

“Water Quality Status of Pashan Lake and Manas Lake Linked by Ramnadi River”- An Experimental Analysis

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Abstract Water pollution has been one of the major topics in the environmental issue of urban India. Pashan Lake and Manas Lake is an important lake in Pune city which attracts migratory birds. Deforestation on nearby hills has caused heavy siltation resulting in decrease in the depth of the lake. The surface water quality of Pashan Lake is severely degraded due to the pollution from surrounding areas directly entering the water. Eight surface sampling points are selected to evaluate the water quality. The study presents the physicochemical characteristics of the lake water and suggests the means to improve the water quality through eco remediation measures for restoration.

Water analysis are done for the parameters like pH, Dissolved Oxygen (DO), Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Alkalinity , Electrical Conductivity for testing the suitability for drinking, agricultural purposes

Keywords — Water Pollution, Lake Water Quality, Ramnadi, Pashan Lake, Manas Lake, Pune

I. INTRODUCTION

Water is an essential and valuable natural resources for entire living community. Hence its quality and quantity are of prime importance. The importance of quality of natural resources of water that is ground water and surface water is significantly increasing since last two decades in India [2]. Water is mainly polluted due to discharge of various effluents like industrial waste water, domestic waste which are discharged directly or indirectly into the water bodies without treatment [1]. Ramnadi is river originates from Manas Lake and meets to Pashan Lake and continues towards Mula River. Manas Lake and Pashan lake is manmade lake built by bunding Ram River. Silting of lake occurs due to deforestation, road construction, and other land disturbances which results erosion. The surface water quality of the Pashan Lake is severely degraded due to the pollution from surrounding areas directly entering the water.

II. OBJECTIVES

- 1) To determine the Pollution Load
- 2) To detect the presence of E-coli Bacteria.
- 3) To develop Pollution variation Profile along river flow.

III. STUDY AREA

i) CAUSES OF WATER POLLUTION

Rapidly increasing population, rising standards of living, growth of industrialization and urbanization have exposed the water resources. Many water bodies including the

Pashan Lake, Manas Lake and Mula River have become unfit for use.

- Industrial Wastes
- Human Wastes
- Religious Wastes
- Dumping of Garbage

ii) EFFECT OF POLLUTED WATER ON LOCAL COMMUNITY

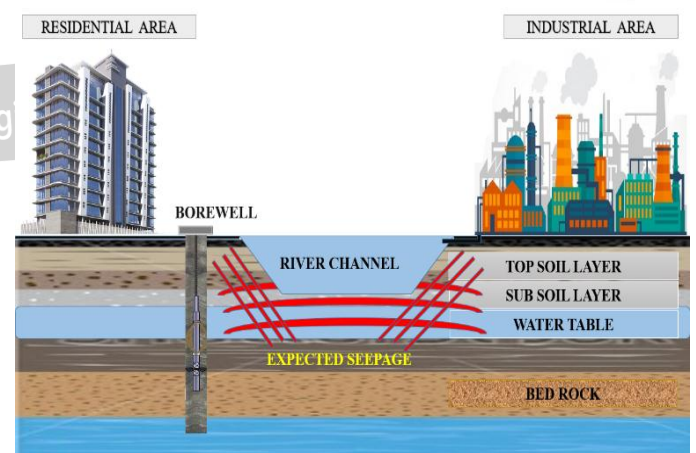


Fig. No. 1: Possible Seepage through river channel

Many people depend on bore well water today because of the limited or no water supply from rivers and lakes. Almost every city is dependent on bore well water. Bore well water is usually hard and contains many harmful impurities. Drinking contaminated bore well water can cause many harmful diseases. Hardness in bore well water

is due to the presence of harmful heavy metals like Arsenic, fluoride, and lead. Lack of water, sanitation, and hygiene results in the loss of 0.4 million lives while air pollution contributes to the death of 0.52 million people annually in India (WHO 2007). Contamination may arise from pollutants entering the water table some distance from the port or from sewage entering the borehole. In cases where overdrawn is evident (water is brackish), tests should be conducted at least monthly [3].

