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16-09-2026

The Most Hon'ble Prime Minister of India
Prime Minister's Office
South Block, Raisina Hill
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Subject: Most respectful submission of the Report titled "Pathways for River Rejuvenation" based on the River Rejuvenation India Summit 2026 – for kind consideration towards restoration of India's rivers

Respected Sir,

With profound respect, we most humbly submit the Report titled "Pathways for River Rejuvenation", prepared on the basis of the deliberations of the River Rejuvenation India Summit 2026 held on 21 August 2026 at Bharat Mandapam, New Delhi. The Summit was organised by the Indian Water Quality Association (IWQA) in association with Water Today and was attended by more than 150 technical experts, water analysts, engineers, administrators, civil-society representatives and technology providers from across the country.

India is blessed with a vast river network comprising more than 30,000 rivers and streams that together carry approximately 1,869 billion cubic metres of annual flow. These rivers are the economic, ecological, cultural and spiritual lifeblood of the nation. Yet, according to the Central Pollution Control Board's 2025 assessment, there are 296 polluted river stretches across 271 rivers. Untreated sewage, industrial and commercial effluents, construction & demolition waste, agricultural runoff and emerging contaminants continue to degrade water quality, threatening public health, aquatic ecosystems and the long-term water security of the country.

The attached Report distills the collective wisdom of the Summit into eleven practical, technology-ready and inter-linked recommendations. These include:

- Adoption of stringent STP/ETP effluent standards ($BOD_5 \leq 5$ mg/L, $COD \leq 30$ mg/L, $TSS \leq 5$ mg/L together with tighter controls on nutrients, pathogens and heavy metals);
- Strengthening of laboratory diagnostics, introduction of public Water Quality Index (WQI) and Effluent Quality Index (EQI);
- Continuous IIoT-based monitoring of industries, commercial establishments and municipal STPs;
- Mandatory deployment of AI-enabled Sewerage Operation Monitoring Software (SOMS) at municipal STPs;
- Control of emerging contaminants (PFAS, microplastics, pharmaceuticals);
- Stopping pollution at source through mandatory on-site treatment and reuse;
- Institutionalisation of reverse sewerage and drain analysis;
- Promotion of decentralised high-performance treatment technologies;
- Mandatory recycle and reuse of treated water;
- Real-time public data sharing of continuous analysers; and
- Rigorous sludge management with GPS tracking and third-party audits.

These recommendations directly address the full pollution chain – from source identification to treatment performance, sludge management and public transparency. Their time-bound implementation will significantly reduce residual pollutant loads entering rivers, accelerate recovery of dissolved oxygen, curb eutrophication, protect biodiversity and enable safe non-potable reuse of treated water. The measures are particularly relevant for nationally prioritised rivers such as the Ganga and Yamuna, as well as for critical drains like the Najafgarh Drain (historically the Sahibi River) that continue to carry heavy pollution loads into major river systems.

We most respectfully request the kind favour of an opportunity to make a detailed presentation on the Report before the Hon'ble Prime Minister or any designated authority, and to hold a meeting at a mutually convenient date and time so that the recommendations may be discussed and a practical national implementation pathway may be charted.

The Indian Water Quality Association and Water Today stand ready to provide any further technical clarification, detailed presentations on individual recommendations, or continuous professional support in the service of this national priority.

With deepest respects and highest regards,

Yours most sincerely,


Dr. Sanjay Sharma
President


Amit Singh
General Secretary

On behalf of
Indian Water Quality Association (IWQA) & Water Today
Encl.: Report – "Pathways for River Rejuvenation" (August 2026)



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REPORT FOR THE CONSIDERATION OF THE GOVERNMENT OF INDIA

“Pathways for River Rejuvenation”

Based on Deliberations of the River Rejuvenation India Summit 2026

Theme: Reviving India's Rivers – Challenges, Solutions & Sustainable Pathways

Venue: Bharat Mandapam, Hall No. 12A, New Delhi

Date of Summit: 21 August 2026 | 10:00 AM – 2:00 PM

Chief Guest: Shri Abhay Verma, Chief Whip (BJP) & MLA, Delhi Assembly

Submitted by

**Indian Water Quality Association (IWQA)
&
Water Today**

“August 2026”

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1. Executive Summary

The River Rejuvenation India Summit 2026, organised by the Indian Water Quality Association (IWQA) in association with Water Today at Bharat Mandapam, New Delhi, convened more than 150 technical experts, water analysts, engineers, administrators, civil-society activists and technology providers. IWQA itself is a professional body of water analysts, engineers and technical experts constituted in 2021, with membership exceeding 250 experts drawn from 14 States of India.

The theme “Reviving India’s Rivers – Challenges, Solutions & Sustainable Pathways” structured the day into technical presentations (Jojari River restoration, integrated water-quality assessment & emerging contaminants by IIT Delhi, sustainable drinking-water solutions linked to river health by IIT Jodhpur, and the critical role of laboratory analysis by Shriram Institute) followed by a multi-stakeholder panel discussion.

India’s river network exceeds 30,000 rivers and streams carrying ~1,869 billion cubic metres of annual flow. Yet CPCB’s 2025 assessment records 296 polluted river stretches across 271 rivers. Untreated sewage, industrial and commercial effluents, C&D waste, agricultural runoff and emerging contaminants (PFAS, microplastics, pharmaceuticals, medical waste) continue to degrade water quality. Conventional STPs remove only a fraction of these pollutants. Case studies of the Jojari River (Balotra), C&D waste discharge into the Ganga at Rishikesh, the Yamuna and the Najafgarh drain illustrated the persistent policy–implementation gap.

