacted water quality and availability. The samples were found to be very alkaline based on the physico-chemical characteristics poondi reservoir pH fluctuates from 7.53 to 8.94. It proves that the study region's cause is the high salt level in the area. The turbidity of water is 10.25 mg/l. The overall hardness value in the poondi reservoir ranges from 152.36. There is 6 mg/l of dissolved oxygen in the poondi reservoir. 26 to 34.9°C is the temperature range at WQI's poondi reservoir region. There are 1785 mpn of total coliform per 100 ml.

Poondi reservoir water samples were collected for 12 places in poondi reservoir. Twenty samples were tested to check water quality standards. A comparison was made between drinking water and reservoir water.

4. Statistical Analysis

The equality test from independent samples was used for the water samples to determine the standard mean and SD mean. Using SPSS, drinking and reservoir water samples were statistically compared to other features. There were no independent variables, and all dependent variables were at sea.

Table 4. The statistic was calculated for an independent sample test between the reservoir and drinking water. The sig. for pH is 0.204. Independent sample of reservoir water and drinking water standard with confidence interval as 95%

Group		Levene's test for Equality of variances		T-test for Equality of Means						
		F	Sig.	t	df	Sig.(2-tailed)	Median Difference	Std.Error Difference	95% Confidence Interval (Lower)	95% Confidence Interval (Upper)
pH	Equal Variances assumed	7.080	0.029	9.844	8.000	0.000	0.596	0.061	0.456	0.736
	Equal Variances are not assumed.			9.844	4.000	0.001	0.596	0.061	0.428	0.764
BOD	Equal Variances assumed	15.540	0.004	-877.73	8.000	0.000	-1023.6	1.166	-1026.289	-1020.911
	Equal Variances are not assumed.			-877.73	4.000	0.000	-1023.6	1.166	-1026.838	-1020.362
TDS	Equal Variances assumed	10.894	0.011	-68.686	8.000	0.000	-51.400	0.748	-53.126	-49.674
	Equal Variances are not assumed.			-68.686	4.000	0.000	-51.400	0.748	-53.478	-49.322
TSS	Equal Variances assumed	6.213	0.037	9.033	8.000	0.000	45.400	5.026	33.810	56.990
	Equal Variances are not assumed.			9.033	4.000	0.001	45.400	5.026	31.446	59.354
COD	Equal Variances assumed	4.852	0.059	1.993	8.000	0.081	42.000	21.071	-6.591	90.591
	Equal Variances are not assumed.			1.993	4.000	0.117	42.000	21.071	-16.503	100.503

To determine the mean differences in pH, dissolved oxygen, total coliform, nitrate, temperature, or turbidity, the 20 reservoir water samples from single distinct sources underwent an independent samples T-test. The findings indicate a considerable mean difference between the standard and reservoir water samples and the population as a whole based on the analysed samples.

5. Results

The reservoir water was evaluated using the mean data and group data, and we determined that the sample's hardness level was high. Calcium levels in reservoir water are kept as low as feasible by treatment. Calcium in drinking water has negative health impacts. Thus, magnesium is crucial to help drinking water break down the minerals in the water. Hard water is not harmful to health because of the minerals in it. Fig. 1 The standard pH value of water is 7, and the reservoir water sample pH is 7.6. Fig. 2 The standard TDS value of water is 2000, and the reservoir water sample pH is 979. Fig. 3 The standard TSS value of water is 100, and the reservoir water sample pH is 49. The water standard is polluted compared to comparing Drinking Water Standard with reservoir water samples taken 4 samples with pH of 7.6, TDS of 979, TSS of 47, BOD of 45, and COD of 320.

