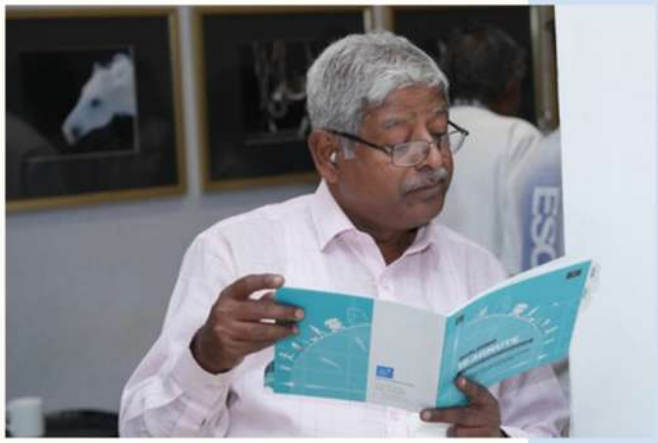
Jana Urban Space

Event Report

Nature-based Solutions for Bengaluru: Reflections on Drainage



18 December 2025

Turf Hall, Renaissance
Bengaluru Race Course Hotel

About Jana Urban Space Foundation

Jana Urban Space Foundation (Jana USP) is a Bengaluru-based not-for-profit institution founded in 2007. It works towards transforming the quality of life in urban India through the streams of urban planning and design, across both policy and practice. JUSF works on policies on land titling, spatial planning reforms, and neighbourhood improvement plans, and works closely with the state governments and Urban Local Governments (ULGs) on implementation of urban design projects for the improvement of public spaces, and on road infrastructure through Tender S.U.R.E. (Specifications for Urban Road Execution) guidelines.

Over nearly two decades, Jana USP has worked extensively to promote systemic reforms in urban planning and design with governments at the Union, State, and ULG levels — including NITI Aayog (formerly the Planning Commission), the Ministry of Housing and Urban Affairs (MoHUA), and the Governments of Andhra Pradesh, Assam, Odisha, Madhya Pradesh, Meghalaya, Karnataka, Rajasthan, Tamil Nadu, and Uttar Pradesh.

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Jana Urban Space

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Executive summary

Bengaluru faces a stark paradox in its water systems: intense rainfall routinely results in localised flooding and waterlogging, even as lakes, wells, and aquifers run dry for much of the year. This reflects a deeper systemic failure of land use planning, drainage design, governance, financing, and technical capacity to retain, absorb, and reuse the water the city already receives.

As a fast growing metropolitan region with a historic lake system, complex topography, and rapid urban expansion, Bengaluru sits at the frontline of climate driven urban water risk. Yet its strong tradition of citizen stewardship and evolving metropolitan governance with the formation of the Greater Bengaluru Authority (GBA) also makes it a powerful testbed for systemic reform, with lessons relevant far beyond the city.

Against this backdrop, Nature-based Solutions for Bengaluru: Reflections on Drainage, a day long convening held on 18 December 2025 at the Renaissance Bengaluru Race Course Hotel, brought together government officials, technical experts, community leaders, and industry stakeholders to advance Nature-based Solutions (NbS), for urban drainage. Organised by Jana Urban Space Foundation in collaboration with Mercedes Benz Research and Development India, the convening aimed to advance a shared understanding of how NbS, combined with resilient grey infrastructure, can strengthen Bengaluru's urban drainage and water systems.

Through a keynote address by Maheshwar Rao M IAS, Chief Commissioner, GBA, and five focused sessions, the convening examined drainage, lakes, rainwater harvesting, best practices from other cities, and governance reform as parts of a single urban water system rather than separate domains.

The convening converged on six overarching lessons to enable systemic adoption of NbS and strengthen integrated urban water management in Bengaluru:

01

Institutionalise stormwater as a core urban service.

Stormwater management must be formally recognised as a core urban service, supported by statutory service standards, dedicated budgets, performance benchmarks, and legislative oversight, on par with water supply and sewerage. Without this institutional elevation, investments will remain fragmented and reactive.

02

Achieve time-bound separation of sewage and stormwater systems.

Citywide, phased programme must eliminate sewage inflows into stormwater drains through sewer network expansion, decentralised treatment where required, and strict enforcement against illegal connections. Clean stormwater is a non-negotiable precondition for recharge, lake rejuvenation, and effective NbS.

03

Plan, design, and manage water systems at the catchment scale.

Urban water management must shift from asset based interventions to catchment based planning that integrates nallahs, lakes, stormwater networks, groundwater aquifers, and public spaces within a single hydrological and ecological framework, enabling coordinated flood mitigation, pollution control, and climate resilience.

04

Mainstream hybrid grey–blue–green infrastructure delivery.

Drainage, lake, and river interventions should be delivered as hybrid systems that integrate engineered, hydrological, and ecological solutions. NbS must be embedded within statutory planning instruments, engineering manuals, and capital works programmes, rather than treated as pilots or add-ons.

05

Align institutional mandates and decentralise stewardship.

Clear alignment of responsibilities across water supply, wastewater, and stormwater agencies is essential, alongside functional separation of sewage and stormwater roles.

Metropolitan coordination mechanisms, particularly the GBA, must be operationalised, while empowering ward level institutions and formally recognising citizen groups as co-stewards for monitoring, operations, and maintenance.

06

Shift to lifecycle, performance, and data driven delivery.

Public agencies and contracting ecosystems must invest in professional capacity and adopt outcome and performance linked standards and contracts that prioritise long-term system performance over asset creation. Shared data platforms, monitoring systems, and statutory tools such as Urban River Management Plans (URMPs) should be operationalised to enable inter-agency coordination, transparency, and adaptive management.

The convening underscored that Bengaluru remains "water positive" in principle; translating this potential into resilience will require moving from reactive, project by project responses to patient institution building and integrated, citizen-centred planning. Thus, NbS, when embedded within this systemic approach, can help transform Bengaluru's water infrastructure into a network of functional, resilient, and public- oriented urban assets.

This event report brings together key insights from the keynote address, thematic panels, and case study discussions to examine how Bengaluru can reimagine its drainage, lakes, and urban water systems in the context of climate risk and rapid urbanisation.

The report is intended as both a record of the convening and a resource for policymakers, practitioners, researchers, and citizen groups seeking to strengthen Bengaluru's urban water systems.

Context

Surjyatapa Ray, Associate Manager - Urban Policy, Jana Urban Space Foundation, setting the context for the convening.

Bengaluru faces a persistent contradiction in its water systems - intense rainfall events routinely lead to flooding and waterlogging, while lakes, wells, and aquifers continue to dry up for much of the year. This imbalance reflects city's diminishing ability to retain, absorb, and reuse the water it receives.

Over the past decade, rapid urbanisation has significantly reduced permeable surfaces and disrupted natural drainage and recharge pathways. Rainwater that once infiltrated soils and replenished groundwater is now rapidly conveyed through hard engineered drains, overwhelming stormwater infrastructure during heavy rainfall while leaving aquifers depleted. At the same time, rising demand has intensified pressure on limited water resources. With an estimated population of 13 million, Bengaluru relies heavily on the Cauvery River, pumping water over long distances and elevations through an energy intensive system marked by high transmission losses and inadequate wastewater treatment capacity.

Despite these challenges, Bengaluru remains water positive in theory. Annual rainfall generates volumes of water that could meet a substantial share of the city's demand if captured and managed effectively. Historically, the city demonstrated this potential through an extensive network of interconnected tanks and nallahs that functioned as a

decentralised water harvesting and storage system.

The erosion of this system over time points to deeper structural failures not only in planning, but also in governance, financing, and technical capacity.

