Azadi Ka Amrit Mahotsav

DECEMBER 15-17th, 2022

New Delhi

7th India Water Impact Summit (IWIS)

Valuing Water | Transforming Ganga

सत्यमेव जयते

NITI Aayog
National Institution for Transforming India

cGanga
Centre for Ganga River Basin Management and Studies
Indian Institute of Technology Kanpur

NAMAMI GANGE
NMCG
National Mission for Clean Ganga
Ministry of Jal Shakti, Government of India

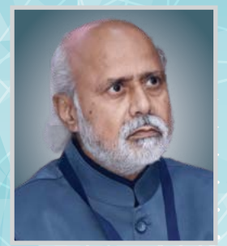
A CONSOLIDATED REPORT ON

SEVENTH INDIA WATER IMPACT SUMMIT (IWIS)

15-17th DECEMBER 2022

Dr Ambedkar International Centre (DAIC)
New Delhi

Preface



VINOD TARE
Professor and Founding Head
Centre for Ganga River Basin Management & Studies (cGanga),
Indian Institute of Technology Kanpur

G ASOK KUMAR
Director General
National Mission for Clean Ganga (NMCG),
Ministry of Jal Shakti, GoI

INTEGRATED RIVER BASIN

Management (IRBM) approach is followed in Namami Gange with multi-sectoral and multiagency interventions such as: (i) for pollution abatement (Nirmal Ganga), (ii) for improving river flows (Aviral Ganga) and ecology, (iii) to strengthen people's river connect (Jan Ganga), and (iv) to facilitate diversified research, scientific mapping, and evidence-based policy formulation (Gyan Ganga)

The Centre for Ganga River Basin Management and Studies (cGanga) led by IIT Kanpur, National Mission for Clean Ganga (NMCG), Ministry of Jal Shakti, and the NITI Aayog, sincerely thank all participants from India and abroad to the 7th India Water Impact Summit (IWIS-2022). The Namami Gange programme, being implemented by NMCG, is an integrated mission for the restoration and conservation of River Ganga and its tributaries. Towards this goal, a strategic comprehensive Ganga River Basin Management Plan (GRBMP-2015) was developed by a consortium of 7 IITs, which is being further evolved by cGanga led by IIT Kanpur. cGanga acts in the capacity of a comprehensive think-tank to NMCG in its stated goals and objectives vis-à-vis the Ganga River Basin. Namami Gange aims to restore the wholesomeness of the river by ensuring Aviral Dhara and Nirmal Dhara, and maintaining its geomorphological and ecological integrity. Integrated River Basin Management (IRBM) approach is followed in Namami Gange with multi-sectoral and multiagency interventions such as: (i) for pollution abatement (Nirmal Ganga), (ii) for improving river flows (Aviral Ganga) and ecology, (iii) to strengthen people's river connect (Jan Ganga), and (iv) to facilitate diversified research, scientific mapping, and evidence-based policy formulation (Gyan Ganga). India Water Impact Summit, which was started as a one-time event a decade ago, has now become an annual event organized jointly by NMCG and cGanga. In the 7th Edition of IWIS, NITI Aayog also extended its support in organizing the event.

At the outset, a brief overview of the past six Summits is outlined here to throw light on the theme of the present IWIS. The first Summit, held in 2012 during the preparation of the Ganga River Basin Management Plan (GRBMP) by the IIT Consortium, was an aggregate of the then prevailing activities on India's water resource management. The 2nd Summit, held in 2017, attempted to establish a new multi-disciplinary, multi-stakeholder forum to bring together policy makers at national and regional levels, technology and engineering firms, finance and investment specialists, and interested civil society members to brainstorm on pressing issues of India's water environment. The 3rd Summit, held in 2018, reviewed the manifold efforts undertaken by government agencies to meet Namami Gange's goals of rejuvenation and conservation of India's National River Ganga, especially in the most critical Ganga Basin States – Bihar, Delhi, Uttarakhand, Uttar Pradesh, and West Bengal. The 4th IWIS in 2019 went further to explore ways and means of integrating science and policy for Integrated Water Resource Management, to assess and prepare for major water impacts in urban and rural areas of India, and developing new and innovative financing mechanisms through the Water Finance Forum initiated in IWIS-2017. The ideas and suggestions that emerged from these four Summits led us to seek comprehensive means to integrate river conservation into India's developmental path in the 5th IWIS (IWIS-2020) from the perspective of Arth Ganga, an ancient Indian concept. IWIS-2020 also intensified efforts to financially strengthen water management and river conservation in India through synergy between planners, executors, financiers, investors and regulatory bodies. A more focused assessment was attempted in IWIS-2021 to evaluate the different types of river resources, their usefulness for ecosystem services for human benefit, and the adverse effects of over-extraction and misuse of these resources on the ecosystem services. This exploration was aimed to help chalk out feasible pathways for sustainable river resource planning and management over the long term to meet the concerns of diverse stakeholders and to aid planners, policymakers and financiers.

In the backdrop of the aforementioned six Summits, it has become apparent to attempt to resolve the issue of divergent impacts of different activities carried out by different agencies and governments for developmental or social purposes. The convergence of five P's, namely, People, Policies, Plans, Programmes and Projects, may be considered crucial for this purpose in the "Samarth Ganga" framework to achieve Sustainable Development Goals (SDGs). Thus, the thrust of deliberations in the Seventh Edition of India Water Impact Summit (7th IWIS) was to understand, elaborate,

THE CONVERGENCE OF 5 P's

namely, People, Policies, Plans, Programmes and Projects is crucial for the "Samarth Ganga" framework to achieve Sustainable Development Goals (SDGs)

delineate potential causes of divergence, and formulate strategies for convergence through collation of views expressed in the Summit. In this context, while many aspects of river management are at play, a select few that are key to initiate and assess the success of river restoration programmes were covered in IWIS-2022, viz.: (i) Setting the goal to determine the health status of rivers; (ii) Establishing norms for bio-physical status of rivers and determining the present condition in different stretches starting from origin to destination; (iii) Formulation and execution of river monitoring programmes; and (iv) information/ data collation, utilisation and dissemination strategy.

The plenary sessions of IWIS-2022, addressed by eminent national and international representatives, were aimed to elucidate both the overarching problems and the successful pathways in river management. The three main issues covered in these sessions addressed the key themes, namely, (i) Restoration and Conservation of Small Rivers in a Large Basin – Mapping and Convergence of 5P's (People, Policies, Plans, Programmes & Projects); (ii) Lessons from Various River Related Programmes; and (iii) Bottlenecks and Course Correction – Lessons from Various River Related Programmes. These plenary talks provided useful guidelines in all future river-related activities in the country.

As in past Summits, the present Summit also covered the overall scientific, technological and policy issues in Track A. The first session of this track helped formulate clear and definable goals for the health status of rivers, without which neither the state of a river nor the impact of river-related activities and restoration efforts can be properly evaluated. The second session of Track A deliberated on the need for and the means to establish the health status of different stretches of rivers and setting milestones to mark their improvements. This setting of standards will naturally be useful to evaluate the progress of river restoration efforts over time. Hence, comprehensive river monitoring programmes will be needed to scientifically evaluate river health status. Foolproof formulation of such river monitoring programmes were therefore discussed and chalked out in the third session of Track A.

It may be noted that both evaluation of river health and the efficacy of river restoration and conservation activities may often depend not only on one's own data collection, but also on data from secondary sources. Hence the need for collation, utilization and dissemination of river-related data to make them truly useful for various river-related purposes were considered in the fourth session of Track A.

Financial resources are essential for sustained efforts in river management. Track B of IWIS-2022 explored the economics and ways and means of: (a) financing comprehensive management of sludge from wastewater treatment plants, and (b) the water recycling and trading market in India.

New technologies and applications being developed worldwide have the potential to significantly improve India's river and water management scenario. Track C, running in parallel with the other two tracks, introduced various new, innovative solutions to India's water and wastewater management needs.

Two special sessions in Track E, namely Session E1 – Decentralised Wastewater Management for Sustainability of Sewerage Assets, and Session E2 – Impact of Land use on Rejuvenation of Small Rivers in Track E related to implementation issues were additional features of the 7th edition of IWIS.

Finally, we wish to thank our strategic partners, panellists, speakers, staff and volunteers who had full faith in our objectives and ability, and have worked hard to make this Summit a success. We hope that the delegates and participants found IWIS-2022 to be as constructive and exciting as the previous six Summits.

THE THREE MAIN ISSUES

covered in the sessions addressed the key themes, namely, (i) Restoration and Conservation of Small Rivers in a Large Basin – Mapping and Convergence of 5P's (People, Policies, Plans, Programmes & Projects); (ii) Lessons from Various River Related Programmes; and (iii) Bottlenecks and Course Correction – Lessons from Various River Related Programmes

TRACK D

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TRACK P

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SCIENCE, TECHNOLOGY & POLICY

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TRACK E

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Plenary Sessions:

P1: Restoration and Conservation of Small Rivers in a Large Basin – "Mapping and Convergence of 5P's (People, Policies, Plans, Programmes & Projects)"

THE OUTCOMES AND recommendations of the summit in form of guiding document or framework will serve as a toolkit for the state governments, district administration and different ministries associated with river restoration so that they can go for the restoration of the whole ecosystem rather than conserving only the larger rivers of the country

DAY 1:
Thursday, December 15, 2022
14:30 – 16:00 hrs

WELCOME ADDRESS:
D P Mathuria [Executive Director (Technical), NMCG]

ABOUT THE SUMMIT THEME:
Vinod Tare [Founding Head – cGanga, IIT Kanpur]

GUEST OF HONOUR:
Pankaj Kumar [Secretary, DoWR, RD & GR, Ministry of Jal Shakti, GoI]

INAUGURAL ADDRESS:
Gajendra Singh Shekhawat [Hon'ble Minister, Jal Shakti, GoI]

VOTE OF THANKS:
Sanmit Ahuja [Expert Member, cGanga]

D P Mathuria, Executive Director, Technical, NMCG

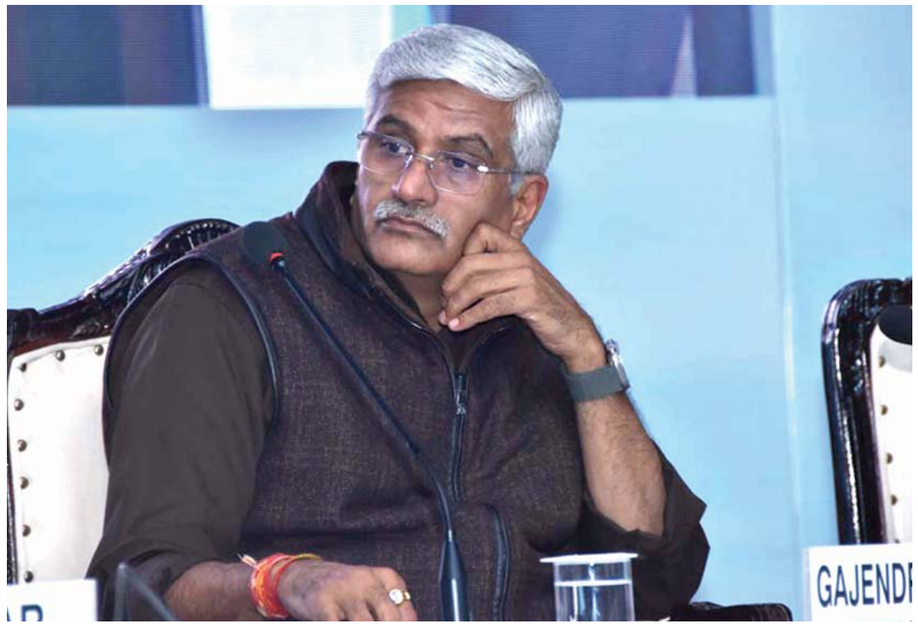
Shri D P Mathuria (ED-Tech. NMCG) welcomed the guests of honour, conference participants and media representatives on behalf of the organizers – cGanga, NMCG and Niti Aayog. He recounted the success of Indian Government's Namami Gange Programme with highly advanced sewage management, pollution control and water quality monitoring leading to improved water quality and environmental flows of River Ganga. Besides he also described many other measures taken up by NMCG such as afforestation, biodiversity conservation, spring rejuvenation, freeing wetlands of encroachments, sludge management research, and people connect by people-centric activities including the setting up of 139 District Ganga Committees, which are of particular significance for the numerous small rivers that work as arteries for the Ganga river system and which underscores the importance of the 7th IWIS. Professor Tare (Founding Head – cGanga, IIT Kanpur) introduced the Summit's Theme based on his experience of initiating a collaborative effort of rejuvenating small rivers with MGNREGA in Uttar Pradesh. He also emphasized the need to develop appropriate yardsticks and norms to measure the success of river rejuvenation programs.

Pankaj Kumar, Secretary, DoWR, RD & GR, Ministry of Jal Shakti, GoI

Shri Pankaj Kumar (Secretary, DoWR, RD & GR, Ministry of Jal Shakti, GoI) highlighted the improvements in many stretches of River Ganga and other Indian rivers, the unexpected new problems faced in many cases, the need for coordination with State governments and District administrations, industrial pollution control, and tackling multiple dependencies to ensure convergence of the 5 P's for all-round river conservation. The outcomes and recommendations of the summit in form of guiding document or framework will serve as a toolkit for the state governments, district administration and different ministries associated with river restoration so that they can go for the restoration of the whole ecosystem rather than conserving only the larger rivers of the country.

Plenary Sessions:
P1: Restoration and Conservation of Small Rivers in a Large Basin – "Mapping and Convergence of 5P's (People, Policies, Plans, Programmes & Projects)"

Gajendra Singh Sekhawat, Hon'ble Minister, Jal Shakti, GoI



Shri Gajendra Singh Sekhawat (Hon'ble Minister, Jal Shakti, GoI) commended the organisers for the theme of IWIS-2022. He said that the focus on reviving small rivers is very important to enable India to overcome its looming water crisis, and praised the revival of several small rivers in Uttar Pradesh. He underscored India's rapid progress in restoring River Ganga over the last five years as against such progress taking many decades for the Thames, Rhine, Danube and other major rivers in developed countries, and highlighted the government's new approach on demand-side management in addition to supply-side management in the water sector. He extolled the importance of Arth Ganga invoked by the Hon'ble Prime Minister several years ago in giving a new dimension and impetus to Indian Government's Namami Gange Programme and emphasized the economic value of small rivers. He hoped that the 3-day Summit would come up with valuable recommendations that can be implemented on the ground to enable India's goal of "Atmanirbhar Bharat".

"मुझे प्रसन्नता है कि इस तीन दिवसीय सम्मेलन में हम जितने भी लोग यहां देश-विदेश से एकत्रित हुए हैं, मिलकर जो चर्चा करेंगे, वह आने वाले समय में देश के सामने बहुत बड़ा संकट, और न केवल देश के सामने, पूरी मानवता के सामने, बहुत बड़ी चुनौती 'जल के संकट', के समाधान की दिशा में एक सकारात्मक कदम होगा".....

पिछले सत्तर वर्षों से हमने केवल जल की आपूर्ति के दृष्टिकोण से काम किया था। मुझे प्रसन्नता है कि अब हमने जल की खपत और प्रसार पर भी अटल भूजल योजना के माध्यम से काम किया है। कई छोटी नदियाँ, जो मुख्य रूप से गैर-ग्लेशियर-पोषित हैं और गंगा बेसिन में धमनियों के रूप में काम करती हैं, वह गुणवत्ता और मात्रा, दोनों के मामले में आम समस्याओं: जैसे गाद, चैनल का अतिक्रमण, जलग्रहण क्षेत्र का क्षरण: जैसे आर्द्रभूमि का सूखना, प्रदूषण के बिंदु स्रोत, और, सबसे महत्वपूर्ण, भूजल स्तर का गिरना के कारण प्रभावित हुई हैं।.....

जिस काम को करने में इंग्लैंड को बीस वर्ष का समय लगा, जर्मनी को राइन के रूपांतरण में लगभग तीस वर्ष का समय लगा, डेन्यूबे के रूपांतरण में स्वीडन को पच्चीस वर्ष से ज्यादा समय लगा, हम पांच वर्ष में उस काम को उसी प्रभाव के साथ में पूरा कर पाए। हमारे सामने सबसे बड़ी चुनौती है वाटर सिक्योरिटी, और वाटर सिक्योरिटी के लिए इन छोटी-छोटी नदियों को पुनर्जीवित करना सबसे बड़ी आवश्यकता है। .....

अगले तीन दिन तक इस सम्मेलन में हम जो चर्चा करेंगे, विचार करेंगे और उस विचार को यदि हम धरातल पर ला पाते हैं तो निश्चित ही उस दिशा में हमारा एक बहुत बड़ा योगदान होगा। इस समाधान से हम देश को आत्मनिर्भर, विकसित, समर्थ और शक्तिशाली बनाने की दिशा में अपना योगदान कर पाएंगे।.....

मैं अभिनंदन करना चाहता हूं सेंटर फॉर गंगा रिवर बेसिन मैनेजमेन्ट एंड स्टडीज (cGanga) का, नीति आयोग का, नमामि गंगे से जुड़े सभी लोगों का जिनके आपसी समन्वय, सहयोग से नदी जल संरक्षण की दिशा में एक सार्थक पहल प्रारंभ हुई है, और मैं इसके लिए इससे जुड़े हुए सभी स्टेकहोल्डर्स को भी धन्यवाद देना चाहता हूं। .....

जिस तरह से, दुनिया के दूसरे देशों में, विशेषकर के पश्चिमी देशों में इस विषय को देखते है, जहाँ शैक्षणिक समुदाय, नीति निर्माताओं एवं नीति कार्यान्वयन करने वाली एजेंसी के बीच में बहुत सहज साम्य होता है, जिसमे नीति निर्माता अपने सामने आने वाली हर चुनौती को शैक्षणिक समुदाय के साथ में साझा करके उनसे विज्ञानआधारित समाधान निकालते हैं और नीति बनाकर उसका अन्य एजेंसियों द्वारा कार्यान्वयन होता है, उसी के समान हमारे देश में प्रयोगशाला में हुए कार्य और नीति कार्यान्वयन करने वाली एजेंसी के किये कार्यों के बीच में उत्पन्न गहरी खाइ को पाटने का काम निश्चित रूप से सेंटर फॉर गंगा रिवर बेसिन मैनेजमेन्ट एंड स्टडीज (cGanga) ने किया है।.....

माननीय प्रधानमंत्री जी के नेतृत्व में जिस तरीके से इन विषयों के समाधान के लिए हमने शैक्षणिक समुदायों के साथ काम करना शुरू किया है, जब भी भारत के भविष्य का इतिहास लिखा जाएगा, जल शक्ति मंत्रालय, राष्ट्रीय स्वच्छ गंगा मिशन और उसके "पाँच पी" के सिद्धांतों के साथ में काम करना तथा राष्ट्रीय स्वच्छ गंगा मिशन के साथ सेंटर फॉर गंगा रिवर बेसिन मैनेजमेन्ट एंड स्टडीज (cGanga) जैसे प्लेटफार्म का जुड़ना कहीं ना कहीं सुनहरे अक्षरों मे उल्लेखित किया जाएगा।"

श्री गजेंद्र सिंह शेखावत

P2: Lessons from Various River Related Programmes

Vinod Tare, Founding Head - cGanga

DAY 2:
Friday, December 16, 2022
11:30 – 13:00 hrs

MODERATOR:
Vinod Tare [Founding Head – cGanga, IIT Kanpur]

PANELLISTS:
G Asok Kumar [Director General, NMCG]
Rajeev Sharma [The Hon'ble Chief Advisor, Govt. of Telangana & Former Mission Director, NMCG, GoI]
D Thara [Addl. Secretary, Ministry of Housing & Urban Affairs, GoI]
Sejal Worah [Program Director, WWF, New Delhi]

Prof. Vinod Tare (Founding Head – cGanga, IIT Kanpur) introduced the Session's theme and posed the crux question: what is river health and how do we make sure that the present health status of rivers is taken to the level that we as a nation aspire for our rivers? He said that, while people give great importance to rivers, how can this priority be brought to the foreground to converge and synthesize it to a cohesive process for reviving and managing our small rivers? Since different government programs such as Namami Gange, Swachh Bharat, AMRUT, Jal Jeevan Mission etc., working for different purposes affect the larger interest of rivers, a national framework for river systems is needed so that all such plans and projects are in synergy with rivers. He said that rivers should be covered under an umbrella program so that various actions can be coordinated under it.