iii) MANAS LAKE



Fig. No.2: Location of Manas Lake [13]

Manas Lake is manmade Lake built by bunding Ram River. Manas Lake is situated between 18°29'44.16"N and 73°44'9.73"E in Bhukum, Bhugaon Pune and is about 4.5 kilometers from Chandani Chowk, and 5 km from Kothrud, and 14 km from Hinjewadi.

iv) PASHAN LAKE



Fig. No.3: Location of Pashan Lake [13]

Pashan Lake is manmade lake has been built by creating a bund around a small rivulet, named Ram Nadi. The man-made lake has a total catchments area of 40 sq. km [13]. Before flowing into the main Mula River, the rivulet originates from Bavdhan and flows via Pashan, Sutarwadi, and Baner to Someshwarwadi. Water of the lake serves the people of the old Pashan Village for growing crops all the year round. It is also supplied to nearby Governor's House. Pashan has the maximum hill area of 5111.89 hectares. The Lake is situated in the city of Pune latitude and longitude is 18° 32' 120" N and 73 47' 240" E. The lake is situated about 9 km to South West of Pune city.

v) RAMNADI RIVER

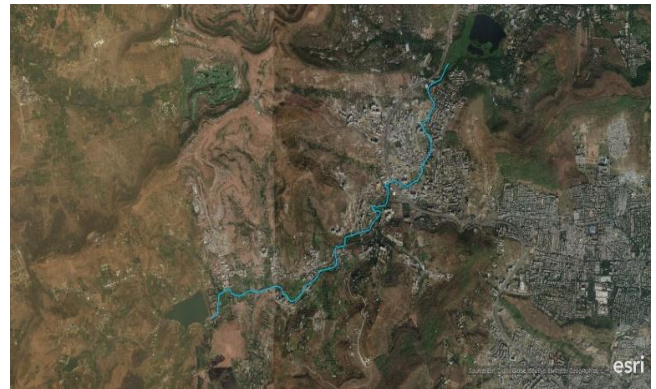


Fig. No.4: Location of Ramnadi from Manas Lake to Pashan Lake [13]

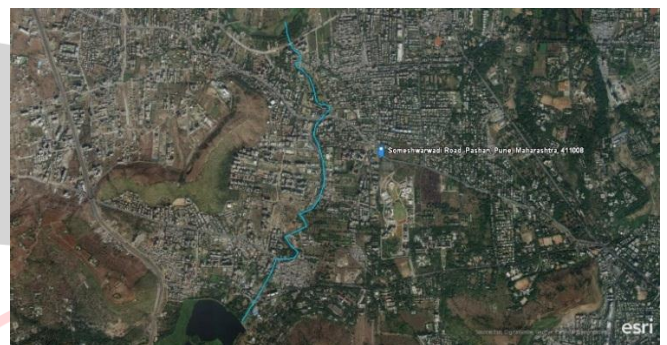


Fig. No.5: Location of Ramnadi from Pashan Lake to Mula River [13]

Ramnadi is a river originates from Manas Lake and meets to Pashan Lake and continues towards Mula river. Length of Ramnadi from Manas lake to Pashan Lake is 8.12 km. Ramnadi which further meets Mula River from Pashan Lake is 4.45 km in length. 'Ram river' located at latitude 18°32'7"N and longitude 73°46'58"E. Mumbai – Bangalore highway (NH 4) touches Lake Boundary at North West. Sutarwadi village, is situated, in the North while on the South, a bridge runs connecting Bavdhan road and National Highway No. 4. Ram River enters the lake from East direction.