Addressing these challenges requires moving beyond isolated engineering interventions toward a catchment based approach that integrates land use, hydrology, and infrastructure. In this framework, drainage systems must evolve from single purpose conduits for rapid runoff to multifunctional networks that slow down flows, improve water quality, and enable groundwater recharge.

Bengaluru's stormwater drainage network comprises roadside drains that collect runoff from built up areas, channelling it into open drains or nallahs and eventually into lakes. The inadequacy of this system can be addressed by integrating NbS with resilient grey infrastructure. NbS systems can be leveraged across stormwater drains, nallahs and open drains, lakes, and rainwater harvesting systems.

Together, these approaches can enhance infiltration, reduce flooding risks, and restore ecological functions, helping Bengaluru address the dual challenge of excess water during monsoons and scarcity during dry periods.

Arun Kumar, General Secretary, Bangalore Apartment Federation (BAF) sharing his perspective.

An observer at the convening, engaging through questions.

Objectives

This convening brought together government officials, technical experts, community leaders, and industry stakeholders to advance the application of NbS for urban drainage in Bengaluru. Through keynote addresses, panel discussions, and a site visit, participants examined innovative approaches to reimagining drainage systems, stewarding urban lakes, strengthening rainwater harvesting, and improving governance frameworks.

The event marked the launch of a draft working paper, "Rebuilding Urban Drainage Systems: Learnings from Nallurhalli Nallah Rejuvenation in Bengaluru", which argues that the city's flooding and water scarcity arise from the same systemic failures and cannot be addressed through isolated drainage projects. The keynote address and working paper launch set the conceptual foundation for the convening, which subsequently focused on building a shared understanding of actionable strategies, fostering cross sector collaboration, and outlining a roadmap for scaling NbS to enhance resilience, sustainability, and community engagement in Bengaluru's water systems.

The convening focussed on the following thematic areas:

1. **Reimagining drains and drainage in Bengaluru.**

   Redesigning streets and nallahs as an integrated drainage system combining pipe and chamber engineering with NbS to reduce flooding, improve water quality, and to move from isolated fixes to a coherent, city scale flood and recharge strategy.

2. **Lake rejuvenation and community stewardship.**

   Reframing lake rejuvenation as a catchment level governance and ecological challenge, where scientific design, institutional coordination, and structured citizen stewardship together restore lakes as functional flood, recharge, and ecological infrastructure.

3 **Making rainwater harvesting work.**

Transforming rainwater harvesting from plot level compliance into a coordinated urban recharge strategy by deploying sponge city principles across streets, open spaces, campuses, and neighbourhoods, supported by regulatory reform, design capacity, and community participation.

4 **Best practices beyond Bengaluru.**

Demonstrating how nature-based solutions can be institutionalised at scale, through Urban River Management Plans, technical rigour, hybrid infrastructure, and social legitimacy, to restore rivers and lakes as climate buffers, ecological systems, and civic spaces across Indian cities.

5 **Governing water and wastewater in Bengaluru (institutions, financing and accountability).**

Advancing a unified approach to governing water supply, wastewater, drainage, and natural systems by operationalising metropolitan coordination under GBA, strengthening decentralised planning, ensuring sustainable financing, and embedding accountability through data and citizen engagement.

Nithya Ramesh, Director - Planning and Design, Jana Urban Space Foundation moderating the plenary session: Reimagining drains and drainage in Bengaluru.

Interactions between the observers and panellists at the convening.

Key takeaways

The discussions across the keynote and five sessions generated a set of grounded, practice oriented insights on urban water management and NbS in Bengaluru. This section distils the key takeaways from each session, highlighting the recurring themes and learnings that emerged from the convening.

01 Keynote address by Maheshwar Rao M IAS, Chief Commissioner, Greater Bengaluru Authority

The Greater Bengaluru Authority (GBA) is prioritising the creation of additional stormwater drains and better use of the lake system, with a focus on increasing storing capacity. By keeping sewage out and fixing underground drainage through nature-based solutions, Bengaluru can also create more public spaces.

The pipe and chamber system implemented under Tender S.U.R.E. roads has worked well in carrying urban runoff and strengthening underground drainage. With its integrated design, this approach improves flood resilience, walkability, and the everyday citizen experience. The GBA plans to scale this system across an additional 173 km.

Maheshwar Rao M IAS
Chief Commissioner
Greater Bengaluru Authority

Bengaluru's flooding context.

Bengaluru's elevated topography gives it a natural advantage against large scale flooding. What is commonly perceived as city wide flooding is, in reality, localised waterlogging at a limited number of vulnerable locations. During recent heavy rainfall events, only two locations experienced water stagnation for over 24 hours, primarily due to development patterns and

capacity constraints. In most parts of the city, stormwater was cleared within an hour. However, public perception amplified by social media often portrays these localised incidents as systemic flooding.

Limitations to stormwater retention and recharge.

The principal reason for persistent waterlogging is the mixing of sewage with stormwater in drainage lines. Bengaluru currently faces a shortfall of approximately 600 million litres per day (MLD) in sewage treatment capacity, alongside gaps in sewage collection. As a result, contaminated stormwater cannot be allowed to infiltrate or recharge groundwater, forcing the city to prioritise rapid conveyance rather than retention or infiltration based solutions.

Rapid runoff removal through engineered drainage interventions.

To address immediate flood risks, the city has focused on improving conveyance capacity. Of the approximately 870 km stormwater drain network, around 730 km have been lined, ensuring quicker and safer removal of runoff.

Positioning Bengaluru to adopt NbS for urban drainage.

With growing clarity on the need to separate sewage and stormwater, the city is now positioned to adopt nature-based solutions (NbS). Initiatives such as the K-100 corridor demonstrate the potential of drains and waterways to function as blue–green infrastructure slowing water flows, improving water quality, enabling groundwater recharge, and supporting public spaces.

Treating water upstream, not just at the lake.

During a recent visit to Ulsoor Lake, it was noted that the lake has four inlet points. Treating water only at the inlet is not sufficient. The need now is to treat water all the way up to the highest point, using nature-based solutions. The idea is to implement such interventions in phases across different corporations, showcase K-100 like projects, and allow demand to grow organically across corporations to create similar systems elsewhere.

Leveraging Bengaluru's lakes as urban flood infrastructure.

Bengaluru's network of nearly 200 lakes presents a strategic opportunity to manage urban

flooding. At high risk locations such as Silk Board, drainage augmentation alone is insufficient. Using lakes like Madiwala for temporary storage during peak rainfall can help attenuate flows before water moves downstream to larger systems such as Bellandur Lake. A city scale master plan is being developed to integrate lakes and drains into a unified flood management framework.

Blue–green infrastructure and public realm enhancement.

Beyond flood mitigation, blue–green infrastructure projects aim to improve public access and ownership of water systems. By integrating drainage and lake networks with accessible public spaces, these interventions enhance stewardship, improve long-term maintenance outcomes, and embed water infrastructure into everyday urban life.

Roads, drainage, and integrated design.

Urban road failures in Bengaluru are closely linked to inadequate drainage. The Tender S.U.R.E. model, with its integrated pipe and chamber system, has demonstrated improved performance. In its second phase, approximately 160 km of roads will be upgraded using this approach. Despite short-term disruptions, the model is expected to deliver durable roads, effective drainage, wider footpaths, and improved walkability.

Financing and institutional commitment.

Funding remains a critical enabler. A ₹2,000 crore World Bank loan has been secured to support drainage improvements and nature-based interventions along nallahs. In parallel, approximately ₹1,500 crore is being invested in expanding underground drainage networks in newly developed areas. Long-term priorities include preventing grey and black water from entering stormwater drains and strengthening the lake network as a core component of flood resilience.

A coordinated approach that treats lakes as flood control infrastructure, separates sewage from stormwater, and scales nature-based solutions can significantly improve Bengaluru's resilience to extreme rainfall. Such an approach not only strengthens flood management systems but also delivers broader co-benefits in the form of enhanced public spaces, improved environmental quality, and a more liveable city.