Dr. Rajeev Sharma said that social, economic and development priorities should be harmoniously balanced with the objective of river conservation and restoration.

Mr. G Asok Kumar said the biggest problem in the water sector had been that it works in silos, with the urban, rural and agriculture sectors not interacting with each other. To sustain rivers, big and small, it is imperative to catch the rain where it falls through water harvesting structures as is being done through MGNREGA funds.

Ms. D Thara said that convergence must happen at State levels where both silos and integrated approach are needed. In the urban water sector, she said that the main problem is untreated sewage of more than 40,000 MLD for which STPs are needed. AMRUT is trying to fund and get these done along with sewerage connections and provision for paid reuse for about 20-40% of the treated water – especially in water-stressed areas. Contractors' capacity building is also being done through the AMRUT programme. She said that NRSC Hyderabad has been preparing dossiers of urban water bodies covering their spreads and some parameters like chlorophyll index and turbidity.

Ms. Sejal Worah opined that effective conservation plans for the thousands of small rivers in the country can indeed be made and executed if the process is decentralised by giving people ownership and accountability for small rivers and river stretches similarly as local communities have been successfully involved in participatory forest management. On the other hand, as of now, rivers stand neglected because they are not covered in any planning such as agricultural planning or urban planning even when rivers flow through cities. By engaging people directly for river rejuvenation, creating a shared and transparent database of conservation measures, and having a well-defined mechanism for deciding trade-offs in water use, our rivers can be vastly improved.

P2: Lessons from Various River Related Programmes

"How do we understand what the river health is and how do we make sure what is the present health status of various rivers?
Many programs and associated activities influence the river; and there are many sectors which depend on the river, and they influence the river. How to ensure that the priority of rivers is consciously brought to the foreground, converged and synthesized into a cohesive process for reviving and managing our small rivers?
The Secretary, Ministry of Jal Shakti, proposed that there should be a national framework for river systems and water bodies so that all relevant plans, programs, and projects that touch upon rivers and water bodies can be consciously included in the priorities and design the plans, programs and projects so that there is convergence in the larger interest of the river. Should we have a national framework for rivers so that all other programs can be coordinated and suitable actions can be suggested to them?"

Prof. Vinod Tare

"One needs to have a harmonious balance between the social, economic and development objectives with river conservation and restoration, that is, both have to be given equal priority and not at the cost of each other."

Dr. Rajeev Sharma

"Catch the rain" because it is the rain water that brings in water to rivers. So, conservation of rainwater is very important.
The ministry of JAL SHAKTI is trying to bring together all departments working in water sector.
If big rivers, small rivers, rivulets, and waterbodies have to be sustained, then the biggest mantra is people's participation
Under the "CATCH THE RAIN" campaign, Rs. 67,000 crore was spent from MGNREGA alone with the help of people to create water harvesting structures to conserve rainwater."

Mr. G Asok Kumar

"Convergence has to happen in the states, cities and districts, and they should have a common idea of convergence. Hence, we need both silos and integrated approach.
72,368 MLD urban sewage gets generated in India, but we have a capacity to treat about 31,000 MLD only. For the amount of toxic urban sewage generated with high microbial load, you need to have concentrated sewage treatment plants. The untreated sewage is the main culprit creating eutrophication of our freshwater systems.
AMRUT is ATAL Mission for Rejuvenation & Urban Transformation which is the first focused water mission of India. By focussing on STPs and sewage treatment it is de facto focussed on river systems.
Out of 18 lakh households in one UP town the gap in number of sewer connections is 11 lakhs, Sewarage connections and networks have to be put in.
NRSC in Hyderabad created temporal data of all waterbodies of cities including chlorophyll index and turbidity of water measured by the satellite. A dossier for 219 big cities in India has been almost completed.
In a water surplus area, water is not going to be reused by payment. But in water stressed areas one may try to link up to the demand and supply and put in a governance mechanism through a technology platform in AMRUT-2. It is water security, but 20% of the water should come from reuse and 40% of industrial waters should come from reuse.
For the first time in AMRUT, contractors' capacity building will be done by the government, including for plumbers and operators."

Ms. D Thara

P2: Lessons from Various River Related Programmes

"Conservation plans for the thousands of small rivers in this country is practical if you decentralize it. There are models from the other sectors, for example, participatory forest management handed over to the local communities and villages taking responsibility for managing those forests. For the management of small stretches of rivers or for smaller rivers, we need people to take ownership and accountability at the sub-basin and sub-sub basin levels.

The challenge is the knowledge base. Can we actually create a knowledge base through citizen science and have a decentralized model, at least for the smaller rivers?

How do we ensure that rivers are integrated into planning, whether urban planning, agricultural planning, or planning for drinking water and sanitation? Even major rivers flowing through cities are not integrated into the master plan as if the rivers didn't exist.

My plea is just three things: one is real citizen engagement, real participation. Secondly let's create a knowledge base that is open, transparent and shared so that everybody can generate and use. And the third is the need to have a genuine mechanism for deciding trade-offs for water use because water is a limited resource."

Ms. Sejal Worah

P3: Bottlenecks and Course Correction in River Related Programmes





DAY 3:
Saturday, December 17, 2022
11:30 – 13:00 hrs

MODERATOR:
Vinod Tare [Founding Head – cGanga, IIT Kanpur]

PANELLISTS:
Rama Kant [Deputy Adviser (PHE), Ministry of Housing and Urban Affairs]
Thippeswamy M N [Chief Engineer (Retired), Bangalore Water Supply and Sewerage Board]
Sundeep Chauhan [Expert – cGanga, IIT Kanpur]
Himansu Badoni [Executive Director (Projects), NMCG]

Introducing the session's theme Prof. Tare highlighted that each sector has its own policies. plans, and programs, and the challenge is to ensure that they serve the larger cause of rivers, how to move away from the interception-diversion concept for urban drains to restoring local rivers and drains so that the cities and villages can willingly contribute to the change. In the case of electric power distribution, we have transformers at almost every corner; likewise, we can have sewage treatment plants in every locality so that it avoids the large network of big sewer lines and also brings the drains to their natural status of serving the purpose of draining surface runoff caused by rainwater and improves them to jell with the requirements of water security and recreation.

Dr. Rama Kant said that enough land is not available in most cities for decentralized treatment plants, but Dr. Tare said that it's a question of choice including treatment technologies.

Mr. Thippeswamy said that Arkavathi river was feeding water to Bengaluru city till 1975, but since the last 2½ decades virtually no water exists in the two reservoirs under Arkavathi scheme due to tremendous change in land use pattern along with a lot of sewage and industrial effluents flowing into it. Besides, even though there has been a spurt in creating STPs, sewerage networks are grossly inadequate.

Mr. Sundeep Chauhan suggested setting up primary treatment plants for clusters of a few hundred houses using renewable solar energy to run the plants for economic and effective improvement, which would also help in job creation.

Mr. Himansu Badoni said that NMCG had decided that the sludge management options of producing organic manure, fuel or fly-ash (after incineration) be left to market forces to decide. Dr. Tare opined that manure generated from sludge would be inferior to conventional fertilizers in terms of N, P and K, but organic manure can be effective in increasing the organic carbon of soils.

Mr. Jagjit Singh Kochar from the audience informed that the nano-bubble technology can handle most of the sewage treatment problems, and the Ganga River can be easily revived without many STPs being built.
For cost comparison, if the benchmark is about four paisa per litre for conventional treatment, nano-bubble process can do it for even less than one paisa he said.

P3: Bottlenecks and Course Correction in River Related Programmes

"The focus of this summit is essentially to pave the way for expediting, mapping, integration and assessment of different scenarios and aspects of river health.
The most important challenge that I think is how do we bring in convergence among the 5 P's, particularly in the context of restoration and conservation of small rivers. The first P is people, the second P is policies, third is plans, then program, and the last is the projects implemented on ground.
For each sector we have policies, plans, programs, but how do they serve the larger cause of rivers? For example, how can we transit from the interception-diversion concept to restoring local rivers and drains? When we intercept at the mouth of the big rivers, there is no strategy or plan for improving the local drains which flow through the cities and villages, and people question why they should spend money on the STPs, why they should contribute when the rivers or drains flowing through their locality continue to stink.
In the case of electrical distribution, we have transformers at almost every street corner. Why can't we have sewage treatment in every colony, so that it avoids big network of sewer lines? While treatment of sewage as a concept is a no regret activity but where and of what capacity one should install STP requires proper study and planning at the city level, if not at the basin level so that the city as a hole becomes better and not just the big river downstream.
There are some estimates that say that in cities if we can spare 5% to 6% of land for waterbodies, we can catch all the rain, store the rain water and we don't have to depend on any other water source. We can also use the treated wastewater to supplement that throughout the year.
When considering sewage sludge, don't look at it as a fertilizer, one can never compare it with fertilizers if parameters such as nitrogen, phosphorus and potash are to be included. One should consider the organic carbon for soil improvements that can enhance microbial activity in root zone and also support nitrogen fixation from atmospheric nitrogen."

Prof. Vinod Tare

"When we talk about decentralized systems, our cities don't have the land for construction of so many STPs.
Our cities are now going for conventional treatment systems and if they have the space, they are also going for decentralized systems."

Dr. Ramakant

"Arkavathi was feeding to Bengaluru city till 1975, but from the last two-three decades there is virtually no water supply from the two reservoirs under Arkavathi. There is tremendous change in land use pattern – from virtually very little farming on the upstream side while now there is horticulture, floriculture etc. developed in a big way. There is also a lot of sewage and industrial effluent coming into, and there is quarrying and mining.
We are trying to build so many STPs, but we are not giving the same amount of importance to sewer networks."

Mr. Thippeswamy M N

"I'm a big votary of primary treatment plants at local levels. Suppose there is a cluster of 500 houses on a particular drain, we can create not only simple primary treatment plants, we can use solar energy (renewable energy) to run those plants, and also create jobs."

Mr. Sundeep Chauhan

"For sludge management, based on the advice of the industry NMCG is of the view that why to decide ourselves and why not let the market decide."

Mr. Himansu Badoni

P4: Valedictory Session

DAY 3:
Saturday, December 17, 2022
16:30 – 18:00 hrs

MODERATOR:
Vinod Tare [Founding Head – cGanga, IIT Kanpur]

SPEAKERS:
G Asok Kumar [Director General, NMCG]
Madhava Kumar [Advisor, NMCG]
Sanmit Ahuja [Expert Member, cGanga]
Sundeep Chauhan [Expert – cGanga, IIT Kanpur]
Santosh G Thampi [Professor, NIT Calicut]

Vinod Tare, Founding Head - cGanga

Prof. Vinod Tare presented a summary of the main points of the Plenary sessions and the Science, Policy & Technology sessions of the 7th IWIS. The focus of the summit was to pave way for expediting mapping, integration and assessment of different scenarios/ aspects of river health. Prof. Tare emphasized that, as the Secretary, Ministry of Jal Shakti had expounded in the inaugural session, we may work in silos but we need to integrate in a national framework for river systems as part of our larger national water policy. Only then can we integrate our diverse plans, programs and projects related to rivers and river systems. The main outcomes of the various sessions were summarized as follows:

- Integration and coordination of sector-wise programme is as much important as implementation of projects with sector-specific knowledge and expertise working in silos.
- We particularly need to look at bottom-up approach (community driven small river basin committees) with coordination at large basin/national level. For smaller rivers local communities and villages should be empowered, while for large basin/ national level knowledge-based organisations should provide leadership and by, funding should be provided by NMCG/NRCD to gather information about health status of all rivers regularly in a sustained manner.
- We need to understand that waste is a resource that is spatially and temporally misplaced. Since soils are as important a natural resource as rivers, hence reclamation of resources from wastes (e.g. from sewage/wastewater and solid residues such as STP sludges) and its reuse in restoration and conservation of natural resources (river systems and soils) should be valued and appropriately accounted in economic sense for creating novel financing models/instruments.
- River Health is to be used as the criterion for evaluating the progress of River Restoration and Conservation (RRC) programmes as well as the status of rivers instead of Designated Best Use Water Quality Criteria.
- Restoration and maintenance of indigenous aquatic life and riparian vegetation akin to pre-industrial and urbanization era (reference condition) reflecting the bio-physical status of healthy rivers in different stretches (from origin to destination) should be adopted as a guiding principle for RRC.

FOR SMALLER RIVERS

local communities and villages should be empowered, while for large basin/ national level knowledge-based organisations should provide leadership; funding should be provided by NMCG/NRCD to gather information about health status of all rivers regularly in a sustained manner

P4: Valedictory Session

The important tasks that need to be accomplished are:

- Identification of the most representative variables/ indicators under each of the broad categories mentioned in Figure 1;
- preparing guidelines for assessing the health of rivers based on these variables/indicators;
- developing criteria for spatio-temporal frequency with which such variables/indicators need to be monitored;
- establishing present condition as well as norms for Bio-physical Status of healthy rivers in different stretches (from Origin to Destination); and
- setting milestones for river rejuvenation programmes.

- The overarching goal in River Health Assessment is to account for Goods & Services (including Ecosystem Services) that a river provides and to take an informed/ evidence-based decision to maintain river status that strikes a balance between River Conservation and Development. Hence, we need a sustained programme for assessing RH and monitoring RRC, and it is from this point of view that we need to set targets for RH in different stretches and in different conditions.
- Collation of information as per the indicative list of variables of River Health in five broad categories for different stretches requires mobilization of substantial resources from local, regional and national/ international level to enhance the limited database for RH assessment.
- Engagement and coordination with numerous stakeholders are essential. The model must be bottom-up from community-based methods to those requiring advanced facilities, but the coordination has to be from the top.
- Evolving and piloting the methodology for river monitoring is necessary. cGanga may initiate this exercise with available resources based on exercise done so far on pilot basis for an initial period of about three years. A workshop may be organised involving all stakeholders including Member Institutes and Partners to work out the details and logistics of executing the river monitoring pilot for a select portion of the Ganga River Basin.
- In the final session Track A on Data, it was validated that the required information/ data mostly don't exist. Dr. Vedire also confirmed that our present data collection activities must go on because such data really do not exist.

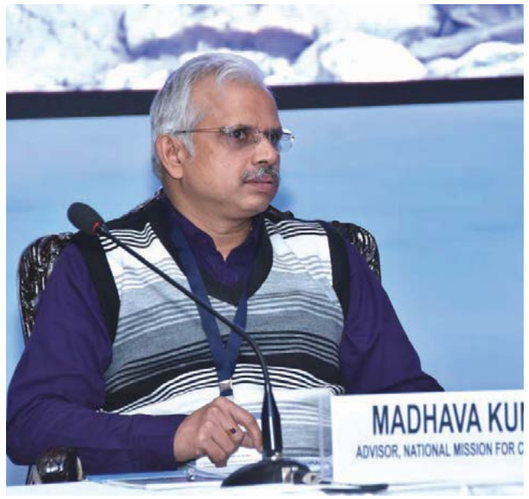
Mr. Sanmit Ahuja presented a summary of the main outcomes of Track D (International Partnerships) and Track B (Economics and Finance) of the 7th IWIS.

- For the International Partnerships session, there were four key representations at the ambassadorial and senior diplomat levels – the German Ambassador, the Slovenian Ambassador, European Union's Deputy Ambassador, and Norway's Head of Innovation which is the main arm of trade and investment in India.
- There is a push to start a COP for water, for which Slovenia has requested India to take a joint lead. That prompted a significant initiative that we are launching, which is the twinning of river systems.
- Given India's G20 presidency our ambition is to have all major international river collaborations in India completed by the time of the next G20 summit in September 2024 in Delhi.
- Another underlying objective is to streamline many of the international river partnerships with India so that there is no duplication.
- In Track B, which is economics and finance, a new and bold initiative was launched called India Water Leaders Council, which is a forum for CEOs, management level and senior management level people and representatives from stakeholder groups, including industry, academia, government, ULBs, regulators, and investors. We had about 30 leaders and Mr. D P Mathuria, Executive Director Technical, NMCG co-chaired the session.
- The purpose of the India Water Leaders Council is to understand each other's

THERE IS A PUSH

to start a COP for water, for which Slovenia has requested India to take a joint lead. That prompted a significant initiative that we are launching, which is the twinning of river systems

P4: Valedictory Session



GIVEN INDIA'S G20 PRESIDENCY
our ambition is to have all major international river collaborations in India completed by the time of the next G20 summit in September 2024 in Delhi

problems and look at where the systemic gaps in the water sector are and what we need to do collectively to fill those gaps and raise the bar. Some of those gaps were identified in terms of capacity, lack of O&M capacity including need to improve the quality of technicians, etc. in the industry, and gaps in the municipal cadre.

- The Council considered how to remove or mitigate the risks and address the risk management framework in the water sector besides also looking at new financial models, bonds, insurance products, et cetera.
- A second session was on sludge, which we have been working on with the Norwegian government and several research institutes there. This partnership started in 2020. In this session, we released a draft consultation paper on sludge management framework. The final report will be released by the middle of next year. One exercise to be included is lifecycle cost comparison of all sludge management technologies from an energy perspective. The second task is on sludge use as what's commonly called fertilizer, soil enhancer, or soil conditioner to rejuvenate our topsoil.
- Another session was on wastewater recycle and reuse. What should be the standards for the recycled wastewater we need to evolve and adopt? These and the hygienization standards are what have been put out in the report which will be finalised and released.
- How do we create a market for recycled water was discussed extensively, and there was a common consensus that we cannot leave the development of the market to just the contractors and concessionaires. So, in the interest of the nation, the government – either through a policy mechanism or incentive or disincentive mechanisms – should promote it.

Mr. Sanmit Ahuja also explained the essential purpose of the ETV program as having a deep nation-nation building, innovation and enterprise agenda in it by linking it to Start-up India and Skill India missions to make India a powerhouse of river science and in water engineering and technological innovation.

Mr. Sundeep Chauhan briefly described the outcome of the ETV presentations of several international companies from Australia. France, Germany, Japan, Norway and Turkey, and the ETV Committee will evaluate the promising new technologies among them. He also emphasized the inclusion of Social Sciences besides Science, Technology, Engineering and Maths in STEMS as essential for the successful Indian application of new technologies.