This report distils the Summit consensus into eleven practical, actionable recommendations for the Government of India. Each recommendation is elaborated with implementation steps, institutional responsibilities, technology options, indicative costs (drawn from proven Yamuna interventions and laboratory practice) and expected benefits. Flow-sheet diagrams illustrate reverse sewerage monitoring, integrated laboratory–IoT systems, and decentralised treatment pathways. Public transparency through Water Quality Index (WQI), Effluent Quality Index (EQI) and open data portals is emphasised throughout.

The overarching message is that river rejuvenation succeeds only when diagnosis is rigorous and public, pollution is stopped at source, treatment assets perform to design, sludge is managed responsibly, and data are transparent and actionable in real time.

2. Background of the Summit

2.1 Organisers, Guests and Structure

Organised by IWQA and Water Today.

Chief Guest: Shri Abhay Verma, Chief Whip (BJP) and MLA, Delhi Assembly.

Program Coordinator: Dr. Sanjay Sharma, President, IWQA.

Emcee: Ms. Anjali, PHED Uttar Pradesh.

Technical Sessions:

- **Jojari River: Origin, Pollution Load, Water Quality Status, Environmental Impacts & Restoration Roadmap** – Sharvan Patel (Thar Wildlife), Dr. Ram Chandra Angasaria, PHED Jodhpur.
- **Integrated Water Quality Assessment and Sustainable River Management: From Health Monitoring to Emerging Contaminants** – Prof. Sovik Das, IIT Delhi (WQI dashboards for Yamuna & Ganga; Effluent Quality Index – EQI; PFAS & microplastics in Yamuna; pond rejuvenation models).
- **Sustainable Drinking Water Solutions through River Health and Basin Management** – Dr. Manoj Kumar Jindal, Center for Sustainable Drinking Water, IIT Jodhpur.
- **Future Threats and the Critical Role of Laboratory Analysis in River Rejuvenation Programmes** – Dr. Jagdish Kumar, Shriram Institute for Industrial Research (emerging contaminants catalogue, PFAS analytical methods ISO/US EPA/DIN, monitoring objectives & primary water-quality criteria).

Panel Discussion (Moderator: Sanjay Sharma; Co-moderator: Anil Kumar)

Panellists representing civil society:

Pankaj Kumar (Earth Warrior);

Dr. Shiv Singh Rawat (Yamuna Bachao Abhiyan);

Dr. Shah Saud (IoT expert);

Ms. Kirti Hegde (Innovative New treatment technology – electrocoagulation);

Shri Satyam Kaul (Expert Laboratory water);

and Shri Amit Singh, Chief Chemist, PHED Haryana (Water Analyst).

2.2 Core Messages from the Welcome Address: Sanjay Sharma, President IWQA

- Rivers are the economic, ecological, cultural and spiritual lifeblood of India; pollution is a cultural and spiritual wound.
- 296 polluted river stretches (CPCB 2025); high BOD, low DO, pathogens and rising emerging contaminants.
- Accurate laboratory diagnosis (conventional + emerging contaminants) is the foundation of any effective programme.
- Policy advances (National Water Policy, Namami Gange, NRCP) exist, yet gaps remain in O&M, source control, inter-state coordination, data sharing and standards for emerging pollutants.
- The persistent policy–implementation gap is driven by fragmented institutions, project delays, limited ULB capacity, weak enforcement and insufficient community ownership. Technology alone is insufficient without accountability and continuous monitoring.

3. Key Challenges Illustrated by Case Studies

- Jojari River (Balotra, Rajasthan): Industrial and municipal discharges overwhelm the system when source control and laboratory surveillance are weak.
- C&D waste into Ganga at Rishikesh: Failure of construction-and-demolition waste management allows solids to enter a nationally prioritised river.
- Yamuna & Najafgarh drain: Decades of investment have not eliminated high BOD, low DO and continuous inflow of untreated/partially treated sewage, underscoring the need for reverse monitoring, STP optimisation and real-time drain surveillance.

These examples confirm that infrastructure creation alone is insufficient; the entire chain—from source identification to laboratory diagnosis, treatment efficiency, asset health, sludge management and transparent public data—must function as an integrated system.

4. Detailed Recommendations for Government Consideration

The galaxy of experts converged on the following eleven inter-linked recommendations. Each is elaborated with practical implementation steps.

4.1 Review of STP Output Parameters

Why it matters:

In pursuit of the objectives of River Rejuvenation Summit 2026, a critical review of the existing treated effluent standards for Sewage Treatment Plants (STPs) has been undertaken. The present proposal advocates a deliberate reduction in the permissible limits of key parameters—namely Biochemical Oxygen Demand (BOD₅), Chemical Oxygen Demand (COD), Total Suspended Solids (TSS), Ammoniacal Nitrogen, Total Phosphorus, Faecal Coliform and associated indicators—so as to substantially lower the residual pollution load discharged into rivers. These revised limits (BOD₅ ≤ 5 mg/L, COD ≤ 30 mg/L, TSS ≤ 5 mg/L, together with tighter controls on nutrients and pathogens) are technologically achievable through proven advanced treatment systems such as Membrane Bioreactor (MBR), Integrated Fixed-Film Activated Sludge (IFAS), Electrocoagulation and tertiary polishing processes. The retrofitting in the existing treatment plants is also possible with upcoming new technologies. Adoption of the more stringent standards will accelerate the restoration of dissolved oxygen levels, curb eutrophication, safeguard aquatic ecosystems and enhance the suitability of treated water for safe non-potable reuse. The measure is expected to yield direct public benefits in the form of improved river water quality, reduced health risks for downstream communities, and greater environmental resilience. This proposal therefore constitutes a practical, science-based and future-ready step towards achieving lasting river rejuvenation.