02 Plenary session: Reimagining drains and drainage in Bengaluru

Panellists

1. **Dr Jagdish Krishnaswamy**, Dean, School of Environment and Sustainability (SES), Indian Institute for Human Settlements (IIHS)
2. **Naresh V Narasimhan**, Co-founder, MOD Foundation
3. **E P Nivedita IA&AS**, Executive Director, National E-Governance Services Ltd (NeSL)
4. **Dr B S Prahallad,** Director (Technical), Bengaluru Smart Infrastructure Limited (B-SMILE)
5. **Nithya Ramesh**, Director - Planning and Design, Jana Urban Space Foundation (panellist and moderator)

The plenary focused on Bengaluru's stormwater drainage challenges, examining why flooding and waterlogging persist despite significant investments in infrastructure. The discussion highlighted drainage as a historically neglected urban service and explored how fragmented governance, weak accountability, and siloed planning have limited effective solutions. Drawing on perspectives from ecology, engineering, urban design, and public finance, the panel discussed the need to move beyond standalone drain projects toward integrated approaches that link street level drainage, nallahs, lakes, and catchments, and combine grey infrastructure with nature based solutions to improve flood resilience and urban water management.

Stormwater drainage is a historically neglected sector with weak accountability.

The session clearly established that stormwater drainage has remained institutionally marginal within India's urban infrastructure priorities. Unlike water supply, sewerage, or solid waste management, drainage has lacked formal benchmarks, manuals, performance standards, and sustained policy attention. It entered public discourse only after repeated flooding events disrupted daily life and economic activity.

This neglect has also translated into weak political accountability. Even when systemic failures are documented through statutory audits, reform does not automatically follow.

The discussion highlighted that governance reform must extend beyond executive agencies to legislative oversight and enforcement. Without this, technical diagnosis does not translate into institutional change.

> Stormwater drainage was always the poor cousin of water supply, sewage and solid waste.
>
> A CAG report has no sanctity unless it is accepted and acted upon by the legislature.
>
> **E P Nivedita IA&AS**
> Executive Director
> National E-Governance Services Ltd (NeSL)

Interactions between participants and panellists at the convening.

Data gaps and missing records are a structural governance failure.

A major insight from the CAG audit experience was that drainage governance is severely. constrained by the absence of reliable institutional memory.
Agencies were unable to produce master plans, DPRs, or tender records, making performance based evaluation and long-term planning nearly impossible.

The use of satellite mapping and joint physical inspections was described as an emergency workaround rather than a sustainable governance model. The panel underscored that without shared datasets, clear asset inventories, and accessible planning documents, coordination between agencies remains fragile and reactive.

> Audit in India is record based. When there are no records, governance itself is in crisis.
>
> **E P Nivedita IA&AS**
> Executive Director
> National E-Governance Services Ltd (NeSL)

Engineering solutions must shift from box drains to integrated pipe and chamber systems.

From an engineering standpoint, Bengaluru is undergoing a critical transition in street level stormwater design. Traditional open box drains often mistaken by residents as sewage lines have encouraged illegal sewage connections, contamination, and maintenance failures. The pipe and chamber system pioneered under BBMP and scaled through B-SMILE offers improved performance, faster drainage response, reduced contamination, and better maintenance access. Importantly, design innovations such as unlined chamber bases allow percolation and silt capture, integrating recharge into grey infrastructure.

> People believed box drains were sewage lines — and connected sewage into them. A closed, dedicated pipe and chamber system below the road changes both performance and public behaviour.

Dr B S Prahallad
Director (Technical)
Bengaluru Smart Infrastructure Limited (B-SMILE)

Drainage cannot be fixed in isolation, it must be addressed at the watershed and catchment scale.

The K-100 (Koramangala–Challaghatta Valley) project demonstrated that treating stormwater drains as isolated channels is fundamentally flawed. Panellists believe that Bengaluru has approximately 450 km of primary rajakaluves. When the secondary and tertiary networks are included, the total length is likely to extend well beyond 1,200–1,400 km. However, the last comprehensive survey of stormwater drains dates back to 2008, which recorded only 852 km across the city.

Effective solutions must be anchored at the micro-watershed scale, prioritising infiltration, retention, and volume reduction before water enters drains. National datasets already map these watersheds, but institutional silos prevent their operational use.

An observer at the convening, engaging through questions.

The idea is not to fix the drain but to stop water from reaching the drain in the first place.

We don't even know the true length of our drainage network — how can we manage it?

Naresh V Narasimhan
Co-founder
MOD Foundation

Nature-based solutions (NbS) must be hybridised with engineering, not romanticised.

Panellists emphasised that Nature-based Solutions should complement and strengthen conventional infrastructure, rather than be seen as a replacement for it.

Bengaluru's altered hydrology driven by rapid urbanisation and sealed surfaces requires hybrid systems combining grey infrastructure, ecological design, and decentralised treatment.

Constructed wetlands, decentralised sewage treatment plants (STPs), percolation systems, and restored lakes must work together.

Importantly, outcomes must be measurable: reduced inflow volumes, improved water quality, and groundwater recharge not cosmetic beautification.

Putting flowers along drains is not an outcome — hydrological performance is.

One acre of wetland can treat 2 MLD naturally, but engineered wetlands reduce land needs tenfold.

Naresh V Narasimhan
Co-founder
MOD Foundation

Lakes and nallahs must be reimagined as dynamic ecological infrastructure, not static water bodies.

Historically, Bengaluru's lakes functioned as seasonal systems emptying, filling, and releasing water downstream. Current policy norms of keeping lakes full year round undermine flood buffering capacity in vulnerable catchments.

Scientific evidence suggests that selectively maintaining lakes as seasonal wetlands or

marsh like systems in flood-prone areas can significantly reduce risk. Additionally, reintroducing meanders and vegetated channels improves nutrient absorption and water quality.

> In some parts of Bengaluru, lakes should function more like marshes than reservoirs.
>
> Meanders are not decorative, they are functional systems for water quality and flow regulation.
>
> **Dr Jagdish Krishnaswamy**
> Dean. School of Environment and Sustainability (SES)
> Indian Institute for Human Settlements (IIHS)

Biodiversity and ecology must be designed below the waterline.

True nature-based solutions require attention to aquatic and benthic biodiversity, not just visible elements like birds and islands. Bengaluru's water bodies are dominated by invasive species, while native aquatic ecosystems remain neglected.

Findings from IIHS constructed wetlands such as the presence of fairy shrimp and freshwater sponges, which require low nutrient, ephemeral conditions demonstrate that well-designed systems can restore deep ecological functions even in urban contexts.

> Nobody looks at what lives below the water, but that's where water quality is maintained.
>
> Native biodiversity is not optional if we claim to be nature-based.
>
> **Dr Jagdish Krishnaswamy**
> Dean. School of Environment and Sustainability (SES)
> Indian Institute for Human Settlements (IIHS)

Contract design and maintenance responsibility are as important as design innovation.

The K-100 project highlighted the governance value of DBOT (Design, Build, Operate and Transfer) contracts with long-term maintenance responsibility.

Moving away from lowest cost tendering toward Quality and Cost Based Selection (QCBS) was identified as a major institutional breakthrough. Embedding maintenance, performance outcomes, and accountability into contracts upfront reduces lifecycle failure and post construction neglect.

> You cannot think of governance and maintenance as an afterthought.
>
> QCBS is not a luxury, it is essential for infrastructure that must last decades.

Naresh V Narasimhan
Co-founder
MOD Foundation

Closing remarks

The plenary highlighted that Bengaluru's drainage crisis is fundamentally an institutional challenge rooted in fragmented governance, weak data systems, and limited accountability. From missing records and uncertain network extents to isolated engineering works and under integrated nature-based solutions, the issues are systemic and interconnected.