Mr. Madhav Kumar briefed the audience about the outcome of Track E (Implementation Challenges). In this track, Decentralized Sewage Treatment Plants (DSTPs) were considered advantageous over conventional large STPs especially for rejuvenating small urban rivers that presently function as wastewater 'nala's, but also for local reuse of treated water, involvement of local people in STP monitoring, and in cases of topographical disadvantages of distant STPs. Hence DSTPs should be encouraged and set up in our cities. On the "Impact of Land-use in the Rejuvenation of Small Rivers" discussed with several DMs, DFOs and CDOs from Uttar Pradesh, two key factors

THE EXERCISE
to be done is lifecycle cost comparison of all sludge management technologies from an energy perspective

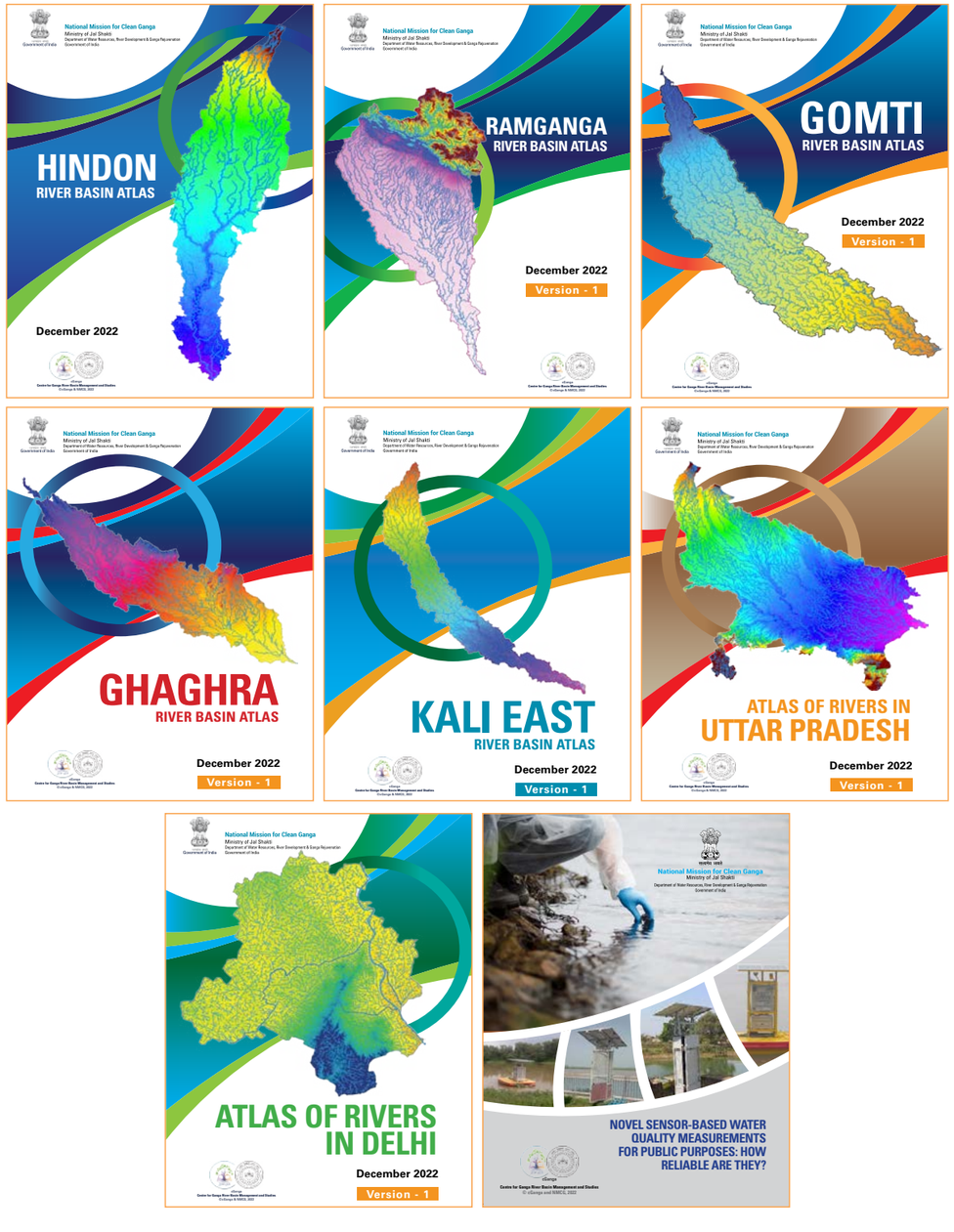
P4: Valedictory Session

that emerged for the success of such activities was the initial identification of small rivers from source onwards and the inclusion of livelihood aspects in the project goals when involving local communities in river restoration.

Mr. G Ashok Kumar, DG, NMCG spoke about the paradigm shift in the last 7-8 years in valuing and respecting water in India, and hence the flurry of initiatives on circular economy, resource recovery, river management as part of urban management, NMCG's River-City Alliances, river-sensitive urban planning, decentralized STPs, local water management, achieving Arth Ganga through the monetization of water, sludge, etc., and NMCG's Jal Shakti Kendras and District Ganga Committees that function as knowledge centres. The increased attention to water has led to both quantity and quality aspects of water being handled in an integrated manner. He also stressed on the need to break the silos in which our institutions work, e.g. between CGWB and CWC that both work under the Jal Shakti Ministry. To ensure water security for the whole country, he urged that both water scarcity (droughts) and water excesses (floods) are managed conjointly. He also suggested that before the 8th Summit, there should be at least 10-15 projects emerging from the last seven Summits should be implemented on the ground. He hoped that India would lead the way and showcase its water management abilities for other sectors in India and for other countries, especially African nations, to benefit from.

On behalf of the organisers of IWIS-2022, Prof Santosh G Thampi from NIT, Calicut thanked Sri Gajendra Singh Sekhawat (Hon'ble Minister Jal Shakti), Sri Bishweswar Tudu (Mins. of State, Jal Shakti) and Sri Prahlad Singh Patel (Mins. of State, Jal Shakti), Sri Pankaj Kumar (Secretary, DoWR, RD & GR, MoJS), Smt. Debashri Mukherjee (Spl. Secy., DoWR, RD & GR, MoJS), Sri G Asok Kumar (DG, NMCG), and all delegates and faculty from various institutes and organisations for their contributions to the 7th IWIS. He lauded the efforts of the volunteers from Team cGanga, IIT Kanpur and Team NMCG for their enthusiastic contributions and making all sessions and events of 7th IWIS highly productive and lively.

Release of Reports



TRACK A

SCIENCE, TECHNOLOGY AND POLICY

PANELISTS


A K Nema


A K Gosain


A K Hakeem


Anshumali Singh


Anshuman


Atya Kapley


Bhawna Badola


Nitin Bassi


Prabhat Kumar Singh


Prakash Muthuswamy


Pranab Mohapatra


Praveen Mishra


P S Rana

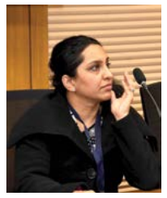

Rajeev Sharma


Simon Tilleard


S K Sarkar


S R Samadder


Suresh Babu


Suvarna Bhat


Thippeswamy M N


Uday Bhonde


Gouri Shanker Priyadarshi


J Sumathi


Mukesh K Sharma


Narendra Kumar


Neeraj Gahlawat


Neetu Kumari Prasad


Rajiv Kapahi


Rakesh Mehrotra


Rebecca Tharme


R R Mishra


Samir Bajpai


Santosh G Thampi


Uday Kelkar


V K Chaurasia


Venkatesh Dutta


Victor Shinde


Vikrant Jain

A1: Setting the Goal to Determine Health Status of the River

EVALUATION OF THE

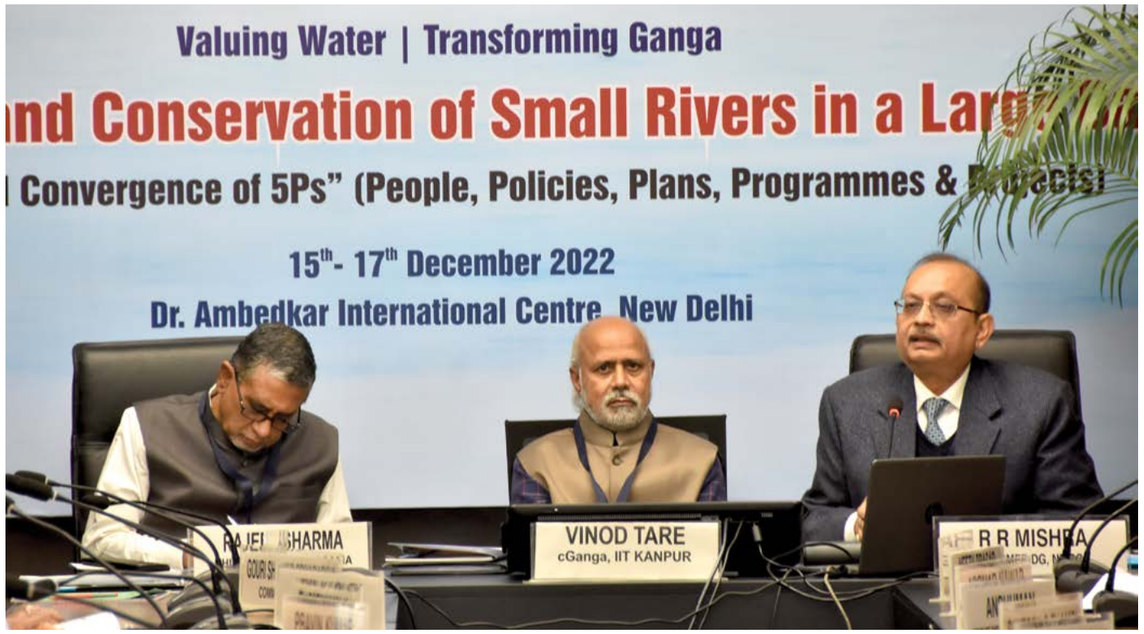
actual state and measuring the rate of changes in the rivers and streams, periodic assessment of its health is essential

DAY 1:
Thursday, December 15, 2022
11:30 – 13:00 hrs

CHAIR:
Rajeev Sharma [Chief Advisor, Telangana]

MODERATOR:
Vinod Tare [Founding Head – cGanga, IIT Kanpur]

PANELISTS:
A K GOSAIN [Indian Institute of Technology Delhi, Delhi]
Anshumali Singh [Associate Professor, IIT (ISM) Dhanbad]
Anshuman [Associate Director, Water Resources, TERI]
Atya Kapley [Chief Scientist, NEERI]
Gouri Shanker Priyadarshi [Commissioner, RD, UP]
Mukesh K Sharma [NIH Roorkee]
Narendra Kumar [Associate Professor, BBAU]
Neeraj Gahlawat [Embassy of Israel]
Neetu Kumari Prasad [IAS, Member Secretary, Telangana PCB]
Prabhat Kumar Singh [Professor, IIT BHU]
Pranab Mohapatra [Professor, IIT Gandhinagar]
Praveen Mishra [Additional Project Director, SMCG, Lucknow]
Rajeev Sharma [Chief Advisor, Telangana]
Rakesh Mehrotra [Associate Professor, DTU]
Rebecca Tharme [Director, Riverfutures Limited (GIZ-UK)]
R R Mishra [Former DG, NMCG]
Santosh G Thampi [Professor, NIT Calicut]
S K SARKAR [Distinguished Fellow and Director Water Resources Division, at TERI, (TERI)]
S R Samadder [Associate Professor, Dept of ESE, IIT (ISM) Dhanbad]
Suresh Babu [Director, WWF]
Suvarna Bhat [Director, HNB Engineers LTD]
Thippeswamy MN [Chief Engineer (Retd), Bangalore Water Supply and Sewerage Board]
Uday Kelkar [MD & CEO, NJS Engineers India Pvt. Ltd, Pune]
V K Chaurasia [Joint Advisor, CPHEEO, MoHUA]



Rivers and streams are among the most endangered ecosystems worldwide. Rivers have economic, social, cultural, aesthetic and ecological values, as well as intrinsic values that are not dependent on people's will. These values of rivers are based on their health. World over, the rivers are over exploited for their functions and are under severe pressure due to various disruptive anthropogenic activities. Numerous stressors such as nutrient enrichment, pollutants, sedimentation, and alterations in stream hydrology and habitat are the major factors of concern for ecological integrity, sustainability and ecosystem health. For evaluation of the actual state and measuring the rate of changes in the rivers and streams, periodic assessment of its health is essential. The focus of this summit is to pave a path for expediting mapping, integration and assessment of different scenarios/ aspects of river health.

Currently, most countries in the world plan for a management approach to sustain the prime natural resources like rivers and streams. At the same time, it is equally important to evaluate how socio-economic development programmes such as water supply, sanitation, agriculture and horticulture, animal husbandry, navigation, recreational, tourism, rural and urban development, hydropower, or even education and culture, etc. are dependent on river systems as well as influence river restoration and conservation efforts.

Presently some of the mega programmes that impact river systems and aim at socio-economic upliftment such as Swachh Bharat Mission, Jal Jeevan Mission, Atal Mission for Rejuvenation and Urban Transformation (AMRUT), MGNREGA are executed employing sectoral planning with much less emphasis on comprehensive micro level project preparations that focus on river restoration and conservation (RRC). As such suboptimal results, and at times even adverse impacts, are seen that raises questions regarding sustainability of actions on ground.

Also, River Health Assessment (RHA), though has been under consideration for River Action Plans, is rarely a requirement for planning and implementation of projects designed with primary focus on RRC. The river health concept and a national river health assessment system is absent in India. This is perhaps because of the lack of (i) suitable assessment methods, (ii) identification of indicators/ variables, and (iii) development of selected indices of river health assessment for evaluating the effectiveness of river cleanup or river restoration and conservation programmes. RHA involves all critical components of a riverine system including aquatic flora

A1: Setting the Goal to Determine Health Status of the River

and fauna, riparian vegetation, geo-morphological features, physical form of the channel, hydrology, water quality, habitat, etc. However, it is impractical to routinely monitor all the variables under these components. Monitoring of some of the critical indicators under these components is a prerequisite to provide a holistic indication of the system health. As a part of the river health assessment, many variables/ indicators are involved, and could be broadly grouped under five major subject matters as depicted in Figure 1.

RIVER HEALTH ASSESSMENT (RHA),
though has been under consideration for River Action Plans, is rarely a requirement for planning and implementation of projects designed with primary focus on RRC

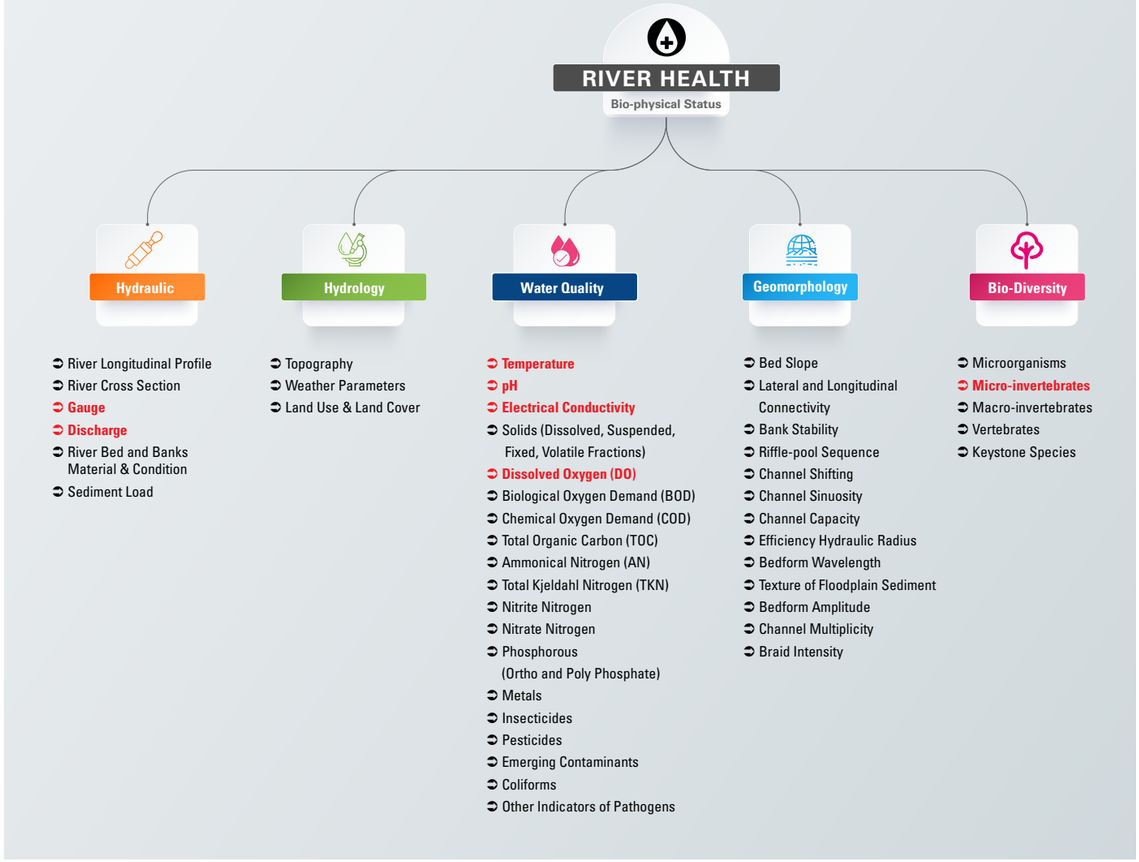


Figure 1: Depiction of Many Variables / Indicators Related to River Health Assessment (RHA) under Four Broad Categories

PROPOSITIONS/ QUESTIONS

- River Restoration and Conservation (RRC) should be on a higher pedestal in comparison to other socio-economic development programmes such as water supply, sanitation, agriculture, horticulture, animal husbandry, navigation, recreation, tourism, rural and urban development, hydropower, education and culture, etc. even though in terms of financial layout and direct social impacts some of these may be of higher priority.
- How to facilitate and identify agencies that could be assigned the responsibility of preparing comprehensive Set of Action for entire river in various stretches lying in different Administrative Boundaries {Detailed Project Report (DPR)} for identifying and

A1: Setting the Goal to Determine Health Status of the River

coordinating activities for optimal utilization of resources deployed through various programmes of the central, state and local governments as well as contributions from NGOs and bilateral and multilateral cooperation?

- What criteria should be adopted for River Restoration and Conservation (RRC) that is effective, simple, relatively easy to monitor, and understood by all stakeholders?

DISCUSSIONS

- The need for an exclusive national policy for rivers and waterbodies was generally agreed upon by the participants, with additional points highlighting the need for river policies at state levels, focussing on river basin management to keep track of groundwater-surface water interactions and water availability versus demands, ecosystem conservation policies, and a national-level Act for rivers as per Entry 56 of the Constitution. In lieu of a policy for rivers, it was also suggested that there should be a framework in which stakeholders should discuss different policies such as for water, sanitation, navigation, etc.
- For river-related works it was felt that planners and implementers should be different, and implementers and monitors should also be different. But the questions remained as to who will decide what is to be done when there are multiple active agencies and who will negotiate between stakeholders for tradeoffs? Keeping track of resource availability and demand at the basin level for sustainability was also needed.
- Participants opined that for river health monitoring there should be a river health assessment framework, and that the present water quality targets are impractical, maintaining healthy aquatic life in rivers is an adequate goal/ criterion.

FOR RIVER HEALTH MONITORING
there should be a river health assessment framework, and that the present water quality targets are impractical, maintaining healthy aquatic life in rivers is an adequate goal/ criterion

RECOMMENDATIONS

1. There should be exclusive national and state policies/ framework and Act for rivers and waterbodies, so that all relevant Plans, Programmes and Projects that touch upon rivers and waterbodies can consciously include them in their priorities.
2. Planners and implementers as well as implementers and monitors should be different for river-related works.
3. There should be a national river health assessment framework, and maintaining healthy aquatic life in rivers is an adequate criterion for river health.

A1: Setting the Goal to Determine Health Status of the River

"The question is who does the planning and preparing the set of projects to be implemented in the districts?"

Prof. Vinod Tare

"There should be an exclusive national policy for rivers and waterbodies so that all relevant plans, programmes and projects that touch upon rivers and waterbodies consciously include them in their priorities. And there should also be State River Policies for all States."

Dr. S K Sarkar

"As per Entry 56 of the Constitution, in case of inter-state rivers, the Union Govt. can bring a law in public interest."

Dr. Rajeev Sharma

"There should also be policy for ecosystem conservation."

Dr. Rebecca Tharme

"Since many aspects of rivers such as water, sanitation, navigation etc. are covered in different policies, there should be a framework in which stakeholders should discuss the policies."

Mr. V K Chaurasia

"(i) Planners and Implementers should be different; Implementers and Monitors should also be different. (ii) Who is going to negotiate between stakeholders for the tradeoffs?"

