



**AAETI**

TATA TRUSTS

**WORKSHOP**

# **WATER AND WASTEWATER MANAGEMENT IN RURAL AREAS**

**MAY 22, 2026 | MAGNOLIA HALL, INDIA HABITAT CENTRE, LODHI ROAD**

**INAUGURAL SESSION**



**ASHOK K K MEENA (IAS)**  
Secretary, Department of  
Drinking Water and Sanitation,  
Ministry of Jal Shakti



**SUNITA NARAIN**  
Director General,  
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Deputy Head of Programmes,  
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**Workshop on  
“Water and wastewater  
management in rural areas”**

**May 22, 2026**

**Centre for Science and Environment**

## WORKSHOP PROCEEDINGS

The workshop was organized into three major sessions:

- **Inaugural Session** — Setting the national context, with keynote presentations and special addresses from senior policymakers and sector leaders.

### **Key Speakers-**

- Subrata Chakraborty, CSE,
- Sunita Narain, Director General, CSE,
- Divyang Waghela, Deputy Head of Programmes, TATA TRUSTS,
- Yugal Kishore Joshi, Programme Director, Water & Land, IT & Telecom, Culture & Tourism and Lead Communication, NITI Ayog,
- Ashok K K Meena (IAS), Secretary, Department of Drinking Water and Sanitation, Ministry of Jal Shakti

### **Panel 1 — Greywater Management Solutions: technology options, state-level implementation models, community engagement, and monitoring.**

- Joseph Ravi Kumar- Former Sr. Water and Sanitation Specialist World Bank
- Rajesh Singh - Scientist E, National Institute of Hydrology, Ministry of Jal Shakti
- Sanjay Singh- Secretary, Parmarth Samaj Sevi Sansthan, Uttar Pradesh
- Bharat Singh –Superintending Engineer Panchayati Raj, Hisar

### **Panel 2 — Securing Drinking Water through Source Protection and Recharge: groundwater governance, watershed development, convergence, and quality-affected areas.**

- A. MURALIDHARAN - Deputy Advisor Drinking Water & Sanitation, Water & Land Resources, NITI Ayog
- T.B.N. SINGH – Member, Central Groundwater Board
- Rajendra Prasad - Joint Director, Watershed Development and Soil Conservation Department, Rajasthan
- Lalit Mohan Sharma – Advisor, Sehgal Foundation, Haryana
- Ravi Parmar, Technical Expert Agriculture, Watershed Development, Department of Land Resources

## Inaugural Session

Subrata Chakraborty welcomed participants emphasizing on the diversity of the gathering — government colleagues, sector partners, and researchers — as a sign of the broad coalition needed to address water challenges.

CSE's long engagement with water was recalled: from the landmark 1997 report *Dying Wisdom* — which championed traditional, decentralised rainwater harvesting — through work on wastewater, sanitation, and nature-based solutions. He positioned today's workshop as building on the same philosophy: catch the rain where it falls, reuse what we use, and close the water cycle.

He highlighted the three base ideas for the workshop –

- Source Sustainability — groundwater recharge, revival of water bodies, and community-managed catchments must be the foundation of every water supply scheme.

- Water Circularity — with 70–80% of water supplied becoming greywater, this resource must be viewed as an opportunity rather than a problem: for recharge, for irrigation, and for ecosystem restoration.

- Climate Reality — glaciers are melting, groundwater is declining, and rainfall is becoming more intense but concentrated in fewer days. The imperative is to hold, store, and reuse water within local landscapes.

## Sunita Narain, Director General, Centre for Science and Environment

She traversed across the journey of CSE from four decades and how she is now also the institutional memory for the government.

She said that the Climate Change: The New Beast in Town-While the water agenda — managing sources, reducing waste, and ensuring equity — remains unchanged, climate change has introduced a new urgency. India's extreme weather events now average one per day, based on IMD data aggregated by CSE. More rain is falling in fewer rainy days; in a worst case, an entire year's rainfall can arrive within 24 hours. The challenge is storage, recharge, and resilience. Heat stress will drive up water demand across sectors, lower soil moisture, and increase evaporation from surface water bodies — making groundwater recharge even more critical. Floods followed immediately by droughts are becoming India's new hydrological normal. Climate change does not change the agenda — but it demands we act faster, smarter, and at scale.