Technical solutions exist and ecological science is available; what remains is the political, legal, and civic will to integrate them at scale.
Meaningful change will depend on coordinated watershed scale planning, enforceable standards, and long-term responsibility embedded in both design and governance.

> Bengaluru's 859 km stormwater drain network spans 1250 acres and is currently plagued by sewage, resulting in an unsightly appearance. We must adopt a zero-tolerance approach towards open sewage in these drains. We should construct sewage treatment plants upstream, incorporate nature-based solutions and transform these stormwater drains into picturesque waterfronts effectively turning them from backyards to coveted courtyards.

Dr B S Prahallad
Director (Technical)
Bengaluru Smart Infrastructure Limited (B-SMILE)

The establishment of the GBA offers Bengaluru an opportunity to overcome fragmented urban water governance and address interconnected challenges, from recurrent flooding and receding groundwater levels to the persistent mixing of sewage and stormwater. While this creates a strong foundation for sustainable wastewater and stormwater management, a resilient water future will ultimately depend on citizens acting as active partners demanding better outcomes and supporting long-term upkeep.

E P Nivedita IA&AS
Executive Director
National E-Governance Services Ltd (NeSL)

Keynote address by Maheshwar Rao M IAS, Chief Commissioner, Greater Bengaluru Authority.

Nithya Ramesh, Director – Planning and Design, Jana Urban Space Foundation. moderating the plenary session: Reimagining drains and drainage in Bengaluru. Seated alongside left to right: Dr B. S. Prahallad, Director (Technical), Bengaluru Smart Infrastructure Limited (B-SMILE) and E. P. Nivedita IA&AS.

From left to right : Dr Jagadish Krishnaswamy, Dean, School of Environment and Sustainability, Indian Institute for Human Settlements (IIHS) seated alongside Naresh V Narsimhan, Co-founder, MOD foundation.

03 Panel discussion: Lake rejuvenation and community stewardship

Panellists

1. **Dr Annapurna Kamath,** Founder Trustee, JaLa Poshan Trust
2. **Ganesh Shankar,** Founder and Chief Executive Officer, FluxGen Technologies
3. **V Ramprasad,** Co-founder, Friends of Lakes and President, Federation of Bengaluru Lakes
4. **Rohini Pradeep,** Senior Program Manager, CDD India
5. **Dr Veena Srinivasan,** Executive Director, WELL Labs (panellist and moderator)

The panel examined the governance challenges and opportunities associated with urban lake rejuvenation in Bengaluru, a city historically dependent on interconnected lake systems for water security, flood moderation, and ecological resilience. Drawing on experiences from citizen led lake conservation, applied research, and technology driven monitoring, the discussion explored why many lake rejuvenation efforts have failed what has worked in practice, and how future interventions can be made more accountable, scientific, and inclusive.

A recurring theme was the disconnect between project driven "rejuvenation" and long-term lake health, particularly in the context of fragmented institutions, well intentioned but misaligned CSR interventions, limited citizen engagement, and insufficient use of scientific diagnostics. The panel emphasised the need to treat citizens as impacted stakeholders, integrate science and technology into decision-making, and adopt clear frameworks for evaluating lake outcomes.

Citizen groups are impacted stakeholders, not external activists.

Across Bengaluru, citizen groups have emerged as the most consistent and enduring actors in lake protection. These groups are best understood not as activists or service providers, but as impacted stakeholders.

If a lake exists today, it is because a citizen group stood behind it. Otherwise, it would have disappeared.

We are not activists. We are impacted stakeholders and that means we cannot be ignored.

V Ramprasad
Co-founder,
Friends of Lakes and President,
Federation of Bengaluru Lakes

Community leadership and relationship building enable long-term stewardship.

The panel underscored that effective lake governance depends not only on infrastructure but also on social processes. Experiences from Jakkur Lake project demonstrated that early investments in community building, trust, and shared purpose were foundational to long-term stewardship.

Rather than beginning with engineering solutions, successful lake groups first engaged users and neighbours to collectively define what the lake should provide ecological, social, and hydrological benefits.

Over time, informal but sustained relationships with officials across multiple agencies helped navigate institutional fragmentation and enabled faster problem solving than formal, file driven processes alone.

Lakes involve many agencies, but relationships often matter more than formal mandates in getting things done.

Dr Annapurna Kamath
Founder Trustee
JaLa Poshan Trust

Lake rejuvenation requires diagnostic, context specific design embedded in community governance.

The panel emphasised that effective lake rejuvenation cannot rely on standard templates or generic wastewater norms. Lakes are dynamic, context specific systems, shaped by variable inflows, seasonal loads, and distinct catchment conditions.

Designs based on weak diagnosis or incorrect assumptions were identified as a primary cause of technical failure.

At the same time, scientific expertise was shown to be most effective when embedded within community led governance, where local stewardship enables continuous learning, adaptive management, and legitimate engagement with state agencies. Baseline studies, source control, catchment management, and ongoing monitoring were framed as prerequisites for resilient, climate responsive lake systems.

There is no one-size-fits-all solution. If the diagnosis is wrong, the design will fail.

Rohini Pradeep
Senior Program Manager
CDD India

We did not have ecological knowledge as citizens but scientific institutions helped us act with confidence.

Dr Annapurna Kamath
Founder Trustee
JaLa Poshan Trust

Technology can improve accountability, but cannot substitute governance.

Digital tools such as satellite imagery, drones, real time sensors, and bathymetric surveys offer powerful means to diagnose lake conditions and monitor interventions. However, the panel cautioned against reducing lake performance to single metrics such as water volume or visual improvement. Technology must support adaptive management and complement both ecological understanding and citizen observation.

One water sample does not represent a lake, spatial variation matters.

Assessment before intervention is what prevents wrong design and cost overruns.

Ganesh Shankar
Founder and Chief Executive Officer
FluxGen Technologies

Corporate Social Responsibility (CSR) funded and Environment, Social and Governance (ESG) funded lake projects require stronger safeguards and performance standards.

While private financing has mobilised significant resources for lake rejuvenation, poorly governed CSR interventions have caused flooding, ecological damage, and community conflict. Incentives focused narrowly on volumetric water offsets or visible beautification have distorted lake design and ignored downstream impacts. The panel stressed the need for clear standards, transparent monitoring, and mandatory engagement with local stakeholders.

In the name of CSR, lakes were deepened without inlets and neighbourhoods flooded.

Donation does not mean communities lose the right to question outcomes.

V Ramprasad
Co-founder
Friends of Lakes and President, Federation of Bengaluru Lakes

Clear frameworks and indicators are needed to define 'successful' lakes.

The panel noted the absence of widely accepted indicators for evaluating lake rejuvenation outcomes. Without shared benchmarks, projects tend to focus on short-term, visible outputs rather than long-term ecological and hydrological performance.

Panellists argued for frameworks that define lake purpose upfront whether flood moderation, recharge, biodiversity, recreation, or a combination and assess outcomes accordingly. Indicators discussed included water quality standards, biodiversity presence, hydrological function, community access, and maintainability over time.

The first question has to be, What is the lake meant to do? The indicators have to follow that purpose.

Rohini Pradeep
Senior Program Manager
CDD India

Lake rejuvenation fails when treated as a standalone intervention rather than a catchment system

The panel emphasised that lakes cannot be restored in isolation from their feeder channels, upstream sewage sources, and surrounding land use change. Rejuvenation efforts that focus solely on in-lake treatment repeatedly fail as pollution loads and inflows continue to increase. Durable outcomes require shifting attention upstream, prioritising source control and catchment level diagnostics.

