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EMERGING TRENDS IN WASTEWATER MANAGEMENT: TECHNOLOGIES AND URBAN DESIGNS TO HARNESS STORMWATER FOR REUSE

Dear Readers,

Welcome to the February edition of EverythingAboutWater Magazine, where we continue our exploration of transformative water management solutions shaping the future of sustainable cities. This month, we focus on the evolving landscape of wastewater management, particularly the advancements in harnessing stormwater for reuse—an area gaining increasing importance in urban resilience and sustainability.

As climate variability intensifies and urban populations expand, the pressure on freshwater resources is mounting. The need for efficient wastewater and stormwater management has never been more crucial. Cities worldwide are turning to cutting-edge technologies such as real-time water quality monitoring, decentralized treatment systems, and AI-driven predictive analytics to optimize wastewater reuse. Innovative urban designs, including permeable pavements, green roofs, and constructed wetlands, are further revolutionizing how stormwater is captured, treated, and reintegrated into urban water cycles.

Beyond the technological advancements, policy frameworks and public-private collaborations play a pivotal role in scaling these solutions. Governments and industries are working together to develop regulatory incentives, infrastructure investments, and community-driven initiatives to ensure that wastewater is not seen as waste—but as a valuable resource.

In this issue, we bring you expert insights, case studies, and emerging strategies that are redefining wastewater management. From pioneering cities leading the way to breakthrough technologies shaping the industry, we aim to provide a comprehensive look at the future of stormwater reuse.

As always, we extend our sincere appreciation to our readers, contributors, and industry partners for your unwavering commitment to water sustainability. Your engagement and expertise continue to drive meaningful change in the sector.

Join us in exploring the innovations and strategies that will shape the next era of water-smart cities.

Warm Regards,
Simran Arora
Associate Editor
EverythingAboutWater Magazine

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NATIONAL WATER NEWS

DROPLETS

HIGHEST NUMBER OF WATER TANKERS DEPLOYED IN PUNE DIVISION AMID GROWING WATER SCARCITY

As temperatures soar and water levels dip across Maharashtra, the Pune division has emerged as the region with the highest number of water tankers deployed to address the escalating water crisis.

According to recent data released by the Maharashtra Water Supply and Sanitation Department, a total 65 water tankers are currently supplying water to parched villages in the Pune division — the highest number of water tankers deployed among all divisions of the state. The Pune division is followed by the Chhatrapati Sambhaji Nagar division with 51 water tankers deployed; the Kokan division with 46 water tankers deployed; the Amravati division with 39 water tankers deployed; and the Nashik division with 22 water tankers deployed. Currently, there are no water tankers deployed in the Nagpur division of the state, as per the data.

This surge in tanker deployment reflects the growing water scarcity in the region.

Among the five districts in the Pune division namely Pune, Satara, Solapur, Sangli and Kolhapur: Satara district accounts for the highest number of water tankers deployed (40); followed by Pune district (19); Solapur district (four); and Sangli district (two). Currently, there are no water tankers deployed in Kolhapur district. That the highest number of water tankers have been deployed in Satara district is being attributed to dwindling groundwater levels and lack of sufficient rainfall during the previous monsoon season.

According to the Maharashtra Water Supply and Sanitation Department, a total of 223 water tankers have been deployed to meet the daily water needs of 178 villages and 606 hamlets across 14 districts of the state. Of the 223, 207 are private water tankers while 16 are government water tankers. While there is a surge in water tanker deployment this year, the numbers are much lower than those during the same period last year.



DDWS JOINS HANDS WITH MINISTRY OF WOMEN AND CHILD DEVELOPMENT FOR POSHAN PAKHWADA 2025, PROMOTING “SHUDDH JAL AUR SWACHHTA SE SWASTH BACHPAN” CAMPAIGN

The Department of Drinking Water and Sanitation (DDWS) under Ministry of Jal Shakti, is actively participating in the 7th edition of Poshan Pakhwada from 8th to 23rd April, 2025. Aligning with the Ministry of Women and Child Development's Saksham Anganwadi scheme, the department's campaign is themed “Shuddh Jal aur Swachhta Se Swasth Bachpan” (Clean Water and Sanitation for Healthy Childhood), with a tagline “Purn Poshan Ki Shuruwaat, Shuddh Jal aur Swachhta Ke Saath” focusing specifically on clean water practices and sanitation as crucial elements for a child's nutrition and overall health.

Poshan Pakhwada aims to combat malnutrition through behaviour changes at individual, family, and community levels, highlighting four key areas:

- Emphasis on the first 1,000 days of human life
- Popularisation of the Beneficiary Module in the Poshan Tracker App
- Effective management of malnutrition through the CMAM module
- Promotion of healthy lifestyles to address childhood obesity

States/UTs will conduct extensive community-level activities to underline the critical role of safe drinking water and sanitation practices in preventing malnutrition and diseases. Through these collective efforts, including WASH (Water, Sanitation, and Hygiene) initiatives, the Jal Jeevan Mission, and the Swachh Bharat Mission-Grameen, Poshan Pakhwada aims to create enduring awareness and drive substantial behavioral change in rural communities, enabling improved health, sanitation, and nutrition for every child in India.

PUNE PCMC TO USE TREATED WATER FOR INDUSTRIAL SUPPLY

The Pimpri-Chinchwad Municipal Corporation (PCMC) plans to supply treated wastewater to industries in Maharashtra Industrial Development Corporation zones to address growing water demand while reducing strain on potable water supplies. The project involves building dedicated pipelines to deliver treated water to industries across multiple areas including Pimpri, Chinchwad, and Hinjawadi.



The city currently operates 20 sewage treatment plants processing 300 million liters daily (MLD), but only 22 MLD is utilized, with the rest released into rivers. Under this initiative, PCMC will redirect treated water to industries to reduce their freshwater dependency. Tata Motors has already requested 1.5 MLD of treated water.

A new software system with QR codes will monitor water distribution, ensuring efficient usage and accurate record-keeping. This initiative aligns with Maharashtra Government guidelines requiring municipalities to recycle wastewater and supports national campaigns like “Swachh Bharat Abhiyan.” Currently, the city draws 620 MLD of water from three sources (Pavan Dam, Andra, and MIDC), but only 300 MLD undergoes treatment. PCMC's efforts to increase treatment plant capacity are essential for the city's long-term water security and represent a model for sustainable urban development that balances growth with environmental stewardship.

UNION MINISTER SHRI C R PATIL INAUGURATES SYMPOSIUM ON “DAM SAFETY ACT, 2021: TOWARDS INTEGRATED DAM SAFETY MANAGEMENT” IN NEW DELHI

Union Minister Shri C R Patil inaugurated Symposium on “Dam Safety Act, 2021”: Towards Integrated Dam Safety Management” organised by National Dam Safety Authority” (NDSA), DoWR, RD & GR, Govt. of India in the presence of Minister of State for Jal Shakti Dr. Raj Bhushan Choudhary in SCOPE Convention Centre, New Delhi today. This event highlighted the progress made in improving dam safety, and it emphasised the need for integrated dam safety management through involvement of all Stakeholders.

DROPLETS

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Shri C. R. Patil outlined the efforts in implementation of the Dam Safety Act. The union minister highlighted how the Act has created a structured safety framework and institutional setup in ensuring compliances of the provisions of the Dam Safety Act. While lauding the role of NDSA in Dam safety Management, HMoJS encouraged stakeholders to view dam safety not merely as compliance; but as a commitment to human safety, ecosystem preservation, and national resilience. HMoJS emphasised that every specified dam owner must earmark sufficient funds as mandated; and uphold global best practices and advanced technology for a secure water future. He highlighted that dams are getting old and more efforts are needed to take preventive measures for Dam Safety.

Dr. Raj Bhushan Choudhary, Minister of State for Jal Shakti urged states to adopt risk-based prioritisation tools and integrate startups and private sector innovation into dam safety practices. He also emphasised the importance of the Dam Health and Rehabilitation Monitoring Application, i.e. DHARMA portal as a repository of data of all the specified dams of the country.



Key releases during the Symposium:

- The National Register of Specified Dams-2025 was released, providing a comprehensive database of all the 6,628 specified dams in the country.
- Guidelines for Preparing Operation & Maintenance Manual for Ungated Dams was released, aimed at improving safety protocols of dams.
- A Compendium on regulations published under the Dam Safety Act, 2021
- The National Strategy for Developing Dams as Sustainable and Responsible Tourism Destinations was introduced to explore eco-friendly tourism opportunities.

GANDHINAGAR GETS RS.606.34 CRORE FOR STP & WATER MANAGEMENT PROJECTS

Chief Minister Bhupendra Patel has granted in-principle approval to allocate ₹606.34 crore from the Swarnim Jayanti Mukhyamantri Shaheri Vikas Yojana to Gandhinagar Municipal Corporation for the Sewage Treatment Plant (STP), along with wastewater management works, rainwater drainage networks, and water distribution station. From this allocation, ₹245 crore will be utilized for the Jaspur STP and its associated works, while ₹361.34 crore will be used for projects in newly incorporated villages and TP (Town Planning) areas within the expanded limits of Gandhinagar Municipal Corporation.

Approximately 60 MLD of drainage water from Sectors 1 to 30 of Gandhinagar, along with villages such as Borij, Palaj, Basan, Dholakuva, Indroda, Adivada, and Gokulpura, is collected at the Sargasan pumping station and efficiently treated at the Jaspur STP, which has a capacity of 76 MLD. Due to the expansion of Gandhinagar Municipal Corporation, the increased population density and water consumption have led to an additional 22 MLD of water being sent through the drainage line from Sargasan to Jaspur. Additionally, 27 MLD of extra drainage water from certain TP areas of Gandhinagar Municipal Corporation, Khoraj village, and GUDA area is pumped through the Adalaj pumping station into the Jaspur STP pipeline. As a result, while the Jaspur STP has a treatment capacity of 75 MLD, it currently receives 109 MLD of drainage water.

The excess accumulation of water has led to the overflow of main inlet and outlet lines at Jaspur STP, Adani Campus, Khoraj village, and the Cloverleaf junction near Adalaj Trimandir. Consequently, sewage water has been overflowing into rural areas, agricultural fields, and roads. Moreover, such overflow poses a potential risk of spreading diseases in the surrounding areas. This decision has been taken to ensure the well-being of Gandhinagar's growing population amidst rapid urban expansion. With this in-principle approval, the 11-kilometer gravity main line from Sargasan to Jaspur, which has been in use for over 20 years, will now be replaced.



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UNION MINISTER OF JAL SHAKTI SHRI C.R. PATIL LAUNCHES WATER RESOURCE CENSUS APPLICATION AND PORTAL AT NEW DELHI

Union Minister of Jal Shakti Shri C.R. Patil launched the Water Resource Census application and portal at Shram Shakti Bhavan, New Delhi. The Water Resource Census application and portal aids in the following census schemes.

- The 7th Minor Irrigation Census
- 2nd Census of Water Bodies
- 1st Census of Springs
- 1st Census of Major and Medium Irrigation Projects

A 100% Centrally Sponsored Scheme, the reference year will be 2023-24 agricultural year (July 2023- June 2024) under Irrigation Census Scheme.

The main objective of the Water Resource Census is to build a comprehensive and reliable database in the irrigation sector for



effective planning and policymaking including water use efficiency, water budgeting etc. The digital application for collection and validation of data significantly enhances data accuracy while reducing the time required for conduct of census.

The key features of the censuses include a paperless and end-to-end digital solution, utilizing mobile applications for data collection and web applications for management and validation processes. The system incorporates ground truthing of data received from the SAC database during the 2nd Census of Water Bodies, while recording the latitude, longitude, and images of all schemes. Previous census data (6th MI and 1st Water Body Census) is pre-populated in the mobile application during data collection using LGD codes whenever possible.

The censuses employ reverse GIS technology to ensure accurate recording of latitude and longitude coordinates for all schemes where village boundaries are available. Additionally, LGD codes are used for preparing the frame of the census, enhancing overall data organization and accessibility.

RS 1.5 CRORE DEVELOPMENT PROJECTS LAUNCHED IN RAJOURI GARDEN

Delhi Environment Minister Manjinder Singh Sirsa inaugurated various improvement and redevelopment projects worth nearly Rs. 1.5 crore in the Rajouri Garden area on Monday. The development works include the installation of new water pipelines, with an estimated cost of Rs. 30 lakh, in Sant Nagar Extension (near Lane No. 5) and the main road in Shyam Nagar Extension.

Additionally, redevelopment of sewer lines with an estimated budget of Rs. 82 lakh has been launched in Vishnu Garden and T.C. Camp to address critical sanitation issues in these areas. The laying of new water pipelines will provide residents with clean, uncontaminated drinking water, ensuring a steady supply. The redevelopment of sewer lines will improve sanitation, reducing health risks and enhancing overall hygiene," said Sirsa.

The minister also inaugurated road improvement and redevelopment works with a budget of Rs. 28 lakh across more than six lanes in Ward No. 96, including Teetarpur, D Block Extension, and several key locations in Tagore Garden and Rajouri Garden. These projects will improve road conditions, drainage, and connectivity for residents.

"These long-standing demands of the residents are being fulfilled today. Every lane we improve and every pipeline we lay is a step towards our dream of Viksit Delhi. Clean drinking water and proper sanitation are necessities, and we are committed to providing them to every resident," Sirsa said.

During the visit, Sirsa interacted with local residents and assured them of swift progress on essential civic amenities like electricity, water, sanitation, and roads. He emphasised his commitment to being



SLUDGE DEWATERING SCREW PRESS MACHINE

ABOUT SCREW PRESS SLUDGE DEWATERING

A sludge dewatering screw press machine is an important component in wastewater treatment plants, used to separate water from sludge, thereby reducing its volume and improving handling and disposal.

WORKING PRINCIPLE

- **Sludge Inlet:** Raw sludge enters the screw press, after primary and secondary treatment stages.
- **Screw Mechanism:** A rotating screw moves the sludge through a cylindrical screen. As the sludge moves, it is compacted.
- **Filtration:** The cylindrical screen allows water to escape while retaining solid particles, effectively dewatering the sludge.
- **Pressure Application:** As the sludge is pushed toward the discharge end, increasing pressure further squeezes out water.
- **Dewatered Sludge Discharge:** The dewatered sludge, now reduced in moisture content, is discharged for further handling, such as disposal or incineration.

BENEFITS OF THE SCREW PRESS

- **Space Efficiency:** Compact design saves space compared to traditional dewatering methods.
- **Energy Efficiency:** Lower energy consumption than some alternatives, such as centrifuges.
- **Reduced Chemical Use:** Often requires fewer chemicals, which lowers operational costs.
- **Low Maintenance:** Fewer moving parts lead to reduced maintenance needs.
- **Environmental Compliance:** Helps meet regulatory requirements for sludge disposal.

APPLICATION AREA

- Municipal
- Pharmaceutical
- Paper
- ETP
- Food
- Chemical
- STP
- Other Industries

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NATIONAL WATER NEWS

MARCH 2025

available for the community, encouraging residents to voice their concerns.

"The government is fully dedicated to regional development and public service. These initiatives will make the area more beautiful and convenient for all. We remain committed to providing residents with a cleaner and more sustainable environment," he said.

ALLURI SITHARAMA RAJU DISTRICT TRIBALS EXCEL IN ANDHRA PRADESH'S NATURAL WATER CONSERVATION EFFORTS UNDER MGNREGS

The Alluri Sitharama Raju (ASR) district stands out among the State's districts in its efforts to conserve natural water resources, such as streams and rain. Under the Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS), as many as 30,000 tribals in 22 mandals of the district have created 16,107 water harvesting structures, including 13,609 soak pits, 2,452 farm ponds and 47 rooftop rainwater harvesting tanks. This is their biggest achievement under the Centre-sponsored scheme, and they have



even topped the State's MGNREGS rankings declared based on the performance for the financial year 2024-25 ending on March 31. "The district administration and the MGNREGS beneficiaries, who are all tribals, have been at the forefront of such water conservation measures in the State with infrastructure development. These water conservation structures will also help neighbouring districts like Anakapalli. People of the ASR district tapped nature's gift (rainwater) by undertaking works under the scheme. ASR's rainfall is good, but water is not stored here as it flows to downstream areas. For the first time in this financial year, we have taken up water conservation activities and stood as toppers in the State," said ASR Collector A.S. Dinesh. According to MGNREGS project director D.V. Vidya Sagar, an

investment of around Rs. 6,000 per unit was made for each soak pit, which includes Rs. 549 in unskilled manpower wages. He added that 230 mm-size boulders were used for each soak pit.

"Overall, 16,107 water conservation structures have been built, including 13,609 soak pits, in the financial year 2024-25. The highest number of soak pits (1,296) were constructed in Anantagiri and the lowest in Mareduilli mandal (231). Other districts like Srikakulam and Anantapur have also undertaken water harvesting works under MGNREGS schemes, but the uniqueness of ASR district is that all the workers (beneficiaries of this scheme) are tribals," Mr. Vidya Sagar concluded..

MESSAGE OF WATER CONSERVATION, SUCCESS IN SAVING 1100 CRORE CUBIC METERS OF WATER

It is a good thing that various water conservation programmes are being run by the Ministry of Jal Shakti, but the desired result will be achieved only when everyone shows readiness to adopt water conservation measures at their own level. The work of water conservation cannot be left to the government and its agencies alone. It is everyone's shared responsibility and it should be carried out in this manner.

Prime Minister Narendra Modi, in his monthly radio programme Mann Ki Baat, gave the right message to the people of the country at the right time by stressing on water conservation. While doing so, the information he gave that in the last seven-eight years, 1,100 crore cubic meters of water has been saved through various measures of water conservation, is going to encourage people and motivate them to understand the importance of water.

Undoubtedly, it is no less than an achievement that a large amount of water has been saved through water conservation measures and the Prime Minister mentioned this because his government has done



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some remarkable work at the policy level for water conservation, but still a lot needs to be done in this direction. This need should be fulfilled by governments, social welfare organisations as well as the general public at their own level, because in our country, measures to save water are not being taken as required. It should not be ignored that a lot of water is wasted during the rainy season.

The government and society should try to collect as much rainwater as possible, because India is one of those countries where water crisis is looming. How seriously water conservation efforts need to be taken can be understood from the fact that 17 percent of the world's population lives in India, while the water available for its use is less than four percent. Under water conservation, not only rainwater should be saved, but attention should also be paid to other measures. For example, more and more ponds should be constructed and traditional water sources should be protected from getting contaminated. Apart from this, those measures should be adopted on priority basis which can reduce the consumption of water in domestic works, industrial activities and agriculture. Such measures



have been adopted only on a limited scale. This is why not only is more water being used in agriculture than required, but also in industrial activities. It is clear that water conservation should be taken care of throughout the year.

It is a good thing that various water conservation programmes are being run by the Ministry of Jal Shakti, but the desired result will be achieved only when everyone shows readiness to adopt water conservation measures at their own level. The work of water conservation cannot be left to the government and its agencies alone. It is everyone's shared responsibility and it should be carried out in this manner.

PARLIAMENT QUESTION: TAP WATER CONNECTION TO RURAL HOUSEHOLDS UNDER JJM

The Government of India launched the Jal Jeevan Mission (JJM) in August 2019 to provide safe, potable tap water to all rural households. As drinking water is a state subject, State/UT governments are responsible for planning and implementing water supply schemes, with the Central Government providing technical and financial support.

Since JJM's launch, significant progress has been made. Initially, only 3.23 Crore (16.71%) rural households had tap water connections. As of March 12, 2025, approximately 12.28 Crore additional households



have received connections, bringing the total to 15.52 Crore (80.15%) of the country's 19.36 Crore rural households.

Under the "Har Ghar Jal" initiative, villages achieving 100% functional connections are certified through Gram Sabha resolutions. A 2021-22 functionality assessment found that 86% of rural households had working tap connections, with 85% receiving adequate water quantity, 80% getting regular supply, and 87% receiving water meeting quality standards. To ensure sustainability, the mission implements quality controls through third-party inspections, IoT-based monitoring, AADHAR linking for targeted delivery, and geo-tagging of assets. Progress is transparently tracked through an online JJM dashboard and mobile app that provides state, district, and village-level data.

DHAYARI AND NARHE TO GET CLEAN WATER AS PMC APPROVES MAJOR PIPELINE PROJECT

The estimated cost of this pipeline extension is Rs. 70 lakh. The tender process has been initiated, and the project will be completed within two months once approved.

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Pune: The Pune Municipal Corporation (PMC) has approved a Rs. 70 crore project to supply clean drinking water to the newly merged Dhayari and Narhe villages. The purified water will be sourced from the Wadgaon Water Purification Plant, as confirmed by Additional Commissioner Prithviraj B.P. Currently, the newly included villages along Sinhadgad Road do not receive purified water. Instead, untreated water is drawn from dams, supplied to local wells, and then pumped into these areas. This lack of proper water treatment has resulted in multiple cases of Guillain-Barre Syndrome (GBS), with some fatalities and several patients still undergoing treatment. To prevent further health risks, the PMC has taken urgent action to improve the water supply system.

New Pipeline to Ensure Purified Water Supply

At present, Dhayari village within Pune's old municipal limits receives purified water from the Wadgaon Water Purification Plant. The PMC now plans to extend this supply to Dhayari and Narhe by connecting a

200-meter-long pipeline to the existing water supply network. The estimated cost of this pipeline extension is Rs. 70 lakh. The tender process has been initiated, and the project will be completed within two months once approved.

Chlorination System Installed Following GBS Outbreak

In response to GBS cases detected in Dhayari, Khadakwasla, Nanded, Narhe, and Kirkatwadi, PMC has also implemented

chlorination machines at four key water sources:

- Nanded Well
- Barangane Mala Well
- Khadakwasla Jackwell
- Prayeja City

The chlorination system has been installed at a total cost of Rs. 87 lakh to ensure safer water supply and prevent further health complications.

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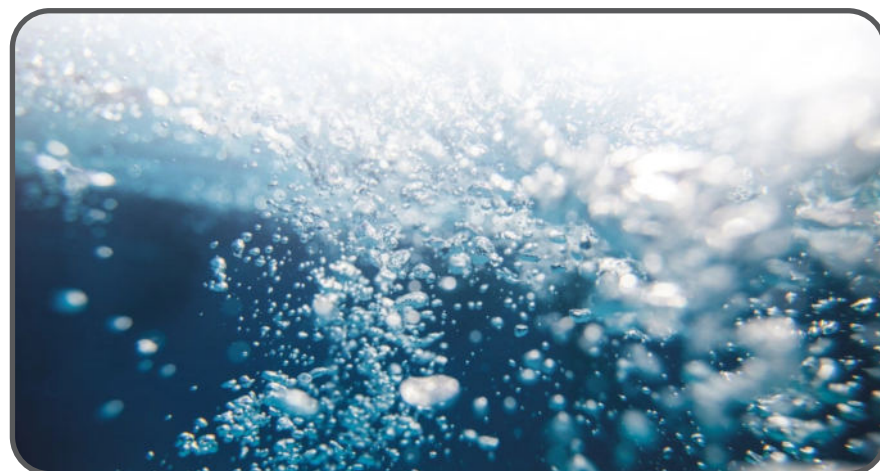
LEE KUAN YEW WATER PRIZE 2026 OPENS FOR NOMINATIONS

Lee Kuan Yew Water Prize (LKYWP) 2026, the prestigious biennial award that honours outstanding contributions by individuals or organisations for solving the world's water challenges, launched its call for nominations today.

2 The LKYWP is named after Singapore's founding Prime Minister Mr Lee Kuan Yew, whose vision and leadership enabled Singapore to overcome its challenges as a water-stressed city-state to secure a resilient and sustainable water supply. Since its inception in 2008, the Prize has gained a strong standing in the global water arena for its recognition of innovative water technologies, programmes and policies, that have been game-changers in their real-world application.

3 The honour roll for the Prize includes Laureates who have developed ground-breaking solutions in wastewater-based epidemiology, membrane technology and used water treatment, as well as holistic water policies and management practices. These solutions have benefitted the lives of millions. Their achievements represent the pinnacle in water solutions that have made a difference to cities and people around the world.

4 Presented in partnership with Temasek Foundation, the LKYWP 2026 Laureate will be announced in April 2026. The Laureate will receive S\$300,000, a gold medallion and a certificate at the Prize banquet and award ceremony during the 11th Singapore International Water Week, which will be held from 15 to 19 June 2026.



INDUSTRIAL RESILIENCE DEPENDS ON WATER STEWARDSHIP STRATEGIES, NEW REPORT REVEALS

Manufacturers will need to step up their water stewardship strategies to mitigate water scarcity and safeguard the future of the process industries, according to a new report. Experts from NIRAS, one of the largest process industries consultancies in Northern Europe, have set out the steps businesses can take to optimise water use both in their operations and across their supply chains.

Their comments appear in a new report, Water Stewardship: Trends and perspectives within the global process industry, which was launched at the Aquatech Amsterdam event in March. The report explores how manufacturers can implement practical solutions to mitigate water-related risks, enhance resource efficiency, and meet evolving regulatory standards. Søren Nøhr Bak, senior expertise director at NIRAS, said: "Water plays an essential role in the manufacturing process, including products, cleaning of process equipment and packaging materials, as well as for utilities. As global water scarcity and environmental concerns mount, the industry faces transformative changes driven by sustainability, legislation and cost imperatives.

The report also details how manufacturers can adopt a strategic approach through watershed management. Watershed management is not just a regulatory obligation but a strategic imperative for industries. Ensuring that water use is balanced with the needs of the environment and local communities is essential to securing a vital social license to operate. "By engaging with local stakeholders and investing in sustainable water practices, companies can build trust, mitigate water scarcity risks, and strengthen the long-term resilience of local watersheds. Investing in water recycling and reuse is helping companies not only save costs and secure their water supply but also contribute to broader environmental goals."

EUROPE'S DIGITAL WATER MARKET FORECAST TO DOUBLE BY 2033 AS POLICY AND TECHNOLOGY DRIVE TRANSFORMATION

This growth, demonstrated by an 8.0% compound annual growth rate (CAGR), will drive a cumulative US\$196.0 billion in spending from 2024 to 2033, highlighting European utilities'



increasing adoption of digital technologies and solutions to manage water infrastructure more efficiently. The expansion of Europe's digital water market signals that water utilities are prioritizing modernization, which signifies a shift toward more resilient water systems. Energy prices in Europe have doubled over the past five years, driven by geopolitical conflicts such as the war in Ukraine. Digital water solutions that optimize energy use and provide real-time asset monitoring are improving utility operations.