She applauded India's transformational progress — while being honest about the gaps that remain:

- MGNREGS has created an estimated 100 water assets per village, on average, across India.

- Jal Jeevan Mission achieved 158 million functional household tap connections.
- The Swachh Bharat Mission built 120 million rural toilets, linking sanitation to dignity and health.
- JJM's defining innovation was redefining a 'tap connection' not as hardware but as a functional water supply — with adequacy, quality, and regularity as the standard.

She brought forward the Four-Point Agenda for Action

- Source Sustainability — insufficient attention to recharge of local water systems is the key reason households are not receiving reliable water. As governments shift to multi-village schemes, dependence on external sources grows while local sources are neglected.
- Greywater Management for Recharge — greywater must be understood not as waste disposal but as a tool for source recharge. Soakpits are not being built; this must become mandatory and integrated with source sustainability.
- Convergence — between schemes, departments, land and water administrations. Separate silos prevent holistic source protection. Finance convergence is equally essential.
- Institutions for Management — Panchayats, Gram Sabhas, Jal Samitis, Jal Mitras, are the foundation of sustainable rural water governance but post-handover governance must be strengthened.
- She cited JJM 2.0 guidelines as progressive and comprehensive — addressing recharge structures, mandatory rainwater harvesting, greywater recharge, source protection from pollution, and a platform to map every village from catchment to source. Her concern was implementation: current evidence shows that post-handover governance is not yet happening at the required scale.
- She highlighted the need to look into peri-urban areas as how no one is looking into it due to lack of ownership and also the opportunity it presents as the community can work together on a clean slate to present much sustainable solutions.
- She highlighted the three major water quality threats — arsenic, fluoride, and microbial contamination — require better monitoring, stronger laboratories, and capacity building so that communities can verify the water they drink. Solutions exist; the challenge is implementation and trust.
- She closed with the story of Yamuna in Delhi: 22 kilometres of river degraded as it passes through Delhi, dead before it leaves. Her message: we all live downstream. Cooperation is not optional — it is survival.

### **Divyang Waghela, Deputy Head of Programmes, TATA TRUSTS**

- Acknowledging the depth and quality of CSE's research, and described the genesis of Tata Trust's engagement with CSE.
- When JJM began in 2019, he was part of the National Task Force focused on implementation capacity. Working with over 3,000 villages across 12 states, the Trust helped support decentralised, community-centric approaches to water supply.
- By 2023–24, as JJM Phase 1 was completing, a critical question emerged: what happens to the systems in 3 or 5 years? The first-generation problem — building infrastructure — had largely been addressed. The second-generation challenge — sustainability, governance, and circularity — was just beginning.
- He described Tata Trust's shift from a compartmentalised view of water (drinking, irrigation, ecology) to a holistic 'One Water' approach, designing programmes rooted in local problems and community realities. Experiences in Rajasthan, Maharashtra, Gujarat, the Deccan, and Nagaland had demonstrated that a single integrated lens — applied at community level — helps overcome the convergence challenge.
- Systems Approach — focus on outcomes, not just outputs and processes. Interconnected water systems require outcome-oriented design.
- Communities at the Centre — the 73rd and 74th constitutional amendments provide the framework; aspirations of communities are rising with digital connectivity.
- Making Circularity the New Normal — island-of-success models are insufficient; frugal, decentralised, contextual technologies must become standard practice.
- Data and Technology — digital public infrastructure for water is critical; real-time data must drive decision-making.
- Climate Resilience — building local-level resilience, not just macro-level adaptation, must become central to programme design.
- Concluded by reaffirming the role of institutions like CSE and Tata Trust in creating evidence, developing case studies, and feeding learning into policy — at district, state, and national levels.

### **Yugal Kishore Joshi, Programme Director, Water & Land, IT & Telecom, Culture & Tourism and Lead Communication, NITI Ayog**

- While climate change is the 'new beast', agriculture is the 'elephant in the room' states the speaker.