> Water bodies are dynamic systems, you cannot copy paste one solution everywhere.
>
> Unless the catchment is addressed, the lake will keep failing, no matter how often it is fixed.
>
> **Rohini Pradeep**
> Senior Program Manager
> CDD India

Closing remarks

The panel concluded that Bengaluru's lake future depends on moving beyond project based rejuvenation toward long-term institution building. This requires embedding citizen participation, scientific diagnostics, transparent data, and accountability into lake governance frameworks. While past efforts have been marked by conflict and learning by doing, the discussion emphasised the importance of forgiveness, reflection, and collaboration. By combining community stewardship with science, technology, and responsive institutions, Bengaluru has the opportunity to reimagine its lakes as resilient urban commons rather than isolated restoration projects.

Panellists from the panel discussion: Lake rejuvenation and community stewardship sharing their views at the convening.

04 Panel discussion: Making rainwater harvesting work

Panellists

1. **Arun Kumar**, General Secretary, Bangalore Apartments' Federation (BAF)
2. **Manushi Ashok Jain**, Co-founder and Director, Sponge Collaborative
3. **Mirza Anwar**, Executive Engineer, Bangalore Water Supply and Sewerage Board (BWSSB)
4. **Sunil Mysore**, Chief Executive Officer, Hinren Technologies Pvt. Ltd.
5. **Avinash Krishnamurthy**, Co-founder and Director, Biome Environmental Trust (panellist and moderator)

Bengaluru's water crisis is often framed as a problem of scarcity, yet the city receives a substantial amount of rainfall annually. The deeper issue lies not in the absence of water, but in how rainfall, groundwater, and urban growth interact within a fragmented institutional and infrastructural landscape. This panel discussion unpacked these interactions, focusing on rainwater harvesting as a critical nature-based solution, the role of groundwater in the city's water system, and the institutional and social challenges that limit effective implementation.

Rainfall abundance versus urban water stress

Bengaluru receives an average annual rainfall of approximately 970 mm, translating into an enormous quantum of water at the city scale. When converted into daily volumes, the amount of rain falling over the city far exceeds the total water supplied from the Cauvery system. Despite this, Bengaluru continues to experience chronic water shortages.

This paradox highlights a fundamental mismatch between natural hydrology and urban water management. Rapid urbanisation, extensive concretisation, and inadequate systems for capture and recharge have turned rainfall into surface runoff rather than a resource.

Rainfall patterns themselves are also changing. Precipitation is increasingly localised and intense, with sharp spatial variation even within short distances. This variability compounds flood risk while failing to recharge groundwater evenly across the city.

> The quantity of rain that falls in Bangalore is equivalent to around 3,000 MLD, while the city's total supply after the latest Cauvery project is around 2,200 MLD.
>
> It's very common in Bangalore that on one side of the road it's raining and on the other side it's not... what's changing is the intensity and distribution of rainfall.
>
> **Avinash Krishnamurthy**
> Co-founder and Director
> Biome Environmental Trust

Urban growth, concretisation, and groundwater dependence.

Bengaluru's rapid population growth particularly in the early 2000s outpaced the expansion of piped water infrastructure. As a result, groundwater became the city's de facto buffer system, filling the gap between demand and supply. Borewells emerged as the default solution for new developments, often even before construction began. At the same time, land cover transformation drastically reduced natural infiltration. Concrete cover increased from under 40% around the year 2000 to nearly 85–90% in recent years, severely limiting the ability of rainfall to recharge aquifers. This combination of rapid growth, heavy reliance on borewells, and reduced recharge, have placed extraordinary stress on Bengaluru's aquifers, leading to declining water tables and dry borewells in many parts of the city.

> Earlier we had about 38% concrete cover. Today it has gone up to 85–90%, leaving almost no natural infiltration.
>
> **Mirza Anwar**
> Executive Engineer
> Bangalore Water Supply and Sewerage Board (BWSSB)

Rainwater harvesting as a policy response.

Against this backdrop, rainwater harvesting emerged as a key policy intervention to improve water self-reliance and reduce dependence on distant river sources. The Bangalore Water Supply and Sewerage (Amendment) Act, 2009 made rainwater harvesting mandatory for a wide range of buildings, with stricter norms for newer constructions.

The law was notable not only for mandating rainwater harvesting, but also for embedding technical design standards based on rainfall intensity. Over time, these standards were strengthened to reflect changing rainfall patterns.

The intent was to ensure that systems were not symbolic, but capable of capturing meaningful volumes of rainwater for recharge or use.

> The design should conform to a 60 mm rainfall event. It's not about the number of pits, it's about the capacity.
>
> **Avinash Krishnamurthy**
> Co-founder and Director
> Biome Environmental Trust

> We wanted to come up with a self reliant system in terms of water, and not be dependent on the Cauvery to a larger extent.
>
> **Mirza Anwar**
> Executive Engineer
> Bangalore Water Supply and Sewerage Board (BWSSB)

Manushi Jain, Co-founder, Sponge Collaborative Contractor sharing her perspective.

From mandate to implementation: Gaps and enforcement.

Despite a progressive legal framework, implementation has been uneven. Awareness of the law remains limited, particularly among apartment residents who inherit infrastructure decisions made by developers. In many cases, rainwater harvesting systems exist only to satisfy approval requirements, without adequate capacity or maintenance. To address low compliance, enforcement mechanisms were gradually strengthened. Penalties linked to water bills were introduced to push property owners toward implementation.

While these measures improved compliance numerically, questions remain about the quality, functionality, and long-term performance of installed systems.

> One pit for a four acre campus is sometimes shown as compliance. That's where the problem lies.
>
> **Arun Kumar**
> General Secretary
> Bangalore Apartments' Federation (BAF)

> We introduced 25% additional charges initially and 50% thereafter until rainwater harvesting was established.
>
> **Mirza Anwar**
> Executive Engineer
> Bangalore Water Supply and Sewerage Board (BWSSB)

Citizen action driven by necessity, not regulation.

On the ground, effective rainwater harvesting is rarely driven by legal compliance alone. Most households and communities turn to rainwater harvesting when water scarcity becomes acute and personal.

This demand-led adoption shapes the type of systems people prefer. Storage and direct use of rainwater are often prioritised over recharge, particularly where water shortages are severe.

Recharge systems, while crucial at a city scale, are sometimes viewed as offering less immediate benefit to individual households.

Most people come to us not for compliance, but because they say, 'We have a water problem.' They want a functional solution.

Sunil Mysore
Chief Executive Officer
Hinren Technologies Pvt. Ltd.

Technical, maintenance, and skill challenges.

Rainwater harvesting is often perceived as a simple intervention, but implementation is highly context specific. Site conditions, soil type, foundation depth, groundwater levels, and existing infrastructure all influence what is feasible. Poorly designed or poorly maintained systems frequently fail within a few years.

A critical bottleneck lies in the ecosystem of skills and services. There is a shortage of trained engineers, plumbers, and technicians who understand rainwater harvesting beyond basic construction. Although training initiatives exist, the scale of capacity building required far exceeds current efforts.

We've seen systems fail after two or three years because no one maintains them.

The last person who actually implements the system becomes the most accountable and the most unrewarded.

Sunil Mysore
Chief Executive Officer
Hinren Technologies Pvt. Ltd.

Beyond plots: Public spaces and sponge city thinking.

Focusing only on individual plots ignores the broader urban hydrological system. Streets, parks, open spaces, and lakes play a crucial role in managing runoff, reducing floods, and enabling large scale recharge. Nature-based solutions in public spaces can combine water management with ecological and social benefits.

Examples from other cities demonstrate how integrating blue-green infrastructure into stormwater networks can significantly increase resilience, reducing flood risk while enhancing recharge.

However, in Bengaluru, many public spaces remain heavily concretised, limiting their hydrological function.

