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AN IN-DEPTH INVESTIGATION INTO WATER QUALITY ISSUES OF THE MULA RIVER IN PUNE DISTRICT (2024) (A COMPARATIVE ANALYSIS WITH 2023 FINDINGS)

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Abstract:

This study presents a year-long assessment (January–December 2024) of the water quality of the Mula River in Pune District, Maharashtra. Building upon previous findings from 2023, the research evaluates seasonal variations and spatial differences in key physicochemical parameters—Temperature, pH, Electrical Conductivity (EC), Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Dissolved Oxygen (DO), and Total Hardness—across five sampling sites: Mulshi Dam, Balewadi, MES, Vishrantwadi, and Sangamwadi Bridge. The results reveal continued organic pollution, particularly in the urban and downstream sections of the river. While Mulshi Dam water remained within acceptable limits, significant deterioration was observed at Sangamwadi, where BOD and COD values exceeded permissible standards. Comparatively, the 2024 results show marginal increases in BOD and COD levels at most sites relative to 2023, indicating rising anthropogenic pressure and insufficient wastewater treatment. The findings underscore the urgent need for stricter pollution control measures, regular monitoring, and community participation in river conservation.

Keywords: *Mula River, Water Quality, BOD, COD, Pune, Comparative Study.*

Introduction:

Rivers are vital freshwater ecosystems that sustain both natural and human environments. However, increasing urbanisation, industrial growth, and domestic waste discharge have led to severe water quality degradation in Indian rivers. The Mula River, which flows through the Pune metropolitan region, faces immense pollution pressure from untreated sewage and industrial effluents. Building upon the 2023 investigation, this study focuses on comparing the 2024 water quality trends to identify emerging issues and track the effectiveness of any management interventions.

Study Area Overview:

The Mula River originates in the Western Ghats and flows eastward through Pune before joining the Mutha River at Sangamwadi. Pune city, located at 18°31'N and 73°52'E, lies in the Deccan Plateau region of Maharashtra. The river is dammed at Panshet and Mulshi, providing water for domestic and industrial purposes. The study area experiences a semi-arid climate with average annual rainfall around 722 mm. Sampling locations include Mulshi Dam (upstream), Balewadi, MES, Vishrantwadi, and Sangamwadi Bridge (downstream confluence).

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Materials and Methods:

Monthly water samples were collected from January to December 2024 at the same five locations studied in 2023. The analysis covered seven major parameters: temperature, pH, EC, BOD, COD, DO, and total hardness. Standard methods outlined by APHA (1995) and Trivedi & Goel (1986) were followed for testing. Temperature was measured on-site using a mercury thermometer, EC with a Systronics conductometer, pH using a digital pH meter, and hardness using EDTA titration. BOD was determined after five days of incubation at 20°C, COD by dichromate reflux, and DO by Winkler's method.

Results and Discussion:

The comparative analysis between 2023 and 2024 indicates that although upstream areas such as Mulshi Dam continue to exhibit good water quality, midstream and downstream sites remain heavily polluted. Average pH values at most sites stayed within the neutral to slightly alkaline range (6.6–8.5). EC values increased slightly across sites, reflecting higher dissolved solids due to runoff and waste inflow. At Sangamwadi, EC rose to 717 µmhos/cm in May 2024 compared to 580 µmhos/cm in April 2023, suggesting intensified pollution. BOD levels increased at several sites, notably at Vishrantwadi (up to 281 mg/L in May 2024) and Sangamwadi (up to 274 mg/L in October 2024), exceeding safe limits. COD values, ranging from 342 to 690 mg/L, remained consistently high, indicating persistent organic and industrial contamination. Dissolved Oxygen levels were near zero at most polluted sites (Balewadi, MES, Sangamwadi), demonstrating severe oxygen depletion. Total hardness values showed minor fluctuations but trended upward overall, especially in the MES and Balewadi regions.

