

# WATER QUALITY ANALYSIS AND ITS SUITABILITY FOR DOMESTIC PURPOSES IN AMRAVATI CITY

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## **ABSTRACT**

*Surface water quality is a major environmental aspect. The present work is to analyse the Water Quality Index (WQI) for the surface water of Wadali Lake, Amravati, Maharashtra. To provide an overview for evaluation of surface water quality of Wadali Lake in Amravati City for applying spatially distributed by using Geographic Information System (GIS). Eight water samples were collected from the Wadali Lake. To determine the water quality index these water samples were analysed for water quality parameters like pH, Fluoride, Dissolved Oxygen (DO), Turbidity, Electrical Conductivity, Chemical Oxygen Demand (COD), using standard techniques in the laboratory. Water Quality Index is used to determine the suitability for the domestic purpose of Wadali Lake in Amravati City, Maharashtra. Water quality index has been proved to be a useful technique for the overall assessment of the water quality of the water body.*

***Keywords: Chemical parameters, COD, DO, Water Quality Index (WQI)***

## **I. INTRODUCTION**

Water is the most important natural resource not only of a state or a country, but also of the entire humanity. The prosperity of a nation depends primarily upon the judicious exploitation of this resource. Thus, it can be stated that the primary wealth of a nation is water. India has an acute shortage of potable water of acceptable quality due to declining freshwater resources. The socio-economic growth of a region is constrained by non-availability of safe drinking water; so Government of India had constituted a Water Technology Mission for drinking water in 1987.

Environmental pollution is one of the serious threats faced by mankind. Among all environmental resources, water is the most essential and precious one. Water is essential for life and thus the quality of water is an important measures of the quality of life or rather the existence of life. Consequently, water quality analysis is one of the most important activities to protect and save human life.

Surface water is used for domestic and industrial water supply and irrigation all over the world. In the last few decades, due to rapid growth of population and the accelerated pace of industrialization, there has been a

tremendous increase in the demand for freshwater. Rapid urbanization has affected the availability and quality of surface water due to its overexploitation and improper waste disposal, especially in the urban areas. According to WHO, water is responsible for 80% of all the diseases in human beings.

GIS is a tool which is very efficient and effective in solving problems where spatial data are important and it is used for assessment of water quality and developing solutions for water resources related problems. As the surface water quality and chemical parameters vary with space and time, mapping it with the use of GIS provides better understanding of their distribution throughout the area.

The objectives of the study are to determine surface water quality chemical characteristics such as pH, Fluoride, Dissolved Oxygen (DO), Turbidity, Electrical Conductivity (EC), Chemical Oxygen Demand (COD), and to determine its suitability for the domestic purpose map of surface water in the study area.

Such a plan needs a systematic study in the lakes to know the spatial distribution of water quality so that any sustainable approach could be implemented in the lakes. Thus, in order to meet society's need for water, preventive measures must be taken to ensure the sustainability of the water resources. Keeping the above criteria in mind, an attempt has been made in water quality assessment and prediction modeling of Wadali Lake in Amravati, in the State of Maharashtra in India.

## II. STUDY AREA

Wadali Lake is situated on the Chandur Railway Road, towards the east of Amravati. It is located between altitudes of  $20^{\circ}55'23''$  N and longitudes of  $77^{\circ}47'45''$  E. This reservoir supplies fresh and clean water in the city. A zoo and a small garden are other highlighting attractions of this Lake and are popular among children. The Lake also offers a relaxing getaway from the city life and is visited by tourists in large number. The location of Wadali Lake which is situated in Amravati is given in the Fig. 1.