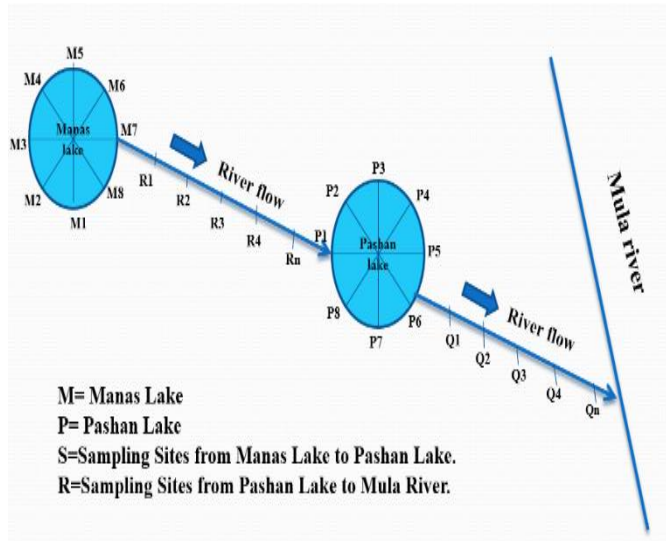
Table No. : 1 Water Sampling Location Points

| WATER SAMPLING LOCATIONS AND CO-ORDINATES | | | |
|---|--|-------------------------------|--------------------------------|
| Sampling Locations | Sampling Points | Co-ordinates of Location | Elevation above Mean Sea Level |
| Manas Lake | ML1, ML2, ML3, ML4, ML5, ML6, ML7, ML8 | 18°29'44.16"N 73°44'9.73"E | 589 M |
| Pashan Lake | PL1, PL2, PL3, PL4, PL5, PL6, PL7, PL8 | 18°32'7"N 73°46'58"E | 589 M |

| | | | |
|---------------------------|--|--------------------------------|-------|
| Manas Lake to Pashan Lake | MR1, MR2, MR3, MR4, MR5, MR6, MR7, MR8 | 18°29'119'' N 73°44'889'' E | 587 M |
| Pashan Lake to Mula River | PR1, PR2, PR3, PR4, PR5, PR6, PR7, PR8 | 18°32'070'' N 73°46'620'' E | 587 M |

IV.METHODOLOGY

Fig. No. 6: Outline Sketch



showing Sampling Points

The area under consideration covers Sutarwadi, Someshwarwadi, and Sus road, Bavdhan Burduk, Bavdhan Khurd and Pashan. The area is comprised of a number of Bore wells. The water samples is to be collected and Temperature and pH will be recorded at the site itself for water samples. The site of the sample collection are marked by the dots in the outline sketch (Fig. No. 6).

In this we studied the water samples which were collected in sterilized bottles using the standard procedure in accordance with the standard method. The samples were collected for a period of 3 months from December 2017 to February 2018, at eight sampling stations from Both the Lakes. The samples were brought to the laboratory with due care and were stored at 20°C for further analysis. The physico-chemical parameters such as pH, Biochemical Oxygen Demand, (BOD), Dissolved 340 to 960 m/m) is used for analysis.

1. Site Investigation

- Aerial
- Physical
- Topographical

2. Study Area

- Catchment area of lakes.
- Effective length of river
- Sources of waste water contamination