Seasonal variations were also evident. During monsoon months (June–August), reduced EC and COD values were recorded due to dilution, while post-monsoon months reflected higher concentrations. Compared to 2023, the 2024 data show slightly worsened BOD and COD levels at three sites (Balewadi, Vishrantwadi, and Sangamwadi), implying increased organic load from domestic and industrial discharges. Upstream Mulshi Dam remains the least affected, maintaining DO levels above 6 mg/L, confirming its relatively unpolluted condition.

Concentration of physicochemical parameters in the water of the Mula River 2023

BOD (mg/l)

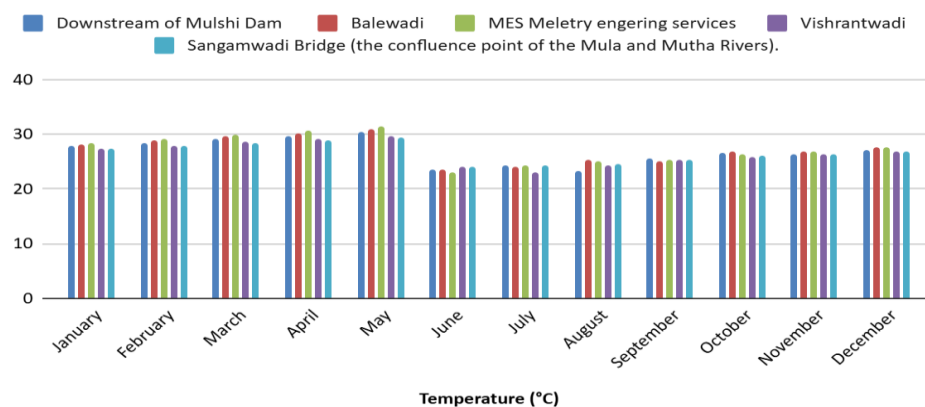

COD (mg/l)