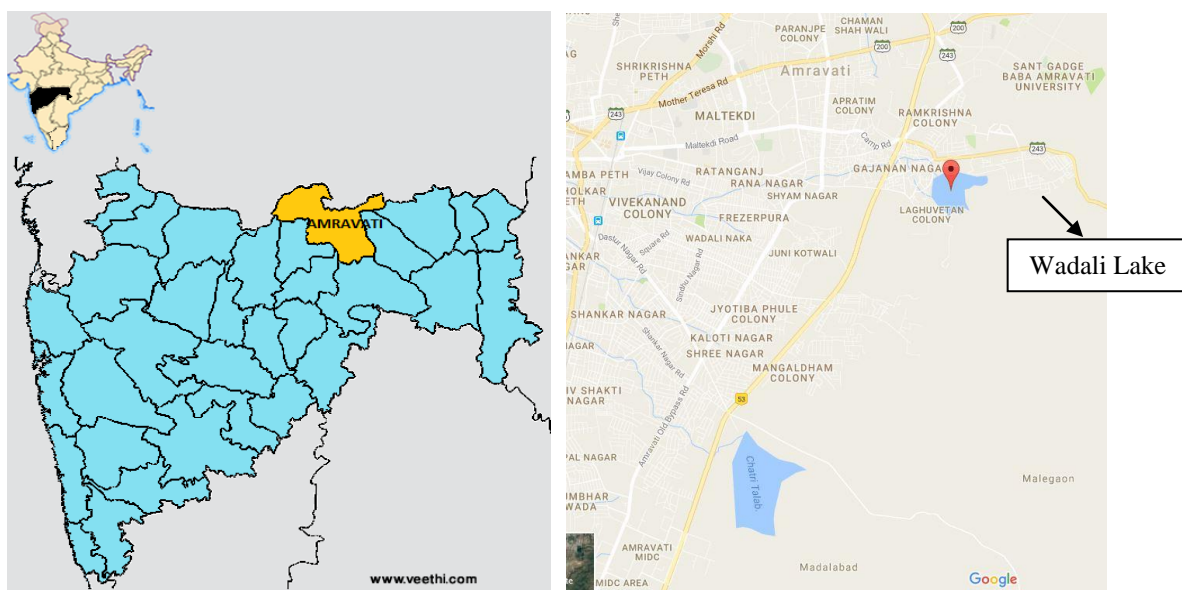


Fig.1: Study Area Location Map

### III. METHODOLOGY

The present study was carried out in the Wadali Lake, Amravati, Maharashtra. A total of 8 samples from surface water were collected and each sample was given ID such as S1 to S8. Here S1 stands for sample number 1 and similarly S8 for sample number 8. The location of the samples are collected by using a hand held GPS (Table 1). These samples were analyzed for different parameters by following the standard methods. The details of the methods used in the study are given in the flowchart (Fig. 2). The primary standards for drinking water based on WHO and Indian standards are given in Table 2. Different level of water quality index and their respective water quality status are shown in Table 3.

**Table 1: Sample location with their GPS values**

| Sample ID | Latitude      | Longitude     |
|-----------|---------------|---------------|
| S1        | 20°55'34''    | 77°47'33.86'' |
| S2        | 20°55'29.5''  | 77°47'34.8''  |
| S3        | 20°55'26.8''  | 77°47'38.22'' |
| S4        | 20°55'31.48'' | 77°47'39.08'' |
| S5        | 20°55'27.05'' | 77°47'43.66'' |
| S6        | 20°55'32.99'' | 77°47'44.3''  |
| S7        | 20°55'35.94'' | 77°47'42.25'' |
| S8        | 20°55'35.58'' | 77°47'37.57'' |

**Table 2: Standards for Quality of Drinking Water**

| Parameters       | WHO     | BIS     |
|------------------|---------|---------|
| pH               | 6.5-8.5 | 6.5-8.5 |
| Turbidity        | 5       | 5       |
| Dissolved Oxygen | 4       | 5       |
| Fluoride         | 1.5     | 1.5     |
| Conductivity     | 1500    | -       |

**Table 3: Water Quality Index (WQI) and Water Quality Status**

| WQI    | Water Quality Status |
|--------|----------------------|
| 0-25   | Excellent            |
| 26-50  | Good                 |
| 51-75  | Poor                 |
| 76-100 | Very poor            |
| >100   | Unfit for drinking   |

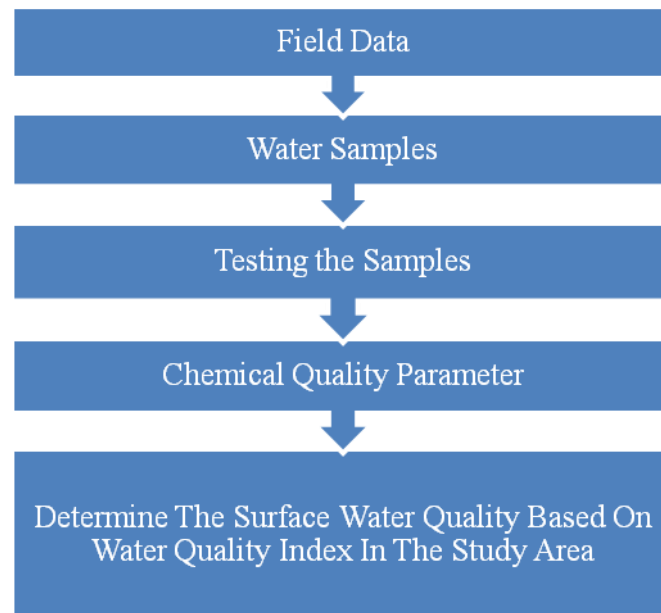


Fig.2:Methodology flowcharts showing various steps for the study

#### IV. RESULTS AND DISCUSSION

Water quality parameters: The analyzed results of the various parameters of the study area are given in the Table 4.