The adoption of digital technologies in the water sector has been significantly boosted by funding initiatives from regional entities like the European Union (EU) and the European Investment Bank. These measures have pushed water utilities to leverage real-time data collection and management tools to address water supply risks. Southern European utilities, in particular, are taking advantage of EU funding to modernize aging infrastructure, focusing on metering, leakage management, and broader digitalization investments.

- Italy is investing US\$2.1 billion in leakage reduction.
- Spain has committed US\$3.3 billion to digitalizing its water cycle, reflecting a regional push for efficiency and sustainability.
- The U.K.'s eight Asset Management Period (AMP8) is fuelling growth in metering, leakage detection, and network optimization.

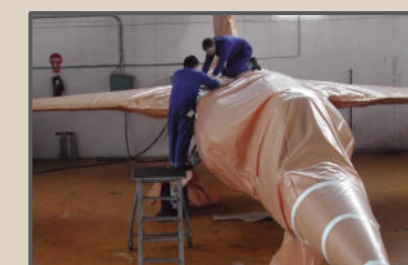
Traditional systems like SCADA, GIS, and metering hardware still dominate digital water spending, accounting for over 75% of forecasted growth in Europe. In parallel, water utilities are increasingly integrating artificial intelligence (AI) and cloud solutions to enhance

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their data-driven intelligence activities to make networks more responsive. EU-wide regulations on AI, data privacy, and water quality monitoring are also tightening compliance requirements, with the EU Network and Information Security Directive underpinning higher investments and spending in cybersecurity over the next decade. Bluefield forecasts that spending on cybersecurity, compliance, and data management in the water sector will grow at a CAGR of 12.2% from 2024 to 2033.

EU INVESTS €4.6M IN NEW WATER SENSOR TO TRACK HIDDEN POLLUTANTS IN LAKES AND RIVERS

An EU consortium is developing IBAIA, a revolutionary photonic sensing platform designed to detect invisible water pollutants from petrochemicals, pesticides, heavy metals, and industrial waste. Backed by €4.6 million in EU funding, this technology combines photonics with electrochemistry to offer real-time monitoring capabilities that conventional methods cannot match.



The multi-sensing platform features four integrated sensors: a Mid-Infrared sensor that identifies organic chemicals by their spectral fingerprints; a Visible-Near Infrared sensor that detects microplastics and salinity changes; an Optode sensor that measures pH, oxygen levels, and temperature; and an Electrochemical sensor that identifies nutrient salts and heavy metals. Together, these provide comprehensive pollution detection in a single system.

Unlike traditional water quality testing that relies on slow laboratory analysis, IBAIA delivers real-time, in-situ data, allowing authorities to respond quickly to contamination events before they escalate into environmental disasters. This innovation addresses the growing

concern around the "cocktail effect" of multiple pollutants, which has been linked to immune system weakening, reproductive issues, and even cancer risks.

Project Manager Radwan Chahal describes environmental water pollution as "one of the most urgent yet overlooked crises of our time," while Izabella Otalega from Modus Research and Innovation emphasizes that "real-time detection means swift intervention." The project is set to conclude in 2026 following field trials across Europe, with the technology expected to become a new standard in protecting water ecosystems across the continent

ASTON UNIVERSITY MICROBIOLOGIST CALLS FOR PUBLIC VIGILANCE AND URGENT ACTION ON THE DANGER OF RAW SEWAGE IN UK SEAS

Sewage contains lots of microorganisms harmful to human health, causing gastrointestinal, respiratory and skin infections. People can become infected through ingestion, inhalation or contact with contaminated water. Vulnerable groups, including older people, those with a compromised immune system (such as organ transplant patients) and pregnant women are particularly at risk. Sewage pollution can also affect marine life. The risks hit home for Dr Cox when, in spring 2024, he contracted a type of bacterial pneumonia following a swim in the sea that was likely connected to an incident of sewage dumping in the area, recorded by the charity Surfers Against Sewage just hours before he took to the water. As frightening as this sounds, Dr Cox does not advise staying out of the water, but checking water quality before visiting a beach. Surfers Against Sewage has developed the Safer Seas and Rivers Service (SSRS), online and as an app, which shows where there have been recent sewage discharges. The government has promised stricter regulations, and advanced sewage treatment technologies are available, but urgent investment is



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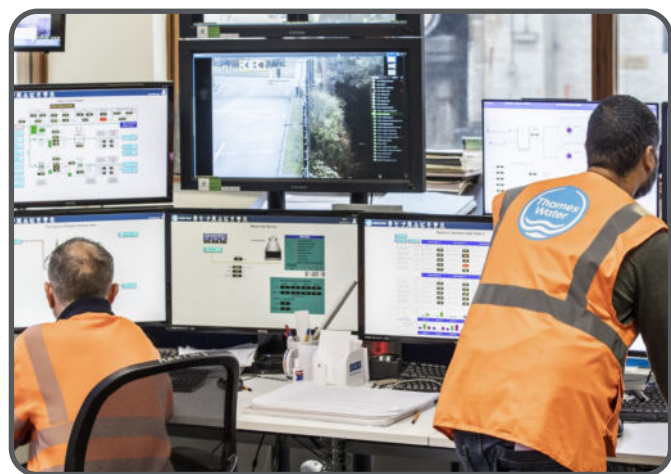
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required to protect public health and the UK's coastal waters. The article demonstrates how microbiologists are involved in addressing challenges that vary from urgent problems demanding immediate solutions, such as new and emerging diseases, through to long-term issues, like antimicrobial drug resistance, food security and environmental sustainability.

Dr Cox concludes:

"Whilst we're waiting for the improved management, innovation and investment that is required to solve the issue and save our seaside, don't bury your head in the sand regarding water quality. Check before you swim. Afterall, prevention is always better than cure."

SMART SEWERS – HOW THAMES WATER'S 20,000 SEWER MONITORS HELP TO PREVENT FLOODING AND POLLUTION INCIDENTS BEFORE THEY OCCUR



Thames Water has invested £20 million over the past three years to develop a smart sewer network, installing over 20,000 monitors that provide real-time data on network health. These devices alert teams to potential blockages before they cause pollution or flooding, allowing engineers and analysts to take proactive action. A successful 2023 pilot program along London's Wealdstone Brook involved installing over 1,000 monitors, resulting in the removal of more than 100 blockages. This success has influenced future installation strategies across the network. Between March 2021 and March 2024, the monitoring network helped identify and remove over 11,500 blockages throughout Thames Water's region. In west London alone, nearly 5,000 monitors have helped remove 2,240 blockages since January 2023.

The company plans to install an additional 31,000 monitors by 2030 as part of its expansion strategy. The data collected helps Thames Water determine which areas of the network need urgent upgrades and future improvements. Anna Boyles, Head of Environmental Performance, emphasized that the smart sewer network represents "a major step forward in preventing blockages before they happen." In 2024, Thames Water cleared approximately 52,000 blockages caused by "sewer abuse" - improper disposal of items like wet wipes, sanitary products, and cotton pads that cannot break down in the sewage system. These blockages can force raw sewage to back up into drains and waterways. The company continues to promote its "three Ps" campaign, encouraging the public to flush only pee, poo, and toilet paper.

SEPA WARNS OF EARLY WATER SCARCITY RISK AS DRY SPELL CONTINUES

The Scottish Environment Protection Agency (SEPA) has issued warnings about emerging water scarcity across Scotland, urging businesses to manage water use and build climate resilience into their operations. SEPA's latest Water Situation Update reveals March brought below-average rainfall to most of Scotland, with some southern areas receiving less than a third of expected precipitation, continuing trends highlighted in SEPA's Winter water situation report.

Particularly concerning are parts of Angus and Fife, which have experienced 10 consecutive months of below-average rainfall and received less than half their normal March precipitation. Only Shetland recorded above-average rainfall during this period. The impacts are already visible with river flows running low to extremely low for this time of year, while groundwater levels continue to decline due to insufficient winter recharge. Current groundwater levels are lower than those recorded in early April 2022, which was followed by summer drought conditions that required restrictions on river



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abstractions in some areas. Only Moray shows above-normal groundwater levels, reflecting higher-than-average winter rainfall in that region. Despite Scotland's reputation for wet weather, climate trends are shifting toward more extended dry periods, increasing water scarcity risks. Kenny Boag, SEPA's Head of Environmental Performance, emphasized that "Water scarcity is becoming a growing challenge in Scotland," noting the increased risk of early-season scarcity this year. Weekly water scarcity reporting will begin in May (or sooner if conditions worsen) to help businesses prepare. SEPA continues working with the Scottish Government, agriculture, industry, and Scottish Water to monitor conditions, manage resources sustainably, and balance environmental protection with human and economic needs.

PORTSMOUTH WATER BEGINS ITS BIGGEST ENVIRONMENTAL STUDY EVER ON RIVER CATCHMENTS



The environmental study commenced this week with drone surveys of seven river catchment areas. The surveys are seeking to identify key locations where habitats can be improved for the benefit of wildlife. Portsmouth Water's supply area encompasses rare and sensitive environments surrounding chalk streams and rivers. Over the next five years, this study will investigate the environmental status and needs of the Itchen, Ems, Meon, and Lavant rivers, as well as the West Sussex rife.

Portsmouth Water said this study will provide a clearer picture of what it would take for all its rivers to reach 'good' environmental status and whether this means limits will need to be placed on how much water Portsmouth Water abstracts from the ground in the future.

In today's world, Portsmouth Water needs to supply an average of 178 million litres of water a day to over 740,000 people across the supply area. Portsmouth Water's current water resource management plan prepares for losses of up to 122 million litres of water per day from its existing supplies in the next 25 years, a gap the company is planning to fill through a mixture of working with customers to reduce demand for water, primarily through its smart metering programme and potentially new sources of water that do not come directly from the environment.

The drones being used in this initial phase of the study are able to carry out hydrological drainage assessments, flood risk surveys, habitat surveys, analyse land use and look for sources of pollution. Using thermal applications to understand temperature and changes in flow will combine to start to develop a clear picture of the environmental health of each of these areas.

Going forward, studies will also include flow and water quality monitoring as well as fish and invertebrate investigations. When complete, this data will be made freely available for students, academics and local interested parties. The water company said the outcome of this work will shape Portsmouth Water's strategic plans and provide evidence to support future investment plans.

MOL TO CREATE 885 JOBS IN WATER SECTOR AS PART OF OMANISATION DRIVE

The Ministry of Labour has launched a joint programme with the Authority for Public Services Regulation (APSR) and Nama Water Services to advance Omanisation efforts in the public sector, with plans to create 885 jobs for Omani nationals. A formal agreement was signed by H E Sayyid Salim bin Musallam al Busaidi, Undersecretary for Human Resources Development in the Ministry of Labour; Qais bin Saud al Zakwani, CEO of Nama Water Services; and H E Dr. Mansour bin Talib bin Ali al Hinai, Chairman of



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APSR. The programme will be implemented in two phases. The first phase, already underway, has offered 379 jobs. The second phase will create an additional 406 job opportunities within Nama Water Services.

The initiative is structured to provide jobseekers with skills and practical experience in the water services sector. It aims to help candidates identify career opportunities, develop in-demand skills, and receive specialised training. Participants will also be assessed to ensure they meet the required standards for employment. The focus on technical roles supports the government's broader Omanisation goals and reflects a strategy to integrate national talent into vital sectors of the economy. The agreement marks a step forward in creating sustainable employment for Omanis and strengthening the local workforce in essential public services.

HONG KONG'S VISION FOR SUSTAINABLE SMART WATER MANAGEMENT



Hong Kong is actively pursuing sustainable smart water management through innovation and technology, recently highlighted at the International Water Pioneers Summit where Chief Executive John Lee addressed nearly 400 professionals and officials from Hong Kong, Mainland China, Asia, and beyond.

The city has overcome significant geographical and resource constraints to secure stable water supplies. A crucial milestone was the 1960s construction of the Dongjiang water supply system—an 83-kilometer channel traversing multiple mountain ranges with multistage pumping stations to lift water from near sea level to higher altitudes. Completed in under a year, it began supplying water in March 1965 and has since expanded from providing 68.2 million

cubic meters annually to 820 million cubic meters, now accounting for 70-80% of Hong Kong's total water consumption.

Hong Kong's commitment to technological innovation has earned it international recognition, ranking among the top ten globally for infrastructure capabilities in the World Competitiveness Yearbook. Notable projects include the High Island Reservoir (Hong Kong's largest) and the Tseung Kwan O Desalination Plant, which incorporates advanced reverse osmosis technology—the first facility in the region to adopt this water treatment method.

To accelerate digital transformation of water services, Hong Kong established a Digital Water Office that promotes smart technologies including digital twin models, artificial intelligence, and smart devices. This initiative aims to progressively automate waterworks operations to enhance efficiency, monitoring, and responsiveness. Through these technological innovations and infrastructure developments, Hong Kong positions itself as a regional and international hub for water management expertise, contributing to both local needs and broader national objectives while building a resilient water system that supports economic growth and environmental stewardship.

HOW SAUDI ARABIA IS PIONEERING SOIL QUALITY AND WATER CONSERVATION SOLUTIONS

Saudi Arabia has been investing in sustainability initiatives for over a decade, implementing groundbreaking projects to combat desertification, improve soil quality, and preserve water resources. These efforts align with the broader goals of the Saudi Green Initiative and are gradually transforming the Kingdom's landscape. One of the most ambitious projects is King Salman Park in Riyadh, designed to be one of the world's largest urban parks. This initiative focuses on increasing green spaces, restoring soil health, and mitigating urban heat island effects through native tree planting and sustainable water management systems.



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At King Abdullah University of Science and Technology (KAUST), Associate Professor Himanshu Mishra has developed innovative solutions to address Saudi Arabia's environmental challenges. Shocked by learning that 80 percent of Saudi Arabia's water is used for food production despite the country importing most of its food, Mishra co-founded SandX—a biodegradable, water-repellent sand coating that reduces water evaporation by over 80 percent without using plastics. Going beyond water conservation, Mishra also developed CarboSoil, a revolutionary soil amendment and carbon capture technology derived from organic waste. Unlike traditional

compost, CarboSoil locks carbon into the soil while enhancing plant growth. Field trials show plants growing approximately 60 percent bigger with wider trunks when CarboSoil is applied. With production scaling up following a KAUST Innovation and Economic Development grant, Mishra believes Saudi Arabia could become a global leader in carbon dioxide removal within five years. The startup plans to expand its operations throughout the Kingdom before extending to the wider Middle East, addressing both immediate environmental needs and long-term sustainability goals across the region.




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Mr. Thomas Nuernberger, Group CSO and CEO, Air Technology APAC & MEA, Dr. Klaus Geissdoerfer, Group CEO, & Mr. Atul Tripathi, Managing Director, ebm-papst India – addressing the media today in Chennai.

ABOUT ebm-papst:

The ebm-papst Group, a family-run company headquartered in Mulfingen, Germany, is the world's leading manufacturer of fans and motors. Since it was founded in 1963, the technological leader has set international industry standards with its core competencies in motor technology, electronics, digitalization, and aerodynamics. ebm-papst offers sustainable, intelligent, and tailor-made solutions for virtually every requirement in ventilation and heating technology. ebm-papst sets the benchmark in almost all sectors, such as ventilation, air conditioning and refrigeration technology, heating technology, information technology, mechanical engineering, intralogistics, and medical technology. In the 2023/24 financial year, the Group generated a turnover of EUR 2.408 billion. It employs just nearly 14,000 people at 27 production sites including in Germany, China, and the US, as well as 49 sales offices worldwide.

Invests INR 340 crore in setting up the new facility in Chennai, Tamilnadu.

Plans to employ around 700 people and aims to be operational by end-2026.

CHENNAI/INDIA, APRIL 4TH, 2025

ebm-papst, the world's leading manufacturer of fans and motors, is strengthening its commitment in India and investing in the expansion of its local production capacities. The official groundbreaking ceremony of the new plant in Chennai will take place on April 4th with internal representatives. Due to its dynamic growth, India plays an important role in ebm-papst's

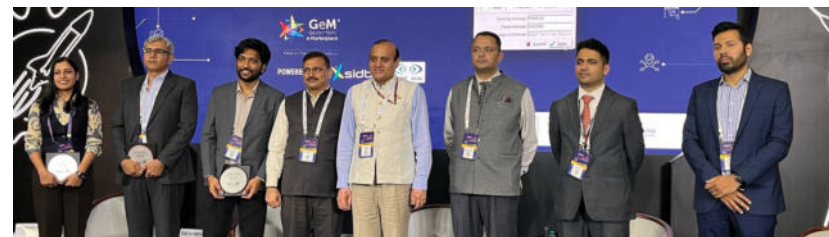
strategy for the Asia-Pacific, Middle East and Africa (APAC & MEA) region.

As part of the planned production expansion, ebm-papst has acquired a 57,600 m² (14.2-acre) plot of land in Chennai. The first phase of the upcoming construction project comprises an area of 23,000 m² and an investment of 36 million euros (INR 340 crore). The production plant, which is expected to be completed by end-2026, will enable the company to serve local customers in the APAC & MEA region quickly and flexibly, as well as to offer customized solutions.

"This investment reflects our long-term vision for India," said Atul Tripathi, Managing Director of ebm-papst India, "By boosting local production, we are not only catering to the growing demand of our Indian customers but also creating sustainable employment opportunities that contribute to the country's industrial development. Once fully operational, the plant will employ around 700 people." The new plant is an important step towards strengthening the resilience of ebm-papst's supply chains and a further step in the "Local for Local" strategy.

"As a technology leader, we are leveraging our glocalization strategy 'local for local' to serve the APAC & MEA region with tailored solutions," said Dr. Klaus Geissdoerfer, CEO of the ebm-papst Group. Thomas Nuernberger, CSO of the ebm-papst Group and CEO Air Technology APAC & MEA, added: "By localizing production and strengthening supply chains, we are ensuring that we can respond quickly and effectively to the needs of our Indian customers."

In addition to expanding its production capacity, ebm-papst established a new Global Capability Centre (GCC) in Chennai in 2023. Spanning 2,800 m², this state-of-the-art facility will house 300 specialists dedicated to developing digital solutions for both ebm-papst's intelligent fan technologies and global processes, supporting the company's digital transformation in the coming years. ebm-papst has been present in the Indian market since 1996 and has a strong presence with 4 sales offices, 2 manufacturing facilities and multiple warehouses, employing around 375 people.



BLACK WATERS AND LANDIA END BAD ODOURS AT THE PAPER MILL



A new aeration system has rescued a paper mill in El Salvador that was on the brink of \$M fines for causing major odor issues. Changes to environmental regulations had put the company into a crisis situation, despite the fact that they had already installed four 30HP surface aerators in their aeration tank in an attempt to quell the increasingly bad odor problems. With the authorities set to take serious punitive measures, the paper mill called in leading wastewater treatment business, Black Waters to see if they could bring about a solution. "This was a major challenge," said Roberto Escalante, Principal of Black Waters. "Nobody in our industry particularly relishes working with a slanted floor (!) rectangular tank (1,000m³), but I can tell you that the twisted face of the paper mill's CEO was in far more pain than mine! "It was primitive; in a bad way, resulting in the possibility of substantial fines that caught the paper mill completely off guard," he added. "The odors were awful, so we went straight into action with a sludge sampler to see what was going on, in order to establish a proper profile." Across the 75.4' (23m) length tank, which has a shallow end at 6.2' (1.87m) and a deep end of 13' (4m), Roberto found that only five of the one-meter sections were free from sediment. The rest ranged from 0.8" to as much as 18" of sediment, varying from light brown towards the shallow end to thick dark gray at the deep end. "No wonder it stank so much," added Roberto. "At the deep end it was septic, because the surface aerators couldn't mix the tank comprehensively. The slanted tank had become a biological reactor, but with the buildup of sediment, there just wasn't enough oxygen to allow the bugs to do their job properly. They couldn't 'breathe' and so would die. It was nasty."

DIRE SITUATION VERY MUCH NEEDED SOME OXYGEN

He continued: "All well and good having some mixing, but this dire situation very much needed some oxygen. The wastewater from the paper, which in this case was from a process manufacturing tissue paper, is surprisingly abrasive. Surface aerators can make it appear as if there is lots happening, but underneath the surface it can be a totally different story. In a fairly short space of time, foul odors will soon tell you that something is seriously wrong!"

With a potential \$M lawsuit for violations on the horizon, Black Water urgently sought a rapid but long-lasting solution, consulting with contacts in the US and beyond to see what might be available.

"With a slanted tank," added Roberto, "they all said they wouldn't blame me if I walked away. But we are engineers of course, so we'll always want to find an answer, even in this case, where it possibly couldn't be a perfect world solution. They told me I was crazy taking it on, but I already knew that. At least I'll never be as crazy as the person who thought that it was such a good idea to design a slanted-floor rectangular tank for a paper mill's wastewater! Additionally, the tank was divided into two halves by a concrete wall, so we had to cut eight-inch holes across it to try to even out the flow distribution."

SIMULTANEOUSLY MIXING AND AERATING

The recommended solution certainly wasn't the cheapest, but it came in the form of a simple design, combining a proven chopper pump with a venturi nozzle; the Landia AirJet. Simultaneously mixing and aerating, this system effectively keeps wastewater fresh; economically delivering dissolved oxygen to provide complete aeration.

The next challenge for Black Water was how to incorporate what would be six of the new Landia AirJets onto both sides of the tank.

"Landia helped us calculate the best positioning," said Roberto, "and I was really pleased that their vastly experienced Aftermarket Manager, Ken Jacobs came over from the US to help ensure that the installation went smoothly. The Landia AirJets had to be installed with middle guideline poles that had to be embedded in specially built concrete blocks. This allowed the aerators to be then slid to the bottom of the basin. The Landia Chopper Pumps that are part of the AirJet system do a great job, and are proving very reliable. Everything is fine now. Thank goodness those horrible odors are no more!"



CERAFILTEC AND XAI COOPERATE IN SUSTAINABLE WATER MANAGEMENT FOR THE WORLD'S LARGEST AI SUPERCOMPUTER DATA CENTER AND CERAMIC MBR

About CERAFILTEC:

CERAFILTEC, headquartered in Germany, is a global leader in ceramic ultrafiltration membrane technology, transforming water and wastewater treatment worldwide. Our technology enhances water quality, increases plant capacity, and reduces operational costs. Committed to a sustainable future, CERAFILTEC aims for CLEAN WATER. EVERYWHERE.

About xAI:

xAI, headquartered in San Francisco, USA, is pioneering the implementation of artificial intelligence to expedite human scientific discovery. Spearheaded by Elon Musk, xAI focuses on creating AI that accelerates our grasp of the cosmos. Their standout creation, Grok, embodies this by integrating real-time data from X, offering profound insights and promoting universal knowledge.

SAARBRÜCKEN, GERMANY – FEB. 20, 2025

xAI will build the world's largest ceramic membrane bioreactor (MBR) to enable reuse of 49.2 MLD (13.0 MGD) of municipal wastewater for cooling its supercomputing data center in Memphis, Tennessee, USA. CERAFILTEC will deliver its most advanced ceramic membrane technology in a fast-track project set for completion in 2025.

The enormous scale of this MBR project highlights the growing demand for advanced ceramic solutions in mission-critical applications of wastewater treatment such as data center cooling. xAI, an artificial intelligence company founded by Elon Musk, who has stated this will be "the most powerful AI training cluster in the world," selected CERAFILTEC for its technological competence, advanced ceramic membrane solution, and ability to meet an accelerated delivery schedule. CERAFILTEC's technology provides



provides superior reliability and efficiency, overcoming common membrane issues such as fiber breakages and delicate cleaning regimens. In a rapidly expanding data center industry, effective, sustainable water management is essential to maintain high operational performance. CERAFILTEC's solution is designed to meet these stringent requirements. The project underscores xAI's commitment to sustainable water management by utilizing municipal wastewater for cooling, thereby conserving precious drinking water and protecting the Memphis Sands Aquifer for the benefit of local communities. With its capacity to treat more wastewater than xAI requires, the plant will also provide surplus treated water to local industries, thus dramatically reducing the aquifer impact from existing users and setting a precedent for green practices in tech. This not only optimizes water reuse but also marks a milestone in environmental leadership, urging high-tech companies towards sustainable water solutions. CERAFILTEC's technology provides a durable, reusable solution that supports a circular economy, effectively eliminating plastic waste from conventional polymeric membranes and significantly minimizing negative environmental impact. "CERAFILTEC's robust ceramic membrane technology meets our demanding requirements for ultra-reliable and efficient water treatment to support our state-of-the-art supercomputer," said Mark Carroll, xAI's wastewater engineer who is leading the design and construction of the recycling plant. "This partnership enables us to set new benchmarks in both technology and water efficiency, ensuring vital cooling water supply for our high-performance computing systems with no impact on local potable water supplies." "Our DNAs are very aligned, and together we are shaping the future of both AI and water treatment," said Dr. Torsten Wintergerste. Dr. Wintergerste, who recently joined CERAFILTEC as CEO, comes from the Swiss technology company Sulzer, where he served as President of the Chemtech division. CERAFILTEC is a privately owned company, Dr. Juergen Hambrecht, Chairman of CERAFILTEC and former CEO and Chairman of BASF, added: "Our collaboration with xAI showcases the transformative potential of ceramic membranes in water and wastewater treatment, offering unparalleled reliability and efficiency. This project establishes a new industry benchmark and reinforces CERAFILTEC's role as a global leader in innovative water solutions."

BAKSHAYAKALPA ORGANIC'S PEERAN CHERUVU LAKE CLEAN-UP INITIATIVE CLEARS 3,200 KG OF PLASTIC WASTE, RESTORING HYDERABAD'S LAKE

About Akshayakalpa Organic:

Akshayakalpa Organic, founded in 2010, is India's first certified organic dairy enterprise that offers milk and milk products that are free from antibiotics, synthetic additives, and chemical pesticide residue. The organization stands true to its name with its vision of building a healthier world through nutrition, based on clean science, and a sustainable farming ecosystem accessible to the entire nation.

Akshayakalpa has crafted a world-class model that not only creates a new industry benchmark in dairy farming practices but also nurtures farmers in line with its mission to create a holistic ecosystem-led transformation through its Farmer- Entrepreneurship Initiatives.

The nutrition-rich products of Akshayakalpa include Milk, Ghee, Cheese, Butter, Paneer, Curd, Buttermilk, Bread, Honey, Batter, Coconut, and Virgin Coconut oil, and many new products to be launched in the pipeline. Akshayakalpa currently has about 3,00,000 individuals across Bengaluru, Chennai, and Hyderabad and is growing.

