

# BACKGROUND NOTE

## **Parallel Session:** **Water, Waste and Resource Efficiency**

**National Urban Conclave**  
24-25 October 2026

## Abbreviations/ Acronyms

|                |                                                         |
|----------------|---------------------------------------------------------|
| <b>AMRUT</b>   | Atal Mission for Rejuvenation and Urban Transformation  |
| <b>BWG</b>     | Bulk Waste Generator                                    |
| <b>CBG</b>     | Compressed Biogas                                       |
| <b>CPCB</b>    | Central Pollution Control Board                         |
| <b>CSE</b>     | Centre for Science and Environment                      |
| <b>EPR</b>     | Extended Producer Responsibility                        |
| <b>FSSM</b>    | Faecal Sludge and Septage Management                    |
| <b>GIS</b>     | Geographic Information System                           |
| <b>GIZ</b>     | Deutsche Gesellschaft für Internationale Zusammenarbeit |
| <b>IoT</b>     | Internet of Things                                      |
| <b>KPI</b>     | Key Performance Indicator                               |
| <b>LPCD</b>    | Litres per Capita per Day                               |
| <b>MLD</b>     | Million Litres per Day                                  |
| <b>MoEFCC</b>  | Ministry of Environment, Forest and Climate Change      |
| <b>MoHUA</b>   | Ministry of Housing & Urban Affairs                     |
| <b>MRF</b>     | Material Recovery Facility                              |
| <b>NIUA</b>    | National Institute of Urban Affairs                     |
| <b>NDC</b>     | Nationally Determined Contribution                      |
| <b>NRW</b>     | Non-Revenue Water                                       |
| <b>NUC</b>     | National Urban Conclave                                 |
| <b>O&amp;M</b> | Operation and Maintenance                               |
| <b>PPP</b>     | Public Private Partnership                              |
| <b>RDF</b>     | Refuse Derived Fuel                                     |
| <b>SBM-U</b>   | Swachh Bharat Mission - Urban                           |
| <b>SCADA</b>   | Supervisory Control and Data Acquisition                |
| <b>SPCB</b>    | State Pollution Control Board                           |
| <b>STP</b>     | Sewage Treatment Plant                                  |
| <b>SWM</b>     | Solid Waste Management                                  |
| <b>ULB</b>     | Urban Local Body                                        |
| <b>WTP</b>     | Water Treatment Plant                                   |

## Executive Summary

India's journey towards *Viksit Bharat 2047* will be shaped by the capacity of its cities to deliver water, sanitation and waste services reliably, efficiently and sustainably. Urban India, home to nearly 500 million people today and projected to host over 875 million by mid-century, is placing growing pressure on water sources, used water systems and waste management infrastructure. Water, used water and solid waste are not separate service silos. They are connected parts of a single urban resource cycle, and how cities manage this cycle will determine their liveability, climate resilience and fiscal health.

This background note frames the discussion for the session on *Water, Waste and Resource Efficiency* at the National Urban Conclave. It reviews the current policy and mission landscape, including AMRUT, the Swachh Bharat Mission - Urban 2.0 and the Solid Waste Management Rules, 2026, and the shift now needed from creating infrastructure to delivering functional, measurable services. It underlines that used water treatment plants should be seen as resource recovery facilities and that every by-product of water and waste systems should return to the economy as a resource.

The note draws on the concept note for the session and from the virtual pre-conclave consultation on 6 October 2026, held with Urban Local Bodies, development partners, research institutions, transaction advisors, technology providers and industry. The consultation highlighted key issues: weak measurement of losses and service levels, operation and maintenance gaps, a persistent gap between treatment and reuse of used water, unreliable waste data, fragmented institutions, limited land and weak markets for recovered products. It outlines recommendations, practices from cities and states, priority areas and a strategy for taking them forward, including a roadmap for circularity in the urban water cycle and an agenda to move waste management from collection to processing and recovery.

## 1. Introduction

### 1.1. Urban Growth and the Need for Resource-Efficient Services

India's vision for Viksit Bharat 2047 seeks a developed, self-reliant and globally competitive economy. Urban India, currently home to 487 million people, is projected to reach 876 million by 2050<sup>1</sup>. Cities contribute over 60% of India's GDP, likely exceeding 70% by 2030<sup>2</sup>. Sustaining this growth requires reliable water, used water and waste services.