Mr. Suresh

"A river is more tangible than water, hence by focussing on rivers we will automatically be able to improve on our water resources while connecting easily to people."

Mr. R R Mishra

"Who is to decide what has to be done, especially at the State levels where there are multiple river agencies?"

Dr. S K Sarkar

"There should be a National River Health Assessment Framework."

Prof. Pranab Mohapatra

"Instead of a River Policy, there should be an Act with a clear definition of rivers."

Mr. Gouri Shanker Priyadarshi

"We have to keep track of the GW-SW interactions and water availability and demands to ensure overall sustainability when programmes are being executed by different agencies. So target should be river basins, not rivers."

Prof. A K Gosain

"Regarding water quality, targets like BOD of 3.0 mg/l are bombastic; maintaining healthy aquatic life is adequate."

Dr. Rajeev Sharma

"Water supply from various sources must ensure the sustainability of the sources."

Mr. R R Mishra

A2: Establishing Present Condition and Norms for Bio-physical Status of Healthy Rivers in Different Stretches (from Origin to Destination) and setting the Milestones

DAY 2:
Friday, December 16, 2022
09:30 – 11:00 hrs

CHAIR:
Vinod Tare [Founding Head, cGanga, IIT Kanpur]

PANELISTS:
A K Gosain [Indian Institute of Technology Delhi, Delhi]
Anshumali Singh [Associate Professor, IIT (ISM) Dhanbad]
Anshuman [Associate Director, Water Resources, TERI]
Atya Kapley [Chief Scientist, NEERI]
Bhawna Badola [CEO, TREE Craze Foundation]
J Sumathi [PCB, Telangana]
Mukesh K Sharma [NIH Roorkee]
Narendra Kumar [Associate Professor, BBAU]
Nitin Bassi [Programme Lead, CEEW]
Prabhat Kumar Singh [Professor, IIT BHU]
Rakesh Mehrotra [Associate Professor, DTU]
Santosh G Thampi [Professor, NIT Calicut]
Simon Tilleard [GM, Alluvium International and Alluvium Consulting India]
Suresh Babu [Director, WWF]
Uday Bhonde [Project Coordinator, NIUA]
Venkatesh Dutta [Professor, BBAU]
Victor Shinde [Sector Coordinator, NIUA]
Vikrant Jain [Professor, IIT Gandhinagar]
V K Chaurasia [Joint Advisor, CPHEEO, MoHUA]

By and large, for most river clean-up programmes worldwide, and particularly in India since the beginning of Ganga Action Plan, much of the emphasis has been on assessment of certain water quality parameters focusing on the ingress of domestic and industrial discharges and disposals. Accordingly, the status of the river has been judged based on CPCB established guidelines for Designated Best Use Water Quality Criteria stated in Table 1. In many forums the appropriateness of such guidelines for assessment of river cleanup measures have been questioned and an alternative measure such as River Health has been strongly advocated.

The most important prerequisite for preparing a roadmap for RRC

Table 1: CPCB's designated Best Use Water Quality Criteria

Designated Best Use	Class of Water	Criteria
Drinking Water Source without Conventional Treatment but after Disinfection	A	☐ Total Coliforms Organism MPN/100ml shall be 50 or less ☐ pH between 6.5 and 8.5 ☐ Dissolved Oxygen 6 mg/l or more ☐ Biochemical Oxygen Demand 5 days 20°C: 2 mg/l or less
Outdoor Bathing (Organised)	B	☐ Total Coliforms Organism MPN/100ml shall be 500 or less ☐ pH between 6.5 and 8.5 ☐ Dissolved Oxygen 5 mg/l or more ☐ Biochemical Oxygen Demand 5 days 20°C: 3 mg/l or less
Drinking Water Source after Conventional Treatment and Disinfection	C	☐ Total Coliforms Organism MPN/100ml shall be 5000 or less pH between 6 to 9 ☐ Dissolved Oxygen 4 mg/l or more ☐ Biochemical Oxygen Demand 5 days 20°C: 3 mg/l or less
Propagation of Wild Life and Fisheries	D	☐ pH between 6.5 to 8.5 ☐ Dissolved Oxygen 4 mg/l or more ☐ Free Ammonia (as N) 1.2 mg/l or less
Irrigation, Industrial Cooling, Controlled Waste Disposal	E	☐ pH between 6.0 to 8.5 ☐ Maximum Electrical Conductivity at 25°C: 2250 micro mhos/cm ☐ Maximum Sodium Absorption Ratio: 26 ☐ Boron Max: 2 mg/l

(i) Hydrological
(ii) Hydraulic
(iii) Geomorphological
(iv) Water Quality
(v) Biological

The focus of deliberations in this session was to develop a roadmap for achieving above mentioned tasks.

DISCUSSIONS

The goal of the present session was set out to establish norms for biophysical status of rivers for the present conditions and reference conditions of rivers, viz.: what is the present condition, what is the target condition, and what's the roadmap with milestones for River Restoration and Conservation (RRC)? The emphasis till now had been on water quality parameters not from a river perspective but from the view of ingress of industrial and domestic discharges. For instance, in what way is BOD important for aquatic life? Also, studies have shown that 60-70% of river coliforms are from non-human sources. Hence do we need to disinfect waters being discharged into rivers? Alternatives to CPCB's Best

A2: Establishing Present Condition and Norms for Bio-physical Status of Healthy Rivers in Different Stretches (from Origin to Destination) and setting the Milestones

Use Water Quality norms, such as River Health, has thus often been suggested. Hence the following propositions/ questions to be decided:

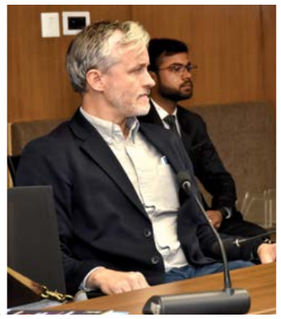
PROPOSITIONS/ QUESTIONS

1. Are designated Best Use Water Quality Criteria appropriate for assessing River Restoration and Conservation (RRC) efforts?
2. Is River Health (RH) an appropriate measure to assess RRC efforts?
3. Are there any appropriate guidelines/ norms exist for River Health Assessment in India or worldwide?
4. What criteria should be adopted for River Restoration and Conservation (RRC) that is effective, simple, relatively easy to monitor, and understood by all stakeholders? It is proposed that restoration and maintenance of indigenous aquatic life (the biological profile of the river) and riparian vegetation akin to pre-industrial conditions is considered a reference condition.

Along with discussions of river problems and restoration efforts in India, the participants broadly

RIVER HEALTH (RH)
is an appropriate concept to assess RRC efforts. The specific parameters and aspects to be included in RH may encompass rivers' biological profiles, ecosystem services, and people's perception of river health

A2: Arth Ganga – River Conservation Synchronized Human Settlement



agreed that biological profiling of rivers at different spatio-temporal scales, output-based considerations in terms of river ecosystem services, and people's perceptions of what constitutes a healthy river should be adopted to assess the present and reference conditions of rivers. Biological profiling may also need to be qualified with other aspects such as dissolved oxygen in some cases. But, very often, just a few typical river species such as fishes and macro-invertebrates, can adequately describe river conditions in specific stretches rather than a host of water quality measurements.

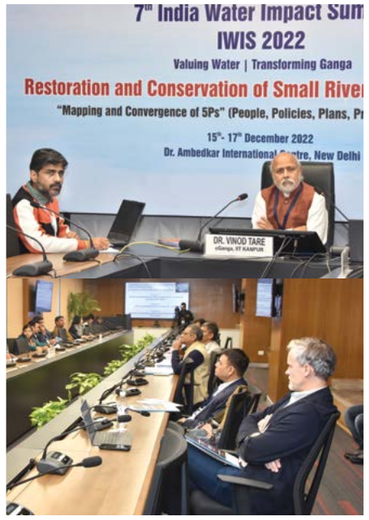
RECOMMENDATIONS

1. Best Use Water Quality Criteria are not suitable for assessing River Restoration and Conservation (RRC) efforts.
2. River Health (RH) is an appropriate concept to assess RRC efforts. The specific parameters and aspects to be included in RH may encompass rivers' biological profiles, ecosystem services, and people's perception of river health.
3. Indigenous aquatic life and riparian vegetation akin to pre-industrial and pre-urbanization era may be adopted as a simplified reference condition reflecting the bio-physical status of healthy rivers in different stretches.

INDIGENOUS AQUATIC LIFE

and riparian vegetation akin to pre-industrial and pre-urbanization era may be adopted as a simplified reference condition reflecting the bio-physical status of healthy rivers in different stretches

A2: Arth Ganga – River Conservation Synchronized Human Settlement



"The issue here is to assess "What are the present conditions and what are the target conditions of the river that we want to achieve?"

Prof. Vinod Tare

"Over the entire length of Ganga from Gangotri to Diamond Harbour the relative abundance of E. Coli to other microbes is minuscule – barely about 0.002%."

Dr. (Mrs.) Atya Kapley

"The river health indicators should be output-based considering the river as an ecosystem, hence in terms of its ecosystem services."

Mr. Nitin Bassi

"River Health in terms of its biological profile or ecology is good. For the Ramganga river, we had found that identifying and assessing a few typical species such as carps or macro-invertebrates in different stretches was fairly indicative of the river's condition rather than water quality which was redundant."

Mr. Suresh Babu

"(i) Can we have only biological indicators for RH? In River Yamuna in Delhi, fishes exist and fishermen catch them but the DO is near zero. (ii) For milestones for RRC programmes, people's expectations of rivers need to be included."

Ms. Bhawna Badola

A3: Formulation and Execution of River Monitoring Programmes

DAY 3:
Saturday, December 17, 2022
09:30 – 11:00 hrs

CHAIR:
Vinod Tare [Founding Head, cGanga, IIT Kanpur]

PANELISTS:
A K Nema [Professor & Head, IIT Delhi]
J Sumathi [PCB, Telangana]
Mukesh K Sharma [NIH, Roorkee]
Narendra Kumar [Associate Professor, BBAU]
P S Rana [Chairman, CIDC]
Prabhat Kumar Singh [Professor, IIT BHU]
Prakash Muthuswamy [Managing Partner, AuM Systems]
Rajiv Kapahi [Sr. Director Finance, JPIN]
Rakesh Mehrotra [Associate Professor, DTU]
Samir Bajpai [Professor, NIT Raipur]
Santosh G Thampi [Professor, NIT Calicut]
Suresh Babu [Director, WWF]
Thippeswamy MN [Chief Engineer (Retd), Bangalore Water Supply and Sewerage Board]
V K Chaurasia [Joint Advisor, CPHEEO, MoHUA]
Vikrant Jain [Professor, IIT Gandhinagar]

The overarching goal in River Health Assessment is to account for Goods & Services including Ecosystem Services and take an informed/ evidence-based decision to maintain river status that strikes a balance between River Conservation & Development as shown in Figure 2. One of the purposes of RHA is to determine challenges in river restoration and conservation programmes as depicted in Figure 3.

Figure 2: Balancing River Conservation and Development

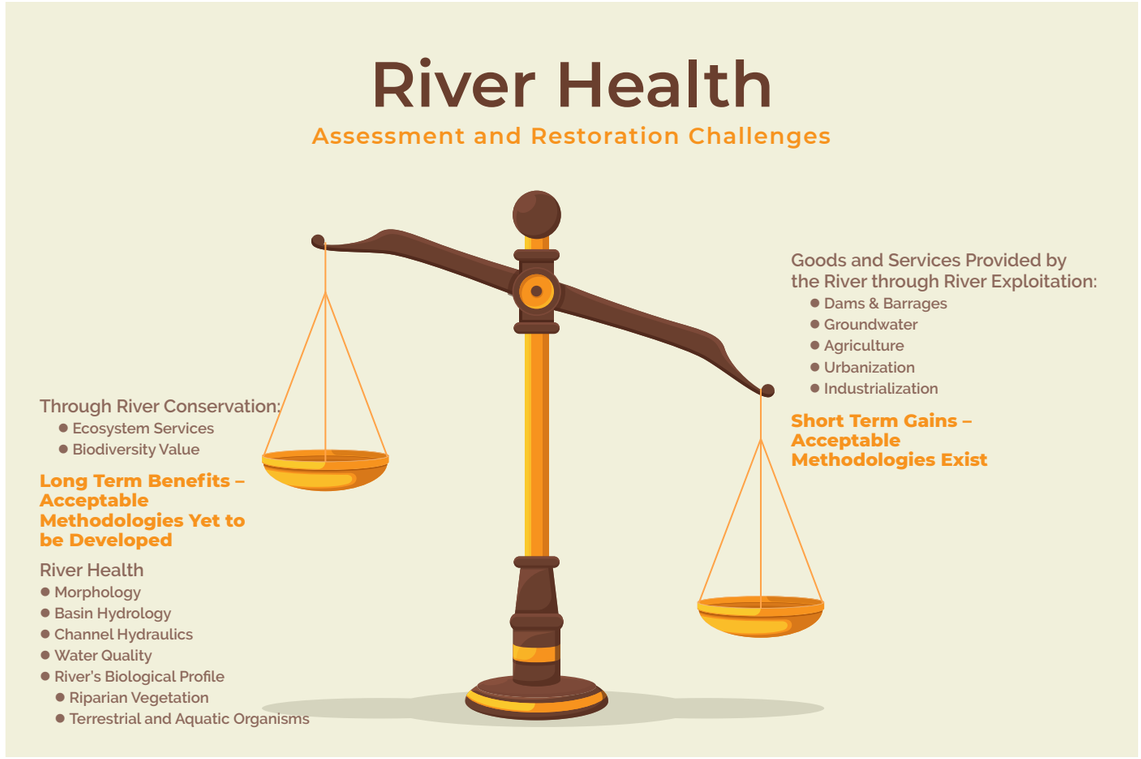


Figure 3: Assessment and Restoration Challenges

The salient aspects that need to be addressed in river health assessment are: (i) why to monitor, (ii) what to monitor, (iii) how to monitor, (iv) who will monitor, (v) value for the resources utilized in monitoring, and (vi) capacity building for monitoring. Table 2 provides an indicative list of variables that may reflect on bio-physical status of a river.

A3: Formulation and Execution of River Monitoring Programmes

Table 2: Indicative List of Variables that may Reflect Bio-physical Status of a River

Category	Parameters
Hydraulic	River Longitudinal Profile; River Cross Section; Gauge; Discharge; River Bed and Banks Material & Condition; Sediment Load
Hydrology	Topography; Weather Parameters; Land Use & Land Cover
Water Quality	Temperature; pH; Electrical Conductivity; Solids (Dissolved, Suspended, Fixed, Volatile Fractions); DO; BOD; COD; TOC; Ammonical Nitrogen; Total Kjeldahl Nitrogen; Nitrite Nitrogen; Nitrate Nitrogen; Phosphorous (ortho and poly phosphate); Metals; Insecticides; Pesticides; Emerging Contaminants; Coliforms; Other Indicators of Pathogens
Geomorphology	Bed Slope; Lateral and Longitudinal Connectivity; Bank Stability; Riffle-pool Sequence; Channel Shifting; Channel Sinuosity; Channel Capacity; Efficiency Hydraulic Radius; Bedform Wavelength; Texture of Floodplain Sediment; Bedform Amplitude; Channel Multiplicity; Braid Intensity
Biological Profile	Microorganisms; Micro-invertebrates; Macro-invertebrates; Vertebrates; Keystone Species

Collation of information as per the indicative list of variables of River Health in five broad categories for different stretches requires mobilization of substantial resources from local, regional and national/international level. Engagement and coordination with numerous stakeholders are essential.
A novel combination of simple riverside community-based methods to those requiring advanced facilities may have to be evolved keeping in the background the existing institutional framework and getting value for the resources utilised. This session will focus on evolving and piloting methodology for river monitoring in light of the background information provided in this document along with schematic illustration provided in Figure 4 that could be adopted for Establishing Present Condition and Norms for Bio-physical Status of Healthy Rivers in Different Stretches (from Origin to Destination) and setting the Milestones for RRC programmes.

A NOVEL COMBINATION

of simple riverside community-based methods to those requiring advanced facilities may have to be evolved keeping in the background the existing institutional framework and getting value for the resources utilised

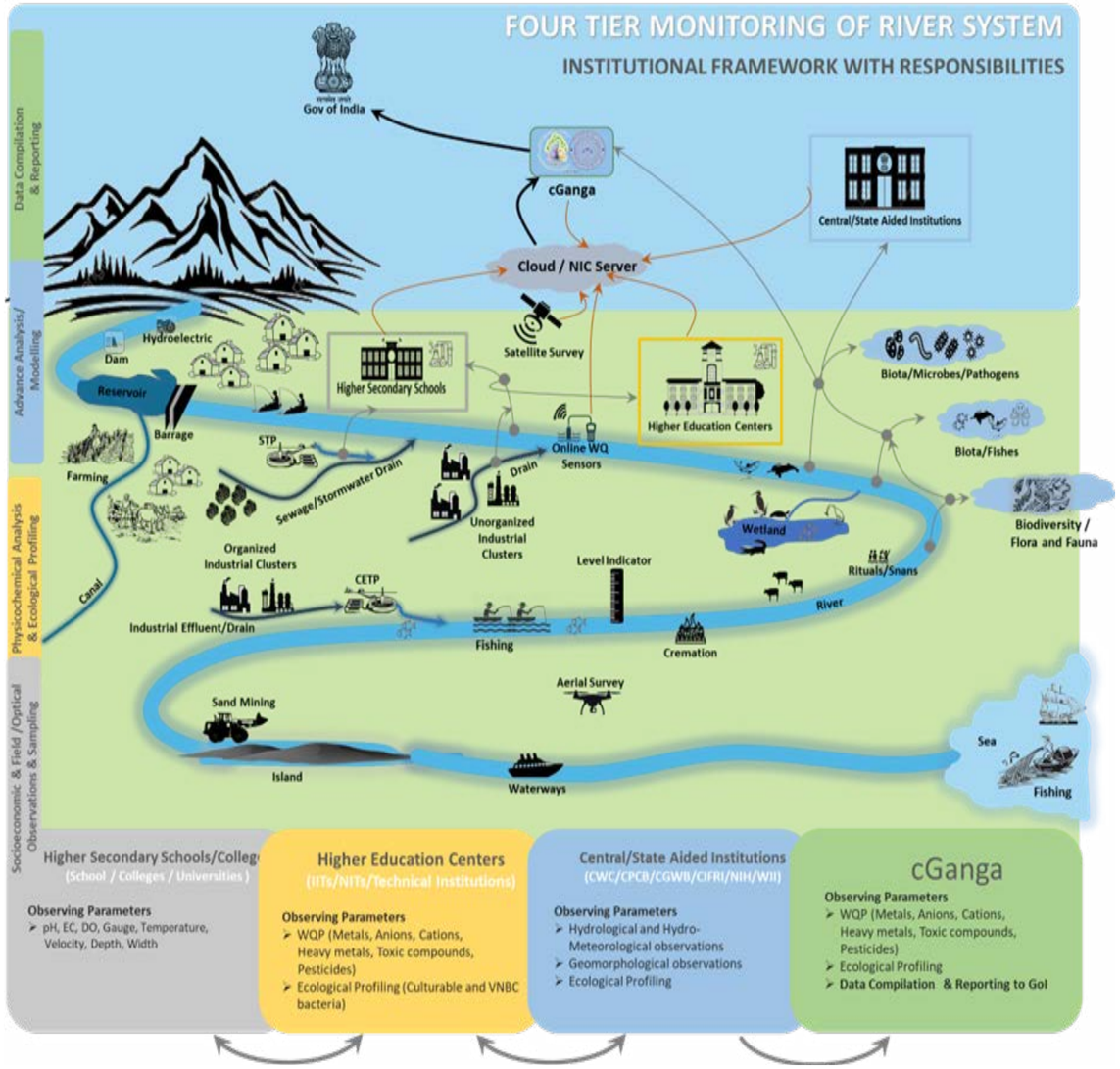


Figure 4: Illustration of a Multi-tier River Monitoring System

DISCUSSIONS

The progressive success of River Restoration and Conservation (RRC) needs to be assessed periodically. The target of RRC rests on the 5 pillars of Samarth Ganga. RH accounts for a river fulfilling its so-called ecosystem goods and services, and it has to be informed and evidence-based. RRC monitoring should be done through River Health (RH) assessments and not in terms of the Best Use Water Quality

A3: Formulation and Execution of River Monitoring Programmes

norms. This raises important questions as follows that need to be decided:

PROPOSITIONS/ QUESTIONS

1. What is River Health (RH), and how do we assess it?
2. Should RH be based on hydrology, hydraulics, geomorphology, water quality, and biological profile?
3. Can there be some composite index or a single aspect that adequately describes RH, e.g. biological profile or keystone species?
4. What should be the frequency and spatial resolution of monitoring?