HYDERABAD, 14TH APRIL, 2025:

In a time when environmental awareness is paramount, Akshayakalpa Organic has adopted Peeran Cheruvu Lake, a 35-acre body of water close to PBEL City in Hyderabad, marking a major step toward ecological restoration. As part of its sustainability and community engagement efforts, the company recently launched the "Peeran Cheruvu Lake Clean-Up" initiative, a monthly lake-cleaning drive held on the second Sunday of every month. Over the past 5 months this initiative has improved the lake's health and reduced plastic waste.

Peeran Cheruvu Lake, known for its picturesque views, short hiking trails, and support for local fishermen, has faced growing plastic pollution and environmental



degradation. To combat this, Akshayakalpa Organic has mobilized its workforce and collaborated with the local community to take collective action. Since its inception, the clean-up drive has successfully removed approximately 3,200 kilograms of plastic waste, significantly improving the lake's condition. Each clean-up event has witnessed enthusiastic participation, including volunteers from NGOs, the Hyderabad Cyclers Group, the Greater Hyderabad Municipal Corporation (GHMC), and local residents from PBEL City, who have joined hands with Akshayakalpa's staff to restore the lake's natural beauty.

The first clean-up event, held on November 17, 2024, saw an impressive turnout of 42 Akshayakalpa staff members and four PBEL City residents, who collectively removed 800 kilograms of plastic waste from the lake. The momentum continued with subsequent clean-ups on December 1, 2024, and January 18, 2025, where 500 kilograms and 850 kilograms of plastic, respectively, were removed with the help of dedicated volunteers. The third event also saw participation from environmental organizations and government bodies, underscoring the growing community involvement in this noble cause. Efforts continued in February and March 2025, with volunteers removing an additional 400 kilograms and 650 kilograms of plastic waste, ensuring that the lake remains clean and thriving. Speaking on this impactful initiative, Mr. Shashi Kumar, Co-founder and CEO of Akshayakalpa Organic, said, "At Akshayakalpa Organic, sustainability is at the core of everything we do—from organic circular farming to harnessing biogas and solar energy, and using recyclable packaging. While these initiatives ensure that our business operates responsibly, we also believe in extending our commitment beyond our farms and into the communities we serve. The Peeran Cheruvu Lake Clean-Up is a reflection of this ideology—an initiative that goes beyond sustainable food production to actively restoring and preserving natural ecosystems. By bringing together employees, volunteers, and local organizations, we are fostering a culture of collective responsibility and action. We encourage more individuals and businesses to join hands with us in making a tangible difference for our planet."

"The company recognizes that true sustainability is not just about business practices but also about actively giving back to nature. By restoring Peeran Cheruvu Lake, Akshayakalpa Organic aims to set an example of corporate social responsibility that inspires individuals, businesses, and communities to take meaningful action for a greener future. With five successful clean-up drives completed, Akshayakalpa Organic remains committed in its mission to create a healthier, pollution-free environment. The company welcomes more volunteers, environmental groups, and local citizens to be part of this transformative journey. By working together, we can ensure that Peeran Cheruvu Lake continues to be a thriving natural space for generations to come."

UNLOCKING THE POTENTIAL OF WATER REUSE

Mohammed Naser Azeez, Managing Director, Aquality Intelligent Solutions

Nothing is more essential to human existence than water. Beyond being a fundamental necessity, adequate and safe water is essential for a nation's wellbeing, economic prosperity, food security, and ecological health. India, once blessed with plentiful water resources, now confronts an unprecedented drinking water crisis. This situation continues to deteriorate as the gap between supply and demand widens and interstate water disputes regularly make news headlines.

The United Nations consistently emphasizes that "access to safe water is a fundamental human need and, therefore, a basic human right." The Sustainable Development Goal 6 (SDG-6) focuses on ensuring the availability and sustainable management of water and sanitation for all by 2030 across nations.

Our planet's population has surpassed 8.2 billion people. Can Earth produce sufficient water to satisfy the thirst of over eight billion individuals! As our population continues to grow, meeting this challenge appears increasingly difficult, with water scarcity emerging as a primary constraint on future food production. This precious resource faces intense and unsustainable pressure from various sectors, forcing agricultural users to compete with urban supplies and industries for access.

Globally, water demand significantly outweighs supply, and farmers face difficult challenges in meeting their needs. The lack of focused attention from policymakers on sustainable water management including policy formulation, investment prioritization, and infrastructure development poses a serious risk of escalating into a full-blown water crisis. This, in turn, could have far-reaching consequences, including widespread food shortages due to the deep interconnection between water availability and agricultural productivity.

To mitigate these risks, a comprehensive and

forward-thinking strategy is urgently needed. This must include robust governance frameworks, long-term planning, and sustained financial investments aimed at building climate-resilient water infrastructure and water reuse practices at different levels. Equally important is the integration of technology, adoption of best practices, community participation, and inter-agency coordination to ensure water security. Only through such dedicated and strategic approach to sustainable water management, we can safeguard water and food security, ensuring equitable access and resilience for current and future generations.

INDIA'S GROWING WATER CRISIS

India is facing a serious water crisis, even though it has big river systems like the Ganges, Brahmaputra, and Indus. The problem is that while India has 18% of the world's people, it only has 4% of the world's freshwater resources. Water availability per person has dropped sharply; from 5,177 cubic meters in 1951, is projected to decrease to around 1341 cubic

meters in 2025, putting India in the water-stressed category.

Addressing water scarcity requires a strategic, future-ready approach, one that includes strong policies, long-term planning, and steady investment in climate-resilient infrastructure and water reuse systems.

This crisis is uneven; some areas face heavy floods, while others suffer from droughts. In many farming regions, groundwater levels are falling by more than one meter each year. Over 600 million people deal with high to extreme water stress, and cities like Delhi, Chennai, Bengaluru, and Hyderabad regularly face water shortages.

As India's population grows and cities and industries



expand, water demand keeps rising. At the same time, pollution is making many water sources unusable. Climate change is making things worse, bringing unpredictable rains, higher evaporation, and more extreme weather.

Only about 30% of the country's wastewater is treated, which means a lot of reusable water is being wasted. Though the government has started programs like the Jal Shakti Abhiyan, National Water Mission, and Atal Bhujal Yojana, there are still challenges in achieving the desired goals. Without comprehensive action, over 40% of India's population is projected to have no access to clean drinking water by 2030. Solving this water crisis is critical for India's future growth and stability. Against this backdrop, water reuse presents not merely an option but an imperative for India's sustainable development trajectory.

WATER REUSE IN INDIA

While the concept of water reuse is not new to India, its systematic implementation at scale remains limited. It is estimated that urban centres in India generates approximately 72,368 million litres per day (MLD) of municipal wastewater and approximately 83,000 million litres of industrial effluent; but a large quantity of it is disposed in the environment without treatment. This leaves a substantial volume of potentially reusable water untreated and unutilized.

The existing water reuse landscape in India is characterized by fragmented approaches and significant regional variations:

Industrial Reuse

Industries, particularly water-intensive sectors like thermal power plants, textiles, paper, pharmaceuticals and steel have been early adopters of water reuse technologies driven by regulatory requirements and economic considerations. For instance, zero liquid discharge (ZLD) policies are not mandated for all industries in India. It is strongly encouraged and becoming increasingly important, especially for water-intensive sectors.

Municipal Reuse

Several urban centres have initiated municipal wastewater reuse projects. Surat in Gujarat treats approximately 57 MLD of municipal wastewater for industrial use. Nagpur's Orange City Water project supplies 190 MLD of treated wastewater to a nearby



thermal power plant. Chennai Metro Water has established tertiary treatment plants that provide recycled water for industrial purposes. Wastewater reuse is often concentrated in urban areas, with cities like Gurugram, Bengaluru, and Chennai leading the way. In Gujarat, thermal power plants situated within 50 km. of sewage treated plants (STPs) or city limits are mandated to use treated wastewater. In Karnataka, industrial estates within 30 km. of STPs are mandated to prioritise treated water.

While not all states have reuse policies, several have adopted them, including Gujarat, Madhya Pradesh, Punjab, Rajasthan, Jharkhand, and others. Many states are focusing on using treated wastewater for agricultural purposes.

AGRICULTURAL REUSE

While informal reuse of untreated or partially treated wastewater for agriculture is widespread, structured systems for safe agricultural water reuse remain underdeveloped. A notable exception is Karnataka's Vrishabhavathi Valley project, where treated wastewater irrigates approximately 16,000 hectares of agricultural land.

PROMOTING SAFE REUSE OF TREATED WASTEWATER

To encourage states and stakeholders to treat and reuse wastewater, the central government introduced the National Framework on Safe Reuse of Treated Water in November 2022. The goal is to help states set clear targets for wastewater treatment and reuse in both cities and villages.

The National Water Policy (2012) explicitly recognizes recycling and reuse of water as priority strategies. The Atal Mission for Rejuvenation and Urban Transformation (AMRUT) and Smart Cities Mission incorporate components for wastewater recycling infrastructure. The Jal Shakti Ministry's guidelines on water reuse aim to ensure that by 2025, 20% of water used by industries should be recycled water.

The framework suggests creating a technical support cell, drafting local reuse policies (with regular reviews), and planning how treated water will be transported using pipelines, tankers, or aqueducts. It also highlights common challenges in urban and rural areas and offers business model options for different end-uses. The framework recommends using treated wastewater for city services like watering parks, flushing toilets, and fire fighting. For groundwater recharge, it suggests strict quality control, monitoring, and safety standards.

Aquality Intelligent Solutions is significantly contributing to the promotion of water reuse by embedding advanced, eco-friendly treatment technologies into its systems. These solutions are designed for energy efficiency and long-term sustainability, making them ideal for deployment even in the remote and off-grid areas. The company not only supports water reuse and environmental conservation but also empowers communities and industries with reliable access to treated water.

CHALLENGES IN SCALING WATER REUSE IN INDIA

Even though water reuse is important and getting policy support, several challenges are slowing its progress in India. On the technical side, issues like unreliable electricity supply affect how well treatment plants work. It is also hard to deal with changes in wastewater quality and quantity depending on the season. There is not enough water testing labs to regularly test treated water quality.

Economically, the cost of setting up advanced treatment system is high. Freshwater is often cheaper, making recycled water less attractive. Urban local bodies also lack the funds to invest in water reuse, and there are not enough public-private partnerships to share the risks and costs.

Socially and culturally, people often have negative



perceptions about using treated water. There's limited awareness about how safe and useful it can be when properly treated. Cultural beliefs and preferences about water sources, along with low community involvement in water-related decisions, also slow down acceptance.

From a governance perspective, responsibilities are scattered across different departments, and there is not appropriate coordination between water supply, sanitation, and reuse planning. Existing laws are not always enforced, and a lack of data makes it harder to design effective reuse systems. Together, these issues show the need for a more integrated and well-supported approach to scale up water reuse in India.

AQUALITY INTELLIGENT SOLUTIONS: ENABLING WATER REUSE WITH SMART AND SUSTAINABLE

TECHNOLOGIES

Aquality Intelligent Solutions is playing a vital role in advancing water reuse by integrating innovative used water treatment technologies into its solar-powered water filtration systems. These systems are designed to be energy-efficient and sustainable, making them especially suitable for remote and off-grid areas. By using solar energy to power water treatment units, AQUALITY helps communities and institutions treat and reuse wastewater in an eco-friendly way, reducing dependence on freshwater sources.

For industries, AQUALITY offers compact and modular wastewater treatment and reuse systems that can be easily installed even in space-constrained environments. These systems help industries treat their effluents on-site and reuse the treated water for

non-potable purposes like cooling, cleaning, and industrial processing thereby minimizing discharge and promoting circular water use.

Through these efforts, AQUALITY is contributing to a future where water reuse becomes an integral part of India's water management strategy, supporting both environmental sustainability and resource efficiency.

FINAL REFLECTION

As India navigates the complex challenges of water security in the 21st century, water reuse must transition from being viewed as an alternative option to becoming the "new normal" in water resource management. Taking inspiration from countries like

Singapore, which successfully treats and reuses over 40% of its wastewater for both potable and non-potable purposes, India has the opportunity to adopt a similar forward-looking approach.

With the country's rapidly growing urban population, expanding industrial activity, and increasingly climate-vulnerable agriculture, continued dependence on traditional freshwater sources is no longer sustainable. To address this, India must prioritize investments in wastewater treatment infrastructure, promote decentralized and localized reuse systems, and establish strict quality standards to ensure safe reuse.

By integrating treated wastewater into municipal,

industrial, and agricultural supply chains, India can ease pressure on freshwater resources, enhance climate resilience, and create a more circular and sustainable water economy. For this to succeed, strong political will, public awareness campaigns, private sector participation, and clear regulatory frameworks will be essential.

India's water future depends significantly on its ability to close the water loop through effective reuse strategies. By doing so, the country can turn the challenge of water scarcity into an opportunity for innovation, sustainability, and resilience. As India works toward becoming a developed nation by 2047, integrated water reuse must feature as a cornerstone of its sustainable development pathway.

ABOUT THE AUTHOR



He established Aquality Intelligent Solutions with a clear vision to deliver cutting-edge water treatment and air purification solutions tailored to domestic, institutional, and industrial needs. Motivated by a deep commitment to improving access to clean drinking water and purified air, he has played a pivotal role in transforming lives. Through relentless dedication, innovative technology, and an unyielding focus on quality, he has consistently driven the company's mission to promote healthier, more sustainable living environments.

Mohammed Naser Azeez, Managing Director, Aquality Intelligent Solutions

To share your feedback or enquire about the author, write to us at editor@eawater.com



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BEHIND THE TAP: UNVEILING THE WATER FILTRATION TECHNOLOGY

Dilip Yewalekar, Senior Vice President, Jain Irrigation Systems Ltd.
Manisha Kinge, Manager, (M.Tech-Agri Engg), Jain Irrigation Systems Ltd.

Every morning begins with a ritual—brewing a cup of tea or coffee. Without much thought, we filter out coarse particles using a sieve before we take that first satisfying sip.



This humble act is a reflection of a deeper principle: filtration, an everyday guardian of health that extends far beyond the kitchen.

While Municipal Corporations and Water Supply Agencies diligently employ various purification methods in their treatment plants, the journey of water from the source to our taps is fraught with potential for recontamination. Aging infrastructure, leaks in distribution networks, and even local ized environmental factors can compromise the water's quality by the time it reaches our communities. This inherent vulnerability has fueled the burgeoning

demand for point-of-use (POU) water purification systems, including Reverse Osmosis (RO) units and other filtration technologies, empowering individuals to take control of their drinking water safety. The aggressive marketing campaigns across various media platforms are a testament to this growing awareness and concern.

At its core, water filtration is a sophisticated process designed to meticulously remove unwanted impurities and contaminants from raw water, transforming it into a potable and palatable resource. This isn't a singular method but rather a spectrum of techniques, each operating on distinct principles and targeting specific types of contaminants. From the initial coarse filtration that sieves out larger debris to the advanced membrane filtration capable of removing microscopic pathogens and dissolved substances, the theory behind these systems is a fascinating interplay of the physical and chemical properties of water, coupled with the size, composition, and even the electrical charge of the particles we seek to eliminate.

THE INDISPENSABLE ROLE OF FILTRATION IN THE WATER SUPPLY ECOSYSTEM

The importance of filtration within the broader water supply system cannot be overstated. Raw water sources – whether rivers, lakes, or groundwater aquifers – are rarely pristine. They are susceptible to a cocktail of contaminants, categorized broadly as physical, chemical, and biological. As highlighted in your Table 1, these impurities range from visible silt and suspended solids to invisible dissolved chemicals, disease-causing pathogens, and even radioactive elements.

Consuming untreated raw water poses significant health risks, potentially leading to a spectrum of waterborne diseases. Filtration acts as a crucial

barrier, a vital stage in the multi-step process of drinking water purification. It is the essential step that bridges the gap between a potentially hazardous raw water source and the safe, clean drinking water we rely on daily. Expanding on the Contaminants (Table 1):

Table 1. Impurities in raw water

Physical impurities	Silt, Clay, Sand, Stones, Suspended particles. Solids, Inorganic matter
Chemical impurities	TDS, Silicates, Chlorides, Calcium, Fluorides, Magnesium, Phosphates, Bicarbonate, Sulfates, Nitrates, and Ferrous compounds
Biological impurities	Pathogens, Bacteria, Protozoa, Viruses, and parasites, Organic matter. Algae, Threaded particles.
Gas	Oxygen, Nitrogen, Carbon-dioxide, Hydrogen-sulfide etc.
Toxic	Arsenic, Cyanides.
Radioactive	Radiation from radioactive elements, mining areas, nuclear reactors.
Other	pH, EC, Foul Smell, Bad Taste, Color-Turbid Appearance.

Let's delve deeper into the categories of impurities:

Physical Impurities:

These are typically larger, insoluble particles that can affect the water's turbidity (cloudiness), taste, and odor. They can also provide a breeding ground for microorganisms and interfere with the effectiveness of other treatment processes. Think of the sediment stirred up after a heavy rain or the fine clay particles

suspended in river water.

Chemical Impurities

This is a vast category encompassing both inorganic and organic substances dissolved in water. Inorganic contaminants like heavy metals (lead, mercury, and arsenic), nitrates, and fluorides can have serious long-term health effects, even at low concentrations. Organic contaminants, such as pesticides, herbicides, and industrial solvents, can also pose significant risks. Total Dissolved Solids (TDS) is a measure of the total concentration of dissolved inorganic and organic substances in water; while some minerals are beneficial, high TDS can affect taste and indicate the presence of harmful substances.

Biological Impurities

These are the disease-causing microorganisms that make untreated water a major public health concern globally. Bacteria (like E. coli and Salmonella), viruses (such as norovirus and hepatitis A), protozoa (like Giardia and Cryptosporidium), and parasites can cause a range of gastrointestinal illnesses and other more severe conditions. The presence of organic matter and algae can further exacerbate these issues by providing nutrients for microbial growth.

Gases

Dissolved gases can affect the taste and odor of water. While oxygen is essential for aquatic life, excessive levels of hydrogen sulfide can produce a foul "rotten egg" smell, and high concentrations of carbon dioxide can lower the pH, making the water more corrosive.

Toxic Substances

This category includes naturally occurring toxins like arsenic and cyanides, as well as synthetic chemicals that can leach into water sources from industrial activities or improper waste disposal. These substances are often harmful even in trace amounts.

Radioactive Contaminants

These can originate from natural geological formations, mining activities, or nuclear facilities. Exposure to radioactive elements in drinking water increases the risk of cancer and other health problems.

Other Factors

Parameters like pH (acidity or alkalinity), electrical conductivity (EC – indicating the presence of dissolved ions), foul smells, bad tastes, and color are aesthetic indicators of water quality and can signal the presence of other underlying contaminants. Turbidity, the cloudiness of water, is another crucial indicator, often associated with the presence of suspended particles.

A SPECTRUM OF FILTRATION SYSTEMS

The filtration system is one of the stages used in water purification plants for drinking purposes.

It is classified under four categories (Figure 1).

1. Sand Separator
2. Sand filtration
3. Screen filter
4. Porous filter



Figure: 1. Spectrum of filtration system

Classification of filtration systems provides a logical progression from coarse to fine particle removal. Let's elaborate on each category:

1. Sand Separator (Settling Basins/ Sedimentation Tanks)

While you describe the vortex action, it's important to note that these are often large basins where gravity plays the primary role. Water is held for a period, allowing heavier suspended solids like sand, grit, and larger organic matter to settle out at the bottom due to their weight. This is a crucial pre-treatment step, protecting subsequent filtration stages from excessive clogging and improving their efficiency. Consider including a photograph of a sedimentation tank in a water treatment plant.

2. Sand Filtration (Rapid and Slow Sand Filters)

Angular Silica Sand of size 1 to 2 mm are used as a base media to remove the physical particles like sand, silt, clay, sand, suspended particles, algae, organic/inorganic matter, solids and other visible contaminants from raw water.

Slow sand filters are particularly effective for treating water with low turbidity and are often used in smaller communities due to their simplicity and low energy consumption. A comparative table highlighting the differences between rapid and slow sand filters could be valuable.

3. Screen/Mesh Filter

These are indeed effective for removing larger suspended particles and are often used as a secondary filtration stage after sand filters to capture any remaining coarser material and protect downstream equipment like pumps and UV disinfection units. The pore size of the mesh determines the level of filtration. These filters are relatively simple to clean, often through backwashing. Stainless steel screen of size 100-150 microns are used in screen/mesh filter and body made from MS sheet and coated with epoxy powder coating for last longevity.





4. Ultrafiltration/Nano filtration

Ultrafiltration (UF) typically has pore sizes ranging from 0.01 to 0.1 microns and is effective in removing bacteria, protozoa, viruses, and larger macromolecules. Nano filtration (NF) has even smaller pores (around 0.001 to 0.01 microns) and can remove divalent ions (like calcium and magnesium, thus softening water), heavy metals, and some organic compounds.

5. Porous Filter (Reverse Osmosis - RO)

The semipermeable membrane with extremely small pores (typically less than 0.0001 microns) effectively rejects almost all dissolved solids, including salts, minerals, and organic molecules. The principle of osmosis, where water naturally moves across a semipermeable membrane from a region of lower solute concentration to higher concentration, is reversed by applying pressure. This forces water from the high solute concentration side (the raw water) to the low solute concentration side (the purified water). RO is crucial for desalination and producing high-purity water for industrial and pharmaceutical applications.

Table 2. Flow regime in Filtration system and uses.

FILTER MEDIA	IMAGE	TYPE OF FLOW	RANGE	PURPOSE
Coarse / Sand		Three/Multi-dimensional	100-300 Micron	To separate algae / suspended particles, silt, clay
Screen		Two dimensional	100-200 Micron	Fine particles
Membrane Ultrafiltration Nano filtration		Two dimensional	50-100 Micron	Suspended, fine particles
Porous		Three/Multi-dimensional	10-50 Micron	Fine suspended particles, pathogens, minerals

DESIGN CRITERIA FOR A ROBUST FILTRATION SYSTEM

Designing an effective water filtration system is a multifaceted engineering challenge that requires meticulous attention to detail.

Water Source Characteristics

Understanding the source is paramount. Is it surface water (river, lake), groundwater (well, aquifer), or seawater? Each source has its unique set of potential contaminants and seasonal variations in water quality and availability. The assured availability throughout the year is also critical for planning.

Climatic Data

Temperature affects water viscosity and microbial activity. Rainfall patterns influence surface runoff and potential contamination. Solar radiation can impact disinfection processes and algae growth. Evaporation rates are important for water storage considerations.

Comprehensive Water Test Report

A thorough analysis of the raw water is non-

negotiable. This includes detailed physical (turbidity, color, odor), chemical (pH, TDS, hardness, specific ions, organic compounds), and biological (total coliforms, E. coli, specific pathogens) parameters. The frequency of testing is also important to account for variations.

Accurate Water Demand Assessment

Projecting current and future water needs is crucial for sizing the filtration system appropriately. This includes domestic, commercial, industrial, and agricultural demands. Peak flow rates also need to be considered.

Reliable Power Source

The chosen power source must be dependable for the continuous operation of pumps and other equipment. Considering backup power options (like diesel generators or solar-hybrid systems) is essential for uninterrupted water supply during power outages.

Site Topography and Geology

Ground elevation influences pumping requirements. Soil strata affect foundation design and potential for groundwater contamination. Localized conditions like seismic activity might also need consideration.

Hydraulics

Pressure and Flow Rates: The efficiency of filtration is directly linked to the pressure applied and the flow rate of water through the filter media. Optimal pressure ensures effective contaminant removal without damaging the filters. Flow rates must be carefully controlled to achieve the desired contact time and filtration efficiency. It is described by Darcy's law.

Darcy's Law describes the flow of a fluid through a porous medium.

$$Q = -K \frac{dl}{dh}$$

Furthermore, hydraulic conductivity K can be related to the intrinsic permeability k of the porous medium and the fluid properties:

$$K = \mu^*k^*\rho^*g$$

Where:

- k is intrinsic permeability (a property of the porous medium only, e.g., in m2).
- p is the fluid density (e.g., in kg/m3).
- g is the acceleration due to gravity (approximately 9.81m/s2).
- μ is the dynamic viscosity of the fluid (e.g., in Pa-s).

Chemical Adsorption Mechanisms

Other adsorption media like ion exchange resins are also crucial for removing specific dissolved ions (e.g., for water softening or removing heavy metals). The selection of the adsorbent depends on the target contaminants.

The Importance of Selective Filtration

Different filter media and technologies exhibit varying degrees of selectivity. For instance, RO membranes are highly selective in rejecting most solutes, while activated carbon is selective for certain organic compounds. Understanding this selectivity is the key to designing a multi-stage filtration system that effectively targets all identified contaminants.

Robust Safety Measures

Implementing stringent safety protocols is paramount to protect operators and maintenance personnel from potential hazards associated with chemical handling, high-pressure systems, and electrical equipment. Regular training and readily available safety equipment are essential.

Quantifiable Contaminant Removal Efficiency

Simply stating that a filter removes "impurities" is insufficient. Design specifications must include quantifiable removal efficiencies for each target contaminant (e.g., 99.99% removal of bacteria, 95% reduction in lead concentration).

Strategic Pre-treatment and Post-treatment

Pre-treatment processes like coagulation, flocculation, and sedimentation can significantly reduce the load on downstream filters, improving their efficiency and lifespan. Post-treatment processes like disinfection (chlorination, UV irradiation, and zonation) are essential to kill any remaining pathogens and ensure the microbiological safety of the treated water.

Economic Considerations

Operating and Maintenance Costs: A comprehensive economic analysis must consider not only the initial capital investment but also the ongoing operational costs (energy consumption, chemical costs, labor) and maintenance costs (filter replacement, equipment repairs).

Optimizing Space and Footprint

In urban environments, space can be a significant constraint. Selecting compact and efficient filtration technologies and considering vertical or modular designs can help minimize the system's footprint.

Space and Footprint

Consider the available space for the filtration system and select equipment and configurations that fit within the available footprint. Vertical or Horizontal configurations may be options.

Navigating Regulatory Compliance

Adherence to local, state, and national water quality standards and regulations (like the Safe Drinking Water Act in the US or equivalent standards in India) is non-negotiable. This includes regular monitoring and reporting requirements. Ensure that the filtration system complies with local, state, and federal regulations and standards governing water quality and treatment. Compliance with guidelines such as the Safe Drinking Water act-SDWA is essential. Filtration system design must account for lifecycle costs and ensure compliance with water quality norms such as:

- BIS 10500: Indian standard for drinking water
- WHO Drinking Water Quality Guidelines
- SDWA (USA)

AI/IoT Based Monitoring and Control System

Modern water treatment plants rely on sophisticated sensors and automated (AI/IoT based) control systems to continuously monitor water quality parameters (pH, turbidity, chlorine residual, flow rate), optimize filter backwashing cycles, and adjust chemical dosing as needed. This ensures consistent and efficient operation.