- 90 percent of India's total freshwater withdrawal is used in agriculture, with 2.2 crore tubewells drilling ever deeper — depriving drinking water sources.
- Free electricity and assured procurement drive unchecked extraction. Without addressing water use efficiency and cropping patterns, India's drinking water challenges cannot be meaningfully solved.
- Crop diversification, micro-irrigation, rational energy pricing, and groundwater governance must be at the centre of water reforms.
- Source Sustenance Committees at the Panchayat level provide a statutory framework for multi-departmental coordination — but must actively engage agriculture, watershed, and forest departments.
- He also highlighted that a growing RO purifier market — projected to reach \$7.5 billion by 2034 — reveals deep public distrust of supplied tap water. He suggested major campaign to build confidence in piped water quality, and proposed that water field testing kits become as ubiquitous as lactometers.
- Community women's groups, Jal Samitis, etc can lead quality testing, awareness, and behavior change.
- Testing must happen at Anganwadis, schools, and households, with results publicly disclosed at Gram Sabhas.
- Universities and colleges could serve as water testing laboratories, with government providing chemicals and training.

**Ashok K K Meena (IAS), Secretary, Department of Drinking Water and Sanitation, Ministry of Jal Shakti**

- Speaker briefed about the first phase of JJM, the lessons learned, and the vision and design of JJM 2.0. He briefed about Government's intent for the next phase of rural water governance in India.
- JJM began in 2019 with the PM's vision of functional tap water in every household — moving beyond the provision of handpumps. COVID pressures contributed to a shift toward contractor-led asset creation, and the urgency to connect households the functionality aspect was compromised.
- By March 2024, approximately 80% of rural households had tap connections, with 80–84% found functional (at least once in a seven-day period). The mission was a major achievement.
- Now the focus is to sustain the existing and complete the pending.
- JJM 2.0 focuses on governance, ownership, and sustainability rather than just the infrastructure alone.

- JJM 2.0 aims to strengthen the third level of governance-the Gram Panchayats-to enable them to operate and own the water systems.
- It is important for communities to be aware of the source to be able to trust the water being supplied in homes. JJM 2.0 guidelines have ensured to focus on localization of systems where GP and Gram Sabha shall own and operate the system
- Gram Sabha and Gram Panchayat feedback loop to be strengthened so that such systems are made to ensure villages take care of this scheme like they used to do it for water sources 30-40years back
- JJM 2.0 is transition taking place from doing to observing.
- The speaker highlighted 6 areas for discussion:
  - Sustainability as a Service Outcome — not an engineering afterthought. Every scheme must be assessed on regularity, adequacy, quality, source reliability, O&M readiness, and citizen satisfaction.
  - Capacity and Handholding for Gram Panchayats — SOPs in local languages, O&M manuals, technical support from District Technical Units.
  - Source Sustainability Linked to Greywater Management — 80% of water supplied returns as greywater; circularity at the household level (kitchen gardens, soakpits) must become standard.
  - Women's Leadership — women as primary water quality monitors, charge collectors, and community mobilisers through Jal Samitis and SHGs.
  - Data Must Lead to Action — dashboards are only useful if they trigger timely responses to contamination, source stress, or pump failure.
  - Community Trust as Foundation — public disclosure of quality results, O&M costs, and panchayat responsibilities at every Gram Sabha.
- The design of JJM 2.0 distinguishes between in-village and out-of-village infrastructure. Out-of-village bulk water supply will be managed by macro-utilities or state PHDs. In-village distribution — from bulk water point to household — will be handed over entirely to Gram Panchayats, which must evolve into micro-utilities: billing, quality testing, new connections, O&M.
- Given the wide variation in Panchayat capacity across India, JJM 2.0 introduces an 'assisted mode' through District Water Sanitation Missions, where Collectors hold monthly review meetings on saturation, quality, and functionality.
- JJM 2.0 shall complete the remaining connections and transfer it systematically to communities through Jal Arpan Process where communities will take a transect walk to understand the system. The technical information will also be handed over in digital mode. AI is being used to ensure

instructions and transactions are available in local language and data shall be visible to common man also through apps

### Panel Discussion 1 – Greywater management solutions for protecting the water sources

**Chair:** Mr. Joseph Ravi Kumar, Former Senior Water and Sanitation Specialist, World Bank

This session examined technologies, implementation models, monitoring frameworks, and community strategies for managing greywater in rural India — recognizing that 80% of water supplied to households returns as greywater, and that managing it is inseparable from source sustainability.