Rising demand, depleting sources, distribution losses and climate extremes are straining urban water security. Poorly managed used water and solid waste further pollute water bodies, land and air. Integrated management is therefore essential to reduce duplication, strengthen accountability and enable resource recovery.

### 1.2. From Infrastructure Creation to Service Outcomes and Circularity

National Missions have expanded investment in water supply, sewerage and waste processing. The focus must now shift from infrastructure created to service outcomes, including assured supply, safe treatment, low losses, energy efficiency, scientific waste processing and resource reuse. This requires changes in how cities plan, procure, finance, operate and monitor services.

Circularity must apply across urban resources. Treated used water can support horticulture, construction, industry and lake rejuvenation, while waste can be converted into compost, biogas, recyclable materials, fuel and raw-material substitutes. This forms the 'waste to wealth' and 'waste to resource' agenda of the National Urban Conclave session.

### 1.3. Objectives of the Session

The session on **Water, Waste and Resource Efficiency** seeks practical approaches for resource-efficient, resilient cities. Its objectives are to:

- develop a national roadmap for circularity in urban water and used water and solid waste management;
- identify interventions and implementation pathways for water reuse, resource recovery, non-revenue water reduction and water-body rejuvenation;
- establish institutional, financial, regulatory and technical frameworks, including private-sector participation and PPP models;
- strengthen waste-processing infrastructure and enforcement of the SWM Rules, 2026;
- create performance indicators linked to service outcomes and resource efficiency; and

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<sup>1</sup> <https://www.un.org/en/desa/68-world-population-projected-live-urban-areas-2050-says-un>

<sup>2</sup> <https://www.niti.gov.in/sites/default/files/2021-09/UrbanPlanningCapacity-in-India-16092021.pdf>

- define measurable and scalable priorities for the NUC 2026 outcome document.

#### 1.4. Discussion Themes

The discussion is organized around six themes: (i) improving reuse of treated used water by creating demand and offtake mechanisms in industry, construction, landscaping and municipal applications; (ii) improving institutional capacities for circularity, including lifecycle asset management; (iii) mainstreaming circular economy across the urban water cycle in policy, planning, design and financing; (iv) technology for the future, including AI, digital twins and IoT; (v) project structuring and O&M, with bankable, outcome-oriented projects and long-term O&M strategies; and (vi) improving service delivery by turning infrastructure investment into measurable outcomes. The same themes extend to solid waste, where the emphasis is on processing infrastructure, legacy waste remediation, rule enforcement and financing.

The note is meant to inform and structure this deliberation, so that the session can arrive at practical recommendations that feed into the outcome document of the National Urban Conclave.

### 2. Current Situation

#### 2.1. Overview

Water supply, sanitation, public health and solid waste management are core functions of Urban Local Bodies (ULBs) under the Twelfth Schedule of the Constitution (74th Amendment) Act, 1992. Water, however, remains a State subject, and responsibility for waste and environmental regulation is shared between the Union, States and ULBs. National missions, regulatory frameworks and State-level policies have together built a framework in which cities are expected to deliver universal access, safe treatment and, increasingly, resource recovery.

This section reviews the policy and regulatory framework, the mission-oriented reforms, the institutional architecture, the use of technology and the emerging circular economy ecosystem.

#### 2.2. Policy and Regulatory Framework

The Solid Waste Management (SWM) Rules, 2026, effective from 1 April 2026, supersede the 2016 Rules and strengthen circular economy principles, Extended Producer Responsibility and the obligations of citizens, bulk generators and ULBs. Key features include:

- four-stream segregation into wet, dry, sanitary and special care waste;
- responsibility of bulk generators producing 100 kg or more per day to process wet waste or obtain a responsibility certificate;
- environmental compensation, user charges and penalties under the polluter pays principle;
- online registration and tracking of waste pickers, transporters and processors;

- time-bound remediation of legacy waste and land allocation for processing facilities; and
- targets for industrial use of RDF, supported by Central and State-level committees.