Design quality is critical. Poorly designed recharge structures can create issues such as mosquito breeding, leading to public resistance. Integrating vegetation and landscape based solutions can address these concerns while improving acceptance.

> Rainwater harvesting should be seen as urban hydrological infrastructure, not just a plot level intervention.

Manushi Ashok Jain
Co-founder and Director
Sponge Collaborative

Groundwater governance and emerging institutional responses.

Groundwater management remains institutionally complex. While groundwater is regulated by a dedicated authority, enforcement and planning integration have historically been weak. Groundwater was largely absent from formal water supply planning, despite its central role in meeting urban demand.

Recent efforts aim to address this gap through better monitoring, data collection, and zoning. Critical and overexploited areas have been identified, with restrictions placed on new borewells in these zones.

These steps mark a shift toward recognising groundwater as a shared, finite resource rather than a private entitlement.

> Groundwater was not included in our planning earlier. We identified 68–70 critical wards, which we now treat as red zones.

Mirza Anwar
Executive Engineer
Bangalore Water Supply and Sewerage Board (BWSSB

Interactions between participants and panellists at the convening.

Closing remarks

The discussion underscored the need to move beyond fragmented approaches. Rainwater, groundwater, wastewater, lakes, and public spaces must be understood as interconnected components of a single urban water system. Pricing, governance, design quality, and citizen engagement all shape outcomes.

Bengaluru already possesses many of the building blocks for water resilience: high rainfall, a tradition of decentralised water systems, and a strong legal framework. The challenge lies in aligning institutions, markets, skills, and citizen action toward a coherent, long-term vision of urban water sustainability.

Avinash Krishnamurthy, Co-founder and Director, Biome Environmental Trust moderating the panel discussion: Making rainwater harvesting work. Seated alongside from left to right: Sunil Mysore, Chief Executive Officer, Hinren Technologies Pvt. Ltd and Arun Kumar, General Secretary, Bangalore Apartment Federation (BAF).

From left to right: Mirza Anwar, Executive Engineer, Bengaluru Water Supply and Sewerage Board (BWSSB) and Manushi Jain, Co-founder, Sponge Collective.

Avinash Krishnamurthy, Co-founder and Director, Biome Environmental Trust sharing his perspective.

05 Beyond Bengaluru: Best Practice Presentations

Speakers

1. **Simranpreet Kaur**, Senior Urban Environment Specialist, National Institute of Urban Affairs (NIUA)
2. **Natasha Zarine**, Co-Founder & Managing Director, EcoSattva Environmental Solutions: Kham river restoration
3. **Ganesh Ahire**, Senior Associate, HCP Design and Project Management Pvt. Ltd. (HCPDCM): Mula-Mutha River Rejuvenation, Pune
4. **Akash Hingorani**, Principal and Co-founder, Oasis Designs Inc: Coimbatore lake rejuvenation

The panel collectively demonstrates that NbS for urban water systems are not a single design approach, but a convergence of policy frameworks, ecological science, engineering, governance reform, and civic engagement across rivers and lakes in Pune, Kham, Coimbatore, and national level urban policy perspectives.

The discussion reveals how NbS can move from fragmented pilots to city scale, institutionally embedded transformation.

NbS as urban systems reform, not standalone environmental projects.

A unifying theme across all speakers was that degraded rivers and lakes are downstream symptoms of urban governance and infrastructure failures. Pollution, flooding, and ecological collapse result from broken sewage systems, altered hydrology, solid waste mismanagement, and land use decisions that ignore natural drainage.

From a national policy perspective, NbS was framed as a tool to re-integrate natural systems into urban planning, rather than an add on after infrastructure is built.

- From NIUA's perspective, national frameworks increasingly recognise NbS as cost-effective climate adaptation infrastructure, not "soft" environmental projects.

- The Kham River restoration treated sewage interception, waste management, and institutional coordination as prerequisites to ecological recovery.

- Pune's river rejuvenation began with catchment wide hydrological and pollution mapping, rejecting piecemeal riverfront beautification.

- Coimbatore's lakes were addressed as nodes within an interconnected urban water network, not isolated waterbodies.

> The river is like a barometer of what is going on in the city.
>
> **Natasha Zarine**
> Co-Founder & Managing Director
> EcoSattva Environmental Solutions

Embedding NbS in policy, planning, and institutional mandates.

A critical insight was that NbS succeeds when mainstreamed into urban governance frameworks, rather than driven solely by project champions.

In this context, Urban River Management Plan (URMP) was positioned as a critical tool, not as design documents but as institutional coordination frameworks. URMPs help cities:

- Align multiple agencies around a shared river vision

- Integrate flood management, land use, ecology, and public access

- Move from ad hoc riverfront projects to phased, long-term river system management

URMPs do not replace master plans or DPRs; instead, they bridge policy intent and project execution, ensuring continuity across political and administrative cycles.

- NIUA's framing emphasises NbS as multi-benefit infrastructure, capable of addressing flooding, heat

stress, biodiversity loss, and public space deficits simultaneously.

- Pune's project integrated red and blue flood lines into the city master plan, institutionalising river space rather than treating it as leftover land.

- Coimbatore's projects succeeded because administrative leadership allowed cross-departmental decisions in real time, preventing roads or real estate from eroding lake buffers.

> These tools act as nudges, helping officials think beyond concretised options.

Simranpreet Kaur
Senior Urban Environment Specialist
National Institute of Urban Affairs (NIUA)

Technical rigor as the backbone of ecological design.

Across all case studies, NbS was underpinned by deep technical analysis, countering the misconception that nature-based approaches are informal or low precision.

- Pune's Mula–Mutha project involved photogrammetry, geological investigations, hydraulic modelling, cadastral mapping, and environmental clearances before design decisions were made.
- The Kham River restoration followed phased interventions—baseline assessment, sewage diversion, floodplain protection, and ecological restoration.
- Coimbatore's lakes employed engineered wetlands, living shorelines, and nutrient balanced planting to handle wastewater-fed systems without ecological collapse.

> Unless we do the hydrology studies in detail, we will not be able to design, we will not be able to strategise, and we will not be able to execute.

Ganesh Ahire
Senior Associate
HCP Design and Project Management Pvt. Ltd. (HCPDCM)

Reframing pollution as a design and ecological challenge.

Rather than treating pollution as something to be hidden or diverted indefinitely, NbS approaches reframed it as a design input that ecological systems can process, within limits.

- The Kham River project intercepted sewage but also relied on in-stream and floodplain ecological processes to improve water quality over time.
- Coimbatore's lakes used treated wastewater to sustain year round water presence, designing plant systems to metabolise nutrients.
- Pune ensured that no untreated outfalls entered the river while redesigning weirs and barrages to maintain flow and prevent stagnation.

> Pollution is also a nutrient, plants love it, so the question is how you use nature-based systems to treat it.

Akash Hingorani
Principal and Co-founder
Oasis Designs Inc

Flood mitigation through working with, not against, water.

Flooding emerged as a key driver for NbS adoption, particularly in dense urban contexts where relocation is impractical.

- Pune's river design prioritised hydraulic efficiency, removal of obstructions, and green embankments over rigid concrete walls.
- Floodplains were designed to temporarily hold water, protecting the city while recovering quickly after flood events.
- The Kham River approach treated flood management as inseparable from sewage and land use reform.

> Flood management is not about blocking water, but about guiding it.

Ganesh Ahire
Senior Associate
HCP Design and Project Management Pvt. Ltd. (HCPDCM)

Differentiated edges: balancing ecology, access, and safety.

All speakers emphasised that uniform riverfronts and lake edges are ecologically and socially counterproductive.

- Pune classified river edges into natural, semi-natural, and hardscape zones, depending on context and risk.
- Coimbatore deliberately limited human access along ecologically sensitive lake edges while enhancing access elsewhere.
- Kham River restoration used selective access to shift perception without overwhelming fragile systems.