#### **Speaker 1: Rajesh Singh**

- Grey water is less polluted, with lower nutrients and microorganisms.
- On-site systems like soak pits, leach pits, and magic pits are recommended under national missions and can support kitchen gardens.
- These solutions treat wastewater at the source and should be widely practiced.
- Hydrogeological conditions must be considered; not suitable for shallow water tables or certain hard rock regions without assessment.
- Kitchen garden reuse is feasible, but crops eaten raw should be avoided due to microbial risks.
- Gray water often mixes with septic systems and contaminates ponds and groundwater, creating unhygienic conditions.
- In such cases, advanced treatment systems are required.
- Rural technologies should be low-cost, user-friendly, and require minimal mechanical operation.
- Recommended systems include constructed wetlands, phytoremediation, and biofilters, which perform well in Indian climates.
- Institute-level innovations include advanced septic tanks, deep bed wetlands, and downflow hanging sponge reactors to reduce land and energy needs.

Moderator raises question on challenges of managing wastewater at source due to hydrogeology, soil, and space constraints and requests insights from Haryana models such as three-pond and five-pond systems.

#### **Speaker 2- Bharat Singh**

- Water management implemented through village and panchayat systems.

- Data on pond conditions collected to prioritize polluted and overflowing ponds.
- Three-pond and five-pond systems used where land is available.
- First pond designed deeper for anaerobic treatment of gray water.
- Sludge removal improves groundwater recharge.
- Systems designed based on surveys of drainage and site conditions.
- Focus is on gray water; black water handled separately.
- Beautification and structured planning included.
- Wetlands used where feasible, depending on site suitability.
- Major challenges include operation, maintenance, and community participation.
- Panchayats and committees formed; funds allocated for maintenance.

**Moderator** asks about community involvement in planning based on experiences in Uttar Pradesh and Madhya Pradesh.

**Speaker 3: Sanjay Singh**

- Gray water management became critical after increased water supply initiatives.
- Village water security plans include gray water management.
- Interventions include kitchen gardens, leach pits, and diversion systems.
- Pond-based recharge improved by removing impermeable layers.
- Untreated water in ponds remains a concern.
- Natural systems like vegetation and grasses used for treatment.
- Emphasis on low-cost, community-driven solutions.
- Kitchen and nutrition gardens effective for reuse.
- Community participation, especially women’s groups, is essential.
- Monitoring and capacity building are critical.
- Local water quality testing builds trust.
- Microbial contamination is the most critical parameter at village level.
- Testing kits and labs exist but require proper training and usage.
- Strengthening labs requires both equipment and skilled personnel.

**Speaker 1: Rajesh Singh- Water Quality Monitoring and Laboratory Capacity**

- Lack of equipment and trained personnel leads to poor water analysis.

- Inconsistent lab results reduce credibility.
- NABL accreditation is necessary for standardization and reliability.
- Inter-laboratory comparisons help validate results.
- Dashboard systems need improvement for public accessibility.
- Improved monitoring will increase public confidence in supplied water.

**Question from Audience - on Heavy metal contamination**

**Answered by Rajesh Singh-**

- Raises issue of heavy metals like chromium and arsenic.
- Chromium contamination linked to legacy dumping in low-lying areas.
- Chromium (III) converts to more toxic Chromium (VI) upon oxidation.
- Solution is cleanup and reclamation of contaminated sites.
- Arsenic is largely geogenic, especially in alluvial plains.
- Reducing conditions caused by organic matter mobilize arsenic in groundwater.
- Increased wastewater leads to organic loading and groundwater contamination.
- Proper wastewater treatment can reduce arsenic mobilization.
- Technologies for chromium and arsenic treatment exist but need implementation.