3. Sampling points

- Manas Lake
- Pashan Lake
- Ramnadi river

V. RESULTS AND DISCUSSION

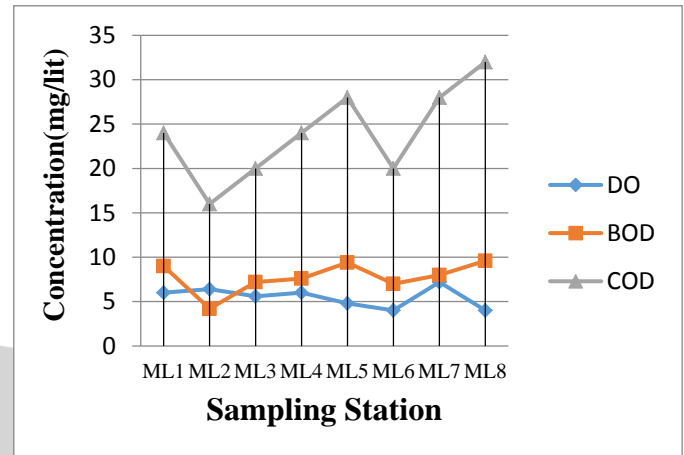


Fig. No. 7: Manas Lake Variation Profile

- DO of Manas Lake varies from 4 to 7.2 mg/lit. DO level in Manas lake is suitable for survival of aquatic life.
- BOD of Manas Lake at ML3 & ML8 is 7.2 & 9.6 mg/lit while COD at ML2 & ML8 is 16 & 32 mg/lit respectively, that means it is within permissible limits.
- Which indicates that the BOD and COD are negligible and water is not much polluted and suitable for use.

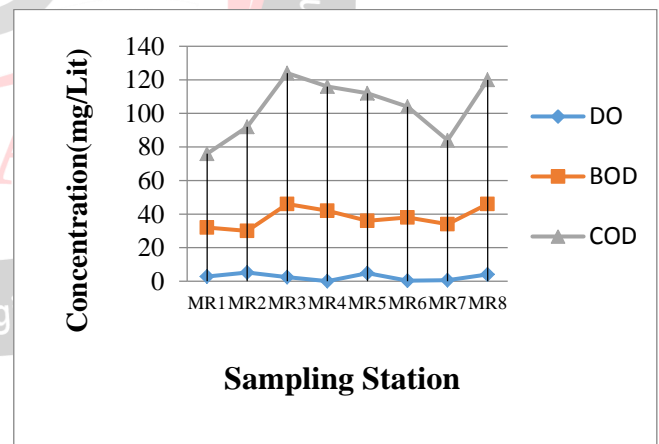


Fig. No. 8: Manas Lake to Pashan Lake (Ramnadi) Variation Profile

- DO level of Ramnadi is found to be very low because the effluent contains high amount of organic wastes depleting the oxygen level and at some places it is found below the detectable level causing threat to water quality.
- BOD level varies between 32 to 46mg/lit due discharge of domestic wastes from the adjoining slum areas.
- COD at MR1 is 76mg/lit which is further increased to 120mg/lit at MR8 due to sudden discharge of organic waste at MR8.

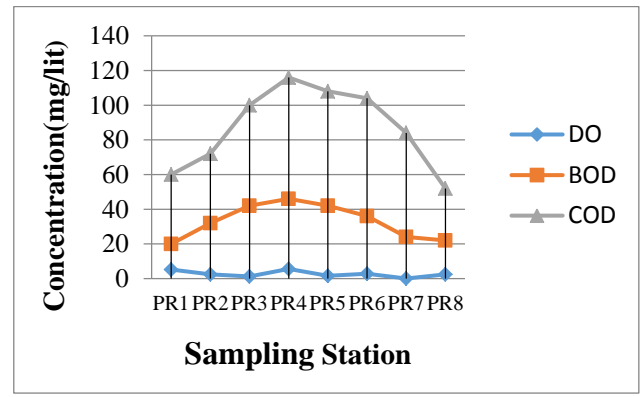
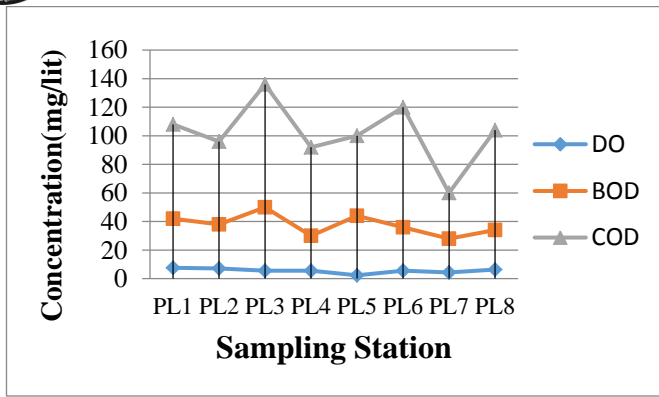