> If you work only with ecology and don't create space for people, the project will fail.
>
> **Akash Hingorani**
> Principal and Co-founder
> Oasis Designs Inc

Social equity, legitimacy, and long-term stewardship.

NbS outcomes are shaped by who benefits, who is excluded, and who maintains the system.

- Pune acknowledged existing settlements within flood zones and designed around social realities rather than idealised planning lines.
- Coimbatore avoided elite capture by resisting commercialisation and gated development.
- Kham River restoration relied heavily on community engagement to change perceptions of the river from waste channel to civic asset.

> If people do not reconnect with the river, you cannot get long-term support or sustainability for the project.
>
> **Natasha Zarine**
> Co-Founder & Managing Director
> EcoSattva Environmental Solutions

Capacity, maintenance, and the challenge of scaling NbS.

A shared concern was that NbS requires new skill sets within municipal systems and contracting ecosystems.

- Contractors struggled with bioengineering and landscape led construction.
- Long-term success depended on budgeting for operations and maintenance, not just capital works.
- Monitoring, adaptive management, and institutional memory were critical to prevent project regression.

> Maintenance is not just about trimming plants; it is about sustaining dissolved oxygen levels and biological health.
>
> **Simranpreet Kaur**
> Senior Urban Environment Specialist
> National Institute of Urban Affairs (NIUA)

Conclusion: Towards a mature NbS practice in India's cities

Taken together, the panel shows that NbS is not an alternative to infrastructure—it is infrastructure, redesigned through ecological intelligence. When embedded in policy, backed by technical rigor, enabled by governance coordination, and legitimised by public access, NbS can restore rivers and lakes as climate buffers, ecological systems, and civic spaces. The transition now required is from project led experimentation to institutionalised practice, where cities routinely plan with water, ecology, and people as interdependent systems rather than competing priorities.

Speakers form the presentations: Beyond Bengaluru: Best practice presentations, interacting with the audience.

06 Panel discussion: Governing water and wastewater in Bengaluru: Institutions, financing and accountability

Panellists

1. **Avinash Krishnamurthy**, Co-founder and Director, Biome Environmental Trust
2. **Dr Ram Prasath Manohar V IAS**, Chairman, Bangalore Water Supply and Sewerage Board (BWSSB)
3. **Dr Veena Srinivasan**, Executive Director, WELL Labs
4. **Srikanth Viswanathan**, Chief Executive Officer, Janaagraha and Executive Director, Jana Urban Space Foundation (moderator)

The panel explored how to strengthen water and wastewater governance in a rapidly growing city. The panellists examined issues ranging from citizen participation and institutional fragmentation to financing constraints, transparency, workforce capacity, and the promise and limits of recent metropolitan governance reforms. A recurring question was how individual successes in lake rejuvenation, rainwater harvesting, and other pilots across sectors, can be institutionalised and scaled through stronger democratic and administrative systems.

Metropolitan governance reforms create an opportunity for coordination, but outcomes depend on implementation.

The creation of the GBA was seen as a positive step toward addressing long standing fragmentation among city agencies. Panelists noted, however, that while structural arrangements now exist, functional clarity, coordination protocols, and accountability mechanisms are still evolving. The GBA represents a long-term institutional opportunity rather than an immediate solution, with its success hinging on how roles, incentives, and inter-agency collaboration are operationalised.

> The structural elements have been built into the GBA, but the functional elements are yet to take its shape.

Dr Ram Prasath Manohar V IAS
Chairman
Bangalore Water Supply and Sewerage Board (BWSSB)

> If the creation of GBA allows agencies to talk better to each other, that's important, but it does not automatically make them more accountable to citizens.

Dr Veena Srinivasan
Executive Director
WELL Labs

The case for integrating drainage with water and wastewater management.

The panel underscored that effective urban water management requires treating water supply, wastewater, and drainage as a single, interconnected system, rather than as isolated functions managed by separate agencies. Keeping drainage outside the ambit of core water institutions limits the city's ability to manage flows, reuse treated wastewater, and work with natural systems. While BWSSB's mandate was originally designed around utility services, the discussion highlighted the growing need to bring drainage and natural drainage systems into the institutional framework governing water.

Recent efforts by BWSSB to engage in lake rejuvenation and recharge initiatives illustrate both the constraints of the current mandate and the case for a more integrated approach aligned with Bengaluru's contemporary urban and ecological realities.

> Water and used water cannot be managed better without a natural drainage ecosystem in place.

Dr Ram Prasath Manohar V IAS
Chairman
Bangalore Water Supply and Sewerage Board (BWSSB)

Citizen engagement as a core governance approach.

A recurring theme was the critical role of citizen engagement in water management. Panelists stressed that top-down solutions alone will not suffice – communities must be partners. Citizen engagement is most effective when it is structured, representative, and trust based.

Rather than ad hoc or confrontational engagement, the panel emphasised the value of working with mature, representative citizen groups that understand institutional constraints. Such engagement was seen as critical during crises, enabling course correction, innovation, and improved compliance.

Importantly, fairness and visible enforcement were identified as key trust-building tools.

> Any crisis... cannot be managed by the government agency alone. Engaging spirited and matured citizenry helps in course correction.
>
> Penalising misuse of drinking water helped people see that the institution works for the larger community interest.
>
> **Dr Ram Prasath Manohar V IAS**
> Chairman
> Bangalore Water Supply and Sewerage Board (BWSSB)

Citizen led initiatives build social capital that can strengthen institutions over time.

The panel emphasised that while citizen action around lakes, rainwater harvesting, and local water issues may appear fragmented in the short term, these efforts play a critical role in building social capital that institutions can later draw upon. Such engagement helps create an informed, motivated, and organised citizen base that can meaningfully participate when formal governance structures such as water or ward level committees eventually take shape.

> Some of this you can't see in the short term, it's a decadal process.
>
> There is value in citizen groups engaging with their local lakes, because when

formal committees eventually emerge, those same groups will participate.

Ultimately, citizen groups can't do it on their own... it has to add up to build state capacity.

Dr Veena Srinivasan
Executive Director
WELL Labs

Decentralisation and ward-level governance remain critical but uncertain.

The panel acknowledged that effective metropolitan governance must be balanced with strong decentralised institutions, particularly ward committees. Without these, citizen participation risks remaining issue based rather than place based. The success of the current reforms was seen as contingent on whether decentralised democratic processes are meaningfully activated.

This is a window of opportunity contingent on bottom-up processes beginning to work.

Avinash Krishnamurthy
Co-founder and Director
Biome Environmental Trust

Data transparency is a critical enabler of accountability and inter-agency coordination.

The panel emphasised data as a governance tool, not merely a technical resource. Shared, open datasets help align agencies, educate citizens, and build trust. Even where full institutional integration is difficult, common data platforms can enable coordination and informed public discourse.

Data is often the mechanism by which agency cooperation happens.

At the least, are we all seeing the same data as the base?

Dr Veena Srinivasan
Executive Director
WELL Labs

Human resource constraints are a systemic risk to service delivery.

Severe staffing gaps, especially at field and operational levels, were identified as a major bottleneck. Despite a surplus of engineering graduates nationally, utilities struggle to attract and retain talent. Addressing this mismatch requires rethinking recruitment pipelines, institutional attractiveness, and the public narrative around utility work.

> The staffing pattern at BWSSB has remained the same for 60 years while the population has increased many fold.
>
> **Dr Ram Prasath Manohar V IAS**
> Chairman
> Bangalore Water Supply and Sewerage Board (BWSSB)

> People don't want to go and run utilities anymore... something has to be done.
>
> **Dr Veena Srinivasan**
> Executive Director
> WELL Labs

Closing remarks

The panel concluded that Bengaluru's water future depends less on isolated innovations and more on patient institution building, strengthening mandates, financing models, staffing capacity, and trust between the state and citizens. While recent governance reforms open new possibilities, translating them into improved outcomes will require deliberate investment in democratic processes, transparency, and long-term capacity, alongside continued citizen engagement.