Long-Term Perspective

Lifecycle Cost and Longevity: Evaluating the lifecycle cost, including the expected lifespan of equipment and filter media, helps in making informed decisions about technology selection and long-term sustainability.

Adapting to Local Conditions and Climate

Extreme temperatures can affect the performance of certain filtration membranes. High humidity can impact electrical equipment. Weather patterns can influence raw water quality. The design must account for these local environmental factors.

Aesthetics and Public Perception

In publicly visible installations, the aesthetic design of the filtration system can impact public perception and acceptance. Integrating the infrastructure seamlessly into the urban landscape is increasingly important.

CONCLUSION

Water filtration may appear simple—just as we strain tea leaves from a cup—but the science behind it is profound. Whether it's safeguarding urban households or purifying brackish water in remote villages, filtration is a frontline defence against a host of waterborne threats.

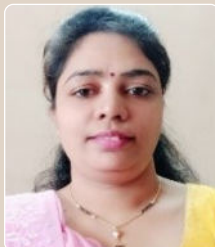
By understanding the theory and engineering behind filtration, we can make informed choices as consumers, planners, or engineers—ensuring that every sip of water is safe, reliable, and sustainable. **Drink safe water for Healthier Tomorrow.**

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- Reviewer –ICID Conference, Beijing, China 2023
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 - Strategic Leader in Micro Irrigation – ABSA Award.
 - Professional Excellence Individual Award – Aqua foundations
 - Great Manager 250 Award, Economics Times, honored by Hon Kumar Mangalam, Birla Group.
- Best Innovative Article in Sabujeema International Magazine
- Overall all experience of 36+ years in Water Management – Irrigation, Agriculture, Civil Engineering, Planning, Designing, Execution, Management & marketing in India and Abroad.
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- 35+ papers/publications at national/international conferences / magazines / books.

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MAYNILAD WATER SERVICES TREATS WASTEWATER INTO CLEAN, POTABLE WATER FOR MORE THAN A QUARTER OF A MILLION RESIDENTS

Neda Simeonova, Senior Product Marketing Manager, at Bentley

TURNING WASTEWATER INTO CLEAN WATER FOR 270,000 PEOPLE

Due to the impacts of climate change, communities in Parañaque City in the Philippines did not have consistent access to clean water. The region needed far more than a stop-gap solution; the water system required a complete overhaul, supported by technology that could withstand the growing challenges that the region will face in the years and

decades to come.

Therefore, Maynilad Water Services sought to design and engineer a new water distribution system in Parañaque City that would take wastewater and treat it so that it could be used as potable water for the community. The USD 2.21 million project used first-of-its-kind technology in Asia and required the installation of new 300-millimeter PVC pipelines to create a distribution network that serves a population

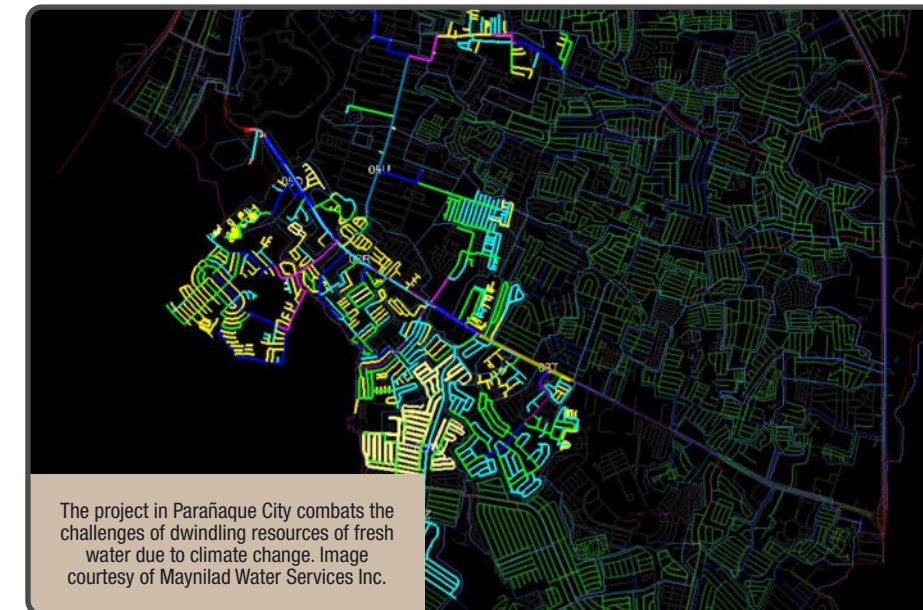
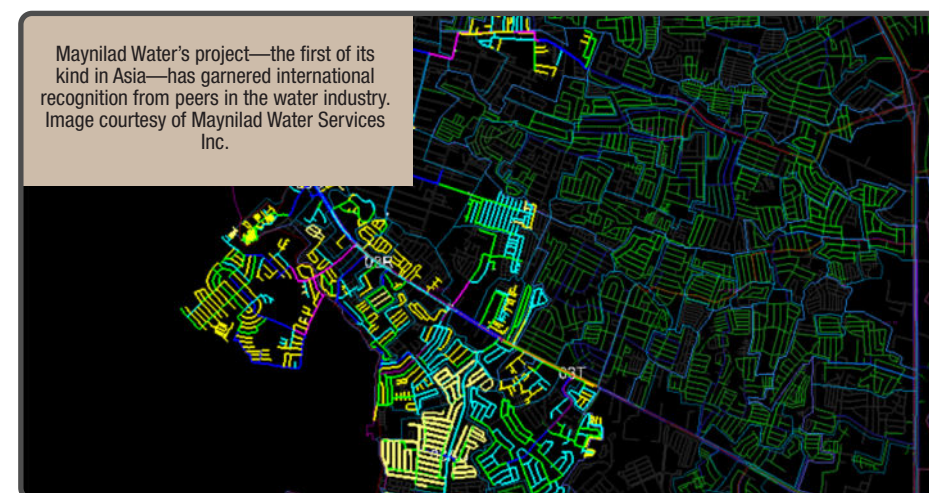
of approximately 270,000 people. The system would be expected to supply 10 million liters of water per day, ensuring a reliable and sustainable water source for the community. Maynilad Water knew the stakes were high on this project, but if they succeeded, they would have a replicable model for greater water resilience across the country.

MEETING THE URGENCY OF THE MOMENT

The project faced and overcame several significant obstacles throughout its development and implementation. The biggest challenge, however, was the tight schedule. The community faced a dire water shortage and could not afford to wait. As such, the project needed to be designed and executed in a short timeline. When projects need to be completed as quickly as this, stakeholders face additional pressure to efficiently collaborate, as any errors can lead to significant delays.

Site constraints also posed difficulties, particularly in integrating the new pipeline with the existing water network and ensuring it could handle the additional supply demands. The team needed to account for pressure requirements and varying site conditions, necessitating precise planning and adjustments during construction.

DELIVERING EXPERTISE THROUGHOUT THE PROJECT LIFECYCLE



Maynilad Water selected Bentley for its extensive experience and technological capabilities to ensure the completion of this project. Specifically, the team employed OpenFlows Water to keep up with the water distribution network's evolving requirements. By precisely measuring and modeling the size of tanks, pipes, and pumps, OpenFlows Water provided multiple scenarios using alternative data sets, resulting in more robust system analyses and design. Also, engineers collected data from the field to calibrate the network model in OpenFlows Water,

which, in turn, provided projected changes in pressure and supply conditions after the project had been finished.

By replicating the network in its current conditions, and adding scenarios based on the new source of water supply from the water reuse plant, Maynilad Water was assured that new network can meet the service requirements for customers. Bentley was able to comprehensively support the project throughout its lifecycle—from design to construction to its ongoing operation.



DELIVERING CLEAN WATER AND ECONOMIC BENEFITS TO THE COMMUNITY

Using OpenFlows Water, Maynilad Water created a distribution network that provides 10 million liters of potable water per day to Parañaque City's 270,000 residents. The project also delivered financial benefits, expected to generate an annual revenue of USD 2.21 million. This ensures the recovery of the project cost within its first year of operation, marking it as a financially viable and impactful endeavor.

Maynilad Water completed this project ahead of schedule. The network design, supported by OpenFlows Water, allowed for rapid deployment, with the project moving from initial brainstorming to operational status within just a few months. This efficiency demonstrates OpenFlows Water's capability to streamline planning and execution processes. Moreover, the use of a digital twin enabled improved collaboration across the project team. It provided a dynamic and flexible platform to test scenarios, adjust designs, and ensure that the network could meet the required pressure and supply conditions.

In an impressively short time span, Bentley's digital twin technology enabled Maynilad Water to deliver critical services to a large community in need. Inspired by the project's success, Maynilad Water is conducting education drives to boost awareness and public acceptance of this technology to improve water systems throughout the country.

PROJECT SUMMARY

Organization: Maynilad Water Services Inc.
Solution: Water and Wastewater
Location: Parañaque, Philippines

PROJECT OBJECTIVES

- To develop a potable reuse water treatment plant for a community of 270,000.
- To design and build the project within a year.

Project Playbook: OpenFlows

FAST FACTS:

- Maynilad Water's project—the first of its kind in Asia—has garnered international recognition from peers in the water industry.
- The project in Parañaque City combats the challenges of dwindling resources of fresh water due to climate change.
- The team used OpenFlows applications to design a distribution network that meets service requirements for customers.

ROI:

Using OpenFlows Water, Maynilad Water created a distribution network that provides 10 million liters of potable water per day to Parañaque City's 270,000 residents.

QUOTE:

"With ever-shifting requirements and site conditions, having a digital twin of the network and the proposed pipeline made it easy to create scenarios and explore possible solutions." — Glenn Matthew G. Manalese, Water Network Officer, Maynilad Water Services Inc

ABOUT THE AUTHOR



Neda Simeonova is a senior product marketing manager, Water Infrastructure, at Bentley Systems. She has been involved in the water, wastewater, and stormwater infrastructure industry for 20 years, including as the former editorial director of Water & Wastes Digest, Storm Water Solutions, and Water Quality Products magazines where she focused on industry trends, technology advancements, and water policies.

Neda Simeonova, senior product marketing manager, water, at Bentley

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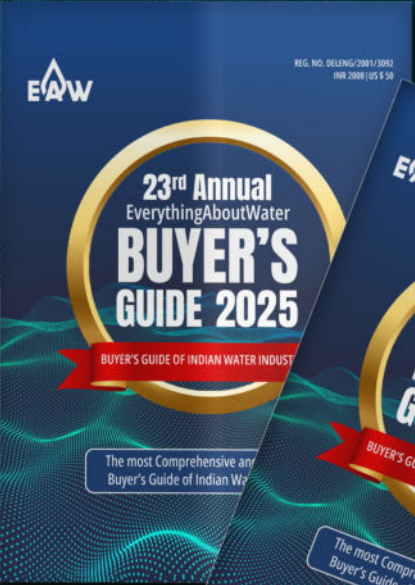
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COGENERATION PLANTS: DETERRING STRAINER CORROSION WITH FRP STRAINERS CONSTRUCTED OF FIBER-REINFORCED PLASTIC (FRP) ARE DESIGNED TO RESIST CORROSION AT A FRACTION OF THE COST OF SPECIAL STAINLESS STEELS

Robert Presser, President of Acme Engineering Prod., Inc.

Cogeneration plants, also known as Combined Heat and Power (CHP), are used globally with a significant presence in Europe, North America, and Asia. In Europe, countries like Germany produce a substantial share of electricity through cogeneration, representing approximately 31% of total CHP electricity production in the EU. Asia and South America are experiencing rapid growth in the cogeneration market, indicating a global trend towards adopting CHP systems.

Cogeneration plants require cooling systems to dissipate excess heat, and seawater cooling is a method employed, especially in coastal regions. This approach involves drawing seawater into the plant, circulating it to absorb heat, and then discharging the warmed water back into the sea. Seawater provides a plentiful and accessible cooling medium for coastal facilities. In the system design, industrial strainers are

essential for screening out debris and large particulates from seawater to protect crucial downstream equipment and processes. The strainers are used not only in the treatment of seawater but also to remove debris from cooling tower or process water.

However, the saline nature of seawater can lead to corrosion of plant equipment like strainers, necessitating the use of corrosion-resistant materials and increasing maintenance costs. Implementing seawater cooling requires careful design to mitigate environmental impacts, such as incorporating cooling towers or heat exchangers to reduce discharge temperatures. Additionally, material selection is crucial to prevent corrosion, often involving the use of specialized alloys, protective coatings, and increasingly Fiber-Reinforced Plastic (FRP).

A much more cost-effective option now in use is

Fiber-Reinforced Plastic strainers specifically designed to resist corrosive environments at a fraction of the cost of duplex or super duplex stainless steels. FRP is a composite material made up of polymer supported with fibers for added strength and is already widely utilized for applications such as power plant piping used to carry seawater for once-through process cooling.

OEMs are now utilizing FRP in cogeneration plant applications where superior corrosion resistance is required at lower cost. For example, some manufacturers offer the option of using corrosion-resistant FRP for external strainer construction, including the pressure vessel itself, while the internal mechanism continues to be made from super duplex or similar steels.

Due to FRP's strength, the material can also be used to

build to ASME BPVC Section X standards, which establish requirements for the fabrication of fiber-reinforced plastic pressure vessels. FRP has already been successfully applied to pressure vessel applications up to 300 PSI. Cogeneration plants can save approximately half the cost or more when the strainer's intake vessels and piping are built with FRP, and only the internals are constructed with super duplex.

To meet industrial requirements, various manufacturers' FRP divisions design and produce several types of FRP strainers including simplex, duplex, automatic scraper, and backflush filters. To help ensure compliance with specifications, they also provide detailed engineering services such as 3-D modeling of FRP piping, piping flexibility and general

stress analysis, and piping layout/isometrics. Complete skids with piping, valves, and instrumentation along with PLC control can also be supplied.

An automatic, self-cleaning scraper strainer is often implemented in FRP construction when cost-effective corrosion resistance is necessary and minimal oversight is desired. One such motorized unit is designed to continually remove both very large and very small, suspended solids from seawater, wastewater, and process streams.

Cleaning is accomplished by a spring-loaded blade and brush system, managed by a fully automatic control system. Four scraper brushes rotate at 8 RPM, resulting in a cleaning rate of 32 strokes per minute.

The scraper brushes get into wedge-wire slots and dislodge resistant particulates and solids. This approach enables the scraper strainers to resist clogging and fouling when faced with large solids and high solids concentration. It ensures a complete cleaning and is very effective against organic matter "biofouling."

Although cogeneration plants have long employed industrial strainers constructed of special stainless steels to resist corrosion, utilizing FRP can be just as effective at a much lower cost. When used with advanced, self-cleaning scraper strainers, downstream equipment and processes can be effectively protected for the long term without premature component replacement or excessive oversight.

ABOUT THE AUTHOR



Robert Presser is the third generation of family management of privately-owned Acme Engineering Products Ltd. Acme is a North American manufacturer of industrial self-cleaning strainers. The company is an ISO 9001:2015 certified manufacturer of environmental controls and systems with integrated mechanical, electrical and electronic capabilities. Acme has been manufacturing electric hot water and steam boilers since the 1960s and high voltage electrode boilers since the 1980s.

Robert Presser, President of Acme Engineering Prod., Inc.

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A PARADIGM SHIFT IN RESERVOIR MANAGEMENT

Jeff Elliott, Torrance, Calif.-Based Technical Writer.

It has been more than 25 years – a quarter of a century – since the U.S. Environmental Protection Agency (EPA) and the National Oceanic and Atmospheric Administration (NOAA) were tasked with managing the escalating risks posed by eutrophication.

This persistent issue causes hypoxia, devastates aquatic ecosystems, and triggers toxic cyanobacterial blooms. Despite decades of effort and significant investment, the problem worsens each year with no meaningful progress in prevention or reversal.

In response, industry professionals are adopting professional risk management strategies for reservoirs that prioritize safety, sustainability, and efficiency. Aligned with established risk management practices, this approach applies structured methods for identifying, analyzing, and mitigating risks. The reservoir risk scorecard improves transparency and decision-making, supporting long-term water resource sustainability.

THE INDUSTRY'S WAKE UP CALL

In 2020, alarmed by the fact that the prevalence and intensity of hypoxia and HABs continue to grow, Congress and the Senate commissioned the Government Accountability Office (GAO) (for a second time) to investigate this failure. The resulting 2022 GAO report, titled, Water Quality: Agencies Should Take More Actions to Manage Risks from Harmful Algal Blooms and Hypoxia, delivered a stark assessment of existing policies and practices and the threats posed to national water security.

The GAO report highlights a key flaw: federal efforts focus on reacting to HAB outbreaks rather than addressing the systemic causes of eutrophication and hypoxia. This reactive approach, necessary for short-term crisis responses, has failed to address the systemic drivers of eutrophication and hypoxia.

The report made two key recommendations:

firstly, develop monitoring protocols to assess conditions, forecast risks, and prioritize actions, and secondly shift from reactive HAB control to proactive interventions targeting the root causes of eutrophication and hypoxia.

These findings are significant. While eutrophication and HABs affect residential lakes and the lake lifestyle, the impact on drinking water reservoirs is critical. These reservoirs are essential for public health and national water security, yet they face growing threats from ecological degradation and management inefficiency.

“To meet these challenges, a fundamental shift in reservoir management is required that is rooted in the principles of professional risk management and aligned with the GAO’s recommendations,” says Dave Grote, VP of Engineering & Operations at Clean-Flo International, a leading US-based OEM of biological solutions for managing water quality in environments such as lakes, reservoirs, rivers, and wastewater treatment facilities.

This framework integrates risk identification, analysis, evaluation, and response strategies tailored to the unique challenges of water resource management professionals.

RISK IDENTIFICATION

Effective risk management begins with identifying the key drivers and threats to reservoir integrity. These risks stem from a complex mix of environmental, human, and historical factors that fuel eutrophication, hypoxia, and HABs.

Climate Change and Extreme Weather

Climate change intensifies reservoir stress with greater volatility and extreme weather events. Droughts lower water levels, concentrating nutrients and expanding hypoxia. Wildfires add nutrient-rich

ash, while stormwater and floods deposit excess sediments and nutrients. Heat waves warm surface waters, promoting stratification, hypoxia, and cyanobacteria dominance.

Increased weather volatility destabilizes reservoir ecosystems, pushing them toward tipping points. Cyanobacteria thrive in these conditions, while beneficial organisms require stability, accelerating degradation and highlighting the need for resilience-building solutions.

“We are seeing covert signs of eutrophication in many reservoirs, where stratification and benthic hypoxia are locked in for most of the year. In several cases, spring and winter turnover is not fully mixing the water column, leaving a permanent hypoxic layer at the bottom. This sets the stage for cyanobacteria HABs and contributes to blooms occurring earlier in the year, sometimes even during winter, and lasting into late fall. Effective risk management starts with preventing hypoxia all year round,” says Grote.

Accumulated Historic Nutrient Inputs In Sediments

Many reservoirs face decades of nutrient loading. Organic sediment stores phosphorus and nitrogen, acting as a high risk “time bomb.” Under stratification and oxygen depletion, these nutrients are released, fueling cyanobacteria and triggering HABs. This internal recycling becomes a self-sustaining driver of eutrophication and HABs.

Urban Development

Urbanization increases nutrient runoff into reservoirs as impervious surfaces accelerate stormwater flow, carrying pollutants. Wastewater discharges further add nitrogen and phosphorus, exacerbating eutrophication.

Misguided Historic Management Practices

Ironically, algaecides and herbicides worsen

eutrophication. While they kill off blooms, decomposing algae deplete oxygen and release nutrients into sediment, intensifying long-term hypoxia. Similarly, precipitants deposit phosphorus into sediment, causing nutrient buildup and recycling. These short-term fixes worsen long-term reservoir degradation.

Harmful Algal Blooms (HABs) and Public Health Risks

Harmful Algal Blooms (HABs) threaten public health and drinking water because cyanobacteria release toxins causing gastrointestinal, liver, and neurological issues, while aerosolized cyanotoxins pose risks to nearby residents.

Litigation Risks

Growing awareness of HAB risks increases litigation risks for negligent reservoir management, including cases linked to cyanotoxin exposure. Economic damage, higher treatment costs, disrupted water supplies, and falling property values may lead to lawsuits or penalties. Utilities that fail to act risk reputational damage and loss of public trust.

RISK ANALYSIS

The GAO’s findings underscore that existing approaches to managing eutrophication, hypoxia, and harmful algal blooms (HABs) are reactive and inadequate, leaving reservoirs vulnerable to escalating threats. A closer examination of these practices reveals fundamental flaws in currently mandated monitoring, control, and mitigation strategies.

Monitoring

Monitoring is essential but often reactive, identifying cyanotoxins after HABs occur rather than preventing root causes like eutrophication and hypoxia. Effective management requires tracking oxygen, nutrient recycling, and phytoplankton. With this data predictive tools can give insight on HAB risk and inform preventive strategies.

Controlling

Algaecides fail to address HAB root causes and often worsen them. Killing cyanobacteria releases toxins, depletes oxygen, and recycles sediment nutrients, fueling eutrophication and future blooms. They also eliminate beneficial algae, giving cyanobacteria a competitive edge.

Mitigation

Reactive measures like warnings and closures protect

public health but highlight risk management failures. Events like Toledo’s 2014 “do not drink” advisory that lasted five days disrupt economies, raise treatment costs, erode trust, and increase legal and reputational risks.

Risk Evaluation

Reservoir risks are dynamic and cumulative, driven by decades of management mistakes, legacy nutrient stockpiles, and climate change. Expanding hypoxic zones and nutrient buildup increases the likelihood of tipping points being reached and HABs occurring. Degraded water quality limits recreation, harms local economies, and disrupts drinking water treatment, often requiring costly upgrades.

Proactive management is essential, not optional. For objective risk evaluation and management, new metrics are needed to assess, track and compare reservoir risks. In response to the GAO’s call for root-cause-focused methodologies, the Reservoir Risk Assessment and Tracking System (RRATS) was developed.

RRATS monitors key indicators like dissolved oxygen, cyanobacterial populations, and sediment nutrient stockpiles, providing a data-driven basis for risk assessment and prioritizing preventive interventions and measuring their impact. The Reservoir Risk Index (RRI) uses RRATS data to generate an objective risk score, offering actionable insights by identifying high-risk reservoirs, forecasting future trends, prioritizing resource allocation, and providing a transparent framework for stakeholder communication.

PROACTIVE RISK MANAGEMENT

The assessment of risks and potential responses highlights the definitive conclusion reached by the GAO: the most effective path forward lies in proactive prevention. RRATS and RRI support prevention-focused strategies by assessing and monitoring efforts to reduce hypoxia and HAB risks. Key strategies include increasing oxygen levels, managing nutrients, controlling sediment, and improving biological conditions.

Oxygenation

Oxygenation is key to eliminating hypoxia and preventing HABs. While various aeration systems exist, costly deployment failures have occurred, but RADOR is the only proven scalable solution for large, deep-water bodies.

Unlike aeration, RADOR maintains uniform oxygen levels throughout the water column, preventing

oxygen-depleted layers and suppressing nutrient release from sediments.

Bio-Dredging

Bio-dredging is a natural, cost-effective method to reduce nutrient-rich sediments driving eutrophication. Using biological processes and enzymes, it breaks down organic sediments without the disruption, haulage, and high costs of mechanical dredging.

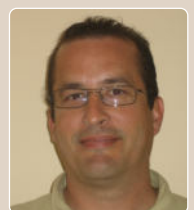
Biological Augmentation

Biological augmentation introduces micronutrients to boost competition to cyanobacteria to prevent HAB formation and restore the foundation layers of the food web to restore natural nutrient clearance pathways. A multi-level risk management program improves raw water quality, reduces chemical treatment costs, and simplifies regulatory compliance by minimizing disinfection by-products (DBPs).

THE PATH FORWARD

The risk landscape for reservoirs is increasingly complex, shaped by factors beyond management control such as volatility of weather patterns and the legacy of inadvertent historical mismanagement. The GAO report has emphasized a crucial need for a paradigm shift from reactive, symptom-focused strategies to proactive, preventative approaches that target root causes. RRATS and RRI represent the first practical steps toward implementing the GAO’s recommendations. By providing a structured, data-driven framework to assess risks, prioritize interventions, and measure outcomes, they enable a proactive shift toward root-cause management and long-term reservoir health.

ABOUT THE AUTHOR



**Jeff Elliott, Torrance
Calif.-Based Technical Writer.**

Jeff Elliott is a Torrance, Calif.-based technical writer. He has researched and written about industrial technologies and issues for the past 20 years.

SELF- SUFFICIENT COMMUNITY RUN WATER SUPPLY SCHEME AT THE FOOTHILLS OF HIMALAYAS: SWAJALDHARA PIPED WATER SUPPLY SCHEME, SISODANGI GULMA TEA ESTATE, DARJEELING

Dr. Debasri Mukherjee, Senior Research Officer, SIGMA Foundation.

Dr. M.N.Roy, President, SIGMA Foundation.

Er. Sohini Tarafdar, Research Officer, SIGMA Foundation.

Rupam Mandal, Field Officer, SIGMA Foundation.

Kabirul Islam, Field Officer, SIGMA Foundation.

BACKGROUND:

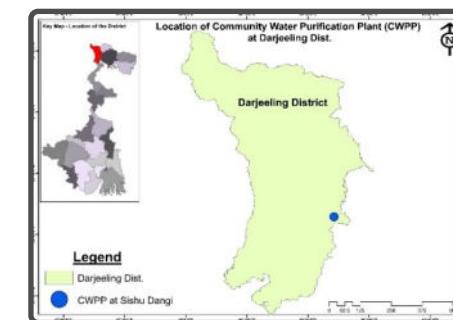
The Swajaldhara scheme was launched by the Department of Drinking Water Supply & Sanitation (DDWS), Government of India (GOI) as a reform in the water sector. This allows establishment of village-based schemes with involvement of the Panchayats and the community. Installation of one such scheme was facilitated by the NGO, Child in Need Institute (CINI) in the Sisodangi area of the Gulma Tea Estate in Siliguri, West Bengal, India in the year 2008. The project aims to provide not only clean drinking water but also sanitation facilities and healthcare to the communities living in the area. The activities included

installation of water treatment plants, construction of water storage tanks and the laying of pipelines to distribute water to the households. Overall, the Swajaldhara project has helped to improve the living conditions of the people in the Sisodangi area, and has provided them with access to basic amenities of clean water and sanitation facilities. The project began to supply water in 2009 after its launch in 2008 and a committee was established to manage the water supply. The first two years went smoothly, but after that, the project ran into trouble as the electricity bill accumulated to Rs. 3.00 lakhs, and the committee was unable to pay the amount resulting into a temporary shutdown of the scheme.