DO (mg/l)
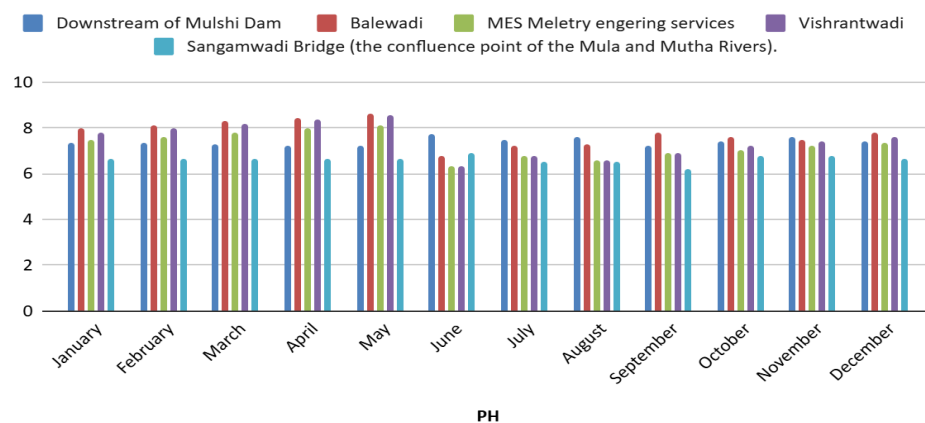
Hardness (mg/l)
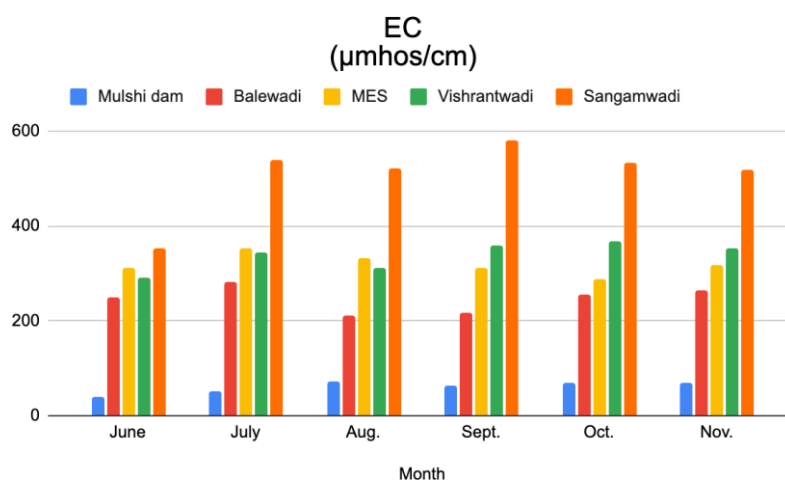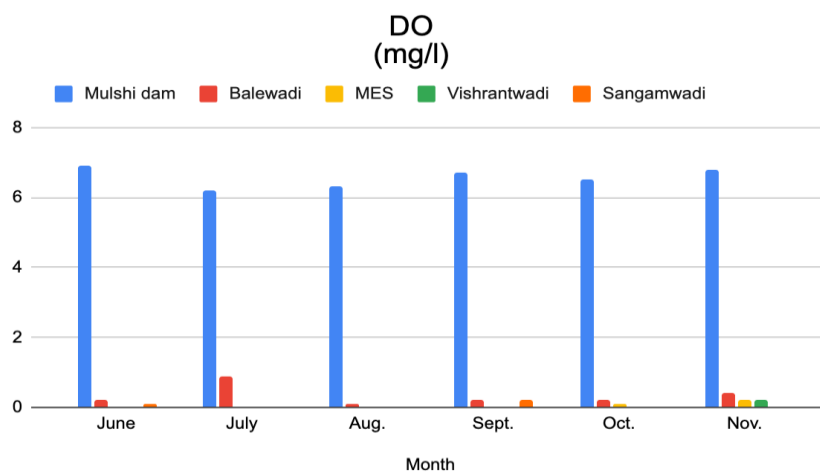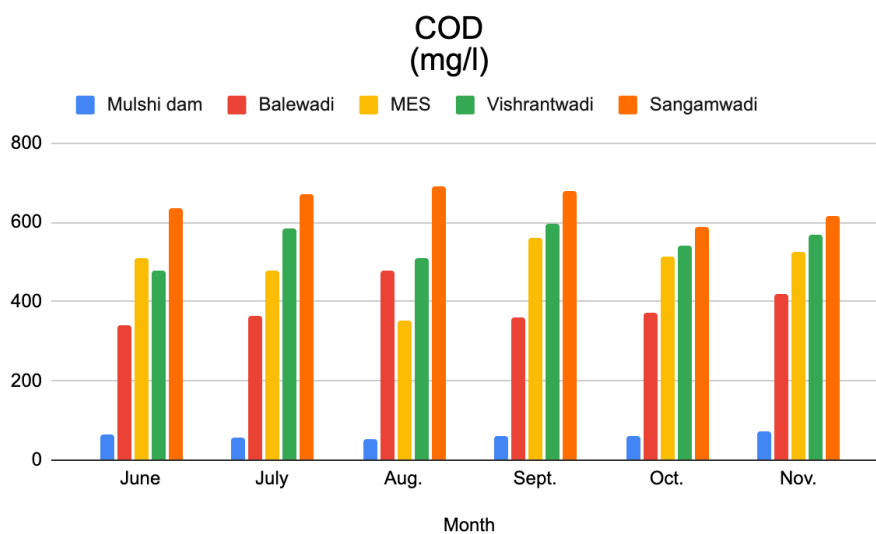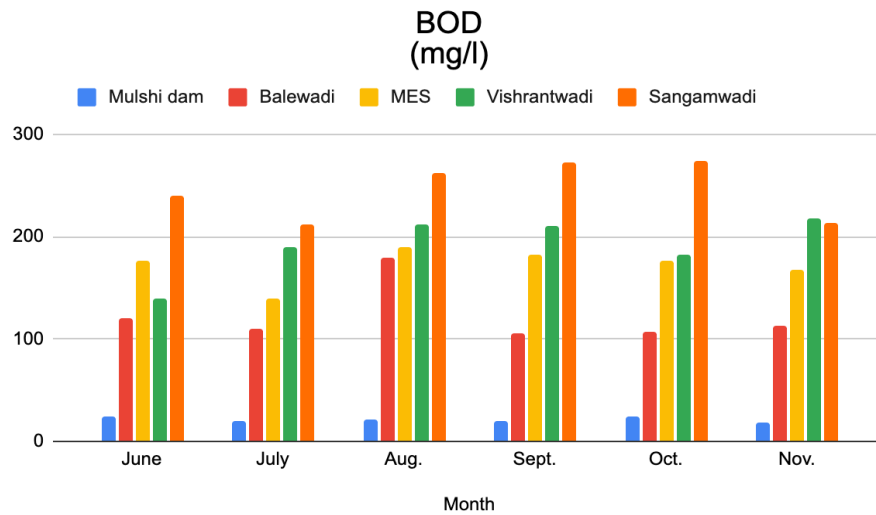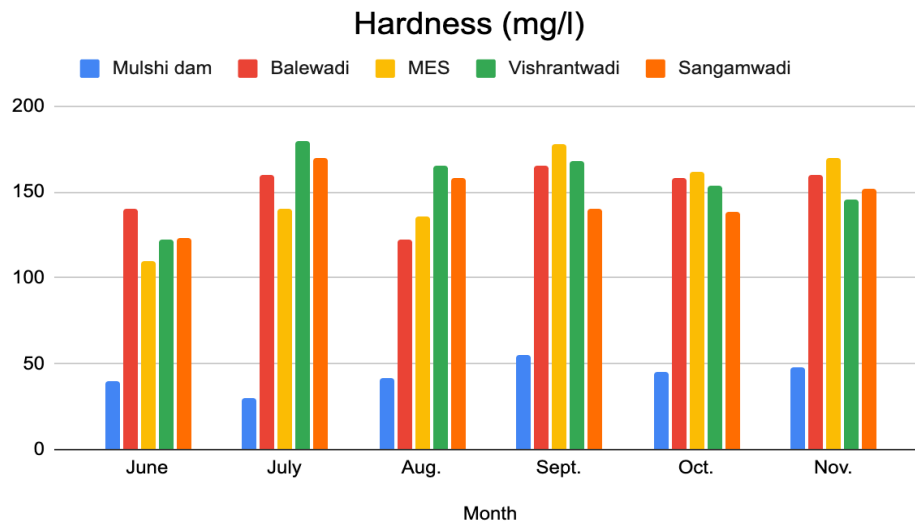
Concentration of physicochemical parameters in the water of the Mula River 2024