Panellists from the Panel discussion: Governing water and wastewater in Bengaluru: Institutions, financing and accountability sharing their views at the convening.

Lessons across panels

The discussions across panels highlighted recurring themes that are critical to advancing Nature-based Solutions (NbS) for Bengaluru's urban water management. Despite the diversity of technical and governance perspectives, several overarching lessons emerged, underscoring the interconnectedness of hydrology, ecology, infrastructure, and citizen engagement.

01 Integration of systems.

A consistent message was that drainage, lakes, rainwater harvesting, and groundwater must be approached as components of a single, interconnected urban water system. Isolated interventions whether plot level rainwater harvesting, lake edge beautification, or standalone drainage improvements are insufficient. Effective outcomes depend on treating streets, nallahs, lakes, and aquifers as linked ecological and hydrological networks.

Catchment level planning and phased, evidence-based interventions emerged as essential strategies to enhance recharge, manage floods, and maintain water quality.

02 Nature-based and multi-scalar solutions.

Across discussions, the potential of NbS such as bioswales, floating wetlands, permeable pavements, and green corridors was repeatedly affirmed. When combined with grey infrastructure, these interventions improve water infiltration, reduce peak flows, enhance ecological health, and create accessible public spaces. Case studies from Bengaluru and other Indian cities reinforced that multi-disciplinary, context specific, and data driven approaches are critical. Baseline assessment, adaptive design, and integration across scales enhance both ecological and social outcomes, while standardised templates risk undermining the functionality and acceptance of interventions.

03 Strategic use of technology.

Technology was recognised not as a substitute for governance or ecology but as a tool to support planning, monitoring, and evaluation. From bathymetric mapping to integrated digital platforms, technology enables informed decision-making and adaptive management when embedded in local ecological and social contexts. NbS offer pathways not only to mitigate floods and enhance recharge but also to restore ecological function, foster community stewardship, and transform urban water infrastructure into vibrant, multifunctional public assets.

04 Contract design, skills, and maintenance.

Across projects, failures were traced less to design intent and more to procurement models and capacity gaps. Lowest cost tendering, short-term contracts, and undervaluation of operations and maintenance repeatedly undermined outcomes. Panels highlighted the importance of quality based procurement, long-term O&M responsibility, trained implementation of ecosystems, and skilled municipal workforces.

NbS, in particular, demands new competencies in bioengineering, landscape led construction, and adaptive management.

05 Institutionalisation of NbS.

Instruments such as watershed plans, Urban River Management Plans, groundwater zoning, and performance linked contracts help translate pilot learning into systemic practice. Without institutionalisation, NbS remains dependent on individual champions and vulnerable to political and administrative turnover.

06 Citizen engagement and governance.

Structured, representative citizen participation was highlighted as a cornerstone of resilient water systems. Panels emphasised that local communities are not external actors but impacted stakeholders, whose engagement can strengthen institutional capacity over time. However, voluntary action alone cannot substitute for formal governance pathways. Integrating citizens into ward committees, lake protection groups, and consultative processes ensures accountability, fosters trust and

enables sustained stewardship, while also enabling the state to scale and institutionalise successful pilot interventions.

07 Capacity, accountability, and institutional support.

Panels repeatedly identified technical, administrative, and human resource constraints as barriers to scaling effective interventions. Long-term success requires professionalised capacity in design, implementation, and maintenance; measurable performance indicators for hydrology, ecology, and social outcomes; and contractual frameworks that ensure accountability. Transparent data systems, inter-agency coordination, and reliable financing were also flagged as enablers of systemic change.

From left to right: Arun Kumar, General Secretary, Bangalore Apartment Federation (BAF) interacting with V Ramprasad, Co-founder, Friends of Lakes; President, Federation of Bengaluru Lakes.

Rohini Pradeep, Senior Program Manager, CDD India sharing her perspective.

Sunil Mysore, Chief Executive Officer, Hinren Technologies Pvt. Ltd sharing his perspective.

Lessons and implications for Bengaluru

Taken together, the discussions converged on seven key lessons for advancing Nature-based Solutions (NbS) and systemic urban water management in Bengaluru:

01 **Plan and act at the catchment scale**, treating nallahs, lakes, drains, and aquifers as a single, continuous system, and institutionalising learning to move from isolated pilots to citywide systems.

02 **Reframe NbS as core urban infrastructure**, embedding them within engineering standards, DPRs, procurement, and maintenance regimes alongside grey infrastructure, with clear performance benchmarks for flood mitigation, water quality, recharge, biodiversity, and public use.

03 **Reform procurement and maintenance models** by shifting to quality based selection, long term operations and maintenance responsibility, and performance linked contracts, especially critical for NbS, which require adaptive management and specialised skills.

04 **Strengthen governance architecture by aligning mandates across water, wastewater, and drainage agencies**; activating ward level institutions; and operationalising the GBA as a coordination platform rather than an additional silo.

05 **Institutionalise citizen engagement by recognising communities as impacted stakeholders,** embedding them in formal decision-making structures, and leveraging local knowledge for monitoring and stewardship.

06 **Invest in professional capacity and performance led delivery**, spanning engineers, designers, contractors, and community stewards, supported by standards and contracts that prioritise long-term outcomes over short-term construction.

07 **Use technology strategically from mapping and monitoring tools to integrated data platforms** to enable transparency, informed planning, and adaptive management, while remaining grounded in ecological science and social realities.

The convening underscored that Bengaluru remains "water positive" in principle: its rainfall and lake network provide a strong foundation for resilience. Realising this potential, however, requires a shift from reactive, project by project interventions to patient institution building, integrated planning, and citizen-centric governance. When embedded within this systemic approach, NbS can transform Bengaluru's water infrastructure into a resilient, multifunctional, and public-oriented urban network.

Observers and participants registering for Nature-based Solutions for Bengaluru: Reflections on Drainage.

Mirza Anwar, Executive Engineer, Bengaluru Water Supply and Sewerage Board (BWSSB) sharing his perspective.

Ganesh Shankar, Founder, Fluxgen Technologies sharing his perspective.

Way forward

Bengaluru faces a persistent water paradox: recurrent urban flooding alongside chronic water scarcity. Jana Urban Space Foundation (JUSP) believes that reimagining urban drainage through a deliberate integration of engineering systems and Nature-based Solutions (NbS) is a critical lever to address both challenges simultaneously.
Drainage, when designed as part of a broader urban water system, can move beyond rapid conveyance to support flood mitigation, groundwater recharge, water quality improvement, and ecological restoration.

As a next step, Jana Urban Space Foundation will refine and publish the working paper on "Rebuilding Urban Drainage Systems: Learnings from Nallurhalli Nallah Rejuvenation in Bengaluru", incorporating insights and feedback from practitioners, researchers, and civil society who engaged with the draft.

Beyond this, we envision continued collaboration with partners across sectors to deepen dialogue, share learning, and support the evolution of policy and practice around NbS, drainage reform, and urban water governance. This convening is therefore seen as a contribution to an ongoing city wide conversation, and an invitation to continue working together toward a water secure, climate resilient Bengaluru, grounded in integrated planning, citizen engagement, and ecologically informed infrastructure.

Srikanth Viswanathan, Chief Executive Officer, Janaagraha and Executive Director, Jana Urban Space Foundation sharing his perspective.

Jana Urban Space Foundation
19/4, Sair Bagh,
3rd Floor, Cunningham Road,
Bengaluru, Karnataka, India - 560052
www.janausp.org