Recommended Additional Parameters

To ensure comprehensive environmental protection, safe reuse potential and regulatory robustness, the following parameters should be incorporated into the design and monitoring criteria:

Parameter	Recommended Limit	Rationale / Notes
pH	6.5 – 8.5	Ensures biological stability and safe discharge
Oil & Grease	≤ 5–10 mg/L	Prevents surface films and interference with treatment

Ammoniacal Nitrogen (NH ₃ -N)	≤ 5 mg/L (preferably ≤ 2 mg/L)	Controls toxicity and oxygen demand
Total Nitrogen (TN)	≤ 10 mg/L	Minimises eutrophication risk
Total Phosphorus (TP)	≤ 1–2 mg/L	Critical for preventing algal blooms
Faecal Coliform	≤ 100 MPN/100 mL (or ≤ 10 for unrestricted reuse)	Safeguards public health and enables safe reuse
Turbidity	≤ 5 NTU (preferably ≤ 2 NTU)	Indicator of clarity and filtration efficiency

Heavy Metals – Recommended Maximum Concentrations

Heavy Metal	Recommended Limit (mg/L)
Arsenic (As)	≤ 0.05 – 0.10
Cadmium (Cd)	≤ 0.01 – 0.05
Chromium (Total)	≤ 0.10 – 0.50
Chromium (Hexavalent)	≤ 0.05 – 0.10
Copper (Cu)	≤ 0.20 – 0.50
Lead (Pb)	≤ 0.05 – 0.10
Mercury (Hg)	≤ 0.001 – 0.01
Nickel (Ni)	≤ 0.20 – 0.50
Zinc (Zn)	≤ 1.0 – 2.0

These limits align with or are stricter than typical CPCB general standards, IFC EHS guidelines and many reuse criteria. MBR systems achieve substantial heavy-metal removal through biosorption onto high-MLSS biomass and membrane rejection of particulate-bound metals.

Technology Availability & Practical Feasibility: The complete suite of parameters is readily attainable using commercially proven technologies available in India and globally. Where very low nutrient or metal

limits are mandated, chemical precipitation, Enhanced Biological Phosphorus Removal (EBPR) or additional polishing steps can be incorporated. Multiple full-scale MBR, IFAS, Electrocoagulation and tertiary polishing installations in India and worldwide consistently demonstrate $BOD_5 < 5 \text{ mg/L}$, $TSS < 5$

mg/L and excellent pathogen reduction, confirming both technical and operational feasibility under Indian conditions.

Significance for River Rejuvenation and Public Benefits: Adoption of these stringent parameters will substantially reduce the residual pollutant load discharged into rivers, thereby accelerating the recovery of dissolved oxygen levels, supporting aquatic biodiversity and preventing eutrophication. Cleaner treated effluent will enhance the aesthetic and recreational value of rivers, lower public-health risks associated with water-borne pathogens and heavy metals, and create opportunities for safe non-potable reuse in gardening, toilet flushing, industrial cooling and urban landscaping. Communities living along the river will benefit from improved water quality for domestic and agricultural use downstream, reduced healthcare costs linked to pollution-related illnesses, and a healthier living environment.

Recommendation: It is recommended that the expanded parameter list (core organics + nutrients + pathogens + key heavy metals) be formally adopted as the design and compliance targets for all STPs contributing to the River Rejuvenation programme. This practical, technology-ready approach will deliver higher environmental protection, enable productive reuse of treated water, and generate measurable benefits for the health, livelihoods and well-being of the people.

4.2 Strengthening Diagnostic & Water-Quality Analysis and Public Quality Indices

Why it matters:

Diagnostics constitute a critical and indispensable foundation for the accurate identification of problems and the formulation of effective remedial measures. In the domain of public health, precise diagnostic procedures enable the determination of root causes prior to the administration of appropriate treatment. An analogous principle applies with equal force to the complex challenge of river rejuvenation and the optimal operation of STPs and ETPs. Comprehensive diagnostic assessment of water quality parameters, pollutant sources, hydrological regimes and ecological indicators is essential. Equally vital is the systematic observation and rigorous analysis of Water Quality Reports, which provide

the empirical evidence necessary to detect trends, identify pollution hotspots and evaluate the efficacy of ongoing interventions. Robust diagnostics, supported by diligent observation and insightful analysis

of water quality reports, form the scientific bedrock upon which successful, sustainable and evidence-based river rejuvenation programmes must be built.