Later on, Mr. Om Pradhan was given the responsibility of operation and maintenance of the Swajaldhara project. He formed a committee consisting of the President, Vice President, Cashier, and Secretary, along with other 16 members. He, thereafter, contacted the Panchayat Pradhan Ms. Sangita Chikbaraik for support. She was of great help and extended all possible support to make the PWSS functional. She paid off all the pending electricity bills and which helped to resume the water supply.

The performance of the PWSS is monitored by the committee members. The entire committee actively participates in the functioning of the PWSS. They monitor the supply and distribution of water, ensure regular payments of the electricity bills, and take up maintenance works like repair of leakages, replacement of check valve and other maintenance activities in a systematic manner. They also ensure that there is no theft or misutilization of water in the area.



COMMUNITY BENEFIT FROM THE SWAJALDHARA SCHEME:

The Swajaldhara Pipe Water Supply Scheme at Gulma Tea Estate has made a notable difference in the lives of the community. It has provided them with reliable access to clean water, improved health outcomes, and alleviated financial burdens. The major changes include the lessening of waterborne disease, enhanced hygiene practices, better overall health and well-being, and increased availability of water for domestic and livelihood purposes in the community. Previously, the community faced various health issues such as skin diseases, frequent diarrhea, and stomach illness. With the implementation of the scheme, these health issues have noticeably reduced. The committee's dedication and proactive approach to addressing challenges have contributed to the scheme's overall performance and success in serving the community's water needs. People receive water

twice a day. The Swajaldhara committee collects Rs. 100.00 per household per month and cumulatively it makes their total income of Rs. 1.32 lakh from 110 households per year. In last 5 years the committee has spent a total of Rs. 4.5 lakhs on electricity bills and Rs. 27,000 on maintaining leakages and replacing check valves. The fund arranged from the consumers is primarily used to pay electricity bills and repairs-related expenses. There are no commercial connections in the village, so therefore, no meters are installed for commercial purposes



SOURCE SUSTAINABILITY:

The main source of water is the groundwater, which is abstracted using a submersible pump at a depth of 114 feet. There is not much seasonal variation in yield of water during summer. However, during that period, the pump running timing is slightly more due to more demand. There has been no theft or misutilization of water of the PWSS. The committee members keep a constant vigil to check any such illegal withdrawals. The committee members also monitor the water usage in the area frequently.

OPERATION & MAINTENANCE OF THE PLANT:

The operation and maintenance (O&M) of the PWSS are primarily managed and monitored by dedicated committee members. Everyone on the committee is responsible for different types of maintenance. Specially, Mr. Om Pradhan and Mr. Kishore Pradhan

actively participate in all kinds of maintenance activities on behalf of the committee. The committee's proactive approach and self-monitoring efforts ensure the smooth functioning of the water supply system. An Overhead Reservoir (OHR) was constructed in this scheme which is cleaned periodically. Filtration processes are conducted only once a month, indicating limited attention to this aspect of maintenance. The OHR is filled twice a day to ensure a continuous water supply to the community. In terms of checking the inlet, delivery, and wash-out valves, the operator performs daily inspections. There is also a sample checking system to check the water quality. In such cases, samples are collected twice a year by the Panchayat, and instant result is declared through using of a green light indicator. There is no formal documentation process for grievances redressal, and everything is handled verbally. When consumers face any problems, Mr. Om Pradhan suggests them specific solutions or asks them to arrange a mechanic from outside at their own expense. The committee members keep an eye on the amount of water supplied per day, the frequency of supply, and the status of the tanks and pipelines. They also keep track of the amount of money collected from the households and the expenses incurred on various maintenance activities.



LESSONS LEARNT:

There are several lessons to be learnt from the Swajaldhara project. These are:

- Ownership and participation by the consumers of any PWSS is very critical for ensuring continuous services.
- There is need for proper training of the personnel engaged for managing any water supply system along with availability of manual for such maintenance.
- For any PWSS serving a small number of

households, even a monthly subscription of Rs 100/ is inadequate to meet the O&M cost. The GPs should come forward to fund major repair and upgradation through GPDP since the GP would have to spend for water supply in absence of the community-based water supply.

- There should be a system of supervision of

community-based schemes by the GP and the Block office to monitor performance and guide for improvement.

- These schemes should conform to the service delivery norms norms of Jal Jeevan Mission for which the GP and the PHED should come forward to extend required support.



ABOUT THE AUTHOR



Dr. M.N. Roy did his M.Tech in electronics from Calcutta University and served the Government of India as a member of the Indian Engineering Services for around 2 years. Thereafter he joined the Indian Administrative Services in 1980. He studied Sustainable Development at the University of Birmingham in 1996. Thereafter, he did his Ph.D from the Tata Institute of Social Sciences, Mumbai and the research topic was Women's Empowerment. Subsequently he headed several departments of the Government of West Bengal including the Department of Panchayats and Rural Development and the Department of Health & Family Welfare and retired as Additional Chief Secretary of the Government of West Bengal. He is the Founder President of SIGMA Foundation, which is a not-for-profit organization. He has many National and International Publications. He is a member of the International Water Association, the Institution of Engineers, India, the Indian Statistical Institute, the Indian Science Congress Association and the Environment and Sustainable Development Association, India.

Dr. Debasri Mukherjee, Senior Research Officer, SIGMA Foundation.



Dr. Debasri Mukherjee is a Senior Research Officer in SIGMA Foundation a 'Not for Profit Organization' based in Kolkata, India. Before this She was a Research Officer (WQMS) from the day of inception of the Water and Sanitation Support Organization (WSSO), Public Health Engineering Department, Govt. of West Bengal for eight years. Prior to that she was with UNICEF Kolkata office for one year. The Energy Research Institute-Delhi (teri) for two years as a WASH Officer and IIT Delhi as a Project Officer for Fluoride Mitigation Programme for one year. She did her PhD from Delhi School of Economics Department of Geography and also having international exposure in the field of Water Quality Monitoring and Surveillance Programme. She specialized with water quality monitoring, management of water supply schemes related issues and in depth knowledge of water safety and security plan implementation. She is having many good publications in water sector at national and international level. She received many awards in water sector. She is a member of the International Water Association (IWA), the Indian Science Congress Association (ISCA) and the Environment and Sustainable Development Association, India.

Dr. M.N.Roy, President, SIGMA Foundation.



Er. Sohini Tarafdar did her M.E by Research in Chemical Engineering from CSIR- NEERI, Nagpur and is specialised in water management technology. She works in the diversified arena of development sector with a special focus on water security and safety, water technology and circular water management for enhancement of water use efficiency for past 10 years. She has worked in various organisations including CSIR-NEERI (Nagpur and Kolkata Zonal Laboratory), CMPDI (Coal India Ltd.), SOS Children's Village Kolkata, Riddhi Foundation and SIGMA Foundation. She has managed major projects of Government and international donor agencies like UNICEF, ADB, AMRUT etc. She also has various national, international and departmental publications. She is also involved with the development of communication materials and capacity building of various target groups related to WASH. She is a full-time member of Organisation for Women in Science for the Developing World (OWSD)- An UNESCO Unit since August, 2022 and certified ESG professional.

Er. Sohini Tarafdar, Research Officer, SIGMA Foundation.



Mr. Rupam Mondol did his Masters of Arts in Adult Education and Extension from Kalyani University, West Bengal. He has been associated with Kalyani Srijani Institute of Research and Management, Pratichi Institute and currently SIGMA Foundation. He is skilled in field investigation and supervision.

Rupam Mandal, Field Officer, SIGMA Foundation.



Mr. Kabirul Islam did his M.Sc in Environmental Science from Global Open University, Nagaland with Diploma in computer application and programming. He has vivid field experience of more than 20 years and has been associated with various organisations like Engo Tea Estate and Sahara India pariwar.

Kabirul Islam, Field Officer, SIGMA Foundation.

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Mr. Shashi Kumar
CEO and Co-Founder
Akshayakalpa Organic



WATER CONSERVATION INITIATIVES BY AKSHAYAKALPA ORGANIC:

Water conservation at Akshayakalpa Organic isn't a practice—it's a lifestyle. We approach water management holistically, beginning with trench and bund construction to harvest and hold rainwater and minimize soil erosion. Our five man-made farm ponds, with an aggregate capacity of 25 lakh liters, are important reservoirs for holding surplus rainwater and are a big contributor to recharging groundwater. We have also established wells and rooftop rainwater collection systems throughout our dairy farms to provide water round the year to our crops.

Effective irrigation is also a major priority. In arid regions, we employ drip irrigation to manage water supply carefully, nourishing our vegetable beds without wastage. Our Effluent Treatment Plants (ETPs) and rainwater harvesting systems are important in ensuring a sustainable water cycle.

We also believe in working with nature. We plant trees along our bunds annually to support groundwater recharge. Rather than depending on monoculture crops such as arecanut and sugarcane, we diversify our fields and follow innovative farming methods like aerobic composting and the System of Rice Intensification (SRI) for paddy cultivation. Our methods that utilize biochar, slurry, and aerobic compost in soil care, and incorporating dairy farming to regulate the water cycle all help lower virtual water use. All this has resulted in a drastic lowering of Akshayakalpa Organic's virtual water footprint for the production of a kilo of mixed vegetables that normally stands at 150-180 liters, far below India's national average of 220-300 liters.


Additionally, these rainwater conservation systems, implemented at our model farms in Tiptur, Pooriyampakkam, and Shadnagar, have been successfully replicated across all our farmer farms. This ensures that every Akshayakalpa farmer follows sustainable water management as an integral part of organic farming practices.




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Jitender Thirwani
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WORLD WATER DAY 2025: MEASURING WATER, SECURING THE FUTURE

Water is the silent force that sustains life, yet its scarcity is becoming one of the greatest challenges of our time. We speak of conservation, sustainability, and responsible usage—but how can we truly protect what we do not measure?

This World Water Day, it's time to shift the conversation. For decades, we have managed water based on estimates and assumptions, treating it as an abundant resource rather than a finite one. But what isn't measured cannot be controlled, and what isn't controlled cannot be saved.

From households to industries, from cities to entire nations, measurement is the foundation of responsible water management. It is the key to understanding patterns of consumption, identifying wastage, and ensuring that every drop is used where it matters most. Whether it is detecting leaks before they become crises, balancing supply and demand efficiently, or ensuring fair distribution, data is our most powerful tool in safeguarding water for the future.

The need to measure is not just about conservation—it is about accountability. It is about empowering individuals and communities to make informed choices, about helping decision-makers craft policies rooted in precision rather than speculation. It is about transforming water from an overlooked necessity into a carefully managed asset. This World Water Day 2025, let us ask ourselves: Are we still relying on guesswork, or are we ready to take control? Because the path to a sustainable water future begins with one simple yet profound step—measuring what we use, so we can protect what we need.



Syamal Sarkar
Distinguished fellow &
Director Water Resources
Division, at TERI

PRESERVING GLACIERS: SAFEGUARDING INDIA'S WATER FUTURE

The World Water Day 2025 is based on theme "Preserving Glaciers", a subject less talked about in India.

Glaciers are critical for human life, the melted water helps using as drinking water, essential for agriculture, industry, clean energy production and ecosystem. If glaciers melt rapidly, it causes uncertainty to water flows, impacting people and our planet.

The larger Himalayan region known as The Third Pole, stores about 12000 cu km of water in the frozen state, as glaciers. Rives emerging from IHR account for two thirds of total river flows in India. The complex ecology of Indian Himalayan Region (IHR) implies an environment subjected to forest fires, landslides, Glacial Lake Outburst Floods (GLOF), floods and earthquakes. The IPCC forecast says that average annual mean temperature will rise by 3°C in IHR by 2050 with the prospect of melting glaciers and more frequent GLOFs.

Rivers descending from Himalayas have high sediment loads often results in unusable hydro dams due to siltation of reservoirs and turbines. Climate change is making predictability of river flows extremely uncertain. Rapid changes in land cover and land use and growing urban pressure and tourism are placing water resources under serious pressure. Springs, the lifetime of mountain people, have seen phenomenal decline. There is a water scarcity due to dying springs and drying rivers. The value of ecosystem in IHR and environmental flows in rivers in these regions has been underplayed so far. Flows in rivers must be viewed as constituted by water quantities and quality, energy content of flows, biodiversity and sediment budget. Research and data on glaciers, glacial melting and glacial retreat must be integrated with water related data for improved water management. There is a need to generate awareness of people in IHR and make them aware of the measures to be taken while Earth's surface, cryosphere, is melting due to higher global warming. The Central Govt. and State Govts. In IHR should draw up an Action plan in this direction. The hydropower sector experts should also consider the impact of glacier melting on hydropower generation and draw up action plan for addressing this impact.



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Julius Gloeckne
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REVOLUTIONIZING WATER REUSE: THE LARGEST CERAMIC MBR

“The need for sustainable water solutions continues to escalate, not only as a result of climate change but also to address new and often formidable challenges. Among these is the growing demand for water created by the explosive growth in AI data centers. Consider this example: xAI will build the world’s largest ceramic membrane bioreactor (MBR) to enable reuse of 49.2 MLD (13.0 MGD) of municipal wastewater for cooling its supercomputing data center in Memphis, Tennessee, USA. CERAFILTEC is providing its most advanced ceramic membrane technology in this enormous, fast-track project that is due to be completed in 2025. The first shipment of our advanced ceramic membranes—supporting an initial 10 MLD (2.6 MGD) of MBR treatment capacity—is already in transit to the site, marking a key milestone in this fast-track deployment. But the data center is not the sole beneficiary of this project. With its capacity to treat more wastewater than xAI requires, the plant will also provide surplus treated water to local industries. This capability dramatically reduces the aquifer impact from existing users and sets a precedent for green practices, creating the ability to conserve precious drinking water and protecting the Memphis Sands Aquifer for the benefit of local communities.

“The choice of technology is critical in any project but especially in endeavors like this one. Known for durability and efficiency, our ceramic membranes also deliver substantially lower lifetime costs—critical advantages in high-demand applications. We are proud to be part of this landmark project that not only optimizes water reuse but, from a global perspective, also denotes a milestone in environmental leadership. Not only does it empower high-tech companies to embrace sustainable water solutions; it also equips them to do so by using a proven, durable, and reusable technology that supports a circular economy.”



Anandana
Coca-Cola India Foundation

WORLD WATER DAY: ANANDANA, THE COCA-COLA INDIA FOUNDATION'S COMMITMENT TO STRENGTHENING WATER SECURITY

Water is life. It fuels agriculture, sustains livelihoods, and empowers communities. Ensuring sustainable water access is key to fostering economic growth and improving daily life in rural India.

On this World Water Day, Anandana – The Coca-Cola India Foundation reaffirms its commitment to water conservation by supporting communities with projects focused on water harvesting, clean drinking water, watershed management, and restoring traditional water sources. Here’s how these initiatives are making a difference:

1. Turning Barren Lands into Thriving Farms in Anantapur

Anantapur, one of India’s driest districts, has long suffered from erratic rainfall and depleting groundwater levels, leaving farmers struggling to grow crops (Source). To address this challenge, Anandana, in collaboration with the SM Sehgal Foundation, launched Project Jaldhara.

The initiative led to the construction of five check dams, replenishing groundwater and reviving agriculture. Farmers who once struggled with barren fields are now cultivating multiple crops, ensuring food security and improved incomes.

“Before, our lands remained dry, and farming was unpredictable. Now, with water readily available, we can grow three to five crops a year instead of just one,” shares E Sudhakar, a farmer from Kodur village.

2. Bringing Water Closer and Empowering Communities in Madhya Pradesh

For women in Bijawar block, Chhatarpur, the daily struggle of fetching water meant walking miles, leaving little time for work or education. Meanwhile, water scarcity had also driven migration, with many farmers abandoning agriculture altogether. With Project Pragati Graam, Anandana and Haritika introduced stop dams and ponds, bringing water access closer to communities. The result? Women now have the freedom to focus on their families and aspirations, while farmers are returning to their land.

“Earlier, we had to carry water on our heads from distant sources. Now, life is easier, and we have more time for our children’s education,” says Kalawati from Ganeshganj.

Makkhan, a farmer who had left Bijawar due to water shortages, is now back: “With better irrigation, I can grow multiple crops and support my family without taking loans.”

3. Reviving Agriculture and Reducing Migration in Dholpur

Once a thriving agricultural hub, Tontari village in Dholpur faced severe groundwater depletion, forcing many farmers to stop cultivation and migrate to cities. Recognizing the need for intervention, Anandana partnered with the Lupin Human Welfare & Research Foundation to construct two check dams, restoring water availability. Today, farming is flourishing again, and migration has significantly reduced.

Kamala from Dholpur recalls, “Every morning, I walked miles just to fetch a single bucket. But with rainwater harvesting initiatives by the Coca-Cola India Foundation, everything changed. The Coca-Cola India Foundation’s rainwater harvesting didn’t just transform my life—it sparked change across our community. Over 100 projects and billions of liters replenished annually prove the power of working together for a better future.”

4. Strengthening Water Security and Livelihoods in Sikar

Sikar, a vast district in Rajasthan, has long struggled with erratic rainfall and over-exploited land, leading to severe socio-economic issues. High fluoride levels in water sources further worsened the crisis, affecting both human health and agricultural productivity. Forced by necessity, many families have had to leave their homes, migrating to the cities in a bid to secure better livelihoods. In collaboration with SARA, Anandana implemented a water conservation initiative, constructing check dams and ponds to restore water availability. This intervention has rejuvenated over a billion liters of water, benefiting thousands of more people. Farmers, who once struggled with severe water shortages, now cultivate their fields with renewed confidence, growing multiple crops every year. This newfound water security has led to increased incomes and livelihood generation, reviving the local economy and community. Women, previously burdened with collecting water, now have more time for household and economic activities, fostering community resilience.

"Earlier, our sheep drank salty tanker water, and many fell sick. Now, they are healthier, and we've expanded our herd from 20 to 50," explains Gumani, a farmer from Mangra village.

From restoring barren lands to improving access to clean drinking water and enhancing community resilience, Anandana’s efforts demonstrate the power of sustainable water management. These initiatives not only provide immediate relief but also create long-term resilience for communities across India.

A COMMITMENT TO WATER SECURITY AND CLIMATE RESILIENCE



Raveendra Bhat
Area Sales Director
Water Utility INDO Region

On World Water Day 2025: ‘Preserving Glaciers,’ Grundfos reaffirms our commitment to water security and UN SDG 6. Glaciers are critical—feeding rivers, supporting communities, and regulating climate. As these ice masses melt, cities worldwide must become flood-resilient while addressing drinking water challenges. As a leading provider of pumping solutions globally, Grundfos calls for meaningful partnerships to protect these vital water sources. Together, we must ensure glaciers continue their essential role in regulating the water cycle, bringing us closer to true water security for future generations.

About Grundfos India

Grundfos Pumps India Pvt. Ltd. (Grundfos India) a wholly owned subsidiary of Grundfos Holdings A/S was established on March 13, 1998. Grundfos India is responsible for sales of Grundfos products in India, Bangladesh, Bhutan, Nepal and Maldives. Currently, Grundfos India has almost 540 employees and works with more than 400 distributors and dealers with 7 branch offices and many more home offices across India.

Grundfos India provides energy efficient pumps and smart pumping solutions for various applications – heating and hot water service systems, cooling and air-conditioning systems, industrial applications, pressure boosting, liquid transfer, groundwater supply, domestic water supply, sewage and wastewater (both for commercial buildings and municipals corporations), dosing, chlorination systems, disinfection systems and pumps running on renewable energy.



Sharad Bhushan
Executive Director
Environment, Water
and Energy at AECOM

INNOVATING FOR WATER SECURITY: THE FUTURE OF SUSTAINABLE CONSERVATION

Water is the essence of life, yet its scarcity is becoming an escalating crisis worldwide. The pressures of urban expansion, climate variability, and inefficient resource management are depleting freshwater reserves at an alarming rate. The need for innovative, sustainable water solutions has never been more urgent. One of the most pressing challenges in water conservation is the inefficient use and management of available resources. A significant portion of treated water is lost due to leakage, aging infrastructure, and operational inefficiencies. However, the integration of smart water management systems—powered by IoT sensors, AI-driven analytics, and real-time monitoring—is transforming how we detect leaks, optimize distribution, and reduce non-revenue water losses. Cities embracing these digital advancements are already witnessing substantial improvements in efficiency and conservation.

Beyond technology, sustainable infrastructure is pivotal in ensuring long-term water resilience. Nature-based solutions, such as constructed wetlands, permeable pavements, and green roofs, support groundwater recharge, reduce urban flooding, and enhance ecosystem health. Additionally, decentralized wastewater treatment plants empower communities by enabling local water reuse, reducing dependency on centralized systems.

A circular economy approach to water management is also redefining traditional practices, ensuring that wastewater is viewed as a resource rather than waste. Advanced innovations like membrane bioreactors (MBRs) and next-generation desalination technologies are enabling large-scale water reclamation, providing sustainable alternatives for industrial and agricultural use.

However, true transformation requires more than just technology—it demands policy innovation and community engagement. Strengthening public-private partnerships, implementing progressive regulatory frameworks, and fostering behavioral change through digital education are crucial to accelerating sustainable water management practices.

The future of water security lies in a holistic, multi-disciplinary approach—one that fuses technological advancements, resilient infrastructure, and policy-driven sustainability. By embracing smart solutions, proactive planning, and responsible consumption, we can reshape the future of water management and preserve this invaluable resource for generations to come



Steve Haan
Vice President of Water, NSF

SUSTAINABILITY

To help combat climate change and save our glaciers, identifying where organizations can improve sustainability is crucial. One way is to reduce waste. Waste in forms including water, chemicals and plastic, all contribute to a company's environmental footprint.

To improve a building's sustainability score, every organization can implement water recycling and rainwater harvesting, renewable energy sources and recycling programs. Organizations in the manufacturing space can consider utilizing recyclable and biodegradable packaging materials, energy-efficient machinery and sustainable cleaning agents.

In addition to waste reduction, establishing an environmental process that defines clear environmental goals like improving energy efficiency is important. This provides a benchmark of what environmental impact assessments (EIA) should be conducted and tracked year over year. For guidance, ISO 14001: Environmental Management System (EMS) Standard can help companies demonstrate and meet Environmental, Social and Governance (ESG) goals that focus on resource efficiency, waste and pollution reduction and climate action.

Organizations can go a step further by not only operating more eco-friendly, but by innovating sustainable solutions. Rainwater harvesting, low-energy desalination and filtration systems are sustainable innovations that have emerged as water technology that is more climate-friendly. It is important that as an industry, innovation doesn't stop here and that we continue developing technology that meets more stringent environmental requirements.



Tony Hardy
Director of Management Systems, NSF



Dr. Mayur J. Kapadia
Former AGM
Quality Control Dept
GNFC Ltd, Bharuch
Gujarat – TC Member
& Resource Person
BIS –Trainer –
Technical Writer –
'Elsevier' Author.

PROTECTING OUR GLACIERS, PROTECTING OUR FUTURE

Since year 1993, 22 March is being celebrated every year as 'World Water Day' to highlight the importance of water in our lives and to support the achievement of Sustainable Development Goal 6 : 'Water and sanitation for all by 2030'. This year, the focus is on glacier preservation — a critical issue that affects us all.

Glaciers are the world's natural water towers, providing fresh water to millions of people and supporting rivers, lakes, and entire ecosystems. But with climate change causing rapid glacier melt, we are losing these vital water sources at an alarming rate. If glaciers continue to disappear, it will lead to water shortages, rising sea levels, and more extreme weather events, impacting communities, agriculture, and biodiversity. Protecting our glaciers starts with reducing global warming. Every action counts — using water wisely, reducing energy consumption, planting trees, and cutting down on waste and pollution. Governments and industries must also step up by investing in clean energy, reducing greenhouse gas emissions, and protecting natural water sources. Raising awareness is just as important. When we understand how glaciers impact our daily lives, we can make better choices to protect them. Whether it is teaching children about climate change, supporting policies that promote sustainability, or simply choosing eco-friendly habits, we all have a role to play.

On this World Water Day, let us reinforce in our minds that glaciers are not just distant ice masses, but they are life-giving sources of water for people across the world. By initiating actions today, let us ensure that access to clean, safe, and sustainable water lasts for many years and many future generations. Every drop matters, and every effort counts in preserving our glaciers and securing our future.

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Subhash Sethi
Chairman
SPML Infra Limited

PRESERVING WATER FOR A SUSTAINABLE FUTURE

On this World Water Day, we reflect on the critical importance of preserving water and the urgent need to protect our water resources – surface, underground and planet’s glaciers. This year’s World Water Day theme, Glacier Preservation, highlights the alarming rate at which glaciers are melting due to climate change and the severe consequences this has on global water security.

Glaciers serve as natural reservoirs, storing vast amounts of freshwater that sustain billions of people living on this planet earth along with the agriculture, and ecosystems. The rising global temperatures have accelerated melting of glaciers across the regions, disrupting water availability, increasing the risk of floods, and threatening long-term water security. India’s major river systems, including the Ganga, Brahmaputra, and Indus, depend heavily on glacial melt from the Himalayas, making glacier preservation not just an environmental issue but a necessity for survival.

As a leading infrastructure development company committed to sustainable water management, SPML Infra recognizes the pivotal role glaciers play in maintaining the world’s freshwater supply, and we are dedicated to contributing to their protection through our projects and innovations. At SPML Infra, our commitment to water sustainability is reflected in the numerous projects we have undertaken to enhance water efficiency, reduce wastage, and improve water distribution networks. Our work in developing integrated water supply systems, advanced water treatment plants, and wastewater recycling initiatives aligns with the broader goal of preserving our water resources.

Through our various projects like the Sauni Yojana, Water Loss Management in Bangaluru, Water Supply projects in Rajasthan and other states, and Sewerage Project in Kanpur, Mira Bhayander and other cities, industrial wastewater treatment projects Manipur Water Supply Project, and Guwahati Water Supply Scheme, we have been instrumental in optimizing water usage and ensuring the availability of clean and sustainable water for over 50 million people and industries. By leveraging smart water technologies, we have minimized water losses, reduced energy consumption, and promoted circular water management to lessen the burden on natural water bodies, including glacial-fed rivers.

SPML Infra, a leader in infrastructure development and sustainable water management, acknowledges the crucial role glaciers play in preserving the world’s freshwater resources.

Our efforts in hydropower infrastructure development support the generation of clean energy while ensuring the responsible utilization of glacial water. Sustainable infrastructure planning, efficient irrigation techniques and robust watershed management solutions are essential in reducing excessive reliance on glacier-fed water, thus helping to slow down their depletion.