In the water sector, mission guidelines promote service benchmarks, water audits, lower non-revenue water, 24x7 supply and treated used-water reuse. However, weak freshwater regulation limits incentives for efficiency and reuse. Participants suggested sectoral NDCs, water-efficiency ratings and wider adoption of water stewardship.

### 2.3. Mission and Scheme-oriented Reforms

National Missions have shifted urban water and sanitation from infrastructure creation towards service outcomes. Key initiatives include:

**AMRUT 2.0:** Launched in October 2021, it targets functional tap connections in around 4,800 statutory towns and universal sewerage and septage coverage in 500 AMRUT cities. Key reforms include:

- meeting at least 20% of city water demand and 40% of industrial water demand at the State level through recycled water;
- promoting circularity including reuse projects and markets for treated used water;
- enabling 24x7 'drink from tap' supply and water-body rejuvenation; and
- preparing GIS-based master plans, improving city credit ratings and mobilising funds through municipal bonds.

**Swachh Bharat Mission - Urban 2.0 (SBM-U 2.0):** Launched in October 2021 with an outlay of Rs 1,41,600 crore, it aims to make cities 'Garbage Free' through source segregation, scientific waste processing, legacy dumpsite remediation, used water management in non-AMRUT cities, and ODF+, ODF++ and Water+ certification. The next phase focuses on processing, remediation and resource recovery.

**Urban Challenge Fund:** Promotes bankable urban water, used water and waste-management projects through market-linked financing.

**Swachh Survekshan:** Benchmarks ULB performance in sanitation, waste management, water supply and reuse.

### 2.4. Institutional Architecture

Water and waste services involve multiple institutions with varying capacities and responsibilities:

- **Union institutions:** MoHUA leads AMRUT and SBM-U, issues guidelines, benchmarks and supports States and ULBs in implementation while MoEFCC, CPCB and SPCBs frame environmental rules and monitor compliance.
- **States and ULBs:** State governments and parastatal agencies implement policies, bulk water, sewerage and treatment, while ULBs provide last-mile services, collect user charges and manage O&M and SWM implementation.

- **Market actors:** Producers, recyclers and industries support EPR and markets for treated water, RDF, compost and other recovered products.
- **Knowledge partners:** NIUA, CSE, GIZ, IITs, advisors and start-ups support planning, technology, pilots and capacity building.

## 2.5. Technology and Digital Monitoring

Technology is increasingly used to improve visibility and control in urban water and waste systems including the following:

- **SCADA, IoT sensors and automation**
- **Smart and AMR metering**
- **Predictive maintenance and digital twins**
- **Remote monitoring of faecal sludge treatment**
- **Online tracking in solid waste:**

## 2.6. Circular Economy and Market Ecosystem

Resource recovery from water and waste is growing but remains uneven:

- **Treated used water:** Reuse includes industry, construction, horticulture, lakes, thermal power plants and agriculture.
- **Waste recovery:** Cement kilns co-process over 7 million tonnes of waste annually, including RDF, while wet and dry waste support compost, CBG and recycling.
- **EPR:** EPR covers several waste streams, but ULB contributions to collection are not adequately monetized.
- **Procurement:** Performance-based contracts rarely incentivize treated water quality, methane recovery or energy generation.
- **Circular water systems:** Reuse reduces freshwater dependence and pollution, improves climate resilience, enables resource recovery and strengthens utility finances and urban water security.
- **Processing infrastructure:** Cities are expanding MRFs, C&D waste recycling, waste-to-electricity facilities and legacy waste remediation, although many projects remain under construction.
- **Financing:** Self-sustaining models can monetize compost, recycled aggregates and green energy through bankable PPPs, green bonds, carbon credits and sustainability funds.

Circularity will scale only with demand for recovered products, bankable business models and accountable operators.

## 3. Challenges

### 3.1. Overview

Following gaps have been identified that limit the translation of investments into

functional services and resource recovery.