During the ensuing discussions, the basic objective of RRC monitoring was seen as diagnosing the problem, devising preventive measures, and curing the problem, which would together decide the frequency and location of monitoring. Moreover, RRC implies taking care of the total eco-hydrological system including ponds, lakes, etc.; hence the micro-water equilibrium concept may be applied to create nearby storages. Monitoring of rivers and their tributaries, including water quality monitoring, should be at different levels – village, taluk, and district levels, and the parameters to be tested will depend on their specific locations.

It was suggested that river sediment quality monitoring can be less frequent and less voluminous than water quality monitoring for relatively long term assessment of heavy metals, etc. It was also suggested that providing a feedback loop of the monitored data to river managers will help them in their functioning. The need for a single composite index for water quality was also felt for use by ordinary stakeholders or lay people. It was agreed that there was a need to educate and skill local community members and high school and college students for river monitoring, and it was proposed that suitable educational/ skilling programs should be devised and integrated into the Skill India programme.

RECOMMENDATIONS

1. Monitoring of rivers and their tributaries should be at different levels – village, taluk, and district levels, and the parameters to be tested will depend on specific monitoring locations.
2. A single composite index for river water quality may be developed for communicating to ordinary stakeholders or lay people.
3. Creating a feedback loop for providing river monitoring data to river managers will help them in their functioning.
4. There is a need to develop suitable educational and skilling programs for river monitoring by unskilled people and high school/ college students.

A3: Formulation and Execution of River Monitoring Programmes

"The success of river conservation should be to sustain indigenous aquatic life (not exotic species) of rivers. Hence to establish reference condition the indigenous species in different stretches before river deterioration is to be determined."

Prof. Vinod Tare

"The basic objective of diagnosing the problem, preventive measure & cure will decide the frequency and location of RH monitoring."

Dr. P S Rana

"Apart from local communities and students, ASHA workers are very dedicated and should be engaged in river monitoring."

Mr. Suresh Babu

"A simple water index should be recommended by cGanga for even laymen to understand the overall water quality of an waterbody."

Ms. Sumati

"The river monitoring education scheme should be integrated in the Skill India initiative."

Mr. Rajiv Kapahi

"River sediment quality is a better indicator than water quality, especially for heavy metals, and with much fewer measurements."

Dr. Mukesh K Sharma

A4: Information/Data Collation, Utilization and Dissemination Strategy

DAY 3:
Saturday, December 17, 2022
14:30 – 16:00 hrs

CHAIR:
Sriram Vedire (Advisor, MoJS)

MODERATOR:
Vinod Tare [Founding Head, cGanga, IIT Kanpur]

PANELISTS:
A K Hakeem [Project Director, NRSC, Hyderabad]
Anshumali Singh [Associate Professor, IIT(ISM) Dhanbad]
Bhawna Badola [CEO, TREE Craze Foundation]
J Sumathi [PCB, Telangana]
Mukesh K Sharma [NIH, Roorkee]
P S Rana [Chairman, CIDC]
Rakesh Mehrotra [Associate Professor, DTU]
Samir Bajpai [Professor, NIT Raipur]
Santosh G Thampi [Professor, NIT Calicut]
S R Samadder [Associate Professor, Dept of ESE, IIT (ISM) Dhanbad]
Thippeswamy MN [Chief Engineer (Retd), Bangalore Water Supply and Sewerage Board]
Vikrant Jain [Professor, IIT Gandhinagar]
V K Chaurasia [Joint Advisor, CPHEEO, MoHUA]

As of now there is scarcity of information about the present condition as well as the desired state of a large number of small river systems in India. This information is a prerequisite for direction and extent of efforts that need to be channelized for restoration and conservation of rivers, and setting the milestones to assess the progress and benefits. A nationwide programme needs to be evolved for gathering information on a regular basis in a sustainable manner so that inventory of such information is available for setting the bench marks (reference) and assessing the progress of activities carried out under various programmes. Historically some of the information is gathered and available with various organisations, institutions, and individuals.

Once such information is collated, a systematic plan of action needs to be developed and executed to fill the gap in information. Only then a comprehensive micro level plan of action could be made so that a cost-effective execution of stretch wise restoration and conservation works, drawing resources from many river-related programmes, for all small or big rivers could be done. This session was intended to pave the way for formulating a road map for executing aforementioned tasks.

PROPOSITIONS/ QUESTIONS

1. Which programme/ organization should coordinate the tasks of collection, collation and dissemination of river-related data?
2. How should the requisite resources be generated/ allocated?
3. What institutional framework needs to be created to execute the above tasks?

DISCUSSIONS

Mr. Sriram Vedire (Advisor, MoJS, GoI) briefly explained the tasks of data collection, pre-processing and mining to meet the eventual goal of knowledge creation for water-related data. Thus National Water Informatics Centre (NWIC) and State Water Informatics Centres (SWIC) are being tried to be set up under NHP in every State

NATIONWIDE PROGRAMME

needs to be evolved for gathering information on a regular basis in a sustainable manner so that inventory of such information is available for setting the bench marks (reference) and assessing the progress of activities carried out under various programmes

A4: Information/Data Collation, Utilization and Dissemination Strategy

and linked to a state-of-the-Art Decision Support System. In trying to create such a knowledge base, for example village-level water balance, a common problem often encountered was lack of raw data. Mr. Hakeem explained the government's National Hydrology Project (NHP) that combines Earth Observation System, GIS, Global Navigation System, and Information Communication System to enable utilization and dissemination of hydrologic data for India, whose results so far include mapping of glaciers of Indian river basins (including outside India), evapo-transpiration data for both small catchments and big river basins, water consumption data (with 3-day lag), datasets needed for hydrological modeling, etc. [available in website: https://bhuvan.nrsc.gov.in/nhp/]. Prof. Tare emphasized the need for a nationwide programme for gathering information on numerous small and large rivers on a regular basis in a sustainable manner to set benchmarks for assessing the success of RRC programmes. Hence the need arises to coordinate such data collection activities, decide on the institutional framework, and garner resources for the same. Some participants felt that related water-related data are collected by different agencies and often the datasets don't synchronize. Hence a single central agency collating all data and assigning unique identities to datasets are needed. Presently, while NHP has been collecting hydrology-related data, efforts are on for more diverse datasets of different ministries to be collected and integrated by Niti Aayog. Mr. Vedire emphasized that both top-bottom and bottom-top approaches are needed for reliable data collection and inventory.

RECOMMENDATIONS

1. There is a need to coordinate river-related data collection activities, decide on the institutional framework, and garner resources for the same.
2. A single central agency collating all data and assigning unique identities to datasets are needed.
3. Both top-bottom and bottom-top approaches are needed for reliable data collection and inventory.

THE NEED FOR A
programme for gathering information on numerous small and large rivers on a regular basis in a sustainable manner to set benchmarks for assessing the success of RRC programmes

A4: Information/Data Collation, Utilization and Dissemination Strategy

"The foremost question in creating our knowledge base is: What's the difference between data and knowledge and information?"

Mr. Sriram Vedire

"Information from different sources, e.g. village boundary maps from Census & from Survey of India, can mismatch depending on how data is collected."

Mr. A K Hakeem

"We don't want duplication of efforts in mapping lower order rivers."

Prof. Vinod Tare

"Datasets created separately by different agencies often don't synchronize. Can there be a single central agency that collects and collates all datasets, and assigns unique identification numbers?"

Ms. Bhawna Badola

"Both Top-Bottom approach and Bottom-Top approach are needed for holistic data creation and inventory."

Mr. Sriram Vedire

"A nationwide programme needs to be evolved for gathering information on a regular basis in a sustainable manner so that inventory of such information is available for setting the bench marks (reference) and assessing the progress of activities."

Prof. Vinod Tare

TRACK B

B1: Economics and Finance of Sewage Treatment Plant Sludges

DAY 2:
Friday, December 16, 2022
14:30 –16:00 hrs

CHAIR:
Himansu Badoni [Executive Director, Projects, National Mission for Clean Ganga]

MODERATOR :
Sanmit Ahuja [Expert Member, cGanga (Moderator)]

PANELISTS:
Ajit Salvi [Deputy Chief Engineer, Municipal Corporation Greater Mumbai]
George Butler [Lead Specialist, IFC]
Krishna Mohan [HOD, Water Desalination Division, BARC]
Line Blytt [Senior Advisor, Norwaste]
Madhava Kumar [Advisor, National Mission for Clean Ganga]
Saurabh Kumar [Director, Keystone Energy Systems]
Shankar Ramamoorthy [CERES]
Suvarna Bhat [Director, HN Bhat Engineers]
Uday Kelkar [MD, NJS Engineers]
Verinder S. Thind [Ex-Chief of engineer, Delhi Jal Board]
Vinod Tare [Professor, IIT Kanpur and Founding Head, cGanga]

As the deployment of number of sewage treatment plants in the country increases, so will the quantity of sludge produced. Although sludge handling should become an integral part of wastewater treatment facility, there are however thousands of STPs in the country that do not have sludge treatment on-site.

SALIENT POINTS OF DISCUSSION
The session highlighted three major perceptions / (mis) understandings around management of STP Sludges:

1. **FIRST POINT:** Sludge has a lot of energy generation potential
a. A general perception created by market participants involved in handling of sludge is that sludge has a lot of trapped biogas that can be utilised for energy generation in a profitable manner.

b. Yes, it is true that there is energy trapped in sludges but the quantum of it is what matters most.
c. The anaerobic digester remains the main energy generator and the aeration tank the main energy consumer in a STP, and both must be optimised to reach the zero-energy goal. The more biogas derived from sludge treatment (anaerobic digester) the more carbon neutral energy will be produced. In India, STPs operate aeration tanks with long solids retention time (SRTs) resulting in

BIOLOGICAL
treatment of STPs in India must be optimised by operating at lower and appropriate retention time to minimise energy use and improve effluent quality

B1: Economics and Finance of Sewage Treatment Plant Sludges

excessive use of air. This also digests the sludge partially/extensively aerobically in the aeration tank resulting in higher air demand.

d. Higher use of air results in higher electrical consumption. Biological treatment of STPs in India must be optimised by operating at lower and appropriate retention time to minimise energy use and improve effluent quality. Recommended SRT for biological systems to achieve less than 10 mg nitrogen/L is 6 -10 days depending on sewage characteristics and temperature. Lower retention times result in lower consumption of air and thus saves energy for aeration. In addition, lower retention times result in younger sludge with higher volatile solids and increased sludge quantities, which will yield more biogas (and energy) when digested in an anaerobic digester. However, this may have an adverse impact on the solid liquid separation and quality of treated effluent.

E. GENERAL AGREEMENT

Therefore, to propagate the theory that digesting sludge will produce enough biogas that can fund the operation of the plant is not advisable. At best there will be a partial reduction in the operational cost of the plant.

2. **SECOND POINT:** Treated sludge can be used as a fertilizer

a. There are several studies worldwide of the benefits of converting sludge to a fertiliser / soil conditioner product. Organic carbon is food for soil microbes, it builds soil tilth, it enhances erosion resistance and increases water-holding capacity and increases the ability to retain nutrients. The average organic carbon content in soil, an index for Indian soilhealth, is as low as 0.3-0.4 per cent, according to Indian Council of Agricultural Research. This is well below the acceptable 1-1.5 per cent carbon content. Indian soil needs addition of a tremendous amount of organic carbon and biosolid is perceived to be potential carbon source for these soils. Composted biosolid contains more carbon due to use of bulking material to produce compost compared to digested biosolids.

b. Digested biosolid may contain higher percentage of nutrients such as nitrogen and phosphorus compared to sludge compost. However, the more stable the added carbon (stable humic) is, themore effective organic fertiliser is to increase soil carbon. Application of 10 to 20 tons of digested biosolids per hectare is usually acceptable to apply every five to ten years. This application rate has to be verified and has to be within the requirement for the plant nutrition for the different crops. Biosolids typically have too little nitrogen (~1.5 per cent) compared to the phosphorus content (~2 per cent), and to achieve a more balanced fertiliser more nitrogen should be applied. If the sludge management plan involvesa strategy for land application of the biosolid, field trials should be performed to educate farmers and biosolids contractors.

B1: Economics and Finance of Sewage Treatment Plant Sludges

TO PROPAGATE

the theory that digesting sludge will produce enough biogas that can fund the operation of the plant is not advisable. At best there will be a partial reduction in the operational cost of the plant

c. High quality biosolids may even be packaged and sold as a soil product for private gardens.

D. GENERAL AGREEMENT

At best sludges are soil enhancers as they cannot match the level of NPK present in the chemical fertilizers.

The resounding agreement was that Indian soil needs addition of a tremendous amount of organic carbon and biosolids is perceived to be a potential carbon source of the soils. The nation should develop a top-soil regeneration programme that can provide the requisite commercial driver to sludge management.

3. **THIRD POINT:** Class A standards should be applied uniformly across the country

a. Different countries around the world have different sludge regulations. However, it is common to regulate the sludge disposal route depending on the hygienic standards of the sludge. Forexample, the US, the UK and South Africa have defined sanitation into three classes of treated sludge or "biosolids". Norway defines only one class, meaning biosolids must be sanitised if used in agriculture or green areas e.g., parks, road slopes, golf course or top cover at landfills.

b. Class A biosolid has gone through a full pathogen kill and is suitable to be used for agricultural purposes.

c. Class B biosolids have reduced numbers of pathogens, however it is not safe to be used in food production. This biosolid may be used in areas with low public access and be part of road slides or land reclamation projects.

d. Class-C sludge is not treated and has to go to landfill with certain restrictions or to be thermally destroyed. Since landfilling of sludge should be avoided and only be an emergency option, drying and thermal destruction is the only option for untreated sludge.

e. The biosolids regulations also demand vector reduction, like risk of flies and rodents. One such option is to reduce the biodegradable organics to a minimum through biological processes. Beside hygienic standards, sludge may have high levels of contaminants of unwanted heavy metals which should not be spread as a fertiliser / soil conditioner. The option route for this kind of sludge should be the same as Class C sludge, in other words, thermal destruction.

F. GENERAL AGREEMENT

Standards need to be defined for each city and location, and blanket standards will not work in the Indian context.

B2: Economics and Financing of Water Recycling and Water Trading Market

DAY 2:
Friday, December 16, 2022
1630 – 1800 hrs

CHAIR:
Bhaskar Dasgupta [Executive Director - Finance, NMCG]

MODERATORS:
Sanmit Ahuja [Expert Member, cGanga

PANELISTS:
Ajit Salvi [Deputy Chief Engineer, Municipal Corporation Greater Mumbai]
Carlo Alberto Amadei [Water and Sanitation Specialist, World Bank]
Krishna Mohan [HOD, Water Desalination Division, BARC]
Madhava Kumar [Advisor, National Mission for Clean Ganga]
MP Singh [Chief Engineer, Thermal Project Planning and Development Division, Central Electricity Authority]
Pankaj Sinha [Senior Investment Officer, IFC]
Suvarna Bhat [Director, HN Bhat Engineers]
Uday Kelkar [MD, NJS Engineers]
Verinder S. Thind [Ex-Chief of engineer, Delhi Jal Board]
Vinod Tare [Professor, IIT Kanpur and Founding Head, cGanga]

For the water market to become more robust, it is important to establish not only the pricing but an efficient trading market.

KEY POINTS RAISED

ISSUE 1: The need for decentralised wastewater treatment:
All general commentary around decentralised wastewater treatment is based on aggregated situations, such as the gap between total demand and total supply, or the long construction times it takes and huge capital requirements for building large-centralised wastewater treatment plants. The main argument made in favour water recycling and water, particularly in the Indian context is that it would generate additional revenues for the urban local body that will help it better maintain the water assets.

This argument, although quite sound, requires a lot more in-depth analysis since the overlap between areas where water can be produced and where it is consumed in bulk is very little. Typically water users in large cities get their supplies from municipal sources which in turn largely depend on river/ nature based water resources or end up extracting ground-water.

WATER USERS
in large cities get their supplies from municipal sources which in turn largely depend on river/ nature based water resources or end up extracting ground-water

Proponents of water recycle and reuse suggest that it is important that urban local bodies stop extracting river water and also put a ban to ground water extraction. Countering voices, although supportive of the overall cause, state practical reasons why this cannot happen. There is no (dis)-incentive for urban local bodies to stop relying on natural sources, and regulating/ monitoring ground water extraction is very difficult.

Furthermore, there are questions around whether the purported buyers are likely to buy water at a premium price when they can just as easily extract ground water.

ISSUE 2: Understanding and matching operating conditions is a must
In order to get the wastewater treatment market going, it is quite important to understand the various operating conditions of the industry. There are many operating conditions where wastewater production may not be co-located with water consumers. The market for recycled water will vary for each of the conditions:

- Waster produced in – households, commercial establishments, industries
- Water consumed in – agriculture, horticulture, commercial establishments including golf-courses and public parks, industries

B2: Economics and Financing of Water Recycling and Water Trading Market

ALL GENERAL

commentary around decentralised wastewater treatment is based on aggregated situations, such as the gap between total demand and total supply, or the long construction times it takes and huge capital requirements for building large centralised wastewater treatment plants

- Water treatment in – centralised or decentralised wastewater treatment plants

Ultimately what the realisable market for treated wastewater in any city will depend on the various permutations of the operating conditions. There may be cities where the location of bulk-water production is also where it maybe possible to treat wastewater and supply it back to the user, but in most cases that is just not possible.

Additionally, transporting wastewater to treatment plants and then back to consumers can be a very expensive proposition, therefore a number of cities are just resorting to discharging treated water as per the national "discharge norms".

This however, creates another scenario where a large portion of cities wastewater is not connected to sewer networks and is unlikely to be so in the coming years. This makes it a compulsion for urban local bodies to find a viable alternative to contain the pollution caused through unconnected and uncontrolled sources.

ISSUE 3: Technologies for decentralization: Despite the trend towards large, centralized wastewater treatment plants, there are numerous technologies that do support treatment of sewage in local decentralised settings. Of the prevalent ones, bio-remediation and biological continuous flow reactors are gaining prominence in the Indian market.

The former relies on special bacteria and enzymes that are dozed in wastewater streams which accelerate the biological reaction in the water. The latter utilises a mix of biological enzymes and specialised engineering to treat water.

The technologies have their pros and cons vis-à-vis land-area requirements, power consumption, time to treat and costs (capex and opex).

The message however is that there are solutions available to treat water in a decentralised matter.