**Moderator:** Asks about O&M protocols for centralized systems where household-level treatment is not feasible.

**Bharat Singh-**

- Public awareness is more critical than funding for maintenance.
- Better awareness leads to improved system upkeep.
- Government support needed where funds are insufficient.
- Maintenance improves after initial stages and plantation establishment.
- Periodic maintenance assigned to engineering staff.

**Moderator** Asks about building community capacity for managing systems.

**Sanjay Singh -**

- Strong governance systems are essential for sustainability.
- Village water and sanitation committees must be trained.
- SHGs and community organizations should be involved.
- Building trust in water quality is crucial.

- Awareness and monitoring help prevent contamination.
- Groundwater depletion and contamination are major concerns.
- Water quality issues are severe in regions like the Ganga-Yamuna doab.
- Collaboration among stakeholders is necessary.

#### **Moderator – Closing Remarks**

- Water scarcity is increasing; more supply leads to more wastewater.
- Household-level wastewater management is preferable and more manageable.
- Centralized systems are complex and harder to maintain.
- Responsibility for wastewater should lie with households.
- Behavioral change and mindset shift are critical.
- User charges may be necessary for accountability.
- Community involvement is essential for sustainable systems.
- Top-down approaches alone are insufficient.
- Emphasizes need for planning beyond sanitation infrastructure.
- Highlights challenges in behavior change and community engagement.
- Emphasizes need for policy-driven behavioral change efforts.
- Points out gaps in planning and implementation across schemes.
- Stresses importance of integrated planning before execution.
- Notes increased water supply leads to higher gray water generation.
- Calls for better policy-level coordination

#### **Panel 2 - Securing drinking water in villages through source protection and recharge.**

**Chair: A. Muralidharan**, Deputy Advisor, Drinking water and sanitation, Water and land resources, NITI Ayog

**Main context** - India's water problem is not absolute scarcity, but mismanagement, allocation imbalance, and systemic inefficiencies.

- Speaker begins with water Availability and Demand- Water availability is sufficient; scarcity is not the primary issue. India's total water usage estimated at ~784 BCM. Agriculture consumes ~561 BCM, forming the largest share. Rural drinking water requirement estimated at ~22.6 BCM

annually considering 65LPCD. Total reservoir storage capacity is ~300–330 BCM. Drinking water demand is <10% of stored water, and only ~5% relative to groundwater availability.

- **Core problem:** Agriculture dominates water use. Most water efficiency gains in irrigation are not redistributed; they are reused within agriculture. Policies and projects fail to reallocate saved water to other sectors (e.g., drinking water). Increasing groundwater extraction (deep borewells) for farming- depletes shallow drinking water sources, forces repeated deepening of wells. Funds are being used to increase agricultural efficiency and reduce water demands but the improvement data is lacking. Rural areas are digging borewells to more than required depth and are in poor state of affairs. ~23 lakh borewells extracting groundwater, Drinking water –Shallower sources available but Compete with deeper agricultural borewells. Recharge structures often missing despite funding
- **Infrastructure and design inefficiencies** - Several systemic issues: Overdesign and over-extraction- Systems designed for future (30-year) demand are operated at full capacity from day one. States often supply >55 LPCD (liters per capita per day) despite guidelines. High assumed losses of 50 % even for short pipelines (4–5 km). Singapore achieves ~6% losses for 1100Sq Km of area, so India needs to look into design aspects to increase efficiencies.
- **Poor distribution design** - Need for intermediate storage structures for long distance conveyance to achieve last mile connectivity and availability. These direct pumping practices where water is pumped directly into systems without proper measurement - leads to lack of accountability on extraction.
- **Weak monitoring and governance** - Engineers handle 80–90 villages each - impractical oversight, 40–50% staff vacancies are available which is not enough. There is lack of Lack of basic monitoring of Water level, Extraction quantity and storage status. The speaker suggests- Low-cost IoT sensor systems (~₹3 lakh per site)
- **Groundwater vs. surface water shift** - Current use ≈ 58% groundwater, 42% surface water. Shift toward surface water is happening, but Drinking water allocations in dams are not being updated Reservoir capacity is declining due to siltation
- Missing elements in policy thinking
  - Forest–water linkage ignored -Forests are critical for recharge. Example: Tokyo manages forest catchments for water supply. India lacks such integration
  - Lack of convergence across schemes- Programs like MGNREGA, Watershed development, Jal Jeevan Mission operate in silos.