Fig. No. 9: Pashan Lake Variation Profile

- DO level is found to be critical at PL5 because there is rapid increase in the growth of water hyacinth which leads to the depletion of dissolved oxygen.
- Water hyacinth contributes to the organic waste in water, which is further decomposed by bacteria. This results to high BOD level at PL3 and PL5.
- The high COD (136mg/lit) and BOD (50mg/lit) level at PL3 is found due to presence of domestic waste and toxic industrial wastes.
- When BOD and COD levels are high, DO levels decrease because the oxygen that is available in the water is being consumed by the bacteria. Since less dissolved oxygen is available in the water, fish and other aquatic organisms may not survive.
- DO content at PR4 is 5.6mg/lit, but it is observed that it is decreasing after PR4 due to organic waste disposal from local areas.
- There is an increase concentration of BOD and COD results at PL4, PL5 and PL6 of river due to discharge of soluble organic compounds contained in wastewater.
- The river also contains toxic and inorganic waste, therefore leading to an increased concentration level of COD.
- The increase in the BOD and COD levels together has contributed to the diminution of dissolved oxygen (DO) content in river water.
- The graph of Manas Lake shows that the results are within the permissible limits and hence the water quality is not much deteriorated and can be used for domestic and Agricultural purposes. Whereas, the Pashan Lake results shows high amount of BOD and COD levels due to dumping of wastes and also due to it has been turned into sewage disposal canal. Also from the biological test it is found that it contains traces of Ecoli bacteria and if such water is consumed it may lead to diseases like typhoid and cholera. Therefore, water of Pashan Lake is unfit to use and needs proper treatment.

Table No. : 2 Physico-Chemical Parameters of Manas Lake ^[6]

| SAMPLE NO. | TEMPERATURE (°C) | pH | ALKALINITY (mg/lit) | CONDUCTIVIY (µs) | DO (mg/lit) | BOD (mg/lit) | COD (mg/lit) | MPN |
|------------|------------------|-----|---------------------|------------------|-------------|--------------|--------------|-----|
| ML 1 | 22.0 | 8.0 | 104 | 172.30 | 6.0 | 9.0 | 24.0 | 2 |
| ML 2 | 22.1 | 8.3 | 110 | 89.46 | 6.4 | 4.2 | 16.0 | |
| ML 3 | 22.0 | 8.3 | 125 | 102.40 | 5.6 | 7.2 | 20.0 | |
| ML 4 | 22.0 | 8.1 | 150 | 93.21 | 6.0 | 7.6 | 24.0 | |
| ML 5 | 22.0 | 8.2 | 114 | 101.90 | 4.8 | 9.4 | 28.0 | |
| ML 6 | 22.1 | 8.3 | 105 | 121.40 | 4.0 | 7.0 | 20.0 | |
| ML 7 | 22.0 | 8.2 | 106 | 156.21 | 7.2 | 8.0 | 28.0 | |
| ML 8 | 22.2 | 8.5 | 94 | 132.28 | 4.0 | 9.6 | 32.0 | |

Table No. : 3 Physico-Chemical Parameters of Pashan Lake ^[6]

| SAMPLE NO. | TEMPERATURE (°C) | pH | ALKALINITY (mg/lit) | CONDUCTIVIY (µs) | DO (mg/lit) | BOD (mg/lit) | COD (mg/lit) | MPN |
|------------|------------------|-----|---------------------|------------------|-------------|--------------|--------------|-----|
| PL 1 | 21.5 | 7.4 | 160.0 | 150.0 | 7.6 | 42.0 | 108.0 | 4 |
| PL 2 | 21.5 | 7.6 | 200.0 | 144.6 | 7.2 | 38.0 | 96.0 | |
| PL 3 | 21.5 | 7.5 | 212.0 | 151.2 | 5.6 | 50.0 | 136.0 | |
| PL 4 | 21.0 | 7.1 | 240.0 | 151.3 | 5.6 | 30.0 | 92.0 | |
| PL 5 | 21.5 | 7.2 | 216.0 | 162.4 | 2.4 | 44.0 | 100.0 | |
| PL 6 | 21.0 | 7.4 | 224.0 | 165.6 | 5.6 | 36.0 | 120.0 | |
| PL 7 | 21.5 | 7.3 | 192.0 | 170.2 | 4.4 | 28.0 | 60.0 | |
| PL 8 | 21.5 | 7.5 | 208.0 | 162.4 | 6.4 | 34.0 | 104.4 | |