Practical reforms (applicable nationwide):

- Proper sampling of water and wastewater with established procedures at prefixed sampling points 500 m downstream of each sub-drain/STP/CETP confluence (both banks if width >15 m); upstream reference points; GIS mapping; quarterly site audits.
- For river or drain samples, standard depth of 30 cm below surface; vertical profiling in deeper drains; calibrated depth gauges.
- Mandatory composite sampling at STP/ETPs for inlet and treated final effluent with automated remotely operated composite samplers with cooling system to maintain 4°C.
- River sampling with floating drones; ISO 17025 calibration logs; insulated transport at 4°C; mobile laboratory sampling vans.
- On-site analysis of unstable parameters (DO, pH, temperature, conductivity, turbidity) with live IoT feed.
- Green-chemistry methods (IS 3025); ICP-MS / GC-MS / LC-MS-MS for metals, organics, microplastics and PFAS.
- Mandatory AI-enabled Laboratory Information Management System (LIMS) with auto-audit facility; full integration of laboratory data with online analyser data.
- Introduce Water Quality Index (WQI) for rivers and Effluent Quality Index (EQI) for STP/ETP outlets so that the public and policymakers receive a single, intuitive score.
- All laboratory reports and plant operational data must be published on a public portal in near-real time. Laboratories must have small effluent treatment plants for hazardous laboratory waste.

Implementation: Mandate the protocol for all SPCBs and ULBs within 12 months. Establish a National River Diagnostics Cell under CPCB to audit compliance and host public WQI/EQI dashboards.

4.3 Stringent Monitoring of Industries, Commercial Units, Group Housing Societies and Municipal STP/ETP

Why it matters:

Hospitals, hotels, restaurants, laboratories, malls, schools, colleges, group housing societies and industries collectively discharge substantial pollutant loads that can rapidly undermine the gains of river rejuvenation if left inadequately controlled. Continuous, AI-enabled surveillance through Industrial Internet of Things (IIoT) systems is therefore essential to ensure real-time accountability and prevent episodic or chronic pollution events. This stringent monitoring framework will directly support river rejuvenation by ensuring that discharges remain within prescribed limits, thereby reducing the cumulative pollutant burden on the river, protecting dissolved oxygen levels, and preventing toxic or nutrient-rich inflows that trigger algal blooms and ecological decline. For the public, the benefits include cleaner river water, lower incidence of water-borne diseases, enhanced recreational value, and safeguarded livelihoods dependent on fisheries.

- Mandate continuous online effluent quality analysers (pH, COD/TOC, TSS, flow) at the final discharge point of every industry, commercial unit above a defined threshold, and every municipal STP/ETP.
- Integrate AI software with IoT hardware to supervise E&M equipment, online analysers and flow meters so that anomalies trigger automatic alerts to the regulatory agency.
- Risk-based, unannounced inspections prioritising the largest pollution-load contributors (mass-balance modelling).
- Link consent-to-operate / trade-licence renewal to verified performance data and laboratory cross-checks.
- Publish monthly compliance scores on a public portal.

4.4 IIoT with AI Software (SOMS – Sewerage Operation Monitoring Software) at Municipal STPs

Why it matters:

A significant number of municipal STPs continue to operate well below their design capacity and treatment efficiency due to undetected equipment failures, suboptimal process control and the absence

of real-time performance visibility. This under-performance results in the discharge of inadequately treated effluent into rivers. The deployment of IIoT devices integrated with AI-powered SOMS offers a practical and transformative solution. When fully implemented, STPs will consistently achieve higher treatment efficiency, maintain effluent quality within stringent limits, and minimise the residual pollution load reaching the river. Citizens will benefit through cleaner downstream water, reduced risk of water-borne diseases, and more reliable availability of treated water for non-potable reuse. Energy savings and predictive maintenance will lower the long-term operational burden on municipal budgets.

- Install IIoT devices on all electrical & mechanical assets and instruments at every municipal STP.
- Integrate the devices with SOMS to enable real-time pictorial plant representation, asset-health scoring, ageing analysis and predictive maintenance scheduling.
- Merge online analyser data with laboratory results on a single platform and automate aeration based on DO and load signals for energy optimisation.
- Indicative cost: approximately ₹3.5 crore per plant (capex + one-year O&M); typical payback period of 18–24 months through energy savings and efficiency gains.

Recommendation: Make the installation of IIoT devices coupled with SOMS mandatory for all municipal STPs above 10 MLD capacity within three years. Central and State Governments should provide co-funding support along with performance-linked incentives.

4.5 Planning for Future Threats – Emerging Contaminants

Why it matters:

Persistent and emerging contaminants—including PFAS (“forever chemicals”), microplastics, pharmaceuticals and personal-care products, endocrine-disrupting compounds, disinfection by-products, medical waste residues and radioactive substances—are already being detected in the Ganga, Yamuna and other major rivers. Conventional STPs remove only a limited fraction of these substances. PFAS are extremely persistent and bio-accumulative; prolonged exposure has been linked to cancers,

immune-system impairment, developmental disorders and adverse reproductive outcomes. Pharmaceuticals and endocrine disruptors interfere with hormonal systems in both humans and wildlife. Microplastics act as carriers for other toxins and enter the food chain. Collectively, these pollutants degrade river ecosystems by reducing biodiversity, impairing reproductive success of fish and

invertebrates, and diminishing the river's capacity for self-purification. Implementation of expanded monitoring, provisional standards, advanced tertiary treatment and strict source-segregation of medical waste will significantly reduce the entry of these contaminants into rivers, protecting public health and restoring ecological integrity.