There is a need to track how each intervention supports drinking water sources

The speaker suggested

- Structural measures such as - Mandatory recharge structures with every water scheme, increase efficiency in irrigation and redistribute saved water, improve pipeline design and reduce losses
- Governance measures -Shift from “supply mindset” to service/utility mindset, better data monitoring and accountability systems and Fill staffing gaps and support with technology
- Policy measures such as reallocate water from agriculture to drinking, update dam water allocation priorities, Integrate Forest management into water planning
- Convergence- Link all rural development and water programs and ensure every intervention supports drinking water sustainability.

**Speaker 1: Ravi Parmar**, Technical Expert, Agriculture and Watershed Development, Department of Land Resources

- Every department works according to its own mandate, uses its own funding, and operates in silos. This is a basic problem across almost every sector in our country.
- The work being done in the Department of Land Resources, particularly its Watershed Management Division, and its role in this sector is as follows
  - One of the key schemes is the Pradhan Mantri Krishi Sinchai Yojana (PMKSY), specifically its Watershed Development Component (WDC).
  - In general, whether in rural areas, agriculture, or even urban contexts, watershed development essentially means managing rainwater scientifically. The idea is that rainfall should be stored and slowed down according to the slope of the land, using different measures, so that it does not simply run off. Instead, water should percolate into the ground at various locations, improving groundwater levels everywhere.
  - This is especially important in rain-fed areas where rainfall is low and there is no assured irrigation for a second crop. In such places, even protective irrigation becomes possible if water is managed properly, allowing at least critical irrigation for crops.
  - Based on slope, topography, agricultural practices, and stream order (first, second, third order streams), different types of structures are created. The focus is on both water recharge and

soil and water conservation. These are interconnected—if water is conserved, soil is also conserved.

- If water is not controlled, heavy runoff carries away large amounts of soil. Therefore, efforts are made simultaneously to conserve both soil and water.

In context of drinking water and source sustainability, it is important to note that proper watershed development indirectly improves groundwater levels. As groundwater rises, water availability in borewells, wells, and other irrigation sources increases. Interventions like farm ponds help in water percolation and improve water sources.

- WDC 2.0, is ongoing, and WDC 3.0 is upcoming. Provisions for convergence exist on paper, but in practice, it is difficult. However, efforts are being made, especially at district and project levels, to integrate with schemes like MGNREGA for better outcomes.
- Another issue is that watershed structures created over the past 25 years often lack proper repair and maintenance. Many structures are now in poor condition. Therefore, there is a focus on repair and maintenance so that these water bodies can be better utilized. In rural areas, these are important water sources for both irrigation and domestic use.
- We are also trying to increase awareness. Last year, we conducted a nationwide campaign called 'Watershed Yatra' to promote awareness and convergence with other departments.
- A major issue observed is siltation in water bodies due to natural processes. Government schemes may not always address such small issues, but they are not very costly to fix. If villagers collectively contribute, even simple efforts like removing silt can significantly increase water storage capacity.
- We are encouraging community participation. Farmers with tractors or machinery like JCBs can help in desilting, and the removed soil is often very fertile, which benefits their fields. This creates a win-win situation.
- We also introduced incentives where projects that perform better through public participation receive additional funding, encouraging further development work. Another important area is springshed management, especially in northeastern and hilly regions, where springs are a major source of drinking water. Our department has worked on thousands of springs across multiple states, and NITI Aayog has recommended creating a dedicated program for springs.
- Overall, convergence across departments and public participation are essential. If water is properly conserved, it improves both groundwater and surface availability. Without proper

conservation and storage, managing supply and usage becomes very difficult. Therefore, I would urge all of you to contribute, as much as possible, toward promoting public participation.