Table 4: Results of Analyzed Water Quality Parameters

| Sample ID | pH   | EC     | DO   | Turbidity | Fluoride | COD   |
|-----------|------|--------|------|-----------|----------|-------|
| S1        | 8.35 | 737    | 8.4  | 0.90      | 0.8      | 31    |
| S2        | 8.41 | 401    | 8.9  | 0.61      | 0.7      | 43    |
| S3        | 7.30 | 382    | 9.3  | 0.64      | 0.9      | 65    |
| S4        | 8.27 | 452    | 8.6  | 0.59      | 0.9      | 47    |
| S5        | 8.37 | 385    | 7.9  | 0.85      | 0.8      | 56    |
| S6        | 8.23 | 375    | 8.6  | 1.24      | 1.0      | 40    |
| S7        | 7.43 | 395    | 9.1  | 1.15      | 1.2      | 34    |
| S8        | 7.49 | 500    | 8.3  | 0.84      | 1.1      | 29    |
| Min       | 7.30 | 382    | 7.9  | 0.59      | 0.7      | 29    |
| Max       | 8.41 | 737    | 9.3  | 1.24      | 1.2      | 65    |
| Average   | 7.98 | 453.37 | 8.64 | 0.85      | 0.925    | 43.12 |

4.1 pH

The most commonly measured chemical attribute of water is its acidity or pH. The pH of the samples lies within a minimum and maximum of 7.30 to 8.41 with an average of 7.98. In these samples, pH values show that lake is alkaline in nature.

#### 4.2 Electrical Conductivity

Pure water is electrically non-conductive but surface water contains dissolved solids and thus, is conductive. Its electrical conductivity depends on the concentration of dissolved solids. In the study area, the electrical conductivity ranges from 382 – 737  $\mu\text{S/cm}$  with an average 453.37  $\mu\text{S/cm}$ .

#### 4.3 Dissolved Oxygen

Measurement of dissolved oxygen is a primary parameter in all pollution studies. The minimum DO was recorded as 7.9 mg/L and the maximum was recorded as 9.3 mg/L. The permissible value recommended for DO is 5 mg/L as per Indian standards. In the present study, lake shows high DO which may be due to the increased solubility of oxygen at lower temperature.

#### 4.4 Turbidity

The turbidity in the present study area ranged from 0.59 NTU - 1.24 NTU. The permissible value for turbidity is 5 NTU. The Lake is observed within the permissible limit.

#### 4.5 Fluoride

Fluoride concentration values ranged from 0.7 to 1.2 mg/l. The fluoride concentration is found to be within the permissible limit which is 1.5 mg/l. When the intake of fluoride is going beyond the permissible limit, it leads to skeletal and dental fluorosis.

#### 4.6 Chemical Oxygen Demand (COD)

Chemical Oxygen Demand (COD) values ranged from 29 to 69 mg/l. The permissible limit for the Chemical Oxygen demand (COD) is 250 mg/l. The study area is found to be within permissible limit for the domestic use.

#### 4.7 Water Quality Index (WQI)

Water Quality Index (WQI) is a group of water quality parameters and combined them into a single number in accordance with the chosen method of computation. The desired use of WQI is to access water quality trends for management/decision making purpose. The water quality parameters, BIS standards and relative weightage are given in the Table 5 which shows the calculated values of Water Quality Index. The quality of the surface water in the study area is currently not bad as most of the sample locations are within the good index range of the sample 26-50 (Table 3).

**Table 5: Calculated values of Water Quality Index (WQI)**

| Parameters | Quality Value | Weight II | Relative Weight III | Water Quality Index I x III |
|------------|---------------|-----------|---------------------|-----------------------------|
| pH         | 65.42         | 3         | 0.125               | 8.18                        |
| EC         | 30.22         | 5         | 0.208               | 6.28                        |
| DO         | 62.11         | 4         | 0.167               | 10.37                       |
| Turbidity  | 17.05         | 3         | 0.125               | 2.13                        |

|          |       |    |       |       |
|----------|-------|----|-------|-------|
| Fluoride | 55.00 | 5  | 0.208 | 11.08 |
| COD      | 17.25 | 4  | 0.167 | 2.88  |
| Total    |       | 24 | 1.0   | 40.92 |

## V. CONCLUSIONS

From the study it is inferred that the pH in the lake is alkaline in nature. However, in most of the locations surface water from the lake is used for the domestic purposes to fulfill the requirement of the day to day life. From the Water Quality Index it is shown that the surface water is in good quality. Generally the study area is in the range of potable to the drinking water quality.

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