Downstream of Mulshi Dam , Balewadi , MES Meletry engering services , Vishrantwadi   and Sangamwadi Bridge (the confluence p…
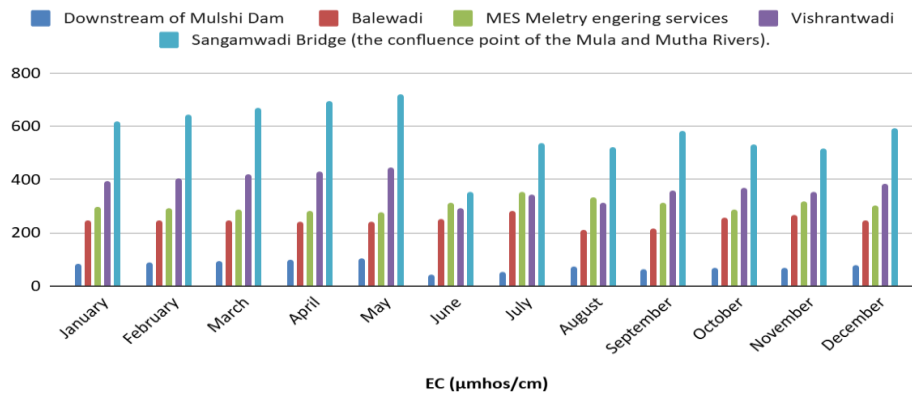