**Moderator-**

- **Convergence Failure** – Case example shared from a Northeastern village where spring rejuvenation done with support from a Pune based organization. Spring dried up within 3–4 months because of Road construction above the spring disrupted natural flow. The main issue in this was lack of coordination between departments (spring development vs road construction). Hence he concludes that convergence is not occurring at implementation level and departments function in isolation without understanding interlinkages.
- **Need for Institutional Convergence-** He suggests constitution of a single coordinating authority at district level where District Magistrate (DM) to act as convergence anchor and he emphasized that the success depends on alignment of PM, CM, and DM. He stated that developmental role of DM has weakened over time and needs to be reinforced.

**Speaker: T.B.N Singh, Member, Central Groundwater Board**

- Talked about the roles and functions of CGWB towards **Sustainable development and management of groundwater.**
- Core Issue of Inadequate water conservation- He stated India has Total utilizable water  $\approx$  **1127 BCM**, Groundwater  $\approx$  **447 BCM** and Surface water  $\approx$  **~600 BCM**. It receives **~4000 BCM rainfall**, but **majority not conserved.**
- Groundwater as a Resource is invisible and difficult to assess and hence cannot be directly observed like surface water.
- It has high spatial and temporal variability and hard rock regions specially have low storage and unpredictable availability.
- CGWB has  $\sim$ 26000 monitoring stations across India which were initially monitored manually and now through Telemetry-based systems.
- Under National Hydrology Project CGWB has  $\sim$ 5,260 piezometers with digital water level recorders (DWLR) with data frequency of every 6 hours (4 readings/day).
- However big data analysis is an emerging challenge.
- He highlights groundwater extraction remains unregulated at user level with no control on quantity and timing of extraction and thus remains over exploited and is depleting

- Data integration is another big challenge as multiple agencies hold data – CGWB, SGWB, WRD and thus it remains fragmented. He highlights the need for an integrated data platform for better analysis, planning and regulation.
- He stated groundwater quality monitoring is now being done pre and post monsoon on parameters like pH, EC, TDS, Nitrate, chloride, Heavy metals (arsenic, cadmium, and mercury). The quality varies due to recharge effects and dilution during monsoon.
- Inter-Departmental collaboration remains limited such as between CGWB and Department of Land Resources (springshed work). CGWB has developed SOPs for springs and require knowledge exchange and collaboration.
- He talked about CGWB having 48 offices nationwide with 18 Regional Director offices and 17 Engineering offices where regular studies, monitoring, planning and advisory activities take place.
- He talked about NAQUIM data available at block and district level on open platforms.
- He mentioned Jal Shakti Abhiyan focusing on water conservation and recharge and MGNREGS recent directive which mentions 65% of funds in over-exploited/critical blocks to be used for water-related works. CGWB is extending technical guidance to districts on location an recharge of structures and planning interventions.

**Speaker: Rajendra Prasad**, Joint Director, Watershed Development and Soil Conservation Department, Government of Rajasthan

He talked about the watershed interventions done in Rajasthan and how only 13% of Rajasthan’s landscape is being used for water conservation.

- He laid strong emphasis on convergence as Core Strategy and only coordination is the most effective approach for water resource management. He stated that since 2015–16, a shift towards watershed/landscape-based planning has been seen and convergence cannot be done until structured system is in place and DM presence is imperative however his functions remain stretched.
- He talked about Rajasthan’s Platform-Based Convergence Model where all water related departments including farmers to planning, implementation and monitoring on a single platform. This improved inter-departmental coordination within watershed landscapes.
- Adoption of Common planning framework (watershed/landscape basis), unified monitoring system, project-level tracking, cross department visibility. There is a shift from scheme based

execution to integrated landscape based planning where forest department looks into their region and likewise.