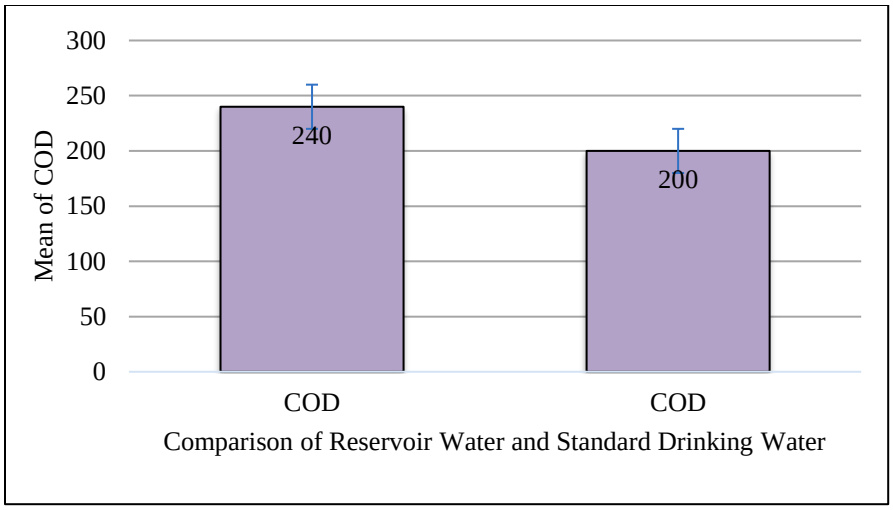

Fig. 5 The standard COD value of water is 200, and the reservoir water sample pH is 240; when compared to drinking water, reservoir water COD is high, so it is used for drinking purposes

Moreover, drinking water quality standards of pH of 7, TDS of 2000, TSS of 100, BOD of 10, and COD of 200. The mean of reservoir water is more polluted (Table 2).

Actual estimates include Mean, Standard Error, and Standard Deviation Median for drinking and reservoir water standards—the t-water test's boundary characteristics. The standard deviation of pH, TDS, TSS, BOD, and COD in reservoir water is 0.030, 1.423, 14.310, 330, and 210, whereas 0.277, 0.500, 1.618, 0.100, and 0.200 in drinking water.

The reservoir water's pH, TDS, TSS, BOD, and COD have respective standard errors of 0.7.25, 0.975, 0.062, 45.25, and 0.342. Drinking water's pH, TDS, TSS, BOD, and COD have respective standard errors of 7.25, 2000.25, 99.25, 10.25, and 251.5 (Table 3). Table 4: The statistic calculated for an independent sample test between the reservoir and drinking water. The sig. for pH is 0.204. Independent sample of reservoir water and drinking water standard with confidence interval as 95%.

The drinking water standard sig. for pH is calculated statistically using a water sample test between reservoir and reservoir water. Fig. 4 The standard BOD value of water is 5, and the reservoir water sample pH is 46. When compared to drinking water, reservoir water BOD is slightly high, so it is used for drinking purposes.

Comparing reservoir water with drinking water quality criteria using 210 independent samples with a 95% confidence level (Table 3). Fig. 5 The standard COD value of water is 200, and the reservoir water sample pH is 240; when compared to drinking water, reservoir water COD is slightly high, so it is used for drinking purposes.

6. Discussion

Water samples from the reservoir were collected in the months of August, September, October, November, and December. pH, electrical conductivity, total dissolved solids, phenolphthalein alkalinity CaCO3, and total alkalinity CaCO3 were all measured. According to Table 3, the pH range of the water samples taken in the study region ranged from 6.9 to 6.2. In general, the second, eleventh, thirteenth, fifteenth, and twentieth samples had lower pH readings.

According to Table 2, the electrical conductivity (EC) of the reservoir water ranged between 0.56 and 1.45 micro s/m. It seems that the water was fairly alkaline phenolphthalein's nitrate value.

Electrical conductivity at Station 1 reaches a maximum of 0.64 s/m and a minimum of 0.53 s/m. The electrical conductivity value for this particular location increased in September before decreasing in November and December. Station 2 has an EC value of 1.9 s/m at its highest and a low of 0.71 s/m. The given chart's pH variations are presented on a monthly basis (Fig. 3). The pH is operated in station 1. Monthly fluctuations in the pH of the supplied chart (Fig 3) are plotted. In station 1, the pH ranges from 6.8 to 7.5. The pH level is 7.5 at this station(Smolders et al. 2014).

TDS is displayed monthly in the chart provided. The TDS measurement at Station 1 ranges from 540 mg/L to 545 mg/L. TDS concentrations are highest in December and lowest in August. TDS at station 2 changed to 520 mg/L in August and November and 530 mg/L in September. At stations 3 and 4, TDS was 540 mg/L and 528 mg/L, respectively. TDS at this station is highest in October and lowest in November. TDS was maximum at 532 mg/L in December and minimum at 541 mg/L at Station 4 in January.

7. Conclusion

Relevant water quality metrics in this study include pH, dissolved oxygen, BOD, TDS, TSS, and total hardness. In this way, it must adhere to the envisioned EU surface water quality directive. Reservoir water is utilized for irrigation as well as drinking water. Reservoir water quality used for drinking and agriculture is the subject of this research. Also, water quality in the research area is worse in August than in December, indicating that agricultural pollution increases in December. The availability and cost of GIS systems are some alternative solutions to this issue.

Authors Contributions

Author NR was involved in data collection, analysis, and manuscript writing. Author MT was involved in conceptualization, data validation, and critical manuscript review.

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