B2: Economics and Financing of Water Recycling and Water Trading Market

ISSUE 4: Creating a market

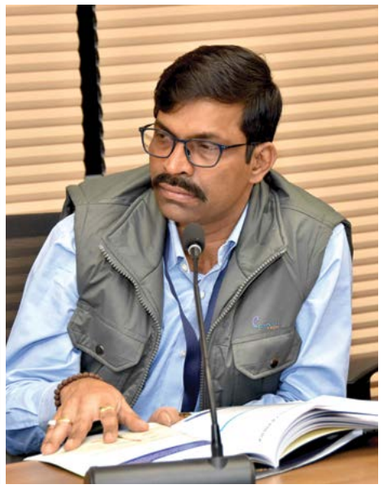
The above arguments help provide a priority order on which segment could provide a ready market for wastewater treatment. The general consensus is that cities should first prioritise: rejuvenating the lakes, ponds and reservoirs as the main segment followed by in-city horticultural uses such as watering gardens, golf-courses, stadia etc before considering potential commercial uses. This is because to create a commercial market would require developing a robust network, regulatory monitoring mechanism and a dynamic pricing regime, all of which would take years to fall in place.

THE GENERAL
consensus is that cities should first prioritise: rejuvenating the lakes, ponds and reservoirs as the main segment followed by in-city horticultural uses such as watering gardens, golf-courses, stadia etc before considering potential commercial uses

REJUVENATING
the water bodies increases the water resilience of cities as these can become sources of water in the long-run

By prioritising the aforementioned areas, the cities can reduce their cost of operations and generate revenues indirectly by improving the landscape around the water bodies which are currently full of sewage and produce a lot of stink. This depresses the prices of land and real estate in the neighbouring areas.

Furthermore, rejuvenating the water bodies increases the water resilience of cities as these can become sources of water in the long-run.



B3: India Water Leaders' Council

DAY 2
Friday, December 16, 2022
09:30 –11:30 hrs

CHAIR:
DP Mathuria [Executive Director – Technical, NMCG]

MODERATOR :
Sanmit Ahuja [Expert Member, cGanga (Moderator)]

PANELISTS:
Ajit Salvi [Dy. Chief Engineer, Birhan Mumbai Municipal Corporation]
Arvind Sharma [Managing Director, Bioxgreen]
Ashish Sahu [Norwegian Water Cluster]
Binoi Jhaveri [Executive Manager, Vasu Chemicals LLP]
Chhaya Bhanti [Founder, CEO, Vertiver]
Jai Mallick [Investment Manager, Foresight Group]
Mukul Bhandula [Ex Chief Engineer, Delhi Jal Board]
Prakash Shirsat [Director, MCGM Centre for Capacity Building and Research]
Rahul S Sutar [Atlas Sani- Tech Private limited]
Rajneesh Chopra [Head Global Business Development, WABAG]
Rajul Parikh [Director, Alfa UV]
Rishabh Sethi [CEO, JWIL]
Shravan Kumar [Project Head, Azure Power]
Shri Madhava Kumar [Advisor, NMCG]
Shweta Chauhan [Head ESG and Impact, Vital Environment]
Siddharth Desai [Managing Director, Kishor Pumps]
Subodh Nandode [Jt. Managing Director, HNB Engineers]
Sushil Chandak [Director, Unity]
Suvarna Bhat [Director, HNB Engineers Ltd]
Verinder S Thind [Ex-Chief of engineer, Delhi Jal Board]
Vijay Kumar Gupta [Former member, Delhi Jal Board]

The India Water Leaders Council (IWLC) was launched in New Delhi at the India Water Impact Summit 2022.

The Council is formed of three core groups:
1. Indian Government stakeholders at all levels that are responsible for the water-sector.
2. Industry leaders from India and around the world.
3. Subject matter experts representing as individuals or via research and non-profit institutions.

The IWLC shall champion critical systemic issues related to the water sector and collectively make recommendations that can be actioned upon. The recommendations will be actioned upon a number of agencies through pilots and commercial demonstration projects.

IWLC's main mission objectives are:
1. To transform the state of water sector in India.
2. Make India water resilient.

To deliver on these headline missions, the Council shall:
1. Identify critical issues in the areas of policy, operation, technologies, commercial, legal and financing.
2. Synthesize collective experience and knowledge to suggest progressive solutions.
3. Propose policy recommendations and demonstrate thought-leadership through white papers.
4. Demonstrate technology, operational, economic and financing innovations through pilots and commercial demonstration projects.
5. Build capacity through devising modern curriculum, adequate training of workforce and educating all stakeholders.
6. Champion outreach and citizen engagement initiatives.

IWLC 2023 Priority areas:
1. Developing a recycle and reuse market of wastewater.
2. Managing sludge effectively in the country.
3. Water pricing and valuation.
4. Decentralised wastewater treatment.

B3: India Water Leaders' Council

MSME SECTOR
should be encouraged to adopt water recycle and reuse approach

5. Increasing technology absorption capacity in the municipalities.
6. Ground water recharging.
7. Reservoir capacity building.
8. River basin management.
9. Strengthening of PPP models for water and wastewater treatment.
10. Credit enhancement instruments for water and wastewater sector.

IWLC IDEAS BANK

These are the main priority areas that the IWLC will be championing in 2023. The first meeting already generated more than 30 individual suggestions which have been added to the "Ideas Bank".

1. Conversion of sludge to bio-manure.
2. Wastewater must be seen as a resource and not a "waste" commodity.
3. Incentive structures for both buyers and sellers are essential pre-requisites to enable creation of an effective wastewater trading market.
4. Water sector has to follow a differential pricing structure.
5. Areas which are water deficient should be prioritised first as they would lap up the establishment of the market.
6. Without measurement, data and analysis any market making effort would be sub-optimal.
7. It is time the country established a wholesale price of water.
8. Water industry and regulators should work together to bring in Standards.
9. Investment in data is critical.
10. MSME sector should be encouraged to adopt water recycle and reuse approach.
11. Increase the rate of technology absorption in the municipal sectors.

B3: India Water Leaders' Council

12. UV treatment of water is still in its infancy.
13. Capacity building of municipality particularly from an asset management perspective is very necessary.
14. Model O&M contracts should be created.
15. Incoming sewage quality and quantity must become part of the contract.
16. Municipalities should be given a lot of operational assistance for running the plants.
17. A best practices forum/repository can be created for all industry players to review.
18. Rehabilitation of STPs could be a huge market segment.

INCENTIVE
structures for both buyers and sellers are essential pre-requisites to enable creation of an effective waste-water trading market

19. Decentralised wastewater treatment should be encouraged for segments not on the network.
20. Technologies exist for reducing water losses in the network and must be fast-tracked.
21. Metering of water supply is still lagging.
22. Technology risk can be managed through a number of instruments – financial and operational.
23. A technology certification and assessment programme should be established.
24. India should create an OPEN DATA FRAMEWORK so that all market participants are able to see the data and assess project risks from a single source of "truth".
25. Introduce the concept of ONE WATER – ground, surface, rain-water should be seen from a singular resource lens.
26. Introduce bio-remediation technology standards.
27. Municipalities should offer technology validation and testing platforms.
28. A dedicated "water" focused municipal engineering and administrative cadre should be established.
29. Water use efficiency in irrigation shall yield massive dividends.
30. IWLC meetings should move around the country.

TRACK C

TECHNOLOGY & INNOVATION

DAY 1 TO DAY 3
Thursday, December 15, 2022
to Saturday, December 17, 2022

CHAIR:
M Jawed [Professor, IIT Guwahati]

CO-CHAIR:
S S Chauhan [Expert, cGanga]
D P Mathuria [ED (Technical), NMCG]

PANELIST:
A A Kazmi [Professor, IIT Roorkee]
B Sikka [Senior Consultant, NMCG]
Kamal Tiwari [Director & CEO, Daiki Axis]
K C Pandey [Advisor, Daiki Axis]

CHAIR

M Jawed

CO-CHAIR

S S Chauhan

D P Mathuria

PANELISTS

Brajesh Sikka

K C Pandey

Kamal Tiwari

A A Kazmi

SESSION C-1 & C-2

Day 1 (15th December 2022)

Technology & Innovation

Innovation plays a key role in the Namami Gange Programme. The programme is being used as a platform to both attract technologies from around the world as well as indigenously develop new innovations. The Environment Technology Verification (ETV) framework developed by cGanga, IIT Kanpur in association with NMCG, Ministry of Jal Shakti, GoI is a unique mechanism to streamline and accelerate the introduction of innovative technologies in the water sector for restoration and conservation of rivers. ETV process provides a single window access to solution providers to bring their innovation to market. Currently over 30 technology companies from 12 countries are enrolled in the ETV process.

This track gave opportunity to companies from around the world to showcase their cutting-edge technologies and innovations that have the potential of making a significant positive impact in the river basin. The 2022 Summit planned to focus on technologies in these areas:

- Digital Water
- Waste to Hydrogen
- Data and Information
- Waste to Biogas
- Decentralized Wastewater Treatment
- Carbon Capture in STPs
- Sustainable Agriculture
- Drinking Water Systems
- Sustainable Hydropower
- Energy Efficiency Systems
- Green Hydrogen
- Inland-water Navigation Systems

SUMMARY

1. 22 companies made presentations in 3 days.
2. The areas covered included Bioremediation, climate change, water food energy nexus, soilless farming, green foundation of cremation saving wood, cluster of Norwegian companies – Cambi, cluster approach for industries and research, forward osmosis that is still under development since last 10 years, waste to fresh, 4 IR- AI/ML/IoT, Learning & Development etc.
3. Countries participated– UK, USA, UKRAINE, AUSTRALIA, NORWAY, GERMANY, JAPAN, TURKEY and FRANCE.
4. Fundamental gleaning of what we may learn, experiment, pilot and implement are based on India's unique requirements that are huge in scale and import.
5. Amalgamation of STEAM- science, technology, engineering, art and math.

Technology & Innovation

Mebifarm (Japan) – Membrane Farming Systems

cGanga had already signed MoU with APEDA in 2021 to develop clusters for export of food produce. Signed an MoU with MPKV university in 2022 to set up first commercial farm of 10 acres (College of Agriculture, Pune). cGanga proposes to set up 75 sites across India and 15 sites to cover the various climatic conditions.

Ganesh Kulkarni, Mebifarm, Japan

Mebifarm is part of ETV programme. Introduced for the first time in India the world's first Hydro-Membrane based Farming Technology called Imec® to address some of the serious issues facing the world today such as water scarcity, reduction of arable land due to soil degradation and contamination, and climate change.

The Imec® Farming Systems comprises of the Hydro-Membrane and the Water and Nutrient Feeding System that is economical and simple to set up and operate which allows anybody and everybody to grow food. The technology is based on water permeable membrane made of hydrogel with nano-sized pores. The nano-sized pores allow only water and nutrients such as various ions, amino acids and sugar to pass and not viruses and microbes as they are too large to pass through the pores. The plant synthesizes a large quantity of sugar, etc. to raise the intracellular osmotic pressure resulting in high quality produce.

Using Mebiol's patented technology, Mebifarm addresses the following key aspects for the global food industry:

1. Excessive use of pesticides
2. Deteriorating nutrient content in food due to increased burden on top soil
3. Global supply chain issues
4. High water requirement
5. Climatic changes
6. Arable land shortage

The company compared membranes with hydroponic systems. Comparative analysis of other farming methodologies was discussed. Current pilot plant is working in Pune since 2021. They are pioneers in climate control greenhouses and claim to comply with all sustainability norms. Technology may have been established. Next steps are expansion in new geographical areas and growing variety of crops.

SUSTAINABLE FARMING

THE EDGE THAT IMEC TECHNOLOGY HAS

FARM FACTS/STATISTICS

Farm Location: Pune, Maharashtra, India
Farm Size: 1008 sqm
Farm Height: 6 mts
Farm Structure: 36m x 28m

SELECTION OF SITE CRITERIA

- Moderate Climate
- Availability of water
- Levelled land

For the first farm we did not want to try out extreme circumstances. However, subsequent farms are being planned for areas with challenging environmental and climatic conditions

TRANSPLANTATION

FOOD MATURITY

Days after transplanting:	62 days
Days after sowing:	83 days
Plant height:	8-10 feet

Technology & Innovation

Green Revolution Foundation, India

There are technologies and materials for greener incineration and may be compared. Also, efforts are required to popularize the technology for its wider uses amongst common masses. Is it possible to replace wood with agricultural residues such as wheat straw of Punjab after converting it into a compressed mass form?

Sahib Sawhney, Green Revolution Foundation, India

Presented an interesting area of green cremations and incinerations. The technology uses an admixture of cow dung logs, small quantity of wood and gas based incinerators. They claimed that the cost of cremation is about INR 2,000 as compared to INR 10,000 using normal wood. There are other technologies, but this is worth looking at. The presented technology has claimed to cremate/incinerate one body using around 80 kg of wood and are capable to handle around 8 bodies in approximately 10 hours.

GREEN CREMATORIA

OUR SUCCESSFULLY INSTALLED & OPERATIONAL GREEN CREMATION PROJECTS

08 Nos of Wood Based Cremation Setup procured by Mathura Vrindavan Development Authority (Kesi Ghat, Moksh-Dham, Vrindavan Crematorium, Uttar Pradesh)
December 2018 Completed

03 Nos of Wood Based and Gas Based Cremation Setup procured by Nagar Nigam Gorakhpur (Baba Mukteshwar Nath Mukti Dham, Raj Ghat, Gorakhpur, Uttar Pradesh)
May 2020 Completed

01 Nos of GRF's Electric Based Cremation System procured by Municipal Corporation of Delhi (Sarai Kale Khan Electric Crematorium, Delhi) **May 2021 Completed**

01 Nos of GRF's Electric Based Cremation System procured by Karnataka Rural Infrastructure Development Limited at Ballari KRIDL Shamshan Ghat, Karnataka) **May 2021 Completed**

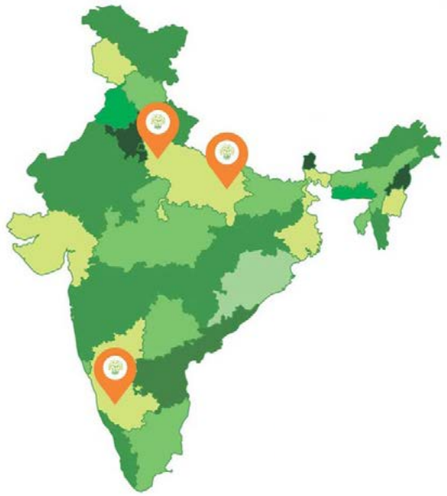
01 Nos of GRF's Electric Based Cremation System procured by BSES Rajdhani Power Ltd. (Sarai Kale Khan Electric Crematorium, Delhi) **June 2022 Completed**

04 Nos of GRF's CNG Based Cremation System procured by Municipal Corporation of Delhi (Punjabi Bagh CNG Crematorium, Delhi) **June 2021 Ongoing**

03 Nos of GRF's Wood Based Cremation System procured by Nagar Nigam Prayagraj (Rasoolabad Ghat, Prayagraj, Uttar Pradesh) **December 2021 Ongoing**

02 Nos of GRF's CNG Based Small Animal Crematorium (PPP Mode) joint venture with Municipal Corporation of Delhi at (Dwarka Sector 29, Delhi) **August 2021 Ongoing**

01 Nos of GRF's Gas Based Advanced and Scientific Cremation System and Civil Construction of Crematorium procured by Aligarh Smart City Limited at Aligarh City, Uttar Pradesh)
August 2022 Ongoing



GLIMPSES OF LIVE PROJECTS

Technology & Innovation

Innovation Norway

Plugged-in for funding in a scheme called Horizon-2020 where they are talking about 100 bn euro investment over 5 years.

Asheesh Agrawal, Embassy of Norway

Ashish Sahu, Norwegian Water Cluster

Norway is a leading Scandinavian country working on cluster based industrial parks. They spoke about seven main categories and call water treatment plant as water factories. They have floating desalination plants from 75 mld to 400 mld. They have plugged-in for funding in a scheme called Horizon-2020 where they are talking about 100 bn euro investment over 5 years. The focus is on compact, modular, decentralised, energy saving technologies. There are seven categories under focus, viz. piping and infrastructure, no dig and pipe renewal systems, sensors- IoT automation, sludge & waste, water treatment drain cleaning, flood water and climate challenges, consultancy and research facilities.

Showcased three sector technology expertise.

1. Maritime - floating vessels, barges, ships
2. Water and Wastewater- treatment and purification- drinking and waste water
3. Oil, Gas and Renewables- Subsea systems, offshore wind and onshore & offshore solar farms

Floating desalination vessels, floating wastewater treatment ship and a ship that is called "Water Factory" that can make drinking water from sea/ rivers @ 5-20 mld per day.

Norwaste

Cluster approach to develop centre of excellence and manufacturing is a relevant idea for India. Water is part of food-energy nexus and no waste concept is a good mantra for solving this gargantuan problem in India.

Line Blytt, Norway

Norwaste (no waste in English) provides training, waste characterisation and consulting services within waste and value chains. The core competence includes:

- Sustainable value chains for recycling
- Market knowledge, including stakeholder and decision processes
- Collection
- Sorting
- Feedstock quality
- Treatment methods and technologies in different value chains (plastic, organic waste, textiles etc.)
- Recovery processes
- Market for recyclates
- Waste regulation and regulation processes, including EPR
- Waste analytics

Some selected projects and services include:

- Development of value chains for plastic waste, including pyrolysis
  - Market
  - Feedstock
  - Sorting
  - Quality and testing
- Single used plastics
- Collection systems for waste, municipal and commercial
- Sorting strategies and technology
- Biological treatment, biodegradable products, product quality and market
- Environmental concerns related to Biowaste and Municipal Sludge
- Other recovery operations, technology assessments

Technology & Innovation

NORWASTE

Learning programs for capacity building include:

- Introduction courses in waste and recycling
- Treatment of organic waste and sludge
- Lectures for Municipalities
- Amongst other things Norwaste has participated in a report, "STP Sludges in India", that was shared in IWIS 2022. Project was financed by Norwegian Development Aid. NORAD. It included:
  - Pre-feasibility study for sludge treatment in selected Indian Cities
  - Project leader and collaboration with Indian experts
  - The sludge value chain
  - The importance to perform a whole Life Cycle Cost Analysis for sludge treatment and biosolids disposal

Discussed RDF (Refuse derived fuel) for the cement industry. 60% RDF is derived from organic waste.

Cambi Thermal Hydrolysis- Anaerobic Digestion of Sludge

Harald Kleiven, Norway

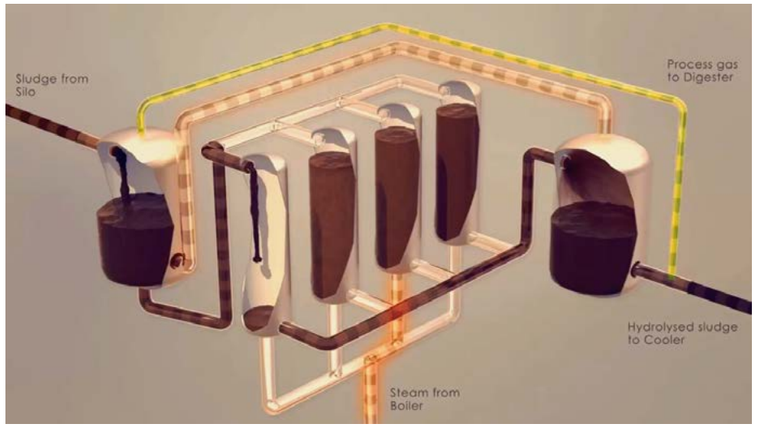
This is an established technology. Pilots can be undertaken for Indian proof of concept.

The presentation was about transforming sewage sludge & organic waste into renewable resources. Cambi is a World leader in producing Advanced Biogas & bio-fertilizer from organic waste & sludge. Sewage sludge typically accounts for over 50% of the costs of wastewater treatment. If there is less final cake to dispose then it leads to costs savings.