- Funds were pooled from multiple schemes such as PMKSY, state schemes, forestry and other water related program funds.
- Selected areas were fully saturated before expansion and funds were distributed strategically across components. Third party evaluation was done for verification of results.
- Output was measured on number of structures created, impact on water availability and sustainability. Outcome based monitoring was the major focus.
- As an impact 64 percent reduction in defunct handpumps and tubewells was seen and 53 percent reduction in tanker supplies.
- State and Central Groundwater board data and data by the project monitoring team revealed 4-5 m rise in groundwater and improvement in rainfall as in case of Alwar districts were defunct borewells became operational and recovery in groundwater tables.
- Success is attributed to GIS based planning, use of aquifer mapping to align watershed works with high recharge areas which was not done before.
- Data driven planning and decision making, strong focus on local community engagement, institutional strengthening by capacity building programs for new recruits, field level engagement systems was also done.
- Increase in per hectare investments and funding mix for visible and measureable outcomes.
- He at the end emphasized the need for greater central funding on the basis of state performance and incentive based funding as 60 percent is fixed funding which limits the funds

**Speaker: Lalit Mohan Sharma, Advisor, Sehgal Foundation**

Topic: Improving Water Quality in Quality-Affected Areas

- Focus on salinity, fluoride, nitrate and arsenic in inland salinity areas and coastal seawater intrusion-affected areas.
- Key causes of water quality deterioration is attributed to
  - a) groundwater flow dynamics altered due to groundwater depletion –leading to saltwater intrusion and ingress of contaminated water,
  - b) Over-exploitation of deeper aquifers despite shallow aquifer availability-mixing of both aquifers and affecting water quality.
  - c) Geogenic contaminants

- d) Poor sanitation practices
  - e) Agricultural pollution
- The speaker highlighted lack of understanding of aquifers, lack of data, weak regulation, limited inter-departmental coordination and lack of community ownership and awareness as major challenges.
- The speaker suggested following strategic interventions-
  - a) Source protection from sanitation wastewater management
  - b) Hydrological interventions at surface and sub-surface level such as aquifer zoning, etc.
  - c) Dilution of contaminants by recharge- freshwater recharge in saline aquifers.
  - d) Identification and use of external safer sources if groundwater is not usable.
  - e) Combined use of surface and groundwater.
  - f) Strengthening Monitoring Networks and use of real time data
  - g) Convergence and community participation.

Moderator:

- Scaling of groundwater and water quality interventions was considered feasible provided there is convergence between technical planning and available funding support, noting that such provisions already exist but are not fully leveraged; emphasis was placed on using existing groundwater data under schemes like Jal Jeevan Mission, where substantial data is already available on portals and should be systematically analyzed to inform recharge planning and source sustainability, highlighting that the key issue lies not in policy absence but in gaps in implementation across states. Regional challenges, particularly in desert areas like Rajasthan with scattered habitations, necessitate community-based and localized water supply solutions where pipeline systems are impractical, alongside achieving targets such as ~65% water harvesting structures, which remain partially implemented. Concerns were raised regarding dam operations and sudden downstream flow disruptions, with clarification that dams must balance irrigation, drinking water, and environmental flow (e-flow) requirements under evolving institutional mechanisms such as the National Dam Safety Authority; it was further noted that rivers, groundwater, and springs are hydrologically interconnected, and declining base flows due to drying springs affect river systems. Discussion on community participation highlighted weak post-workshop continuity, lack of accountable authority, and limited translation of knowledge into action, although watershed planning frameworks formally include collaboration between technical experts and local communities, with increasing but selective involvement of NGOs and

youth organizations. Institutional constraints persist in the form of weak monitoring, coordination, and follow-up mechanisms, despite commitments to integrate suggested improvements subject to approvals. A broader perspective emphasized that water management in India was historically community-driven, with strong cultural and ethical norms—evident in traditional practices and references from epics—discouraging pollution and promoting stewardship, but this shifted over time toward state control, leading to long-term community disengagement; current efforts aim to reintroduce community participation, though behavioral and institutional change will take time. The overall conclusion stressed that sustainable water management requires integration of data-driven technical planning, effective implementation of existing policies, ecological considerations such as e-flows and recharge, active community participation, and restoration of societal respect for water.