On World Water Day, I urge all stakeholders; government bodies, industries, and individuals to take proactive measures in protecting our glaciers. This includes adopting sustainable water practices, reducing carbon footprints, and investing in climate-resilient infrastructure. SPML Infra remains steadfast in its mission to build a future where water resources are managed responsibly, ensuring long-term water security for generations to come. Let us work together to safeguard our glaciers, protect our water sources, and create a resilient and water-secure world.



Mohammed Abdul Rahman
CEO, Sahara Industry

ADVANCING WATER TREATMENT FOR A SUSTAINABLE FUTURE

On the World Water Day, we come together to recognize the need for clean and pollution free water and sustainable management of our planet’s most vital resource. This year’s theme, Glacier Preservation, draws our attention to the alarming rate of glaciers melting due to climate change, uncontrolled human activities and the profound impact it has on global water security.

Glaciers are the lifeline of many of the world’s major river systems, serving as natural reservoirs that supply freshwater to global population.

In India, the Himalayan glaciers are crucial for sustaining the Ganga, Yamuna, and Brahmaputra river basins, which support agriculture, drinking water supply, and industrial activities. However, the rapid melting of these glaciers poses a severe threat to water availability, increasing the risk of floods, droughts, and long-term water shortages.

Addressing this crisis requires a multi-pronged approach that includes sustainable water use, advanced treatment technologies, lesser chemical use and climate-conscious infrastructure development.

As a company dedicated to providing innovative water treatment solutions; Sahara Industry is dedicated to delivering innovative water treatment solutions, remains committed to protecting freshwater sources and ensuring sustainable water management across the value chain. By integrating advanced technology and best practices, we strive to enhance water efficiency and promote long-term environmental stewardship.

At Sahara Industry, we believe that advancing water treatment technology is essential for easing the burden on our natural water sources, including glacial-fed rivers. By developing efficient and sustainable solutions, we aim to preserve these vital resources, ensure clean water access, and contribute to a greener, more water-secure future.

At Sahara Industry, we believe that innovation in water treatment plays a critical role in reducing the strain on our natural water sources, including glacial-fed rivers. Our state-of-the-art reverse osmosis (RO) plants, ultra-pure water systems, sewage treatment plants (STPs), and effluent treatment plants (ETPs) are designed to promote water recycling and reuse, minimizing wastage and dependence on freshwater sources.

By implementing high-efficiency desalination and water purification systems, we are helping industries and communities access clean water without over-extracting from vulnerable water bodies. Our low-energy and sustainable water treatment solutions significantly reduce the carbon footprint associated with water purification, indirectly contributing to slowing down climate change and protecting glaciers.

Our advanced filtration technologies, such as ion exchange resins and membrane-based purification systems, ensure that industries can treat and reuse wastewater efficiently. By reducing industrial pollution and promoting water recycling, we contribute to keeping glacial-fed rivers clean and free from contaminants, ensuring the long-term health of these ecosystems.

In collaboration with various stakeholders, Sahara Industry is actively working on sustainable water management projects that focus on optimizing water usage and promoting circular water economy practices. By integrating smart water monitoring systems and AI-driven analytics, we are enabling real-time tracking of water consumption, leak detection, and wastewater recycling, thereby reducing unnecessary wastage.

On this World Water Day, I urge governments, industries, and individuals to take conscious steps towards sustainable water management and glacier preservation. Simple actions such as reducing water wastage, supporting wastewater recycling, and embracing energy-efficient water treatment technologies can collectively make a significant impact.

At Sahara Industry, we remain dedicated to pioneering innovative water treatment solutions that support a sustainable and water-secure future. Let us work together to protect our glaciers, conserve our water resources, and create a resilient world for the generations to come.



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Mohammed Naser Azeez
Managing Director
Aquality Intelligent Solutions Pvt. Ltd.

PROTECTING WATER SOURCES: SECURING OUR FUTURE

On World Water Day 2025, let us embrace the theme of glacier preservation, recognizing the urgent need to protect our planet's glaciers, one of the most vital sources of freshwater. As the global warming and climate change accelerates glaciers melting, the consequences on global water security, ecosystems, and human populations are becoming increasingly severe.

The Importance of Glaciers in Our Water Ecosystem

Glaciers store approximately 70% of the world's freshwater, acting as natural reservoirs that regulate water flow to rivers, lakes, and groundwater sources. In the mountainous regions like the Himalayas, Alps, and Andes, these glaciers sustain the livelihood of billions of people, providing drinking water, irrigation, industrial production and hydroelectric power. However, with rising global temperatures, glaciers are melting at unprecedented rates, disrupting water cycles, causing flash floods, and leading to long-term water scarcity.

India, which depends heavily on Himalayan glaciers for its major rivers, including the Ganga, Brahmaputra, and Indus faces a dire threat to water security. The melting of these glaciers endangers not only drinking water supplies but also agriculture, industry, and biodiversity. Addressing this challenge requires sustainable solutions that reduce water wastage, promote recycling, and minimize reliance on glacial-fed water sources.

Aquality's Commitment to Water Sustainability

At Aquality Intelligent Solutions, we are committed to sustainable water management through innovative water purification technologies, air purification solutions, and solar-powered water treatment plants - all aimed at reducing environmental impact and conserving our natural water sources.

We recognize the urgent need to reduce stress on natural water sources and embrace sustainable practices. Our cutting-edge water and air purification technologies play a crucial role in conserving freshwater, preventing contamination, and ensuring access to clean drinking water in the most remote locations.

Solar-Powered Water Treatment Plants

One of our flagship innovations is our solar-powered water treatment plants, designed to provide clean drinking water to off-grid areas, communities, industries, and security forces deployed in remote locations. These plants operate without dependency on fossil fuels, significantly reducing carbon emissions, which are a major driver of climate change and glacial melt. By adopting renewable energy for water purification, we contribute to reducing global warming and mitigating its impact on glaciers.

Advanced Water Purification Systems

Our state-of-the-art RO (Reverse Osmosis) systems, ultrafiltration technologies, and advanced membrane-based purification solutions ensure efficient water treatment with minimal energy consumption. These solutions enable industries, municipalities, and rural communities to access safe drinking water without over-extracting from rivers and glacial-fed water sources.

Air Purification for Climate and Water Conservation

Air pollution and climate change are closely linked, and by improving air quality, we indirectly support glacier preservation. Our advanced air purification solutions, which include HEPA and activated carbon filtration systems, remove pollutants that contribute to global warming. By reducing carbon and particulate emissions, we help slow down glacial melting and climate change-induced water crises.

Smart Water Management and Recycling Technologies

We advocate for a circular water economy, ensuring that every drop of water is utilized efficiently. Our intelligent water monitoring systems leverage AI and IoT technology to detect leaks, optimize water distribution, and enhance recycling efforts in residential, commercial, and industrial sectors. By minimizing water losses and promoting reuse, we reduce the pressure on glacial-fed rivers.

On World Water Day 2025, it is crucial for governments, businesses, and individuals to take immediate steps to protect glaciers and promote sustainable water management. The growing impact of climate change threatens our freshwater sources, making it essential



Shri Amitava Mukherjee
CMD, NMDC Limited

SUSTAINING WATER, SECURING FUTURES: NMDC'S COMMITMENT TO RESPONSIBLE WATER MANAGEMENT

Water is the lifeline of industries, communities, and ecosystems alike. At NMDC, we recognize how critical this resource is— not just for our operations, but for the communities around us. As a water-intensive industry, we take our responsibility for its conservation very seriously. Managing water efficiently is not just a business imperative, it's a commitment to sustainability, and for our future generations.

I take immense pride in NMDC's standing as one of the only players with lowest water consumptions in the global mining sector. We have employed Zero Liquid Discharge (ZLD) systems at our plants, ensuring that no untreated water is released directly into the environment. By focusing on rigorous water audits, we are continuously improving our efficiency and reducing our industrial impact.

At NMDC, we recognize that our role towards water extends beyond our mines. Water sustains livelihoods, and we are committed to its conservation through innovation, efficiency, and community collaboration. By practising rainwater harvesting, and optimizing reuse, we are minimizing wastage while preserving resources. Our check dams, garland drains, and treatment plants are further strengthening these efforts. Beyond operations, we support communities with limited water access, reinforcing our commitment to sustainability and social well-being. Moving forward, we will continue working with governments, partners, and communities to balance operational needs with environmental stewardship, ensuring water security for generations to come. Together, we can build a future where growth and sustainability go hand in hand, ensuring water security for generations to come.



Mr. Nilesh Todi
Executive Director
of MMP Filtration Pvt. Ltd.

WATER IS LIFE. IT NOURISHES US, SUSTAINS OUR WORLD, AND POWERS OUR DAILY LIVES. BUT FOR MILLIONS, ACCESS TO CLEAN, SAFE WATER REMAINS A CHALLENGE.

At MMP Filtration Pvt. Ltd., we believe that pure water isn't a privilege—it's a right. This World Water Day, we reaffirm our mission to make clean water accessible to all through cutting-edge filtration solutions. Every drop we purify means healthier families, stronger communities, and a more sustainable future. From households to industries, we are committed to delivering advanced filtration technology that removes contaminants and ensures water remains pure and reliable for generations.

Because safe water isn't just about survival—it's about thriving. Join us in making a difference. Together, we can create a world where clean water flows for all.



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Shar Govindan
Senior Director for Energy
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CELEBRATING WATER!

Imagine for a minute, being thirsty without access to water for a day and night, and then drinking a cup of refreshing water. Every water drop has probably taken the amazing journey from the ocean to clouds, then to a water resource, purified, and traveled through thousands of miles of pipes before being delivered to you.

As we celebrate water, it is important to recognize some of the innovative technologies that are incrementally improving the way water gets treated and distributed. Among these advancements, water modeling and digital twins combined with AI have generated great impact and have greater 'untapped' potential.

Water models help understand the behavior of complex water distribution networks by analyzing various contributing factors. They help evaluate current, past, and futuristic scenarios/options side-by-side to make informed decisions. This ensures the water system can meet expected and unexpected demands, exceed water quality standards, optimize energy use, plan/prioritize infrastructure improvements and so much more. Water models powered by AI optimize water infrastructure, increasing efficiency, resiliency, and sustainability.

Digital Twins complement water models by creating a virtual replica of water systems. They are powered by real-time data from smart devices, various data sources, and AI. This helps with decision making for operations and faster emergency response times for field repair crews. In addition, digital twins can help with predictive maintenance, sustainable water management but most importantly happy water utility customers. That is practically most of us except the ones drawing water from wells and aquifers.

As we look forward, the combined power of 3D visualization, AI, Digital Twins, Smart Devices, and Water Modeling will continue to offer unprecedented opportunities to advance, for current and future generations. So, let us celebrate Water, and also the people, processes, and platforms that are continuously advancing water infrastructure!




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INTERVIEW WITH MR. SOURAV DASPATNAIK MANAGING DIRECTOR SWACH ENVIRONMENT PVT. LTD.

PIONEERING THE FUTURE OF FILTRATION – A SWACH PERSPECTIVE

At Swach Environment Private Limited, we recognize that the future of water sustainability lies in smarter, cleaner, and more adaptive filtration technologies to provide efficient water services. As a company at the forefront of integrated water solutions, we are closely aligned with the breakthroughs and trends shaping the next generation of filtration systems to provide efficient water delivery for reuse and recycle and lowering the water footprint.

Q: What are the most significant breakthroughs in filtration technologies that you have seen in recent years?

A: Recent years have witnessed transformative advances such as graphene-based membranes, hybrid ceramic-polymer membranes, and electrochemical filtration systems. These innovations offer improved selectivity, higher flow rates, and better durability, significantly enhancing water treatment performance.

Q: How are advanced filtration methods improving operational efficiency in large-scale water treatment facilities?

A: Advanced methods like membrane bioreactors

(MBRs), reverse osmosis with energy recovery devices, and real-time data monitoring systems are enabling treatment plants to reduce downtime, improve throughput, and ensure consistent water quality. These technologies reduce energy consumption, extend equipment lifespan, and optimize performance through real-time analytics. At SWACH, we prioritize deploying such systems to enhance both environmental and operational outcomes.

Q: What are the key factors driving innovation in membrane filtration, and how do you see these evolving?

A: Key factors include the rising demand for clean water, stringent environmental regulations, and the need to treat complex contaminants. Innovations are focusing on antifouling materials, increased permeability, and lower energy demands with lower ground footprint—areas that are continuously evolving with new materials science breakthroughs.

Q: How is nanotechnology enhancing filtration performance, and what challenges remain in its widespread adoption?

A: Nanomaterials like carbon nanotubes and nano-

silver are enhancing filtration by increasing surface area and targeting specific contaminants removal, including for emerging pollutants like microplastics and pharmaceuticals. However, widespread adoption faces hurdles such as high production costs, scalability issues, and regulatory concerns regarding the environmental impact of nanomaterials. At SWACH as a technology neutral company, we are exploring responsible, scalable nanotech applications that balance performance with safety and sustainability.

Q: With AI and IoT integration becoming more common, how are smart filtration systems improving real-time monitoring and maintenance?

A: AI and IoT integration allows predictive maintenance, anomaly detection, and adaptive process control. We leverage these technologies to enable real-time data tracking, predictive maintenance, and automated system optimization. Sensors continuously monitor parameters like pressure, flow rate, and turbidity, while AI analyses trends to detect anomalies before failures occur. This not only reduces downtime and manual intervention but also extends equipment life and improves overall efficiency—making filtration more reliable, responsive, and cost-effective. Smart filtration systems reduce human error. This is an area where water Companies will need to constantly work to upgrade their capability.

Q: What advancements have been made in tackling emerging contaminants like microplastics, PFAS, and pharmaceutical residues?

A: Filtration systems now incorporate activated carbon, advanced oxidation processes, and nanofiltration membranes to address microplastics, PFAS, and pharmaceuticals. Research continues to push for cost-effective, scalable solutions to these growing threats. We focus on integrating these advanced treatment steps into our filtration systems, ensuring compliance with evolving water quality standards and protecting both human health and the environment.

Q: How are filtration technologies evolving to reduce energy consumption and overall operating costs for industrial applications?

A: Innovations like gravity-driven membranes, forward osmosis, and improved pretreatment steps help reduce energy loads. In addition, smart sensors ensure systems operate within optimal parameters, contributing to lower lifecycle costs. At SWACH, we integrate smart automation and sensor-driven controls to optimize system performance in real-time, ensuring minimal energy use and lower operating costs—especially critical for large-scale and continuous industrial operations.

Q: What are the biggest technical and logistical challenges you face when implementing new filtration solutions in water treatment plants?

A: Major challenges include retrofitting existing infrastructure, managing membrane fouling, and securing skilled technicians. There is a challenge in ensuring compatibility between legacy systems and modern technologies, this also demands careful planning and investment. In a legacy system at existing technologies, major data and design parameters are not available. This poses a challenge.

Technical Challenges:

- **System Compatibility:** Integrating with existing infrastructure can be complex and costly.
- **Performance:** Ensuring consistent water quality and system efficiency over time.
- **Maintenance:** New systems may require more frequent upkeep or have durability issues. There is urgent need for skilled manpower in process design and operations.
- **Energy Use:** Some technologies demand higher

- energy, increasing operational costs.
- **Water Quality Variability:** New systems may struggle with fluctuating raw water conditions including seasonality.

Logistical Challenges:

- **Supply Chain Issues:** Delays in sourcing materials and equipment. Certain components are imported and have high levels of import tariff. With the ongoing tariff issues, some of the supply chain may get disrupted.
- **Skilled Labor:** Need for specialized training for staff on new technologies including operations and maintenance.
- **Cost Management:** High initial and ongoing operational costs.
- **Regulatory Compliance:** Ensuring the system meets local or international standards. Emerging trends include stringent discharge norms and sludge disposal.
- **Coordination:** Managing system installation without disrupting plant operations.
- **Environmental Impact:** Minimizing waste and energy use from new systems.

Q: How do you balance innovation with regulatory compliance when adopting new filtration technologies?

A: As the race continues to develop new and innovative therapies and products, one challenge is regulatory compliance. Close collaboration with regulators during the development phase, along with third-party certifications and pilot testing, ensures new solutions meet compliance without stifling innovation. Transparency in performance data is also essential for regulatory trust.

Q: What steps are being taken to make filtration systems more sustainable, particularly in terms of material selection and waste reduction?

A: Filtration systems are becoming more sustainable through the use of eco-friendly materials, energy-efficient designs, and waste reduction techniques. Manufacturers are opting for recyclable or natural filter media and designing systems that consume less power. Efforts are also being made to reduce sludge and wastewater, extend filter life, and use smart monitoring to optimize performance and resource use. These steps help lower environmental impact while ensuring effective water treatment.

Reducing filter waste and water loss during treatment is central to these sustainability goals.

Q: How are advancements in filtration impacting industries such as agriculture, pharmaceuticals, and manufacturing?

A: **Agriculture:** Modern filters help remove contaminants from irrigation water, improving crop yield and reducing soil degradation. For example, microfiltration removes pathogens that could harm plants. **Pharmaceuticals:** High-precision filters like nanofiltration ensure purity in drug manufacturing, helping meet strict safety standards and improving product quality. **Manufacturing:** Advanced filtration systems in industries like electronics and food processing remove fine particles and chemicals, protecting equipment and ensuring product consistency. These improvements lead to higher efficiency, better quality, and reduced environmental impact across.

Q: What role does decentralized water treatment play in the future of filtration technologies, especially in remote or underdeveloped areas?

A: Decentralized water treatment plays a key role in the future of filtration, especially for remote or underdeveloped areas. It brings clean water directly to communities without relying on large, centralized systems. These smaller, modular units are easier to install, cost-effective, and can be tailored to local water conditions. They often use advanced, low-energy filtration methods and require less infrastructure, making them ideal for areas with limited resources. This approach increases access to safe water, promotes sustainability, and supports quicker emergency response in disaster-affected regions.

Q: What are some of the most promising research areas in filtration that could reshape the industry in the next decade?

A: Fields such as biomimetic membranes, AI-enhanced process design, and photocatalytic filtration hold promise for the next decade. Nanotechnology development of nanomaterials for ultra-fine filtration, enabling removal of viruses, heavy metals, and micropollutants. These technologies aim to mimic nature, improve pollutant breakdown, and self-regulate operations for optimum performance.

Q: How do you see the market for advanced filtration evolving, and what trends should industry professionals be preparing for?

A: The market is moving towards integration—smart, modular, and adaptive systems that can evolve with shifting needs. Trends include increased adoption in developing regions, greater automation, and more investment in R&D for emerging contaminants. Governments worldwide are enforcing stringent standards on emissions and wastewater discharge, compelling industries to adopt advanced filtration systems. Rising Demand in Pharmaceuticals and Biotechnology, the need for

high-purity materials and sterile environments is driving the growth of filtration technologies in these sectors.

Q: What advice would you give to companies looking to invest in or adopt the latest filtration technologies for their operations?

A: Start by clearly defining your water quality goals. Invest in pilot projects, prioritize scalability, and work with partners who understand both the technology and your operational environment. Staying informed on regulations and trends is also critical for future-

proofing your investment. For example, Coca-Cola uses microfiltration and UV in its bottling plants to maintain water quality and safety standards globally. To ensure regulatory compliance in India, new CPCB norms are pushing industries to reuse 100% of treated water—advanced filtration is crucial to meet this. We also need to prioritize cost-efficiency & ROI, a 2023 study found reverse osmosis systems, though 20–30% more expensive upfront, reduces long-term treatment costs by up to 25% due to lower chemical and energy use.



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Q: Can you share your company's vision and mission regarding water management and sustainability? How does your company differentiate itself in the competitive landscape of the water industry?

A: Vision: To lead the transformation of global water management through innovative automation solutions, ensuring sustainable and efficient use of resources for future generations.

Mission: At CIMCON, we are committed to revolutionizing water management by integrating advanced automation technologies. Our mission is to:

Innovative Automation: Pioneering state-of-the-art, modular, and scalable products that set new standards in water management efficiency.

Cost-effectiveness: Delivering groundbreaking, cost-effective solutions that reduce maintenance time and operational costs.

Technological Leadership: Leveraging flexible wireless technology and continuous product upgrades to stay ahead of industry trends.

End-to-End Solutions: Providing comprehensive turnkey project implementation, from hardware design to software configuration and integration.

Research & Development Excellence: Maintaining robust in-house software and R&D teams with cutting-edge infrastructure to drive continuous innovation.

Environmental Commitment: Embedding strong social responsibility and environmentally-friendly practices into our operations, promoting sustainable water use.

Local Expertise: Empowering local communities with dedicated sales resources and engineering expertise, ensuring tailored solutions that meet regional needs.

Q: What are the current trends and major innovations in the water industry? How do you see the future of the water industry evolving over the next 5-10 years?

A: Investing in the water sector offers a lot of promising opportunities. Here are some key areas with high potential for growth and development:

Improving Water Infrastructure:

- Urban Water Supply and Sanitation: Cities are growing, and there's a big need for better water supply systems and modern sanitation. Investing here can improve public health and quality of life.

- Rural Water Supply: There's a significant need to enhance water access in rural areas through various projects.

Water Treatment and Recycling:

- Wastewater Treatment Plants: Building and upgrading facilities to treat wastewater can help manage pollution and keep water bodies clean.
- Water Recycling Technologies: Encouraging industries and cities to recycle and reuse water can reduce the demand for fresh water.

Managing Water in Agriculture:

- Irrigation Systems: Modernizing irrigation with systems like drip and sprinkler irrigation can save a lot of water in farming, which uses the most water.
- Precision Agriculture: Investing in technologies like soil moisture sensors can help farmers use water more efficiently.

Smart Water Management:

- Digital Solutions: Using IoT and AI for monitoring water usage and detecting leaks can improve water management.
- Smart Metering: Installing smart water meters can help track water use more accurately and encourage conservation.

Desalination Projects:

- Coastal Areas: Desalination, which turns seawater into drinking water, can be a good solution for coastal regions facing water shortages.

Rainwater Harvesting and Groundwater Recharge:

- Urban and Rural Areas: Encouraging rainwater harvesting and groundwater recharge can help replenish groundwater and reduce water scarcity.

Public-Private Partnerships (PPPs):

- Collaborative Projects: Partnering between the public and private sectors can bring innovation and efficiency in developing water infrastructure and services.

Renewable Energy for Water Projects:

- Solar-Powered Water Pumps: Using solar energy for water pumps in agriculture can reduce reliance on electricity and diesel, promoting sustainable water use.

Investing in these areas can provide good returns while also helping solve one of the biggest challenges—managing and conserving water.

Q: Can you share some of the initiatives your organization has taken to combat water scarcity and promote sustainable water management in India?

A: CIMCON has actively participated in the Save Water Awareness Program in Bangalore, addressing the critical water crisis in Karnataka. Our operation of 11 pump houses, coupled with the innovative use of SCADA systems in MES Township, exemplifies our commitment to leveraging advanced technology for efficient water management. This initiative has received commendation from notable dignitaries, including IAS officers and the Chairman of the Bangalore Water Supply and Sewerage Board (BWSSB), Dr. Ram Prasath Manohar, highlighting the importance of collaborative efforts in mitigating water scarcity. CIMCON remains dedicated to sustainable water practices and technological advancements, ensuring the conservation of water resources for current and future generations. This initiative underscores the significance of unity and innovation in achieving a water-secure future.

Q: In your view, where are the best investment opportunities in India's water sector? Which areas do you think have the highest potential for growth and development?

A: There are some best investment opportunities in India's water sector here: are some key areas with high potential for growth and development:

- Water Treatment Plants
- Sewage collection, treatment, and disposal system
- Storm Water Drainage System
- Solid Waste Management
- Agricultural Water Management
- Rainwater Harvesting and Groundwater Recharge

Q: What are some key technologies and innovations that are helping to improve efficiency and sustainability in water management?

A: Smart Water Meters and Sensors:

- Advanced Meters: These provide real-time data on water usage, helping to quickly detect leaks and optimize water distribution.
- IoT Sensors: Monitor water quality, pressure, and flow in real-time, allowing for proactive maintenance and reduced water loss.

Data Analytics and Artificial Intelligence:

- Predictive Tools: Use data to foresee and prevent issues like pipe bursts and contamination.
- AI Systems: Help optimize water distribution and treatment, saving energy and cutting costs.

Sustainable Irrigation:

- Drip Irrigation: Directs water to plant roots, reducing waste and improving crop yields.
- Precision Farming: Uses data from sensors and drones to optimize when and how much to water crops.

Q: How can the water industry in India benefit from digitalization and data-driven strategies to enhance management practices and decision-making?

The water industry in India can significantly benefit from digitalization and data-driven strategies to enhance management practices and decision-making. Here are some ways:

- Real-Time Monitoring and Management
- Predictive Analytics and AI
- Water Quality Management
- Cost Efficiency

Q: Balancing the needs of agricultural, industrial, and domestic water users can be challenging. How do you think these competing demands can be managed effectively?

A: Balancing the needs of agriculture, industry, and households for water can be challenging, but it can be managed effectively with the following approaches:

Comprehensive Planning

- Integrated Approach: Develop water management plans that consider the needs of all sectors—agriculture, industry, and households

Efficient Irrigation Practices

- Precision Agriculture: Use data-driven irrigation systems that apply water based on soil moisture levels and weather forecasts, minimizing waste.

Data and Technology

- Monitoring Systems: Implement advanced monitoring systems to track water usage and quality across sectors in real-time.
- Data Analytics: Use data analytics to identify trends, forecast demand, and optimize water distribution and usage.

Q: What lessons can India learn from other countries that have successfully addressed water issues? How can these be adapted to the Indian context?

A: India can learn a lot from countries that have successfully dealt with water problems. For example, Israel uses advanced drip irrigation and desalination methods to make the most of its water supply. Singapore has an integrated water management system that includes collecting rainwater and recycling wastewater.

To make these ideas work in India, we need to customize them for our local conditions. This means looking at the specific water needs and availability in different regions. Building strong partnerships between the government and private sector, investing in better infrastructure, and educating people about the importance of saving water are all crucial steps. Additionally, creating clear water management policies and involving local communities will help ensure that India's water resources are used sustainably for the long term.

Q: Looking ahead, what do you expect for the future of the water industry in India over the next five to ten years,

particularly in terms of technological advancements, policy changes, and overall growth?

A: In the next five to ten years, the water industry in India is poised for significant growth, driven by technological advancements, policy reforms, and increased awareness of water conservation.

Technologically, we can expect wider adoption of smart water management systems, including IoT-based monitoring, advanced filtration methods, and efficient irrigation techniques like precision agriculture. These innovations will help optimize water usage and reduce wastage.