### 3.2. Water and Used Water

- **Weak measurement and data:** Water losses lack rigorous measurement, baselines, metering and dashboards.
- **Focus on infrastructure:** Planning and funding prioritize pipe length and treatment capacity over functionality, service levels, loss reduction and citizen benefits.
- **O&M gaps:** Corrosion, fouling, uncalibrated sensors, limited operating funds and unclear operator accountability lead to asset failures and underutilization.
- **Treatment-reuse gap:** Limited demand assessment, tertiary treatment, buyer registries, quality standards and pricing constrain reuse, particularly by industries.
- **Procurement constraints:** Item-rate contracts and procurement documents rarely link payments to service outcomes, circularity or performance incentives.

### 3.3. Solid Waste Management

- **Source segregation and behaviour:** Citizen compliance remains difficult despite awareness efforts, while user-charge collection is uneven and enforcement does not always improve segregation.
- **Collection-processing gap:** Collection and transportation have improved, but waste processing, legacy dumpsite remediation and implementation of the SWM Rules, 2026 continue to face operational and institutional constraints.
- **Incomplete infrastructure:** Delays in MRFs, waste-to-electricity plants and C&D waste facilities affect processing targets.
- **Land constraints:** Cities lack designated land for processing, recycling and material recovery facilities.
- **Data:** Waste data is often unreliable, with reported segregation exceeding ground-level performance and incomplete generator records.

### 3.4. Governance, Finance, Markets and Capacity

- **Fragmented governance:** Responsibilities are dispersed across institutions, with no single accountable body and unclear roles within ULBs.
- **Weak recovery markets:** Demand, buy-back arrangements and quality assurance for compost, recycled materials, RDF, CBG and digestate remain limited.
- **Financial sustainability:** Weak user charges, inadequate O&M funding, limited ULB participation in EPR proceeds, and the lack of robust PPP and climate-finance models affect service quality.
- **Technology and capacity:** Limited ULB involvement in technology selection and weak technical capacity, particularly in smaller cities, constrain implementation and monitoring.

- **Worker safety:** Sanitation workers continue to face risks in sewers and septic tanks, while PPE compliance remains difficult to monitor.

#### 4. Pre-conclave Deliberations and Outcomes

##### 4.1. Consultation Overview

Inputs from ULBs, States, partner organizations, technology providers, consultants and industry identified the following priorities:

##### 4.2. Priority areas identified by the stakeholders

- **Measurement and technology:** Mandate baselines, metering, NRW measurement, calibrated digital monitoring and reliable dashboards, supported by a repository of technologies and start-ups.
- **O&M and service-based contracts:** Introduce multi-year, service-linked contracts with performance incentives, results-based financing and preventive maintenance.
- **Treated used-water reuse:** Assess demand, establish buyer registries and quality and pricing standards, and prepare State and city reuse plans.
- **Circularity and waste governance:** Develop verifiable circularity indicators, improve real-time waste reporting, and define ULB roles, KPIs and accountability.
- **Processing infrastructure:** Complete pending MRFs, C&D plants and waste-to-electricity facilities and set targets for legacy-waste remediation and reclaimed-land reuse.
- **Lifecycle and climate financing:** Ensure predictable O&M funding, bankable PPPs, EPR sharing and access to green bonds, carbon credits and sustainability funds.
- **Land and markets:** Earmark land for waste facilities and create purchase commitments, quality standards and viable markets for recovered products.
- **Capacity, policy and safety:** Strengthen ULB capacity, integrate AMRUT and SBM-U planning, and consider water regulation, efficiency labelling, stewardship, water credits, sectoral NDCs and technology-enabled worker safety.

##### 4.3. Good Practices Shared

The following practices were shared during the pre-conclave consultation. They are indicative, and details are to be validated with the respective States and ULBs before being presented at the Conclave.

**Rajasthan: SCADA-based FSTP Monitoring:** Rajasthan is developing around 350 FSTPs, including many in small ULBs. Plant data is relayed through SCADA to a State-level command centre, while a chatbot provides FSSM information. This demonstrates how centralised monitoring can support multiple small plants.

**Surat: Water Plaza:** Surat's water plaza captures rainwater to reduce flooding and enable reuse. During dry periods, it functions as a revenue-generating venue, combining stormwater management, water reuse and productive public-space use.

**Pune: Digital Water and STP Monitoring:** Pune uses IoT sensors, AMR meters, PLC-SCADA automation and online STP monitoring to track network performance and outlet quality, enabling rapid water audits and assessment of interventions.