The thermal hydrolysis process depicted in a process diagram below:

1. In the diagram, we can see three main elements: to the left – the **pulper**, in the middle – the **reactors**, and to the right – the **flash tank**
2. From the wastewater treatment plant's primary and secondary treatment units, raw sewage sludge is collected and pre-thickened to typically 16 to 18% dry solids. This thickened sludge is continuously fed into the pulper. The pulper has the role to homogenise and pre-heat the sludge to a temperature close to 100°C, using steam recovered from the flash tank.
3. From the pulper, the warm sludge is fed continuously to the reactors, in a sequential process that ensures sealed batches of sludge in each reactor. Once a reactor fills up, sludge flows to the next available reactor. There are typically between 2 and 5 reactors in a Cambi thermal hydrolysis train, depending on sludge volume, reactor size and hydraulic retention time.
4. When the reactor is full and sealed, steam is added to raise the temperature to about 165 °C at a pressure of about 6 bars. The thermal hydrolysis process is typically set at 20 to 30 minutes for each batch, to ensure both pathogen kill and a high rate of hydrolysis.
5. From the reactor, sterilised sludge is passed rapidly to the flash tank, which operates at atmospheric pressure. The sudden pressure drop leads to substantial cell destruction for the organic matter in the sewage sludge, adding to the improved digestibility.
6. Leaving the flash tank, the sludge is cooled to the typical temperature for anaerobic digestion, partly by adding dilution water and partly in heat exchangers. Then it is fed to the anaerobic digesters.
7. All process gas is collected in the pulper head space, is cooled down and then

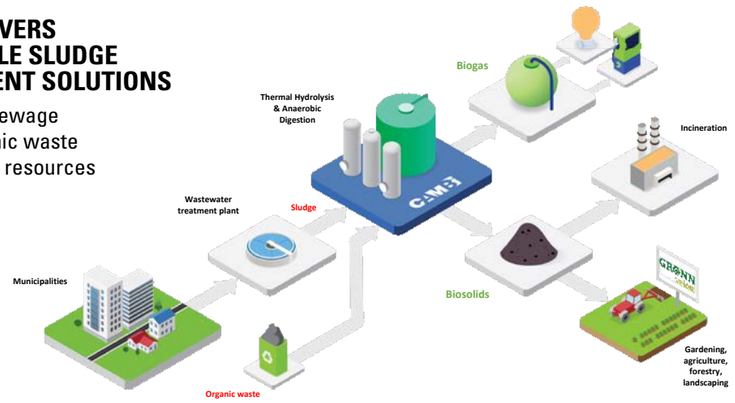
Technology & Innovation



CAMBI

CAMBI DELIVERS RESPONSIBLE SLUDGE MANAGEMENT SOLUTIONS

Transforming sewage sludge & organic waste into renewable resources



transferred to the digesters together with the hydrolysed sludge. The THP process is completely gas tight with zero gas emissions.

Cambi's main business is converting odourous and contaminated sludge and food waste to biogas and a high-quality, low-odour biosolids product to be used in agriculture, gardens, and other landbank. The energy production, in the form of biogas, is maximized concurrently. The carbon footprint seems to be lower.

WORLD LEADER IN ADVANCED BIOGAS & BIO-FERTILIZER FROM ORGANIC WASTE & SLUDGE

- 81 reference plants
- 25 countries
- 112 million people can be served by Cambi's thermal hydrolysis
- 1.1 million tonnes CO_2 mitigated annually

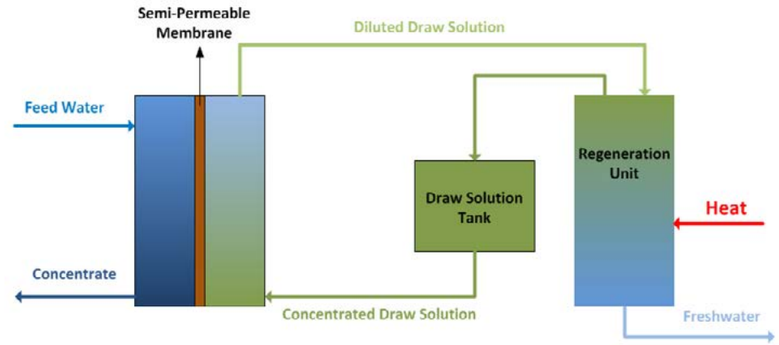
Forward Osmosis

Alireza Abbassi Monjezi, Waterwhelm

These technologies are worth taking a look as they tick water, energy nexus. A pilot in India may be a good idea. Possible ETV candidate.

Forward osmosis is an alternative to reverse osmosis (RO) that works with heat rather than electricity as shown schematically below. Technology still under development, but has huge future. The patent is pending.

TECHNOLOGY:



A comparison was also presented for a 1,00,000 m^3/day RO and Waterwhelm technology plant.

Capex, energy consumption, carbon emissions are much lower.

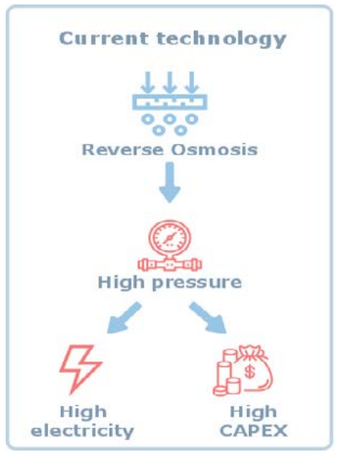
INNOVATE UK DEMONSTRATE IMPACT PROJECT RESULTS:

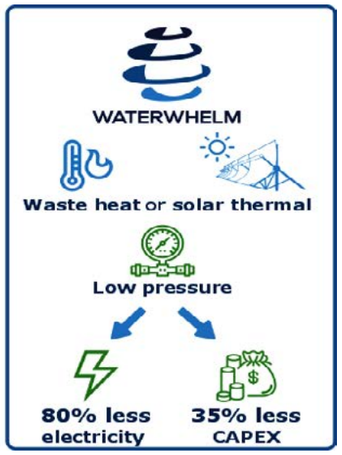
- Waterwhelm's technology combined with solar trough collectors 30-40% lower CAPEX than current PV-Reverse Osmosis systems
- Design and supply chain established for potential plants
- About 20,000 m^2 of space required to continuously supply 1,000 m^3/day of desalinated water in the MENA region
- Potential for heat integration with existing solar thermal plants
- Claims it is the world's most efficient solar desalination technology

HYDROGEN OPPORTUNITY:

The world is talking about green hydrogen.

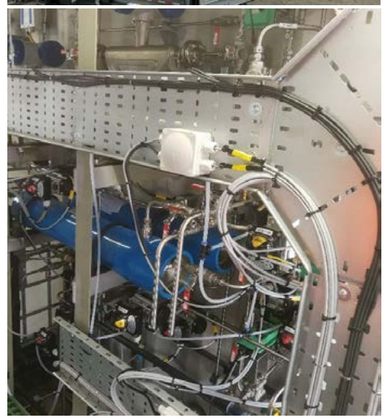
Technology & Innovation





FORWARD OSMOSIS: OUR PILOT PLANT

All hydrogen production methods require clean water. Clean water supply is a major challenge in hydrogen production. Using inherent waste heat streams in hydrogen production and utilisation the technology can treat wastewater or desalinate seawater in a cost-effective closed-loop manner. A £200k project grant was awarded by Innovate UK to develop this technology further.



Wastewater Treatment Technology

Satheesh Krishnamurthy, Wastetofresh, Turkey/UK STEM Research Ltd.

Technology Organisations to accelerate and de-risk the development of an innovative solution to focus on the issue of freshwater resource scarcity and industrial water pollution.

VISION:
Deliver closed-loop industrial processes in European and global textile manufacturing and other energy-intensive industries via provision of Waste2Fresh closed-loop wastewater recycling solution that will considerably reduce industrial water pollution and improve water availability for local communities.

MISSION:
Provide a modular closed-loop near-zero discharge industrial water recycling system for textile and energy intensive process operations across Europe and worldwide, increase resource and water efficiency by 30% compared to the current state-of-the-art.

OBJECTIVE:
To develop and demonstrate a closed loop recycling system for the dye wastewater from textile manufacturing factories such as the denim ERAK factory. Waste2Fresh system will integrate novel catalytic degradation approaches with highly selective separation and extraction techniques to deliver a closed loop system that assures near-zero discharge, reduces current use of freshwater resources and considerably increases the recovery of water, energy and other resources (organics, salts and heavy metals). The system will therefore increase resource and water efficiency and ultimately lead to considerable environmental gains weighted against EU and global environmental footprints.
The project involves international collaboration between 17 partners from EU member states, Turkey, the UK and developing countries including Ukraine and Columbia.

NANOFIQUE LIMITED:
Novel products and processes for industrial wastewater treatment. Main focus areas are:

There are multiple projects at various stages of development. The ETV committee could explore industrial effluent treatment technologies. Open learning courses could be developed in collaboration with cGanga.

SKILLS DEVELOPMENT OPEN LEARN COURSE:
The Open University was the world's first successful distance teaching university, established in 1969 to promote social justice by making education accessible to all. Currently the largest academic institution in the UK with over 2,00,000 students each year – most diverse student population in UK, today. OpenLearn is the Open Universities Free Learning platform.

KEY OFFERINGS:
- 900+ short courses (ranging from 1 - 100 hours of study)
- Thousands of articles, quizzes and interactive games
- Hundreds of videos and audios, ranging from Greek history to modern-day politics, and everything in between
- Printed posters and booklets made for our TV & radio programmes co-produced with the BBC

WASTE2FRESH:
It is an EUH2020 funded project that is bringing an innovative solution to the textile manufacturing industry to address freshwater resource scarcity and industrial water pollution, into the market. The project will bring together the leading textile manufacturing companies and relevant SME's across Europe, as well as supporting Industry Innovation and Research &

SESSION C-1 & C-2

Day 1 (15th December 2022)

Technology & Innovation

Denim dyeing and Denim wash plants. Products and processes

- Nanofique bio composite
- Photocatalysis
- Removal & upgrade of Heavy metal ions
- Nanobubbles
- Removal & upgrade of salt
- Sensors – water testing
- Antifouling coatings
- Bio composites can be used for an essential step of wastewater treatment: Decolourization

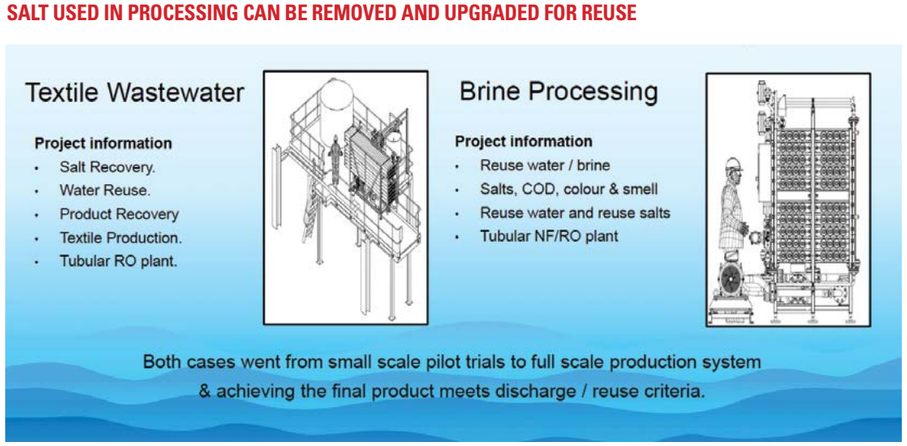
Photocatalysis is a quick degradation technique for organics

- Implementation at scale in Turkey
- Can use daylight with solar concentrator

Nanobubble technology supplies ultra fine oxygen bubbles

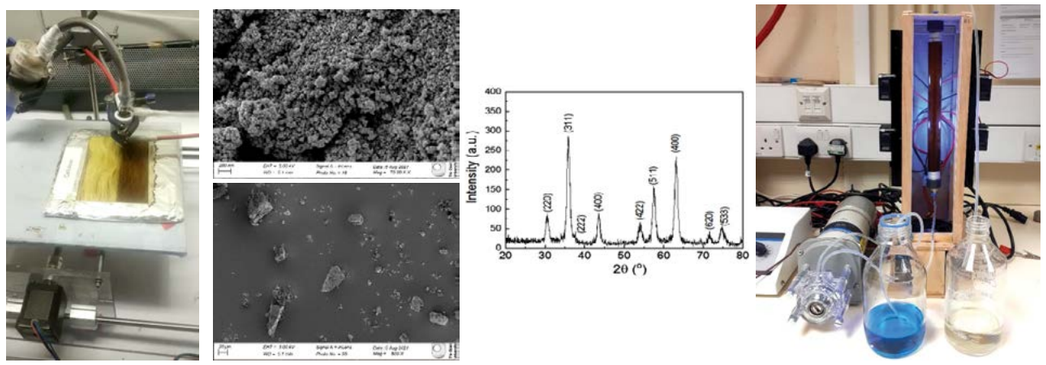
- Speeds up the aerobic biodegradation of wastewater pollutant
- Enhances catalytic and photocatalytic processes
- Increases aeration

SALT USED IN PROCESSING CAN BE REMOVED AND UPGRADED FOR REUSE



WASTE TO FRESH

Nanofique bio-based catalyst using plasma printing of catalyst



Membranes

Andrew Walker, EVOVE, UK

Evove's main business is to provide solutions linked with high CO_2 emission. Address challenges to decarbonisation and transition to net zero with filtration and separation technologies are the major focousing areas. The range of enhancement products are developed in recent time such as products with speciality coating for 2x in selectivity, products with 3-D printed inserts for 5x in flux, products with 3D-printed Spacers for +40% active surface area. They make polymer membranes by additive manufacturing and use super-computers for 3D printing using AI to reduce cost of production.

Technology & Innovation

An interesting concept and encouraged to explore collaboration with cGanga for one area/ rivulet as part of ETV process.

The Tame in the West Midlands

Kathryn Moore, Birmingham City University, UK

A UK based company. A think-tank that helps to make policies for national parks (not as we understand in India). Design long term spatial development resuscitation of systems in the national park. The West Midlands National Park (WMNP) is an urban national park based on a new idea of landscape, incorporating the entire region of the West Midlands, its towns and cities, its rural and peri urban areas, with a population of about 2mi. The conurbation is in the basin created by the headwaters of the Tame, on an uplifted plateau that forms the watershed between the two of the largest river systems in the UK, the Severn and the Trent. Formerly the crucible of the industrial revolution, the region is now often forgotten and overlooked.

This project uses a radical, landscape led regional, spatial approach to redevelop the Tame as a fully performative biosphere. Working with international partners and state of the art technologies, this collaborative project is about resuscitating its lost hydrological, environmental, and cultural infrastructure of rivers, streams, groundwaters and canals. Its purpose is to rediscover its immense restorative capacity, its role in creating a sense of place, health and well-being, confidence, pride and to benefit from its huge economic value as the infrastructure upon which we all depend - something that is essential if we are to deal with the global challenges faced by society including the accelerating climate change emergency.

Crossing traditional silos of science and art, nature and culture, the entity will compile, curate and map multiple layers of data at scale, to develop knowledge of the bigger picture, generate hidden or forgotten spatial relationships to unite communities, give hope and contribute to future resilience.

There is a strong potential to explore the possibilities of collaborating with cGanga. Can explore what can be learned and shared between two great, regional scale projects, investigating how the skills and knowledge and approaches developed by each can support each other, in relationship to philosophy, approach, process, generation of new knowledge and engagement. It is the biggest opportunity we have for true regional transformation, to achieve a proper green recovery, levelling up and increasing our ability compete globally for knowledge and skills.

THERE IS A STRONG potential to explore the possibilities of collaborating with cGanga. Can explore what can be learned and shared between two great, regional scale projects, investigating how the skills and knowledge and approaches developed by each can support each other, in relationship to philosophy, approach, process, generation of new knowledge and engagement

Technology & Innovation

An interesting concept of tectonic fissure water source. Not discussed the economics but worth exploring further if technical aspects are well established.

Juvenile Water (Fresh Water Everywhere)

Ruslan Lavrinenko, Zander, Ukraine

Borehole discovery technology. They claim that they have 97% success in looking for water underground.

Across the globe water is diffused with pollutants of nitrogen, pesticides from agriculture, antibiotics and metals. National policies to protect drinking water resources have not achieved consistent results in most countries.

The technology of spring water source discovery allows the company to solve problems comprehensively, for both centralized and decentralized water supply. They can discover a source of water supply with enough volume of the high-quality water precisely in the place where the consumer needs in most cases.

The geo scanning method developed by the company is a unique technology that allow to find water-bearing cracks (zones of tectonic disturbance) and determine their coordinates with the necessary accuracy. This is an interesting concept.

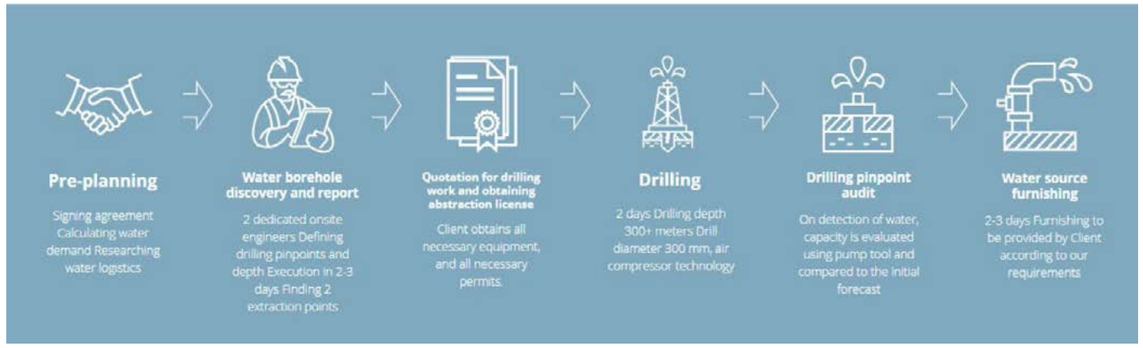
The claim is about technology that is really game changing. It's not about groundwater in the common sense. The water is juvenile, magmatic similar to artesian waters with exceptionally high quality. It has never circulated in the air and in the soil. It is from under the tectonic plates.

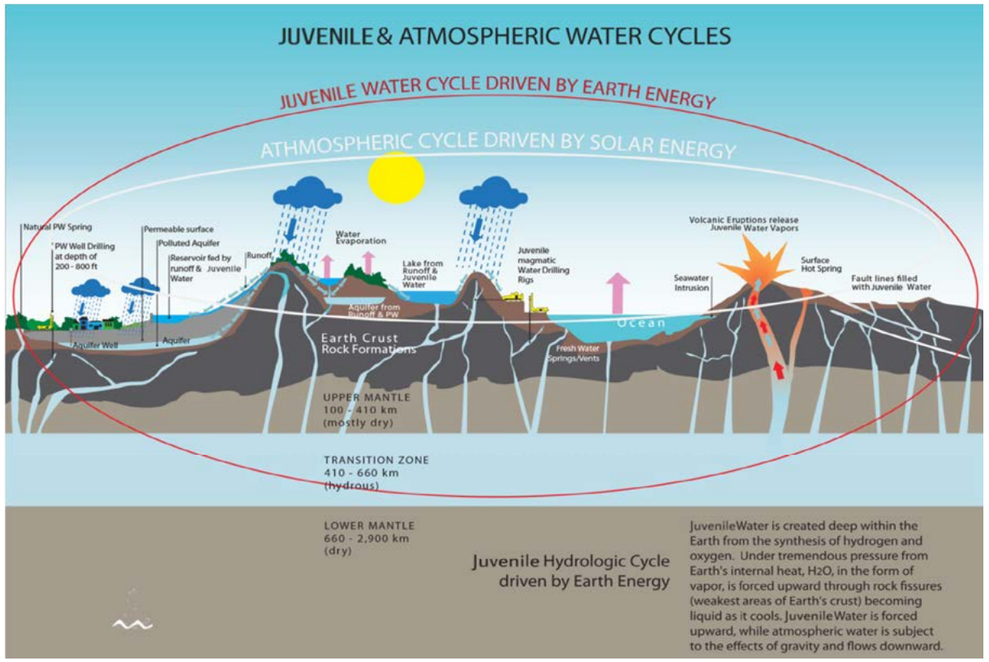
The company guarantees for at least 3 years for the functionality of water source. Otherwise in cases where the flow rate decreases more than 30% the company either repairs the water source or delivers the new one.