- Expand the national monitoring suite and equip laboratories in each state with LC-MS/MS, ICP-MS, GC-MS, HPLC capability in accordance with ISO 25101 / 21675, US EPA 537.1 / 533 / 8327 and DIN 38407 methods.
- Issue provisional environmental quality standards for priority PFAS compounds and selected pharmaceuticals within 18 months.
- Immediate installation of advanced tertiary treatment (ozonation, activated carbon or electrocoagulation polishing) at all STPs discharging into sensitive river stretches.
- Mandate source-segregation and scientifically sound disposal protocols for medical and pharmaceutical waste across healthcare facilities.

4.6 Stopping Contaminants at Source

Why it matters:

Once a pollutant enters a drain or sewer, its subsequent removal becomes exponentially more expensive, technically challenging and less effective. Untreated or partially treated inputs exert severe pressure on river ecosystems: elevated organic and nutrient loads deplete dissolved oxygen, trigger algal blooms and create hypoxic zones; toxic chemicals and heavy metals destroy sensitive habitats and reduce biodiversity; suspended solids smother benthic communities. Preventing pollutants at source is therefore the most cost-effective and environmentally sound strategy. Rivers will receive cleaner inflows, enabling faster recovery of dissolved oxygen, restoration of aquatic habitats and revival of biodiversity. Municipal treatment plants will operate more efficiently and at lower cost. Communities

will gain safer downstream water, reduced health risks and expanded opportunities for non-potable water reuse.

- Enforce zero-liquid-discharge or high-quality recycle standards for all water-intensive industries located in river basins.
- Require every new housing society, hotel, hospital, mall, airport, bus terminal, government and private office, cinema hall, restaurant and automobile workshop to install on-site treatment systems producing water fit for non-potable reuse ($\text{BOD}_5 \leq 5 \text{ mg/L}$, $\text{COD} \leq 30 \text{ mg/L}$, $\text{TSS} \leq 5 \text{ mg/L}$, Coliform nil).
- Ban the discharge of untreated C&D waste, solid waste and septage into any water body or storm-water drain; enforce through GPS-tracked vehicles and deterrent penalties.
- Implement agricultural non-point source control in critical catchments through precision fertiliser application, vegetated buffer strips and constructed wetlands.

4.7 Reverse Sewerage and Drain Analysis

Why it matters:

Traditional water-quality monitoring begins at the river or STP and therefore detects pollution only after it has already entered the aquatic environment. Reverse sewerage monitoring starts at the river or STP influent and systematically works upstream through the trunk sewers, peripheral sewers and internal networks until the exact pollution source is located and isolated. By intercepting contamination at its origin, the method sharply reduces the residual load that would otherwise degrade water quality, destroy benthic habitats and diminish biodiversity. Cleaner inflows allow dissolved oxygen levels to recover and support the re-establishment of sensitive aquatic species. Municipal STPs receive a more consistent and less toxic influent, enabling higher efficiency and lower O&M costs.

Flow Path: SOURCE OF POLLUTION → INTERNAL SEWER → PERIPHERAL SEWER → TRUNK SEWER → SPS → STP (Investigation proceeds from right to left—from the river/STP back to the polluting source). Requirements: upgraded laboratories + AI software for pattern recognition and source apportionment.

- Precise identification and segregation of pollutants at source.
- Optimised utilisation of STP by-products and higher overall plant efficiency.

- Significant reduction in treatment and O&M costs.
- Early warning of chemical spikes or potential epidemic risks; accelerated improvement in river water quality and faster ecological recovery.

4.8 New Technologies – Decentralised Treatment & High-Performance Processes

Why it matters:

Large centralised STPs suffer from long conveyance losses, progressive silting of sewer networks, frequent blockages, sewage overflows, high energy consumption for pumping, and difficulty in achieving ultra-low effluent standards. Treating wastewater near the source eliminates these problems. Short or non-existent sewer lines remove the risk of silting and overflows; pumping requirements and energy consumption fall sharply; and high-quality treated water becomes available for immediate non-potable reuse within the same premises. Even when treated water is released into local drains, the pollutant load is far lower, giving the receiving river a lighter burden. Decentralised systems are equally valuable in remote villages and peri-urban areas.

Electrocoagulation-based Decentralised Systems (demonstrated at the Summit):

- Achieve BOD, COD and TSS well below 5 mg/L, turbidity of 1–2 NTU and near-nil coliform levels—approaching non-potable reuse standards.
- Suitable for industry sites, hospitals, malls, hotels, housing societies, airports, government offices, schools, colleges, public toilets and remote villages.
- Treated water must be reused within the premises; real-time IoT-based flow and quality monitoring is mandatory and subject to regulatory audit.

Complementary Upgrades at Existing Large STPs (proven on Yamuna STPs):

- Intelligent chemical dosing (PAC/Alum/PE for BOD and TSS; ferric chloride for sulphide and phosphate) through Self-Administered Self-Monitored systems (ISASM-CD).
- Demonstrated results at Okhla and Yamuna Vihar STPs: outlet TSS 4–10 mg/L and BOD 4–14 mg/L (96–99 % reduction). Indicative cost ≈ ₹1.25–1.5 crore per plant.