Policy-wise, the government is likely to introduce more comprehensive water management regulations, focusing on sustainable practices, water recycling, and conservation incentives. These changes will aim to address the pressing challenges of water scarcity and quality.

Overall, the industry's growth will be marked by greater investments in infrastructure, stronger public-private partnerships, and enhanced community involvement. This holistic approach will not only improve water availability and quality but also ensure the long-term sustainability of India's water resources.

Q: Can you talk about any notable projects or initiatives you've been involved in that address water-related challenges in India? What were the outcomes and key takeaways from these experiences?

A: Although I haven't personally been involved in any specific projects addressing water-related challenges in India, I can share insights from various successful initiatives and their outcomes.

Project: CANAL SCADA Solutions

Objective: The primary goal of this project is to implement a Master SCADA system for real-time monitoring and automated gate operations, ensuring precise and efficient water management.

Addressing Key Challenges:

- **Manual Operations:** Previously, operations were time-consuming and prone to errors.
- **Labor-Intensive:** Significant human resources were required.
- **Delayed Response:** There was a slow reaction to changing conditions.
- **Limited Accessibility:** Remote control options were non-existent.

Key Benefits:

- **Automated Control:** Reduces errors and ensures precision in operations.
- **Real-Time Monitoring:** Enables quick responses to changes.
- **Remote Accessibility:** Improves overall efficiency and safety by allowing operations to be controlled remotely.
- **Enhanced Data Management:** Provides accurate data for better decision-making.
- **Improved Efficiency:** Streamlines operations and reduces the need for manual labor.
- **Operational Safety:** Minimizes risks associated with gate operations.
- **Consistent Water Supply:** Ensures reliable irrigation for agriculture.
- **Optimized Electricity Generation:** Allows better control of water releases for electricity production.

Q: How can the government, private sector, and civil society work together to ensure sustainable water management and secure water resources for future generations in India?

A: To ensure sustainable water management and secure water resources for future generations in India, the government, private sector, and civil society need to work together.

Government: The government can create and enforce strong water policies, invest in necessary infrastructure, and offer incentives for water-saving practices. They can set rules and encourage sustainable water use to guide everyone in the right direction.

Private Sector: Businesses can invest in new water management technologies like smart irrigation and recycling wastewater. They can also adopt eco-friendly practices in their operations and support community water projects. By partnering with the government, they can pool resources and expertise to make these projects bigger and more effective.

Civil Society: Community groups and NGOs can educate people about the importance of saving water and teach sustainable practices. They can also push for policy changes that support water conservation. By involving local communities in water projects, they can ensure solutions are practical and well-received. Working together, these groups can promote a culture of saving water, encourage innovation, and

implement effective solutions for managing water sustainably in India.

Q: What role do you see for innovation and entrepreneurship in driving positive changes in India's water industry? Are there any promising startups or initiatives that have caught your attention?

A: Innovation and entrepreneurship play a crucial role in transforming India's water industry by introducing cutting-edge technologies and creative solutions to longstanding challenges. Startups and innovative initiatives are driving positive change by developing smart water management systems, efficient purification methods, and sustainable agricultural practices.

One promising startup is ****JaJeevan****, which uses IoT technology for real-time water quality monitoring and management, ensuring safe drinking water for communities. Another noteworthy initiative is ****Nirvana Technologies****, which focuses on affordable and scalable desalination solutions to address water scarcity.

These examples demonstrate the potential of innovation and entrepreneurship to revolutionize water management in India, making it more efficient, sustainable, and accessible for all.

Q: On a personal note, do you have a favorite book or author? How about a favorite movie?

A: I don't have any favourite book or favourite movie generally it depends on story line.

Q: What piece of advice would you offer to the team at EverythingAboutWater?

A: My advice to the team at EverythingAboutWater is to keep looking for and using the latest technologies and sustainable practices in water management. Partner with innovative startups and use data to create effective solutions. Also, focus on engaging and educating communities about the importance of saving water. This will help ensure the long-term success and sustainability of your projects.

Q: Lastly, How can our audience stay informed about your company's latest developments and initiatives?

A: To stay informed about our latest developments share updates, success stories, and insights on and initiatives, follow us on social media, subscribe to our newsletter, and visit our website regularly. We innovative water solutions, ensuring you're always in the loop with our progress and impact.

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INTERVIEW WITH SHARAD BHUSHAN EXECUTIVE DIRECTOR, ENVIRONMENT, WATER AND ENERGY AT AECOM INDIA

Q: What are the most significant breakthroughs in filtration technologies that you have seen in recent years?

A: One of the most notable advancements is the microbubble technology developed by AECOM in collaboration with Sheffield University and Perlemax. This innovation utilizes a solid-state oscillator integrated into aeration blower pipework to produce ultra-fine microbubbles, significantly enhancing aeration efficiency. The technology enables up to 60% energy savings in wastewater treatment and up to 90% in potable water clarification processes. These efficiencies lead to lower operational costs and a reduced environmental footprint through minimized greenhouse gas emissions.

Q: How are advanced filtration methods improving operational efficiency in large-scale water treatment facilities?

A: AECOM has implemented advanced membrane-based systems, including ultrafiltration and reverse osmosis, that achieve up to 95% water recovery. These systems are built to handle varying water qualities while complying with stringent regulations. The integration of digital twins and real-time analytics optimizes operational parameters, reduces downtime, and enhances system reliability.

High-recovery reverse osmosis technologies further reduce brine production, offering both operational and environmental advantages.

Q: What are the key factors driving innovation in membrane filtration, and how do you see these evolving?

A: Key drivers of innovation in membrane filtration include the need for greater operational efficiency, environmental sustainability, and adherence to increasingly strict regulatory standards. AECOM focuses on advancing membrane materials that offer higher durability and fouling resistance, paired with digital monitoring and predictive maintenance tools. Looking ahead, innovation will emphasize circular economy principles, energy-efficient operations, and stronger collaboration among industry, academia, and technology developers.

Q: How is nanotechnology enhancing filtration performance, and what challenges remain in its widespread adoption?

A: Nanotechnology is improving filtration by enabling membranes to achieve higher permeability, selectivity, and fouling resistance. AECOM is actively exploring the application of materials such as graphene and carbon nanotubes to improve filtration

performance and incorporate antimicrobial properties. However, widespread adoption is hindered by high production costs, environmental and health concerns, and the lack of fully developed regulatory frameworks. Additionally, scaling nanotechnology-based solutions from lab to field remains a challenge.

Q: With AI and IoT integration becoming more common, how are smart filtration systems improving real-time monitoring and maintenance?

A: AECOM incorporates AI and IoT to enhance real-time monitoring and system performance. IoT sensors continuously track key parameters like flow, pressure, and water quality, while AI algorithms process this data to optimize system operations and enable predictive maintenance. This smart integration allows for remote control, automatic adjustment of system settings, improved regulatory compliance, and a significant reduction in operational downtime and maintenance costs.

Q: What advancements have been made in tackling emerging contaminants like microplastics, PFAS, and pharmaceutical residues?

A: AECOM has advanced the removal of emerging contaminants through a range of technologies. For microplastics, advanced membranes and

nanomaterial-based filters enhance capture capabilities. PFAS, known for their persistence, are addressed using granular activated carbon, ion exchange resins, and novel destructive methods like electrochemical oxidation. Pharmaceutical residues are mitigated through ozonation, advanced oxidation processes, and membrane bioreactors. While these solutions are effective, cost, scalability, and regulatory adaptation continue to be key challenges.

Q: How are filtration technologies evolving to reduce energy consumption and overall operating costs for industrial applications?

A: AECOM is piloting microbubble technology using a fluidic oscillator that improves oxygen transfer rates by 50%, significantly reducing energy use. The promotion of effluent water reuse in industrial processes also decreases demand for freshwater and energy-intensive pumping. Additionally, cloth media filters reduce chemical use and operate continuously during backwash, enhancing efficiency. The adoption of energy-efficient aeration systems and diffusers further contributes to reduced operating costs and environmental impact.

Q: What are the biggest technical and logistical challenges you face when implementing new filtration solutions in water treatment plants?

A: Implementing new filtration systems often involves overcoming complex regulatory requirements and upgrading outdated infrastructure. AECOM frequently addresses challenges posed by variable water quality, high capital and operational costs, and limited technical expertise at facilities. Ensuring that new systems integrate smoothly with existing infrastructure without service disruption is a key logistical concern, requiring detailed planning and coordination.

Q: How do you balance innovation with regulatory compliance when adopting new filtration technologies?

A: AECOM ensures regulatory alignment through its structured innovation evaluation platform, 'Innoverse.' This seven-step process includes early engagement with regulators and stakeholders, risk-based technology assessment, and continuous feedback integration. By building stakeholder advocacy and ensuring compliance throughout the innovation lifecycle, AECOM facilitates the adoption of

scalable, sustainable, and regulation-compliant filtration technologies.

Q: What steps are being taken to make filtration systems more sustainable, particularly in terms of material selection and waste reduction?

A: AECOM focuses on using environmentally responsible materials that are durable, recyclable, or repurposable. Waste reduction is achieved by designing systems that generate less waste and by integrating waste-to-energy approaches, such as converting biogas from anaerobic digestion into usable energy. By applying circular economy strategies, including reusing sludge as fuel, and deploying efficient treatment technologies like IFAS, AECOM ensures sustainability across the entire filtration lifecycle.

Q: How are advancements in filtration impacting industries such as agriculture, pharmaceuticals, and manufacturing?

A: In agriculture, AECOM's filtration systems enable treated wastewater reuse for irrigation, helping conserve freshwater in water-scarce regions. The pharmaceutical industry benefits from higher purity water in production and effective removal of active compounds from effluents. In manufacturing, filtration technologies support wastewater recycling and handle high-strength waste while ensuring compliance with environmental regulations. These advancements drive sustainability and improve process efficiency across all three sectors.

Q: What role does decentralized water treatment play in the future of filtration technologies, especially in remote or underdeveloped areas?

A: AECOM views decentralized treatment as critical for improving access to clean water in remote and underdeveloped areas. These systems can be customized for local water quality challenges and do not require extensive infrastructure. By utilizing advanced membranes and compact treatment technologies, decentralized systems offer resilience against climate impacts, reduce distribution costs, and provide sustainable, on-site water treatment solutions.

Q: What are some of the most promising research areas in filtration that could reshape the industry in the next decade?

A: Future advancements will likely stem from breakthroughs in membrane science, particularly graphene oxide and nanocomposites that offer superior filtration efficiency and durability. AECOM is also exploring biologically integrated systems, such as membrane bioreactors, which leverage microbial processes for enhanced treatment. The development of intelligent filtration systems using sensors and AI, alongside energy-efficient methods like forward osmosis, will redefine industry practices. Circular economy-based resource recovery from wastewater streams remains a major area of interest.

Q: How do you see the market for advanced filtration evolving, and what trends should industry professionals be preparing for?

A: AECOM anticipates growing demand for clean water driven by urbanization and population growth, accompanied by increasingly stringent environmental regulations. Emerging technologies in materials science will make filtration systems more efficient and affordable. There will also be greater integration of smart systems for monitoring and adaptive control. The market will continue to emphasize sustainability, energy efficiency, and modular, customizable solutions tailored to specific industry needs.

Q: What advice would you give to companies looking to invest in or adopt the latest filtration technologies for their operations?

A: AECOM advises companies to begin with thorough research and needs assessment, followed by an evaluation of total cost of ownership, including energy use and maintenance. Technologies should be scalable and adaptable to future regulatory or operational changes. Sustainability, smart integration (AI and IoT), and collaboration with experienced consultants are key. Pilot testing is strongly recommended before full implementation, along with investing in staff training and ensuring supplier support for long-term success.





INTERVIEW WITH THEOGENE RUSATIRA WASH EXPERT, MOVIMENTO LOTTA FAME NEL MONDO (MLFM)

Q: Can you share your company's vision and mission regarding water management and sustainability? How does your company differentiate itself in the competitive landscape of the water industry?

A: Movimento Lotta alla Fame nel Mondo (MLFM) is an international non-profit organization that aims at improving access to safe drinking water, adequate sanitation, and hygiene education. MLFM works hand in hand with the local authorities to improve water and sanitation policies to meet the needs of the population and reach the targets of the Sustainable Development Goals.

Q: What are the current trends and major innovations in the water industry? How do you see the future of the water industry evolving over the next 5-10 years?

A: Current trends and major innovations in the water industry are:

1. Ensure availability and sustainable management of water and sanitation for all .

- The increment of non-revenue water

- The future of the water industry evolving over the next 5-10 years.
- 2. The reduction of non-revenue water as much as possible.
- 3. Availability and sustainable management of water and sanitation for all.
- The increase of water sources to accommodate future population growth.

Q: Can you share some of the initiatives your organization has taken to combat water scarcity and promote sustainable water management in India?

A: From 02nd to 04th February this year, People from our Company were sent in India during Global South Academic Conclave on WASH and Climate linkages to discuss with the water experts around the world the solution of water scarcity in India.

Q: In your view, where are the best investment opportunities in India's water sector? Which areas do you think have the highest potential for growth and development?

A: The increase of Wastewater treatment technologies to the acceptable standards limits to be used as the additional water source.

- Investment in the decrease of non-revenue water.
- The increase of alternative of water sources, for instance rainwater harvesting, underground water extraction, as the second option to top up the existing water sources in use.

Q: What are some key technologies and innovations that are helping to improve efficiency and sustainability in water management?

A: 1. Introduction of smart water meter for proper water management.

2. To form and empower water user committees for proper water management.

3. Sensibilisation for women to use less water in their daily home activities for proper water management at family level.

4. Formation of technicians at village level to address water problems (Leakage, pipe broken, etc).

Q: How can the water industry in India benefit from digitalization and data-driven strategies to enhance management practices and decision-making?

A: The introduction of smart water meter technologies and other data-driven technologies like the use of Global Positioning Systems (GPS), Supervisory Control and Data Acquisition (SCADA) systems are used for controlling, monitoring, and analyzing industrial devices and processes.

Q: Balancing the needs of agricultural, industrial, and domestic water users can be challenging. How do you think these competing demands can be managed effectively?

A: It is important to search for the other source of water to top up the existing source of water currently in use, those sources can be:

- Extraction of underground water sources.
- Introduction of rainwater harvesting practices.
- Introduction of wastewater treatment technologies whereby supernatants meeting the standards limit to be reused.
- Invest More In Water Conservation Projects.

Q: What lessons can India learn from other countries that have successfully addressed water issues? How can these be adapted to the Indian context?

A: 1. Reduce Excessive Dependency On Water Sources

Be it groundwater or water bodies, excessive usage will inevitably lead to exhaustion as has happened in the case of Cape Town and closer home, Bengaluru. 395 billion cubic metres of groundwater is available in India, the usage of which has gone up to 66 per cent in 2015 from 58 per cent in 2004, and water experts are concerned about. India's groundwater usage is expected to reach nearly 75 per cent in 2025, an alarming number. To avoid a Cape Town like situation, urban spaces must reduce their dependency on water sources and invest more in water recycling and rainwater harvesting.

2. Encourage Rainwater Harvesting

Sierra Leone, a West African country used to be one of the world's worst water scarce countries till 2010, with people paying exorbitant amounts for as low as 10 litres of water per capita daily. Since 2011, rainwater harvesting has become widespread in Sierra Leone, and currently nearly 40 per cent of the country's area is covered by rainwater harvesting

systems in scales large and small. Rainwater harvesting serves multiple purposes, including using the water for irrigation, a large concern in India as water from the ground and rivers, lakes is extensively used to water crops. India can learn from the likes of Singapore, Thailand, Japan, Indonesia and closer home, neighbour Bangladesh to harvest rainwater successfully.

3. Check Rapid Urbanisation

In 2013, World Water Council corroborated reports for its study on the relationship between urbanisation and water crisis. Findings showed that unplanned urbanisation, especially in developing economies has had devastating effects on water levels. In India, rapid expansion of cities like Bengaluru, Delhi, Mumbai and the depleting levels of groundwater, along with pollution of adjoining rivers is a stark example of how urbanisation affects water. Not allowing commercial or residential establishments to operate within a certain parameter from a water body is a step that must be considered in India if the country's water crisis is to be addressed seriously.

4. Invest More In Water Conservation Projects

Given India's population of 1.2 billion and volume of water usage of nearly 1,000 billion cubic metres in 2013, the gravity of the water crisis is on a bigger scale, compared to smaller countries. It must also be kept in mind that pan India water conservation projects will cost significantly, so sufficient budgetary allocations need to be made for water conservation. The Rs 20,000 crore allocation for the Namami Gange programme, which aims to clean the river Ganga and restore its flow is an example of a significant allocation towards a large scale water conservation project. Similar projects must be undertaken for other waterbodies and groundwater in India to tackle the water crisis. China has invested \$131 billion (Rs 64,000 crore) in 2017 alone towards large scale water conservation projects. The country has identified several sites where large storage containers will be built and rainwater will be stored to minimise dependency on groundwater. In Brazil, the citizens have been actively encouraged by the government to ration water. Water drawn from reservoirs has also been reduced by 22% by the government, so that the gap between consumption and the filling of reservoirs can be shortened.

5. Create Further Public Awareness

In Tanzania, one of the poorest countries in East Africa, water crisis had reached enormous levels in mid 90s.

To make the situation better, the government launched a campaign to encourage water conservation and educated people on how to conserve water and reduce wastage. By 2010, the country had begun to harvest almost 50 per cent of its rainwater. This is a prime example that economic stability need not be the only benchmark to conserve water. Creating awareness among people, especially ensuring they understand that water is not an unending resource, is highly important to make water conservation a mass movement.

Q: Looking ahead, what do you expect for the future of the water industry in India over the next five to ten years, particularly in terms of technological advancements, policy changes, and overall growth?

A: The water industry in India is undergoing significant changes and facing both opportunities and challenges within 5 to 10 years period. Here are some key points:

1. Bottled Water Industry:

- India was the 12th largest consumer of bottled water by value and the 14th biggest by volume in 2021.
- However, the booming bottled water industry raises concerns about access to safe water sources and groundwater depletion.
- Plastic containers dominate packaging, despite efforts to reduce single-use plastic.

2. Water Treatment Market:

- The Indian water and wastewater treatment market is expected to reach \$2.08 billion by 2025, growing at a compound annual growth rate (CAGR) of 9.7%.
- Increasing urbanization, climate change, and fresh water demands drive the need for advanced technologies.

3. Challenges and Initiatives:

- Rapid urbanization necessitates changes in water management.
- Automation and digitization are crucial for water companies to stay competitive.
- India's water demand is projected to increase, emphasizing the need for sustainable solutions³.
- Balancing water supply, quality, and environmental impact remains a challenge.

Q: Can you talk about any notable projects or initiatives you've been involved in that address water-related challenges in India? What were the outcomes and key takeaways from these experiences?

A: Initiative to wastewater treatment technologies whereby supernatants meeting the standards limit to be reused. Once adopted, it will top up the water source currently in use.

Q: How can the government, private sector, and civil society work together to ensure sustainable water management and secure water resources for future generations in India?

A: It is very important that joint projects being implemented to ensure sustainability of water resources management.

Many companies are realizing that such projects are most efficient and transformative when conducted in collaboration with governments, civil society, communities and others. Companies seek out partnerships with other organizational actors in order to gain other perspectives, build on internal competencies, increase leverage, enhance credibility and pool resources to address shared water risks.

Companies, non-governmental organizations, communities and governments have a shared interest

in sustainable water management broadly, there are many specific elements where interests might diverge. For example, while the system as a whole benefits from water allocations that prevent wasteful use, specific actors have an interest in maximizing their allocation in relation to other users.



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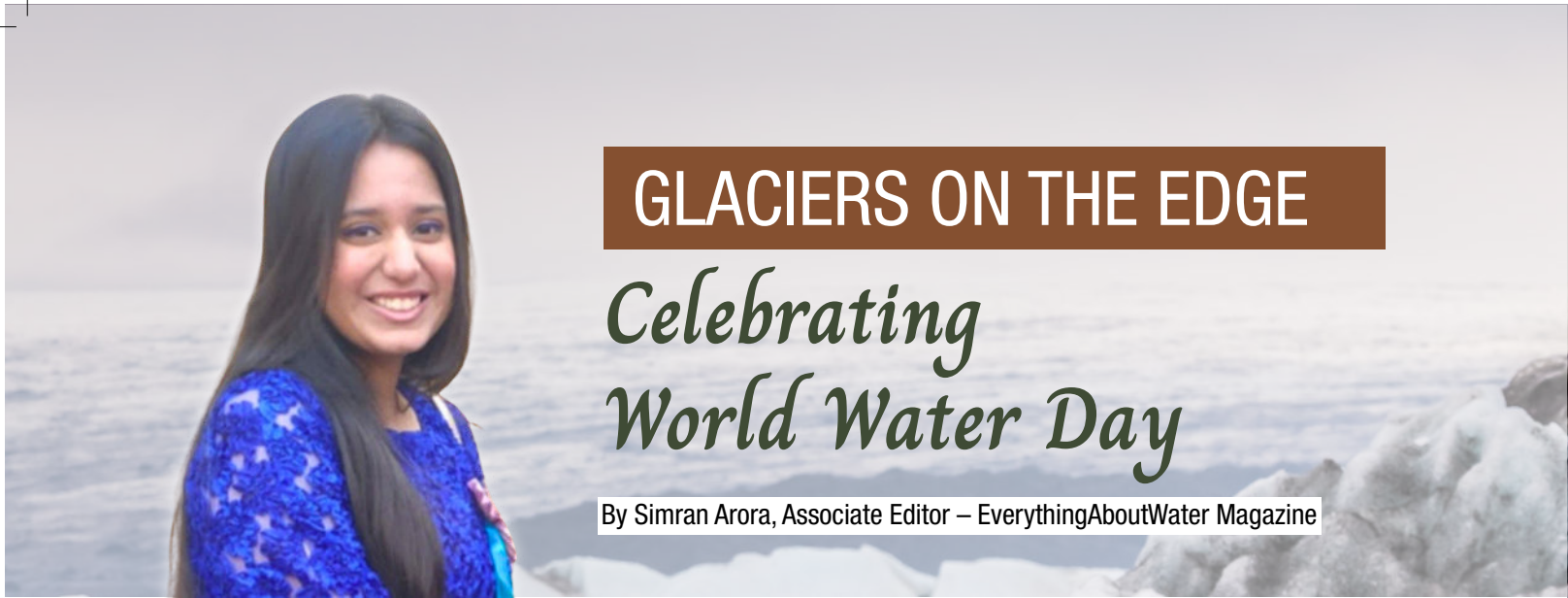
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GLACIERS ON THE EDGE

Celebrating World Water Day

By Simran Arora, Associate Editor – EverythingAboutWater Magazine

INTRODUCTION: A FROZEN CRISIS UNFOLDS

March 22nd, World Water Day 2025, centers around a theme that could not be more urgent: Glacier Preservation. Glaciers—majestic, formidable, and vital—are not just remnants of the Ice Age. They are living reservoirs that support ecosystems, feed rivers, stabilize climates, and offer lifelines to billions of people.

Yet, they are disappearing.

From the Himalayas to the Andes, the Alps to Antarctica, glaciers are melting at unprecedented rates due to global warming. According to the Intergovernmental Panel on Climate Change (IPCC), over 80% of mountain glaciers will disappear by the year 2100 if emissions are not curbed. The consequences? Water scarcity, sea-level rise, extreme weather patterns, and irreversible loss of biodiversity.

In this special feature, we embark on a comprehensive exploration of glacier preservation: the science, the stakes, the solutions, and the shared responsibility of humanity.

1. UNDERSTANDING GLACIERS: NATURE'S FRESHWATER VAULTS

1.1 What Are Glaciers?

Glaciers are massive, persistent bodies of dense ice that form from accumulated snowfall over centuries. Found predominantly in polar and mountainous regions, glaciers hold about **69% of the world's freshwater**.

1.2 Types of Glaciers

- **Valley Glaciers** – Flow through mountain valleys (e.g., Gangotri in the Himalayas)
- **Continental Glaciers** – Cover vast land areas (e.g., Antarctica, Greenland)
- **Tidewater Glaciers** – Terminate in the sea, contributing to sea-level rise

1.3 Hydrological Importance

Many of the world's great rivers—like the Ganges, Brahmaputra, Yangtze, and Indus—originate from glacial melt. In dry seasons, these rivers are primarily sustained by glacier-fed flows, ensuring water security for agriculture, drinking, and sanitation.

2. MELTING ICE, RISING ALARMS: THE CURRENT STATE OF GLACIERS

2.1 Global Meltdown

Data from the **World Glacier Monitoring Service (WGMS)** indicates that glaciers are losing 335 billion tons of ice annually. Iconic glaciers like Switzerland's Morteratsch or Alaska's Exit Glacier have receded by hundreds of meters over the past few decades.

2.2 The Asian Water Tower Crisis

The **Hindu Kush-Himalaya region**—also dubbed the “Third Pole”—is warming at twice the global average. This region supports **1.9 billion people**, making its glaciers crucial for water stability in South Asia. Yet, it's losing ice mass rapidly, threatening water security in India, Pakistan, Bangladesh, and China.

2.3 The Arctic Tipping Point

Greenland alone has the potential to raise sea levels

by over 7 meters if its ice sheet collapses. And with Arctic sea ice melting, feedback loops are accelerating: less ice means less sunlight reflected, leading to faster warming.

3. IMPACTS BEYOND BORDERS: WHY GLACIER LOSS MATTERS TO ALL

3.1 Water Scarcity

Seasonal melt from glaciers sustains crops in arid and semi-arid zones. As glaciers recede, this dependable flow dwindles, resulting in food insecurity, droughts, and conflict over water.

3.2 Sea-Level Rise

Melting glaciers contribute approximately 30% to global sea-level rise. This jeopardizes low-lying countries like Maldives, Bangladesh, and Pacific island nations.

3.3 Disasters and Hazards

Glacial lake outburst floods (GLOFs) are on the rise. These catastrophic floods occur when melting ice forms lakes that burst through natural dams. The 2021 Chamoli disaster in Uttarakhand is a grim example.

3.4 Biodiversity and Ecosystems

Cold-water fish species, alpine flora, and entire high-altitude ecosystems are dependent on glacial waters. Their extinction is inevitable without intervention.

4. GLACIER MONITORING: TECHNOLOGY AS A TORCHBEARER

4.1 Remote Sensing and Satellites

Agencies like NASA and ESA are employing satellites like **Landsat, Sentinel-2, and ICESat-2** to track glacier volume, mass balance, and retreat rates.