Temperature (°C)

Downstream of Mulshi Dam pH, Balewadi pH, MES Meletry engering services pH, Vishrantwadi pH and Sangamwadi Bridge (the conflue…

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Downstream of Mulshi Dam , Balewadi , MES Meletry engering services , Vishrantwadi   and Sangamwadi Bridge (the confluence p...

- Downstream of Mulshi Dam
- Balewadi
- MES Meletry engering services
- Vishrantwadi
- Sangamwadi Bridge (the confluence point of the Mula and Mutha Rivers).

EC (µmhos/cm)

Downstream of Mulshi Dam , Balewadi , MES Meletry engering services , Vishrantwadi   and Sangamwadi Bridge (the confluence p...

- Downstream of Mulshi Dam
- Balewadi
- MES Meletry engering services
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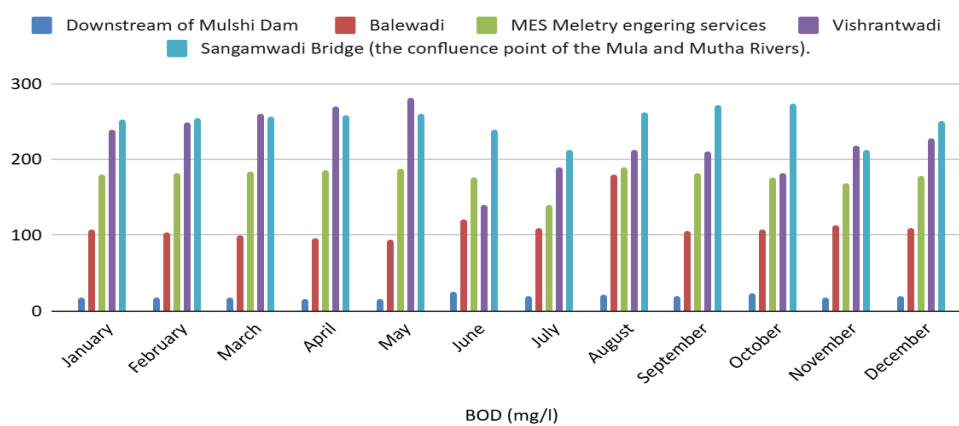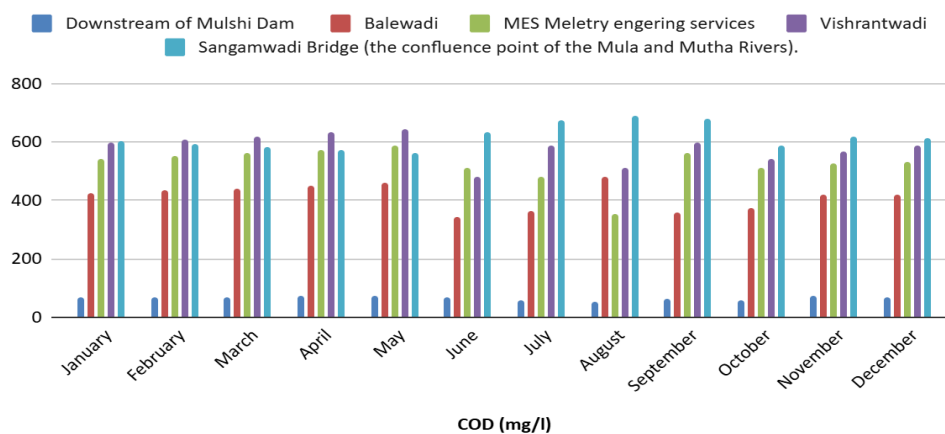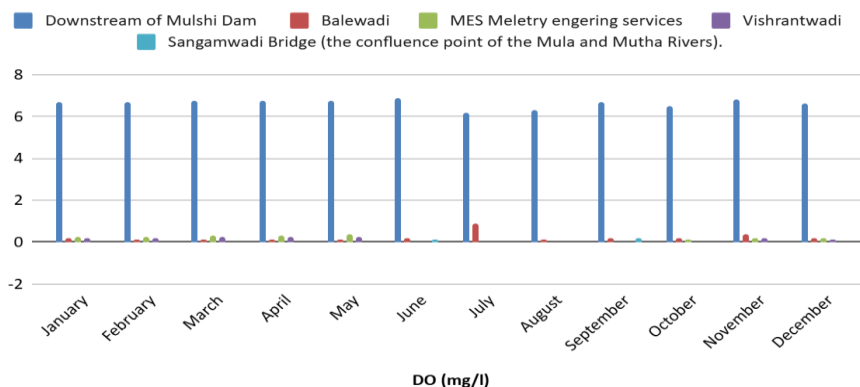