4.9 Policy on Recycle and Reuse of Water

Why it matters:

Every cubic metre of untreated or partially treated wastewater that enters a drain or sewer ultimately adds to the pollutant burden on the receiving river. On-site treatment and reuse interrupt this pathway at its origin. By requiring industries, hospitals, commercial establishments, institutions and housing

societies to treat their own wastewater to reusable standards and utilise the treated water within their premises, the volume and strength of sewage entering the public drainage network are substantially reduced. Freshwater that would otherwise have been consumed for non-potable purposes is conserved. Lower organic and nutrient discharges allow dissolved oxygen levels to recover, suppress eutrophication and protect fish and invertebrate populations. Communities gain lower water bills, reduced municipal freshwater demand, fewer sewer overflows and cleaner local drains.

- All industries, hospitals, malls, cinema halls, hotels, restaurants, automobile workshops, airports, bus terminals, public toilets, government offices, private offices and housing societies shall treat their wastewater on-site to standards suitable for non-potable reuse and shall reuse the treated water within their own premises.
- The quantity and quality of recycled water shall be monitored in real time through IoT-based flow and quality systems; the data shall remain continuously accessible to the regulatory authority and to the public.

4.10 Mandatory Water-Quality Analysers and Public Data Sharing by Industries

Why it matters:

Transparency is the most powerful driver of sustained compliance. When the quality and quantity of industrial and large commercial discharges remain hidden, violations can persist for years, steadily loading rivers with organic matter, nutrients, heavy metals and toxic chemicals. Mandatory continuous analysers on both discharge and recycle lines, coupled with real-time transmission to a publicly accessible portal, makes non-compliance politically, socially and financially costly. Regulators can respond within hours; citizens can track performance; industries gain a strong incentive to maintain

treatment systems at peak efficiency. Cleaner inflows allow dissolved oxygen recovery, suppress eutrophication and accelerate restoration of aquatic habitats.

Public access to real-time data builds trust and strengthens collective ownership of the river-rejuvenation effort.

- Every industry and every large commercial or institutional establishment shall install continuous water-quality analysers on both final discharge and recycle lines, together with accurate flow meters.
- Quality and quantity data shall be transmitted in real time to a publicly accessible national or state portal.
- Non-transmission of data or any evidence of manipulation shall automatically attract environmental compensation charges and progressive directions for temporary or permanent closure.

4.11 Sludge Management, Proper Disposal and Stringent Audits

Why it matters:

Sewage and effluent treatment plants generate large quantities of sludge that concentrate pathogens, heavy metals, nutrients, organic toxins and emerging contaminants. When this sludge is poorly managed, the contaminants are simply transferred back into the environment through leachates, runoff and unauthorised dumping. The river receives a second wave of pollution that depletes dissolved oxygen, poisons benthic organisms, promotes eutrophication and allows heavy metals to accumulate in sediments and the aquatic food chain. Proper sludge management—mandatory dewatering, stabilisation, safe disposal or beneficial reuse, continuous tracking with GPS-enabled transport, independent third-party audits and public disclosure—closes this critical loophole. Cleaner sediments and lower pathogen/metal loads allow dissolved oxygen to stabilise, support recovery of sensitive aquatic species and accelerate restoration of the river's self-purification capacity.

- Mandate proper sludge dewatering, stabilisation and either safe disposal or beneficial reuse (after verified compliance with quality criteria) at every STP and ETP.

- Require continuous tracking of sludge quantities generated, treated and disposed of, using GPS-enabled transport restricted to authorised sites only.
- Conduct regular independent third-party audits of sludge management practices and publicly disclose the findings.
- Support research and pilot projects for safe sludge-to-resource conversion pathways, building on successful demonstrations in pond rejuvenation and related resource-recovery frameworks.

5. Proposed Integrated Implementation Plan

The eleven recommendations set out in Section 4 are inter-dependent and mutually reinforcing. Their successful translation into measurable river-quality improvement requires a single, coherent implementation architecture that aligns institutions, technology, finance, data systems and community engagement. The following integrated plan is proposed for adoption by the Government of India.

5.1 Institutional Architecture

- National River Rejuvenation Mission (NRRM): Establish a high-level Mission under the Ministry of Jal Shakti, with a dedicated Mission Director and representation from CPCB, MoEF&CC, Ministry of Housing & Urban Affairs, Ministry of Health, and State Governments. The Mission shall provide policy direction, allocate resources and review progress quarterly.
- National River Diagnostics Cell (under CPCB): Responsible for standardised sampling protocols, laboratory accreditation, WQI/EQI dashboards, inter-laboratory proficiency testing and public data portals.
- State River Rejuvenation Cells: Mirror the national structure in every State/UT; coordinate ULBs, SPCBs, PHED and irrigation departments; prepare State Implementation Plans within six months of national guidelines.
- Basin-level Coordination Committees: For inter-state rivers (Yamuna, Ganga, Godavari, etc.), establish permanent coordination platforms to align standards, monitoring and enforcement across State boundaries.

5.2 Technology & Infrastructure Package

- Stringent STP Standards: Notify revised effluent standards ($\text{BOD}_5 \leq 5 \text{ mg/L}$, $\text{COD} \leq 30 \text{ mg/L}$, $\text{TSS} \leq 5 \text{ mg/L}$ + nutrients, pathogens and priority metals) for all new STPs immediately and for existing STPs >10 MLD within three years, with retrofit support.
- IIoT + SOMS Mandate: Require installation of IIoT sensors and SOMS platform at all municipal STPs >10 MLD within three years; central/state co-funding with performance-linked incentives.
- Decentralised Treatment Push: Mandate on-site treatment and reuse for all new large commercial, institutional and housing projects; promote electrocoagulation and other high-performance modular systems for remote and peri-urban areas.
- Advanced Tertiary Treatment: Require ozonation, activated carbon or electrocoagulation polishing at STPs discharging into sensitive stretches; prioritise emerging-contaminant removal.
- Sludge Management Infrastructure: Establish authorised sludge processing and disposal facilities in every major urban agglomeration; GPS-tracked transport and third-party audit regime.