4.2 Ground-Based Observations

Field stations such as HIMANSH in the Himalayas provide real-time data. Ice cores, ablation markers, and snow-depth sensors are tools scientists use to understand glacial health.

4.3 Citizen Science

In countries like Switzerland and Nepal, trekkers, mountaineers, and locals are participating in glacier photography and mapping, helping to crowdsource data.

5. GLACIER PRESERVATION: WHAT CAN BE DONE?

5.1 Mitigating Global Warming

Reducing greenhouse gas emissions is the only long-term solution. This includes shifting to renewables, enforcing carbon taxes, and pushing for energy efficiency.

5.2 Geoengineering and Technological Interventions

- **Glacier Blankets:** Switzerland has wrapped parts of glaciers in reflective blankets to slow melting.
- **Artificial Glaciers:** India's Ladakh region has experimented with “ice stupas” to store winter meltwater.
- **Cloud Seeding:** Can increase snowfall in key glacier zones, but its long-term impact is debated.

5.3 Policy-Level Actions

- **Glacier Conservation Acts:** Like India's draft policy for Himalayan glacier protection.
- **Transboundary Cooperation:** Glacial rivers cross national borders; thus, regional treaties are essential.
- **Climate Adaptation Funds:** The UN Green Climate Fund supports glacier-reliant nations.

6. THE HUMAN ELEMENT: COMMUNITIES,

CULTURE, AND CLIMATE

6.1 Indigenous Wisdom

Many indigenous communities, from the Andes to the Alps, have lived in harmony with glaciers, respecting their spiritual significance and understanding their behavior.

6.2 Glacier Tourism and Its Footprint

While glacier tourism educates, it also harms. Excessive foot traffic, waste, and pollution in fragile areas necessitate sustainable tourism models.

6.3 Education and Awareness

World Water Day 2025 is an opportunity for schools, institutions, and governments to integrate glacier education into curricula, helping the next generation understand what's at stake.

7. GLACIER STORIES FROM AROUND THE WORLD

7.1 India – The Vanishing Gangotri

The sacred Gangotri glacier has retreated by over 1,500 meters in the last 70 years. Pilgrims and scientists alike are sounding alarms.

7.2 Peru – Climate Exodus

In the Cordillera Blanca, communities have migrated after glacial streams dried up. Lake Palcacocha now poses a GLOF risk to Huaraz city.

7.3 Iceland – Funeral for Okjökull

In 2019, Iceland held a funeral for Okjökull glacier—the first to be lost to climate change. A plaque reads: “We know what is happening. What are we going to do about it?”

8. THE ROLE OF INDUSTRY: SUSTAINABLE BUSINESS AND GLACIER PRESERVATION

8.1 Water-Intensive Industries

Hydropower, bottling plants, and agriculture rely on glacial runoff. These industries must audit their water footprint and adopt efficient technologies.

8.2 Corporate Accountability

Sustainability reporting and ESG mandates should include glacier impact assessments.

8.3 Innovation

Startups are creating low-carbon desalination, glacier-safe tourism gear, and smart irrigation using glacial water.

9. INDIA'S GLACIER FUTURE: A NATIONAL RESPONSIBILITY

India must take a leadership role in glacier preservation. Initiatives like National Mission on Sustaining the Himalayan Ecosystem (NMSHE) and collaboration with ISRO on glaciology must be strengthened.

Additionally, India can:

- Establish Glacier Parks for restricted ecological zones
- Promote cold region research through higher funding
- Use media to amplify glacial literacy

10. A VISION FOR 2050: CAN WE STILL SAVE OUR GLACIERS?

While complete preservation may not be possible, slowing the melt is within our reach. It requires:

- Global solidarity
- Behavioral shifts
- Sustainable water use
- Technology and tradition working together

CONCLUSION: A GLACIER'S PLEA

As editors, policymakers, scientists, and citizens, we are all witnesses to a quiet crisis—one that's white, melting, and often invisible until it is too late.

On this World Water Day 2025, let us listen to the glaciers. Their silence is not peace—it is peril.

Let us act not just with urgency, but with empathy. Because preserving glaciers is not just about preserving frozen water.

It is about preserving life itself.

COOLING TOWER WATER OZONATION: OZONE WONDER

The use of ozone in cooling tower water treatment is well known, In India surprisingly there are many large cooling towers, all of the in powerplants that are using ozone. The worlds largest cooling tower ozonation is in India at Yerrmarus. (near Raichur) . KPCL as well as Mahagenco and pioneers in this field. Yerrmarus has 3 x 38 Kg ozone system. . In Europe (Germany) we find companies like Shell use ozone for many of their cooling towers. Unfortunately, we do not find too many industrial houses using Ozone in cooling towers. Mostly because they are comfortable sticking to the existing treatment methods and show resistance to change.

It is well known fact that cooling tower operators use large quantities of toxic chemicals to keep the cooling water clean to protect the cooling towers. They discharge highly polluted blow down water that needs to be treated before discharge. There is tremendous pressure from environmentalists.

Users of Ozone Technology around the globe have always accepted the benefits of Ozonation; however, the viability of using ozone in India has always been a question for lack of quantified studies and working references. Ozonia (SUEZ) have undertaken extensive studies in the use of ozone in cooling towers in the past and have published papers.

The use of ozone provides the following benefits in a nutshell:

- Completely eliminates Biocides ,making the discharge water cleaner.
- More than reduces 90% of Sulphuric acids and de-scalents for large towers.
- No hazardous chemical storage and Handling such as gas chlorine.
- Enables the CT to be operated at Higher COC , eliminates controlled blow down.
- Prevents scaling, corrosion and reduces algal growth.
- Saves energy in operation of the Cooling tower.
- Finally Saves water, saves chemicals costs, allows the power plant comply with environmental needs and make them environmentally friendly.

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JACOB'S WELL: TEXAS' CRYSTAL TRAP



Tucked away in the limestone heart of the Texas Hill Country, Jacob's Well appears serene—its sapphire waters glinting under the sun, surrounded by rustic greenery. This spring, nestled in Wimberley, Texas, looks like a picturesque oasis, inviting locals and travelers alike with its cool, inviting waters and peaceful ambiance. But beneath this natural marvel lies something far more complex and dangerous: a labyrinthine cave system that has both fascinated and terrified divers for decades. What looks like a tranquil swimming hole is actually one of the most perilous underwater caves in the United States.

Stretching over 140 feet deep with twisting passages and narrow entrances, Jacob's Well has claimed more than a few lives. The descent begins with a wide entrance, but the passage quickly narrows into a complex network of submerged chambers, tight crevices, and silt-lined tunnels. Its crystalline clarity often deceives the eye, luring adventurous divers into an environment where visibility and direction can shift in an instant. What begins as a clear view can turn opaque with the flick of a fin, and air supply becomes a ticking clock. The system's tight restrictions and sudden drop-offs have led to disorientation, entrapment, and tragedy—even for experienced cave divers equipped with the best gear.

Local legend surrounds the well, adding layers to its mystery. Some stories speak of it as a sacred site used by Native American tribes, who considered it a spiritual portal or a life-giving spring. Others describe strange feelings—an invisible pressure, or sudden chills—experienced by visitors near its depths. Whispers of ghostly apparitions or an eerie silence that falls as one approaches its edge contribute to the aura that surrounds Jacob's Well. Scientists and researchers have explored its passages using specialized diving robots and sonar technology, but parts of the cave still remain uncharted, reinforcing its mythic status among thrill-seekers, geologists, and paranormal enthusiasts alike.

Despite the risks, Jacob's Well continues to draw visitors year-round—swimmers in summer, mystics in winter, and divers hoping to glimpse the hidden chambers below. On hot Texas days, families gather around its banks, dipping toes into its refreshing waters, often unaware of the complex system lurking below. For others, the draw is more introspective—searching not just for adventure, but for answers, for a connection to something ancient and mysterious. It is a place where natural beauty meets the unknown, and where curiosity must always be balanced with caution.





March 2025

International Conference on Advances in Water Treatment and Management
1 - 2 March 2025
Gandhinagar, Gujarat, India
www.pdeu-h2o.com

Sioux Empire Water Festival
4 - 5 March 2025
Sioux Falls, USA
sewf.org

Hot Water & Hot Air
4 - 6 March 2025
Portland, USA
www.aceee.org/2025-hot-water-hot-air-forums

International Conference on Water Management Modeling
5 - 7 March 2025
Toronto, Canada
www.icwmm.org

Oman Sustainability Week
11 - 15 May 2025
Muscat, Oman
www.omansustainabilityweek.com

ISH - World's leading trade fair HVAC + Water
17 - 21 March 2025
Frankfurt, Germany
ish.messefrankfurt.com/frankfurt/en.html

Aqua Netherlands
18 - 20 March 2025
Evenementenhal Gorinchem, Netherlands
www.aquanederland.nl/en

Water & Clean Tech India Expo
19 - 21 March 2025
Pragati Maidan, New Delhi
www.smartcitiesindia.com

Water Phillipines Expo & Conference
19 - 21 March 2025
SMX Convention Center, Manila, Philippines
www.waterphilippinesexpo.com

April 2025

China Clean Expo Shanghai
31 Mar - 03 Apr 2025
Shanghai New International Expo Centre(SNIEC), Shanghai, China
www.chinacleanexpo.com/en

American Worlds Water Association Annual Conference
07 - 10 Apr 2025
Anaheim, USA
www.inawwa.org/event/2025-annual-conference-april-21-25th/

Baku Water Week
08 - 10 Apr 2025
Baku Expo Center
bakuwaterweek.az/en/

Water Environment Association of Ontario Annual Conference
13 - 15 Apr 2025
London Convention Centre, London, Canada
weao.org/about/

Smart Water Systems
14 - 15 April 2025
London, United Kingdom
www.smgconferences.com

MiningWorld Russia
23 - 25 Apr 2025
Crocus Expo International Exhibition Center, Krasnogorsk, Russia
miningworld.ru/en/

Our Ocean Conference KOREA
28 - 30 Apr 2025
Centum City Industrial Complex, Busan, South Korea
ourocean2025.kr

2025 Water for Food Global Conference
28 Apr - 02 May 2025
University of Nebraska
waterforfood.nebraska.edu

May 2025

Water Management Show (WaterEx)
01 - 03 May 2025
ICCB, Dhaka, Banglade
shsavor-watermanagement.com

International Water Summit 2025
05 - 06 May 2025
Midreshet Ben-Gurion, Israel
www.watersummitziwr.com

Power of Water Canada Technical Conference & Trade Show 2025
07 - 09 May 2025
Niagara-on-the-Lake, Canada
powc25.vfairs.com/en/

Stormwater and Wastewater Conference Saudi Arabia 2025
11 - 12 May 2025
Jeddah Hilton, Jeddah, Saudi Arabia
stormwaterandwastewaterksa.com

Commonwealth Chemistry Congress (CCC)
11 - 14 May 2025
Stellenbosch, South Africa
commonwealthchemistry.org

Industrial Water Management - Effective Process Water Treatment 2025
15 - 16 May 2025
ibis Styles Berlin Treptow, Berlin, Germany

Enlit Africa
20 - 22 May 2025
Cape Town, South Africa
www.enlit.world/events/enlit-africa-2024/

CWRA Annual Conference 2025
25 - 29 May 2025
Penticton, Canada
conference.cwra.org/upcomingconferences/

June 2025

World Environment Expo 2025
04 - 06 Jun 2025
Greater Noida, India
worldenvironment.in

Green Tech 2025
03 - 05 Jun 2025
Berlin, Germany
greentechfestival.com

AWWA Annual Conference & Expo 2025
08 - 11 Jun 2025
The Colorado Convention Center, Denver, USA
www.ace.awwa.org

Water & Long-Term Value 2025
10 June 2025
Skytop Studio, Rome, USA

Infrastructure Africa 2025
11 - 12 Jun 2025
Johannesburg, South Africa
www.infrastructure-africa.com

Future of Utilities Summit 2025
11 - 12 Jun 2025
QEII Centre, London, UK
futureofutilities.com/events/summit/

Groundwater Quality 2025
10 - 13 Jun 2025
Bordeaux INP, Talence, France
groundwaterquality2025.fr

DrinkTechAsia 2025
12 - 15 Jun 2025
Bangkok, Thailand
www.propakasia.com

China (Guangzhou) International High-end Drinking Water Industry Expo 2025
12 - 14 Jun 2025
Guangzhou, China
waterexpocn.com/en/

Michigan Water Environment Association Annual Conference 2025
15 - 18 Jun 2025
Boyne Mountain Resort, Boyne Falls, USA
www.mi-wea.org

IFAT Brasil 2025
25 - 27 Jun 2025
Sao Paulo Expo, São Paulo, Brazil
ifat.de/en/brasil/

July 2025

Thai Water Expo 2025
02 - 04 Jul 2025
Queen Sirikit National Convention Center, Bangkok, Thailand
www.thai-water.com

Qingdao International Water Conference 2025
02 - 04 Jul 2025
Hilton Qingdao Golden Beach, Qingdao, China
www.cda-apdwr2009.com/english/

Indo Fisheries Expo & Forum 2025
02 - 04 Jul 2025
Grand City Mall & Convex Surabaya, Surabaya, Indonesia
indofisheries.id

Frontiers in Water Biophysics 2025
12 - 16 Jul 2025
Centro Di Cultura Scientifica Ettore Majorana, Erice, Italy
www.waterbiophysics.eu/

Louisiana Rural Water Association Conference 2025
13 - 17 Jul 2025
Lake Charles Civic Center, Lake Charles, USA
lrwa.org/annual-conference/

International Forum on Water 2025
14 - 17 Jul 2025
Athens Institute For Education and Research (ATINER), Athens, Greece
www.atiner.gr/water

Build4Asia 2025
15 - 17 Jul 2025
AsiaWorld-Expo, Hong Kong
www.build4asia.com

August 2025

AgriTech India 2025
01 - 03 Aug 2025
BIEC, Bengaluru, India
agritechindia.com

ISWPT 2025
02 - 04 Aug 2025
Bangkok, Thailand
iswpt.org

Indo Water Expo & Forum 2025
13 - 15 Aug 2025
Jakarta, Indonesia
indowater.com

World Congress on Mechanical, Chemical, and Material Engineering (MCM 2025)
19 - 21 Aug 2025
Paris, France
mcmcongress.com

The Water Expo 2025
20 - 21 Aug 2025
Fort Lauderdale, USA
www.thewaterexpo.com

KWEA & KsAWWA Joint Annual Water and Wastewater Conference 2025
26 - 28 Aug 2025
Topeka, USA
www.kswaterwastewater.com

20th EverythingAboutWater Expo 2025
28-30 Aug 2025
Pragati Maidan, New Delhi
www.eawaterexpo.com

September 2025

WaterReuse California Conference 2025
11 - 13 Sep 2025
San Diego, USA
www.acwa.com

Global Summit on Climate Change & Environmental Sustainability
18 - 19 Sep 2025
Los Angeles, USA
climatechangeconferences.org

WATEC Israel 2025
08 - 10 Sep 2025
Jerusalem, Israel
watec-israel.com

EkvaTek 2025
09 - 11 Sep 2025
Crocus Expo, Moscow, Russia
ecwatech.ru

LGNSW Water Management Conference 2025
09 - 11 Sep 2025
Albury Entertainment Centre, Albury, Australia
lgnsw.org.au

Water, Wastewater & Environmental Management Expo
17 - 18 Sep 2025
NEC Birmingham, UK
www.ess-expo.co.uk/wwem

Turbomachinery & Pump Symposia 2025
16 - 18 Sep 2025
Houston, TX, USA
tps.tamu.edu

MRO Asia- Pacific Conference & Exhibition 2025
16 - 18 Sep 2025Singapore Expo, Singapore
mroasia.aviationweek.com

Air Quality & Emissions (AQE) Expo
17 - 18 Sep 2025
NEC, Birmingham, UK
www.ess-expo.co.uk

Pharma Pro & Pack Expo
18 - 20 Sep 2025

Hitex Exhibition Center, Hyderabad, India
pharmapropack.com

October 2025

International Exhibition of IRAN HVAC & R
03 - 06 Oct 2025
Tehran International Exhibition Center, Tehran, Iran
www.iranhvac.com/en

Plastics Summit - Global Event 2025
06 Oct 2025
Lisbon, Portugal
www.plasticssummit-globalevent.com

International Congress on Water Management in Mining and Industrial Processes 2025
07 - 09 Oct 2025
Sheraton Santiago Hotel and Convention Center, Santiago, Chile
www.gecamin.com/watercongress

WaterSmart Innovations Conference & Expo 2025
07 - 09 Oct 2025
Reno-Sparks Convention Center, Reno, USA
www.awwa.org

Envitech 2025
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BAYWATCH



The WestAfrica Water Expo (WAVE 2025), scheduled to take place from May 20 to 22 at the Landmark Centre in Lagos, Nigeria, is a major international trade fair focused on water and wastewater management technologies. Organized by Elan Expo, this annual event serves as a critical platform for showcasing innovations in water treatment, purification, filtration, desalination, and smart water infrastructure. With participation from over 140 exhibitors representing more than 15 countries, WAVE attracts approximately 3,800 industry professionals, including engineers, policymakers, environmental consultants, and procurement specialists. Attendees benefit from networking opportunities, technical workshops, and B2B matchmaking sessions, making it an essential event for those involved in municipal, industrial, and agricultural water management across West Africa. WAVE 2025 is particularly significant given the growing demand for sustainable water solutions in the region, and it plays a pivotal role in facilitating knowledge exchange and investment in critical water infrastructure.

Date: 20-22, May 2025 | **Venue:** Landmark Centre, Lagos, Nigeria
Website: elanexpo.net/waweexpo



The 22nd EURO-INBO International Conference will be held from May 20 to 23, 2025, in Parma, Italy, hosted by the Po River District Basin Authority and the Municipality of Parma, in partnership with the French Biodiversity Agency. Organized by the International Network of Basin Organizations (INBO), the event brings together water authorities, policymakers, and basin organizations from across Europe to exchange knowledge on implementing the EU Water Framework Directive and related policies. The conference will include workshops and thematic sessions focused on sustainable water governance, climate change adaptation, water-efficient agriculture, and ecological restoration. The program also features cultural and technical visits, fostering both professional dialogue and regional engagement. Interpretation in English, French, and Italian will be provided to support broad participation.

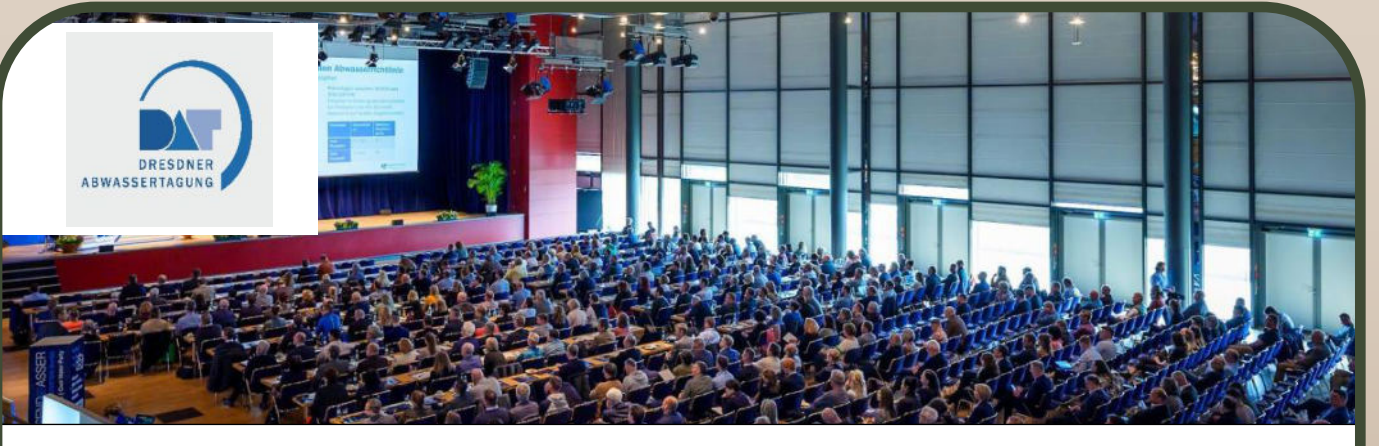
Date: 20-23, May 2025 | **Venue:** Parma, Italy
Website: www.inbo-news.org/events/euro-inbo-2025

BAYWATCH



The 20th EverythingAboutWater Expo 2025 stands as a remarkable and all-encompassing annual event in India, spotlighting cutting-edge technologies and solutions within the water sector. This event serves as an exceptional gateway for stakeholders worldwide to immerse themselves in the expansive and dynamic realm of the Indian Water management Industry, facilitating the exchange of business opportunities, networking, and the exploration of innovative Water solutions. India is currently on a trajectory towards severe water stress, with projections indicating a critical situation by 2030. The rapid pace of Industrialization and the burgeoning population have significantly widened the gap between water supply and demand, a matter of deep concern for both the Central and State Governments. Within the framework of the 20th EverythingAboutWater Expo 2025 unparalleled business prospects will emerge for both domestic and international players in the Water Industry. Attendees will have the opportunity to gain valuable insights, discover future trends, and navigate the evolving landscape of the Indian Water market.

Date: 28th-30th August 2025 | **Venue:** Bharat Mandpam, Pragati Maidan, New Delhi
Website: www.eawaterexpo.com



The Dresden Wastewater Conference 2025 (Dresdner Abwassertagung) will take place on May 6-7 at the Internationales Congress Center Dresden. Organized by Stadtentwässerung Dresden GmbH, it is one of Germany's key regional events for professionals in the water and wastewater sectors. The conference begins with a Practice Forum and technical excursion, followed by a trade exhibition and networking evening. On the second day, expert presentations and a keynote speech will highlight current challenges and innovations in wastewater management. Over 100 companies will exhibit, and around 800 participants are expected to attend, making it a prime platform for knowledge exchange and professional networking.

Date: 6-7, May 2025 | **Venue:** Internationales Congress Center Dresden, Germany
Website: www.dat.info

TENDER

Reverse Osmosis Based Point of Use Water Treatment System for Drinking Purposes (v3) As Per is 16240 Mse Exemption for Years Of Experience And Turnover/No.			
Category	Agro, Marine, Food Products Tenders		
Location	Chorasi, Gujarat		
Bid Open Date	25 April 2025	Tender Value	2.30 Lac
Doc Collection Date	25 April 2025	FTID	250411449370
Water Treatment Plant for Khejuri li Block and Panchayat Samity Office Compound at Jl 85 Plot 1092 at Janka Under Khejuri li Panchayat Samity.			
Category	Real Estate, Property, Land Tenders		
Location	Baratala, West Bengal		
Bid Open Date	18 April 2025	Tender Value	7.99 Lac
Doc Collection Date	18 April 2025	FTID	250411477570
Construction of 7.0 Mld Water Treatment Plant and Other Related Works Including Operation and Maintenance for A Period of 5 Years at Ferozepur Cantonment Town, District Ferozepur, Punjab (part-2) Unde.			
Category	Miscellaneous Tenders		
Location	Firozepur, Punjab		
Bid Open Date	05 May 2025	Tender Value	21.46 Crore
Doc Collection Date	05 May 2025	FTID	250407482510
Water Treatment Plant at Jaypaltola Sansad 5. Activity Code 98157349.			
Category	Agro, Marine, Food Products Tenders		
Location	West Bengal, Manikchjak		
Bid Open Date	19 April 2025	Tender Value	3.20 Lac
Doc Collection Date	19 April 2025	FTID	2504114120730
Construction of Arsenic Free Water Treatment Plant At Malipara with Maintenance at Katlamari Igp Under Raninagar li Panchayat Samity.			
Category	Construction, Infrastructure, Civil Work Tenders		
Location	West Bengal, Murshidabad		
Bid Open Date	19 February 2025	Tender Value	7.57 Lac
Doc Collection Date	19 February 2025	FTID	2502144148940
Water Treatment Plant at Karbala Maidan at Samaspur Sansad No Xxiv Code-92677551.			
Category	Agro, Marine, Food Products Tenders		
Location	West Bengal, Murshidabad		
Bid Open Date	25 April 2025	Tender Value	15.75 Lacs

TENDER

Doc Collection Date	25 April 2025	FTID	2504104133680
Construction of Decentralized Waste Water Treatment System (dewats) in Panchayat Sirtingal Block Bhaderwah (sbm-g) 2 Nd Call.			
Category	Sewer, Sewerage, Sanitation, Environmental Services Tenders		
Location	Jammu & Kashmir, Doda		
Bid Open Date	30 April 2025	Tender Value	10.11 Lac
Doc Collection Date	30 April 2025	FTID	250410472190
Ro Water Treatment System Above 50 Lph Filtration Capacity Minimum Average Annual Turnover of The Bidder (for 3 Years)/ 4 Lakh (s) (3).			
Category	Furniture, Sports, Home Equipments Tenders		
Location	Gujarat, Valsad		
Bid Open Date	19 April 2025	Tender Value	9.00 Lac
Doc Collection Date	19 April 2025	FTID	250410492560
Ro Water Treatment System Above 50 Lph Filtration Capacity Minimum Average Annual Turnover of The Bidder (for 3 Years) 610 Lakh (s) (3).			
Category	Furniture, Sports, Home Equipments Tenders		
Location	Maharashtra, Nashik		
Bid Open Date	30 April 2025	Tender Value	20.33 Crores
Doc Collection Date	30 April 2025	FTID	250408476610



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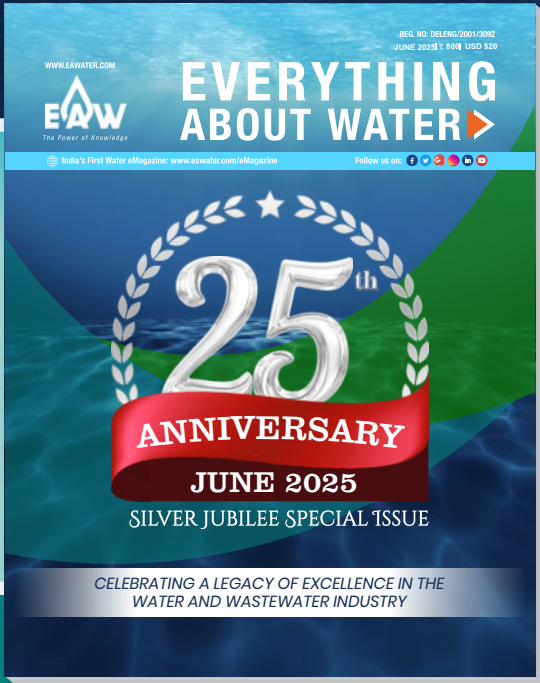
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