BOD (mg/l)

Downstream of Mulshi Dam , Balewadi , MES Meletry engering services , Vishrantwadi   and Sangamwadi Bridge (the confluence p...

- Downstream of Mulshi Dam
- Balewadi
- MES Meletry engering services
- Vishrantwadi
- Sangamwadi Bridge (the confluence point of the Mula and Mutha Rivers).

COD (mg/l)

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Downstream of Mulshi Dam , Balewadi , MES Meletry engering services , Vishrantwadi and Sangamwadi Bridge (the confluence p…

DO (mg/l)

Downstream of Mulshi Dam , Balewadi , MES Meletry engering services , Vishrantwadi and Sangamwadi Bridge (the confluence p…

Hardness (mg/l)
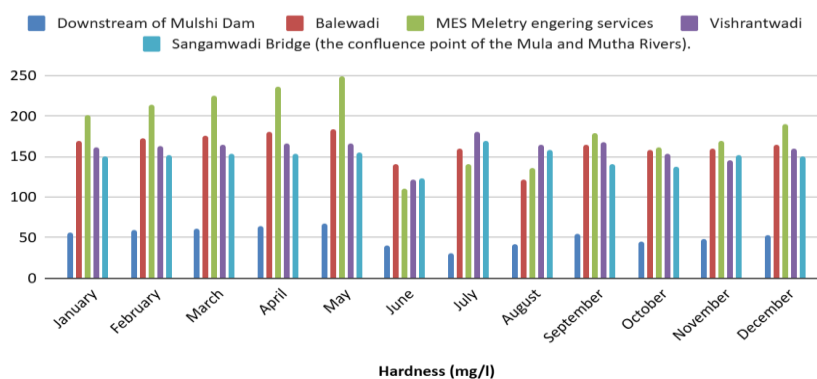
Conclusion:

The 2024 study of the Mula River reveals continued and intensifying water quality degradation in the urban stretches of Pune. Key conclusions include:

1. Mulshi Dam maintains good water quality, whereas downstream sites show severe organic pollution.

2. EC, BOD, and COD values increased slightly compared to 2023, especially at Sangamwadi.

3. DO levels remain critically low (0–0.3 mg/L) at Balewadi, MES, and Sangamwadi, threatening aquatic ecosystems.

4. Seasonal variations highlight the impact of monsoon dilution and post-monsoon concentration effects.

5. Urgent need for sewage treatment, effluent control, and integrated watershed management remains unchanged.

The 2024 assessment of the Mula River, which flows through the urban heart of Pune city, highlights a continuing and alarming trend of water quality deterioration, particularly in its urban and downstream stretches. The study provides critical insights into the changing physico-chemical characteristics of the river and emphasizes the need for immediate and effective intervention to restore its ecological health. The key findings and their implications are discussed below:

1. Upstream vs. Downstream Water Quality

The study reaffirms a stark contrast between the upstream (Mulshi Dam) and downstream urban sites of the Mula River.