5.3 Monitoring, Data & Transparency Framework

- Continuous Online Analysers: Mandate at every industry above threshold, every large commercial establishment and every municipal STP/ETP, with real-time data feed to public portals.
- Reverse Sewerage Monitoring: Institutionalise upstream investigative protocols as the default method for identifying pollution sources; equip SPCBs with AI-enabled source-apportionment tools.
- Public Dashboards: Launch national and state WQI and EQI dashboards within 12 months; all laboratory and online-analyser data to be open by default.
- Laboratory Strengthening: Equip at least one laboratory per State with LC-MS/MS, ICP-MS and GC-MS capability for PFAS and emerging contaminants; enforce ISO 17025 accreditation.

5.4 Financing & Incentives

- Convergence of existing schemes (Namami Gange, NRCP, AMRUT, Smart Cities, Jal Jeevan Mission) under a single River Rejuvenation financing window.
- Performance-linked grants to States and ULBs based on measurable improvement in WQI/EQI and compliance rates.
- Co-funding for IIoT/SOMS, LIMS, tertiary treatment and decentralised systems; soft loans or viability-gap funding for private and PPP projects.
- Environmental compensation funds generated from non-compliance to be ring-fenced for river rejuvenation works in the same basin.

5.5 Capacity Building & Community Engagement

- National training programme for STP operators, laboratory analysts, SPCB officers and ULB engineers on advanced treatment, IIoT, emerging contaminants and reverse monitoring.
- Public awareness campaigns on water reuse, source segregation and citizen science monitoring.
- Formal partnerships with professional bodies (IWQA and others), IITs, research institutions and civil-society organisations for continuous technical support and independent oversight.

6. Suggested Implementation Roadmap

The following phased roadmap is proposed to translate the integrated plan into concrete action over a five-year horizon (2026–2031), with clear milestones and accountability.

Phase 1: Foundation (0–12 months) – Policy, Standards & Diagnostics

- Notify revised STP effluent standards ($BOD_5 \leq 5$, $COD \leq 30$, $TSS \leq 5$ mg/L + nutrients, pathogens, metals) for all new plants and for existing plants >10 MLD on a phased retrofit schedule.
- Issue national protocol for sampling, analysis, LIMS and public reporting; establish National River Diagnostics Cell under CPCB.
- Launch pilot WQI and EQI public dashboards for Yamuna, Ganga and three additional priority rivers.

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- Issue provisional environmental quality standards for priority PFAS and selected pharmaceuticals.
 - Notify mandatory continuous online analysers and real-time data transmission for all industries above defined threshold and all municipal STPs/ETPs.
 - Constitute National River Rejuvenation Mission and State River Rejuvenation Cells; finalise State Implementation Plans.

Phase 2: Systems Strengthening (12–36 months) – Technology Roll-out & Source Control

- Complete IIoT + SOMS installation at all municipal STPs >10 MLD; commence performance-linked incentive disbursement.
- Mandate and enforce on-site treatment and reuse for all new large commercial, institutional and housing projects; accelerate installation of decentralised systems in peri-urban and remote areas.
- Roll out reverse sewerage monitoring protocols in at least ten priority cities; equip SPCBs with AI source-apportionment tools.
- Equip one laboratory per State with advanced instrumentation for emerging contaminants; achieve ISO 17025 accreditation.
- Establish authorised sludge processing/disposal facilities in major urban centres; enforce GPS tracking and third-party audits.
- Begin advanced tertiary treatment (ozonation/activated carbon/electrocoagulation) at STPs discharging into sensitive stretches.

Phase 3: Consolidation & Scale-up (36–60 months) – Full Compliance & Ecological Recovery

- Achieve full compliance with revised effluent standards at all STPs >10 MLD; extend standards to smaller plants on a risk-prioritised basis.
- Extend continuous online monitoring and public data portals to all remaining commercial and institutional establishments above threshold.
- Operationalise national and state WQI/EQI dashboards for all major rivers and polluted stretches; publish annual State of India's Rivers report.

- Demonstrate measurable improvement in dissolved oxygen, reduction in BOD/COD and recovery of aquatic biodiversity in priority stretches (Yamuna, Ganga, Jojari and others).
- Institutionalise performance-linked funding and environmental-compensation recycling as permanent features of river governance.
- Conduct independent mid-term and end-of-mission evaluations; refine standards and protocols on the basis of evidence.

7. Conclusion and Recommendations to the Government of India

The River Rejuvenation India Summit 2026 reaffirmed a simple but powerful truth: India's rivers can be restored if diagnosis is rigorous, pollution is stopped at source, treatment assets perform to design, sludge is managed responsibly, and data are transparent and actionable in real time. Infrastructure alone

has proven insufficient. What is required now is an integrated system of standards, technology, monitoring, enforcement and public accountability.