Table No. : 4 Physico-Chemical Parameters of Ramnadi (Manas Lake to Pashan Lake)^[6]

| SAMPLE NO. | TEMPERATURE (°C) | pH | ALKALINITY (mg/lit) | CONDUCTIVIY (µs) | DO (mg/lit) | BOD (mg/lit) | COD (mg/lit) | MPN |
|------------|------------------|-----|---------------------|------------------|-------------|--------------|--------------|-----|
| MR 1 | 22.5 | 7.4 | 380 | 146.8 | 2.8 | 32.0 | 76.0 | 4 |
| MR 2 | 22.0 | 7.6 | 360 | 187.4 | 5.2 | 30.0 | 92.0 | |
| MR 3 | 22.0 | 7.0 | 460 | 177.7 | 2.4 | 46.0 | 114.0 | |
| MR 4 | 22.5 | 6.7 | 412 | 181.4 | 0 | 42.0 | 116.0 | |
| MR 5 | 22.0 | 7.4 | 508 | 192.7 | 4.8 | 36.0 | 112.0 | |
| MR 6 | 22.0 | 7.3 | 440 | 195.8 | 0.36 | 38.0 | 104.0 | |
| MR 7 | 22.0 | 7.3 | 600 | 193.8 | 0.6 | 34.0 | 84.0 | |
| MR 8 | 22.5 | 7.4 | 480 | 204.08 | 4.0 | 46.0 | 120.0 | |

Table No. : 5 Physico-Chemical Parameters of Ramnadi (Pashan Lake to Mula River)^[6]

| SAMPLE NO. | TEMPERATURE (°C) | pH | ALKALINITY (mg/lit) | CONDUCTIVIY (µs) | DO (mg/lit) | BOD (mg/lit) | COD (mg/lit) | MPN |
|------------|------------------|-----|---------------------|------------------|-------------|--------------|--------------|-----|
| PR 1 | 23.0 | 7.1 | 324.0 | 168.8 | 5.2 | 20.0 | 60.0 | 4 |
| PR 2 | 23.0 | 6.9 | 364.0 | 153.7 | 2.4 | 32.0 | 72.0 | |
| PR 3 | 23.0 | 7.8 | 328.0 | 157.2 | 1.2 | 42.0 | 100.0 | |
| PR 4 | 23.0 | 7.4 | 336.0 | 156.3 | 5.6 | 46.0 | 116.0 | |
| PR 5 | 23.0 | 7.3 | 296.0 | 158.6 | 1.6 | 42.0 | 108.0 | |
| PR 6 | 23.0 | 7.2 | 228.0 | 160.3 | 2.8 | 36.0 | 104.0 | |
| PR 7 | 23.0 | 7.1 | 320.0 | 168.7 | 0 | 24.0 | 84.0 | |
| PR 8 | 23.0 | 7.1 | 296.0 | 158.3 | 2.4 | 22.0 | 52.0 | |

VI. CONCLUSION

After studying the result it is clear that the water quality has been deteriorated based on the parameters of water. A comprehensive research work, that included both field and laboratory components, was done with the view to know the comparative study of lakes and river. Samples were collected from different sites of lakes and river.^[4] The results of the investigation showed that Pashan Lake was

more polluted compared to Manas Lake and river Ramnadi flowing from Pashan Lake to Mula River is also much more polluted and not totally safe for drinking purpose. It requires proper monitoring and environment management plans to control the release of effluents. It is suggested to arrange the proper drainage facility and avoid the dumping of waste in lake as it deteriorate the water quality^[12]. We should give awareness to people about the Need for protecting the water reservoir from pollution. Strict legal action should be taken against for contamination of water.^[9]

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