The Mulshi Dam, which represents the headwaters of the river, continues to maintain good water quality with relatively low levels of pollutants and stable physico-chemical parameters.

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However, as the river enters the urban limits of Pune, it is subjected to heavy domestic sewage inflow, untreated industrial effluents, and urban runoff. This results in severe organic pollution downstream, especially at monitoring sites such as Balewadi, MES (Khadki), and Sangamwadi.

The contrast indicates that the pollution is largely anthropogenic, arising from urbanization and poor wastewater management practices rather than natural causes.

2. Rise in EC, BOD, and COD Values

Comparative analysis between 2023 and 2024 shows a slight but significant increase in key pollution indicators—Electrical Conductivity (EC), Biochemical Oxygen Demand (BOD), and Chemical Oxygen Demand (COD).

The EC values, which indicate the presence of dissolved salts and ions, rose marginally, pointing to increasing levels of domestic wastewater and industrial discharges.

The BOD and COD values, which reflect the organic load and oxidizable pollutants, were found to be especially high at Sangamwadi, suggesting intensified organic and chemical contamination.

This upward trend is concerning because it suggests that despite awareness and policy discussions, on-ground pollution control measures have remained ineffective or insufficient.

3. Critically Low DO Levels and Ecological Threats

Perhaps the most serious indicator of ecological stress is the Dissolved Oxygen (DO) level.

The study recorded DO values ranging from 0 to 0.3 mg/L at Balewadi, MES, and Sangamwadi, far below the permissible limits for sustaining aquatic life (generally >5 mg/L).

Such critically low DO levels imply anoxic conditions, leading to the death of aquatic organisms, reduced biodiversity, and foul odor generation due to anaerobic decomposition.

The persistence of such conditions underscores that the river stretch has essentially turned into a sewage drain, losing its natural self-purification ability.

4. Seasonal Variations and Monsoon Influence

The study also emphasized the seasonal dynamics in water quality.

During the monsoon season, dilution effects temporarily improve certain parameters due to increased flow and reduced concentration of pollutants.

However, in the post-monsoon and summer periods, when water levels recede, pollutant concentrations rise sharply, worsening the water quality.

This cyclic pattern highlights that while monsoon rains offer short-term relief, structural pollution sources remain constant and continue to degrade the river during low-flow periods.

5. Continuing Need for Comprehensive Management

The final conclusion of the 2024 study reiterates an urgent and persistent need for remedial measures, including:

Expansion and proper functioning of Sewage Treatment Plants (STPs) to prevent untreated domestic wastewater from entering the river.

Strict control and monitoring of industrial effluents, particularly from small-scale industries along the riverbanks.

Implementation of integrated watershed management that addresses land use, solid waste disposal, and urban runoff in a coordinated manner.

Public participation and awareness programs to foster community involvement in river restoration efforts.

Despite earlier recommendations in previous years, the lack of enforcement and infrastructural delays continues to hamper meaningful improvement in the river's health.

References:

1. American Public Health Association (1995). Standard Methods for the Examination of Water and Wastewater, 18th Ed. APHA, Washington D.C.

2. Trivedi, R. K., & Goel, P. K. (1986). Chemical and Biological Methods for Water Pollution Studies. Environmental Publications, Karad.

3. Maharashtra Pollution Control Board (2003). Water Quality Report, 4–48.

4. Central Pollution Control Board (2005). National Water Quality Monitoring Programme Report.

5. Bellos, D., & Sawidis, T. (2005). Chemical Pollution from the River Pinios (Thessalia-Greece). Journal of Environmental Management.

6. UNEP (2001). State of the Environment – India. United Nations Environment Programme.