The eleven recommendations presented in this report—ranging from stringent STP effluent standards and IIoT-enabled plant management to reverse sewerage monitoring, decentralised treatment, emerging-contaminant control, mandatory on-site reuse, public data portals and rigorous sludge management—constitute a practical, technology-ready and financially feasible pathway. Each measure has been tested or demonstrated in Indian conditions (Yamuna STPs, electrocoagulation pilots, laboratory practice and field experience shared at the Summit). Collectively they address the full pollution chain from source to river and close the long-standing policy–implementation gap.

The Government of India is therefore urged to:

- Formally adopt the expanded STP effluent standards ($\text{BOD}_5 \leq 5 \text{ mg/L}$, $\text{COD} \leq 30 \text{ mg/L}$, $\text{TSS} \leq 5 \text{ mg/L}$ together with nutrient, pathogen and priority metal limits) as national design and compliance targets.
- Establish the National River Rejuvenation Mission and the National River Diagnostics Cell under CPCB within six months, with clear mandates, budgets and reporting lines.

- Mandate IIoT + SOMS at all municipal STPs above 10 MLD, continuous online analysers with public data transmission for industries and large establishments, and reverse sewerage monitoring as the default investigative method.
- Mandate AI based LIMS for all waste water testing laboratories.
- Require on-site treatment and reuse for all new large commercial, institutional and housing projects, and accelerate decentralised high-performance systems (including electrocoagulation, MBR etc) in peri-urban and rural areas.
- Issue provisional standards for priority PFAS and pharmaceuticals within 18 months and equip State laboratories with advanced analytical capability.
- Enforce rigorous sludge management with GPS tracking, authorised disposal/reuse sites and mandatory third-party audits.
- Launch national and state public dashboards for Water Quality Index and Effluent Quality Index within twelve months, making all relevant data open by default.
- Converge existing central schemes under a single financing window, introduce performance-linked grants, and ring-fence environmental compensation funds for basin-level rejuvenation works.
- Invest in capacity building of operators, analysts and regulators, and institutionalise partnerships with professional bodies, research institutions and civil society for continuous technical support and independent oversight.

If these recommendations are accepted and implemented with urgency and consistency, India can reverse the degradation of its rivers within a decade, restore ecological health, protect public health, secure water for future generations, and reaffirm the cultural and spiritual value that rivers have always held in the life of the nation.

The Indian Water Quality Association stands ready to provide technical assistance, independent monitoring support and continuous professional engagement in the service of this national priority.

A handwritten signature in black ink, appearing to read "Sanjay Sharma".

Dr. Sanjay Sharma
President

A handwritten signature in black ink, appearing to read "Amit Singh".

Amit Singh
General Secretary

Annexure – List of Acronyms and Abbreviations

The following acronyms and abbreviations are used in this report:

Acronym	Full Form
AI	Artificial Intelligence
AMRUT	Atal Mission for Rejuvenation and Urban Transformation
BOD / BOD ₅	Biochemical Oxygen Demand (5-day)
C&D	Construction and Demolition (waste)
CETP	Common Effluent Treatment Plant
COD	Chemical Oxygen Demand
CPCB	Central Pollution Control Board
DIN	Deutsches Institut für Normung (German Institute for Standardisation)
DO	Dissolved Oxygen
DSTP	Decentralised Sewage Treatment Plant
E&M	Electrical and Mechanical
EBPR	Enhanced Biological Phosphorus Removal
EQI	Effluent Quality Index
ETP	Effluent Treatment Plant
FC	Faecal Coliform
GC-MS	Gas Chromatography–Mass Spectrometry
GIS	Geographic Information System
GPS	Global Positioning System
HPLC	High-Performance Liquid Chromatography
ICP-MS	Inductively Coupled Plasma–Mass Spectrometry

IFAS	Integrated Fixed-Film Activated Sludge
IFC EHS	International Finance Corporation Environmental, Health and Safety (guidelines)
IIoT	Industrial Internet of Things
IoT	Internet of Things
IS	Indian Standard
ISASM-CD	Intelligent Self-Administered Self-Monitored Chemical Dosing
ISO	International Organization for Standardization
IWQA	Indian Water Quality Association
KSPCB	Karnataka State Pollution Control Board
LC-MS/MS	Liquid Chromatography–Tandem Mass Spectrometry
LIMS	Laboratory Information Management System
MBR	Membrane Bioreactor
MLD	Million Litres per Day
MLSS	Mixed Liquor Suspended Solids
MoEF&CC	Ministry of Environment, Forest and Climate Change
MPN	Most Probable Number
NGT	National Green Tribunal
NH ₃ -N	Ammoniacal Nitrogen
NRCP	National River Conservation Plan
NRRM	National River Rejuvenation Mission (proposed)
NTU	Nephelometric Turbidity Unit
O&M	Operation and Maintenance
PAC	Poly-Aluminium Chloride

PE	Polyelectrolyte
PFAS	Per- and Polyfluoroalkyl Substances
PHED	Public Health Engineering Department
PPP	Public–Private Partnership
QC	Quality Control
SOMS	Sewerage Operation Monitoring Software
SPCB	State Pollution Control Board
SPS	Sewage Pumping Station
STP	Sewage Treatment Plant
TN	Total Nitrogen
TOC	Total Organic Carbon
TP	Total Phosphorus
TSS	Total Suspended Solids
ULB	Urban Local Body
US EPA	United States Environmental Protection Agency
UT	Union Territory
WQI	Water Quality Index
ZLD	Zero Liquid Discharge

— End of Report —

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