**Rajkot: Treatment and Assisted Segregation:** Rajkot treats its entire 256 MLD of used water, largely for agricultural reuse, and is piloting assisted four-way waste segregation through cooperatives and service fees. The model combines service delivery, user contributions and employment.

**Gurugram, Chennai and Uttar Pradesh: Treated Water Reuse:** Gurugram supports multiple reuse applications, Chennai supplies tertiary-treated water, and Uttar Pradesh has prepared State and city reuse plans. These examples show how reuse planning can identify users and unlock demand.

**Varanasi: Recycling Model City:** Varanasi is reclaiming around 30 acres for an MRF and plastic and paper recycling units, providing a model that could be implemented through PPPs in larger cities and public funding in smaller cities.

**Madukkarai and Prayagraj: Waste Remediation:** Madukkarai achieved zero landfill through community participation, affordable fees and material segregation, while Prayagraj remediated a major dumpsite through a lower-cost business model. Both demonstrate the importance of community participation and markets for recovered materials.

#### 4.4. Recommendations Emerging from the Consultation

The following initiatives can help cities and States shift from infrastructure creation to measurable service delivery, reuse and resource efficiency:

- **Integrated planning:** Prepare integrated plans for water, used water and waste by aligning AMRUT, SBM-U and related programmes, and designing treatment plants as resource-recovery facilities.
- **Measurement and monitoring:** Mandate baselines, metering, calibrated SCADA/IoT systems and public dashboards, with regular reporting of non-revenue water and service-level benchmarks.
- **Service-based contracting:** Introduce multi-year O&M, technology-enabled monitoring, service-linked payments, incentives and disincentives, supported by revised procurement guidelines and O&M-based awards.
- **Predictive maintenance:** Use sensors and digital twins to identify leakages, pump inefficiencies and asset failures, and improve energy efficiency.
- **Treated water reuse:** Assess demand before tertiary-treatment investments, establish buyer-seller registries, standardise quality and pricing, and prepare State and city reuse plans. Model procurement documents should include reuse and resource-recovery clauses.
- **Circularity index:** Develop a city-level score covering treated-water reuse, safe

treatment, non-revenue water, waste segregation, resource recovery and uptake of recycled products.

- **Solid waste governance:** Define ULB roles and KPIs, ensure integrated accountability from collection to disposal, involve ULBs in technology selection, and combine user charges and penalties with assisted segregation.
- **Processing and legacy waste:** Fast-track MRFs, C&D plants and waste-to-electricity facilities and set time-bound targets for legacy waste remediation and reuse of reclaimed land.
- **Lifecycle and climate financing:** Provide predictable, outcome-linked O&M funding and develop bankable PPPs supported by green bonds, carbon credits and international sustainability funds.
- **Institutional capacity and data:** Strengthen ULB and utility capacity for lifecycle asset management and operationalize verified real-time reporting, including registration of bulk waste generators.
- **Land and EPR:** Earmark land for waste infrastructure, provide results-based O&M financing and consider sharing EPR proceeds with ULBs.
- **Market creation:** Promote government procurement and quality standards for compost, CBG, recycled products and construction materials, in consultation with industry and recyclers.
- **Water policy reforms:** Explore economic regulation, efficiency labelling, stewardship standards, water credits and sectoral NDCs for water and wastewater.
- **Safety and inclusion:** Use technology to monitor PPE and safe practices, while improving the dignity and livelihoods of sanitation and informal workers.

## 5. NUC 2026: Key Discussion Areas

### 5.1. Strategic Questions for Deliberation

- **From Asset Creation to Service Outcomes:** How can cities measure service quality, reliability and resource efficiency instead of infrastructure created?
- **From Treatment to Reuse:** How can cities develop markets for treated water, sludge, CBG, compost and recycled materials alongside resource-recovery infrastructure?
- **Integrated Governance and Accountability:** Should cities adopt a single resource-management framework or strengthen coordination among existing institutions, and how should accountability be measured?
- **Project Bankability through Financing and Procurement:** How can financing and procurement improve project bankability while rewarding service delivery, reuse, circularity and lifecycle performance?