The company has successfully implemented projects in Germany, India, South Africa, Belgium, Saudi Arabia, Turkey, Latvia, Guinea, Azerbaijan etc. and would be pleased to explore further.

JUVENILE WATER

Our technology of spring water source discovery allows us to solve problems comprehensively, and this is related to both centralized and decentralized water supply. We can discover a source of water supply with enough volume of the high-quality water precisely in the place where the consumer needs





Technology & Innovation

Both technologies look robust, developed in collaboration with leading university and CSIRO. Has patents and claims to be scalable. May be discussed further for co-developing solutions for India.

Low Energy Natural Water Treatment Systems

Envirostream Solutions Pty Ltd. (Enviss) and EnrgiStream Pty Ltd. (EnrgiStream) are Australian water technology development companies. The solutions for the treatment and management of polluted water cover stormwater, polluted ground and surface water, industrial wastewater through to the treatment of sewage. Enviss was incorporated to develop and commercialise stormwater treatment technology in conjunction with Monash University in Melbourne, Australia, a major research contributor for the Water Sensitive Cities Initiative.

EnrgiStream is focused on the development of a wastewater treatment process utilising forward osmosis technology to concentrate organic waste in sewage and wastewater. The concentrated waste stream can then be used to supplement solid organic waste in co-digestion systems. This technology has been developed with Australia's leading Commonwealth Scientific and Industrial Research Organisation (CSIRO).

TECHNOLOGY SHOWCASED:

Enviss Filtration Media: Robust engineered filtration media for removal of heavy metals, nitrogen and phosphorus from stormwater runoff. Deployed in end of pipe systems. Deployed in Residential developments, Commercial precincts and Urban retrofit

Enviss Sentinel Pits: For distributed storm water treatment solution, trafficable, robust, reliable maintenance and suitable for residential use.

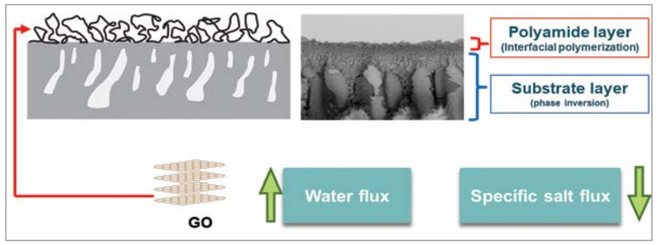
BioSentinel Sewage Treatment: Onsite treatment of sewage, discharges water suitable for irrigation use, low cost and low maintenance. Applications include waterway quality improvement, decentralised sewage treatment and sewage treatment augmentation.

EnrgiStream Process: Advanced organic wastewater treatment process, uses very low power, produces clean water, energy and nutrients. Applications include municipal sewage, industrial wastewater, organic recycling plants, landfill leachate.

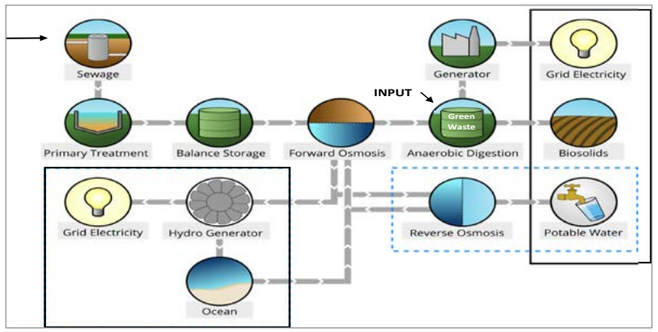
The forward osmosis technology was showcased. Forward Osmosis is a natural process where clean water is attracted to a draw solution due to a difference in pressure (osmotic pressure). The EnrgiStream FO Membrane achieves comprehensive improvements on membrane filtration, flux, efficiency and durability with enhanced anti-fouling properties.

The Membrane is a graphene enhanced thin film composite (TFC) polyamide (PA).

- High permeability (>30 LMH)
- Rejection of colour, DOC, viruses, bacteria and micropollutants
- High water recovery
- Low energy use
- Chlorine and pH tolerance



THE PATENTED ENRGISTREAM WASTE TO ENERGY PROCESS OVERVIEW:



Where sea water is used as the draw solution and returned to the ocean diluted with the clean water extracted from the waste, additional electricity is produced. No potable water is produced as the clean water in the draw solution is not recovered by RO.

ADDING GREEN WASTE TO THE WASTE TO ENERGY PROCESS:

Claims:

- Supercharges the Waste to Energy digestion process which produces the biogas, heat and fertiliser.
- Combining sewage with green waste reduces the time in which the green waste is broken down by up to 40%.
- Sewage treatment plants are ideal reception centres for green waste.

THE DEVELOPMENTS SO FAR:

Enrgistream has patented a process for converting Waste to Energy based on the FO Membrane. The EnrgiStream FO Membrane provides the key to its patented integrated sewage treatment and green waste co-digestion system. The patented system converts waste to pure clean water. It uses renewable energy (biogas produced by digestion, heat, osmotic power); fertiliser; briquettes with no methane or nitrous oxide escaping into the environment. It can make cities in arid/desert areas viable by providing pure clean water recycled from sewage. Can liberate huge tracts of land used in conventional sewage treatment because the footprint of the plant is reduced by up to 90% when compared with traditional process.

Technology & Innovation

Daiki India Axis

Kamal Tiwari, Daiki Axis, Japan

Innovation in Used Water Management- Removal of Water Reuse Bottlenecks through
Smart, Innovative and Sustainable solutions.

Japan is a leading country for robust decentralized used water treatment systems. They use Johkasou technology. Launched Johkasou Act in 1973. Johkasou installation is incorporated in "National Building Code". There are Nationally qualified "Johkasou technicians".

Demonstrated Johkasou technology for treatment of used water. They are already working on decentralized water systems and have two factories in India – manufacturing different sizes of units. They have an MoC with NMCG signed in 2020.

Johkasou Basic concept is "Treat at Site, Reuse at Site". Even in High-density population areas, Johkasou treat wastewater at site and reduce pressure to Centralized STP.

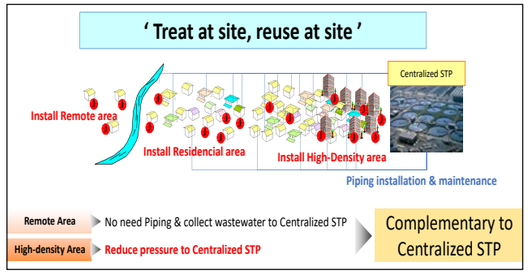
COMMENTS

Daiki Axis has factories in Vapi and Palwal in India and proposes to expand rapidly in India.
The company is already getting ready for a long haul in India. It has a MoC with NMCG supported by the Japanese government. Currently in absence of standard protocol on decentralized systems, it may be a good idea to study other systems, juxtapose with Johkasou and decide on next course. cGanga as a thinktank can guide as a technology neutral platform but supportive of solutions irrespective. Let us cover all areas of rurban with a population of 500 and above across our vast country and make thousands of used water factories for discharge in water bodies for flow or use it for agriculture.
This may serve many SDGs, Sustainability and resilience and net zero.

INSTALLED OVER 20 LAKHS UNITS ALL OVER THE WORLD, AND 450 UNITS ALL OVER THE INDIA

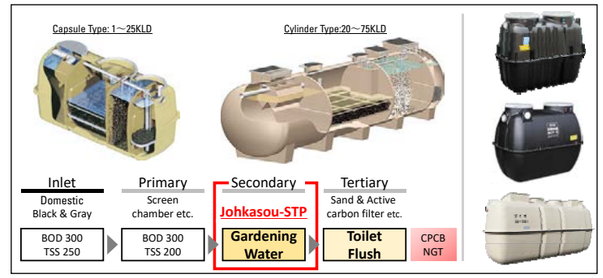
DAIKI: BASIC CONCEPT ONSITE TREATMENT

- Johkasou Basic concept is `Treat at Site, Reuse at Site'
- Even High-density area, Johkasou treat wastewater at site and reduce pressure to Centralized STP



JOHKASOU-STP FROM JAPAN:

- JOHKASOU is the Domestic wastewater treatment packaged STP developed in Japan and completely Factory made Product



SESSION C-3 & C-4

Day 2 (16th December 2022)

Technology & Innovation

New data sets over long term may be generated to understand the trends in water discharge. This is a long haul and needs new technologies to measure real time data for evidence based decision making. As climate warms and vicissitudes of weather reach acute angularities triggered by global climate change, India needs to get its water balance right in all river basins. But contactless sensor's efficacy, accuracy and cost economics must be aligned with broader data generation and security policy. Water is a National Security Issue.

Flow Measurements In Rivers & Associated Drains

Prakash Muthuswamy, AuM Systems

The company has global competency in water measurement. They do,

- Water Audit studies for Municipalities and Process Industry
- Wastewater flow studies for accurate quantification of discharges harmful to the environment, as well as assessments on ingress and infiltration
- High accuracy permanent metering solutions.
- Consultancy services to evolve strategies for cost effective metering solutions
- Performance verification of existing metering systems and recalibration

Measurement technologies include-

1. Doppler based metering solution
2. Cross correlation-based metering solution
3. Radar based metering solution

AuM is working on measuring flows in Hindon river discharge at selected sites. Data sets are being generated to plan informed actions.

THE OBJECTIVE:

1. Identify discharge points along Hindon river
2. Review technology options for measuring discharges into the river
3. Review possibility of permanent metering as against measurements with portable meters

OEM TECHNOLOGIES PROPOSED:

1. NIVUS GmbH, Germany
2. Blue-Siren Inc., USA
3. Geolux Radars, Croatia

CHALLENGES:

The river (drain including) is inundated with debris, including clothes, plastic bags, dead animals, meat waste, thus posing serious environmental threat, as all the debris with the wastewater flows directly into Yamuna.

DAIKI: BASIC CONCEPT ONSITE TREATMENT

Some pictures in current state with dead animals, solid waste flotilla etc. clogging rivers

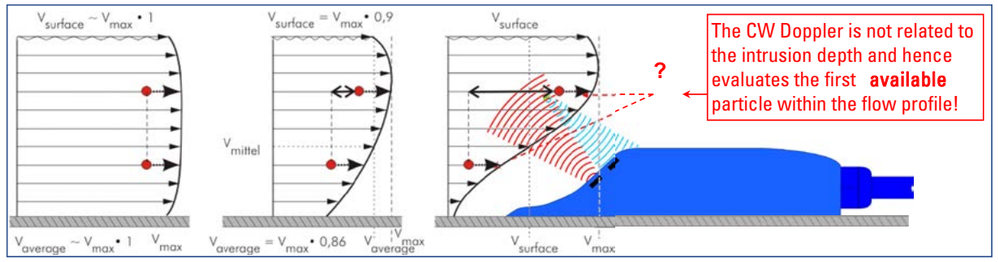
AUM SYSTEM: DOPPLER BASED METERING SOLUTION

CONTINUOUS WAVE DOPPLER

OPERATIONAL PRINCIPLE:

- Particles in the medium are continuously scanned by the sensor
- Reflections from the particles are sensed by the sensors
- The frequency shift of the reflected sound from the particles corresponds to the velocity of the medium

FLOW PROFILE (LONGITUDINAL SECTION) THROUGH PIPE WITH USUAL CONCRETE ROUGHNESS:



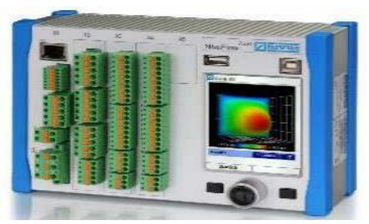
AUMS –WHAT CAN THEY DO?

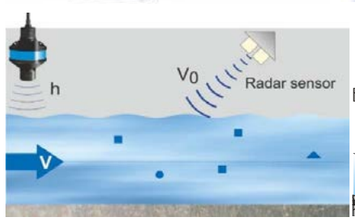
1. It is recommended to provide screens upstream of measurement points for removal of solid waste. It will also prevent accumulation of solid waste in Yamuna.
2. Non-contact Radar sensors will provide long term reliable measurements wherever there is excess of solid waste.
3. Measurements using portable flow meters for a duration of 24 or 48 hours' duration can be carried out so that seasonal flow changes can be recorded and assessed.
4. With the present short term measurement, AuM Systems demonstrates feasibility of accurate wastewater discharge measurements into our water bodies. We request cGanga to approve and adopt the same and obtain accurate data for improved management of our rivers.

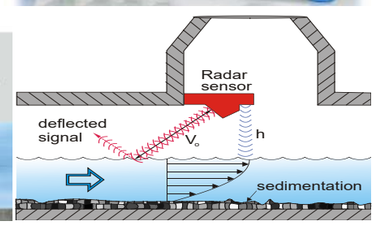
RADAR BASED METERING SOLUTION

RADAR BASED METERING SOLUTION:

- Radar sensor is a non-contact measurement
- The surface velocity is measured
- The phase shift of the reflected wave translates to velocity
- Radar beam coverage area depends on the height of radar instrument above the water surface and instrument inclination







Technology & Innovation

Biopipe is already using their technology in India. Sounds novel but it needs to be seen by experts for comparison with other technologies that provide equally good solution.

STP Biopipe, Turkey

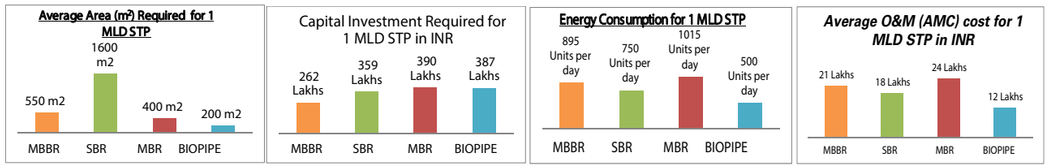
Enes Kutluca, Biopipe, Turkey

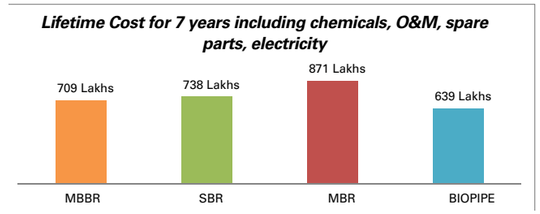
The focus is on decentralized wastewater treatment for municipal and industrial wastes.

The mission is to become a global technology leader in low-cost, low- maintenance, eco-friendly, decentralized wastewater treatment. The core competency is well-established in sewage wastewater treatment, and adding solutions for treatment of effluents in textile, tannery, fisheries, dairy and processed water industries.

TECHNOLOGY:
The world's first biological wastewater treatment system where the process takes place entirely inside the pipe and is patented in more than 55 countries. It is supposed to be scalable, sustainable, eco-friendly and cost-effective wastewater treatment solutions in the world.

SOME COMPARISONS:





Case studies of Pimpri Chinchwad etc. were showcased.
The plant is a 15 KLD that treats and feeds another STP.
Showcased the ABRIMIX Process that utilises high shear with pressure to rapidly achieve a treated wastewater end point.

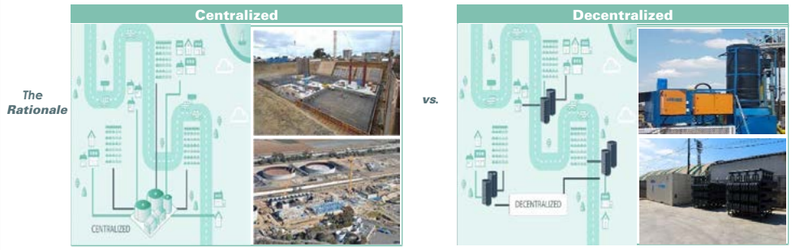
SOME APPLICATIONS:

BIOPIPE

FOCUS ON DECENTRALIZED MARKET

Our mission is to become a global technology leader in low-cost, low- maintenance, eco-friendly, decentralized waste water treatment. Our core competency is well-established in sewage waste water treatment, but we intend to rapidly add solutions for treatment of effluents in textile, tannery, fisheries, dairy and processed water industries.

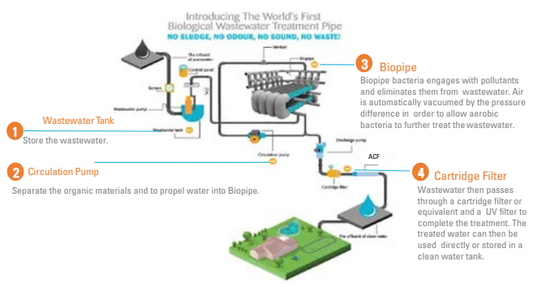
Urgent Need For Affordable, Fast-to-Deploy Solutions



- × 2/3 of CAPEX before the plant (piping, pumping)
- × Expensive to maintain and upgrade
- × No flexibility and scalability
- × Mainly for well developed urban areas

- ✓ 90 day of time-to-complete and lower, just-in-time CAPEX
- ✓ Capturing more value
- ✓ Scalable and customized to fit current needs
- ✓ Easy to upgrade and relocate

The world's first biological wastewater treatment system where the process takes place entirely inside ***the pipe*** and is patented in more than 55 countries. It is the result of years of research that has now developed into one of the most scalable, sustainable, eco-friendly and cost-effective wastewater treatment solutions in the world.



- Eco friendly
- Scalable with a flexible modular design
- Cost efficient
- Sustainable
- Fully automated

Technology & Innovation

360water is a leading learning company in USA. They are subscribed by major US water sector companies. cGanga may take a look at quality of courses and collaborate for possibility for India ULBs managing water/ wastewater infrastructures.

Digital Twins in O&M

Laura Tegethoff, 360water, USA

360water has expertise in online interactive training program for succession training and asset management.

This is a knowledge management company and has created huge learning programmes in municipalities and industries in US. The modus is:

Capture and transfer critical knowledge from your engineers, manufacturers, and Operations & Maintenance staff. A succession planning tool for your facility.

Our learning management system ensures your staff is knowledgeable on its municipal utility systems. The LMS can protect and extend the life-span of capital equipment.

Our documentation system tracks your staff's progress so that managers can assess the skill sets and training levels of all employees. The 360water asset management tool can be used for all your training.

DIGITAL TWINS

Utilizing innovative technology partnered with your existing face-to-face training experts, 360water offers municipalities and industries a comprehensive solution.

With over 22 years in business and hundreds of projects we have the experience to succeed.

360water can integrate with whatever systems you currently use. We offer a customized deliverable. It can grow with your needs, solving staff sustainability and knowledge transfer concerns.

Courseware follows a set deliverable that supports knowledge transfer.

- Abstract
- Introduction
- Key words and phrases
- Body of Text with multimedia and interactivity
- Start-up, shut-down, operation, maintenance, and troubleshooting
- Final Test requiring 100%

Technology & Innovation

An interesting project to save the forests for eternity while ticking planet, people and profits- a triple bottom line approach. Maybe India could look at bio diversity hotspots and protect them on similar lines.

The Digitisation and Fractionalisation of the Reserve

Robin Daniels, REDPILL GROUP, UK/ France

They are into large 50,000 acres reserves of rainforests. They are into protection of national assets like forests and bio-reserves.

TECHNOLOGY INNOVATION IN THE AMAZON RAINFOREST:
Incubated by Redpill Group Ltd, AMATECH LABS is the center of an international innovation ecosystem that brings together industry partners, universities and investors to develop, launch and scale science and technology to combat the climate emergency. Amatech Labs uses private 50,000 acre Amazon Reserve, on the banks of the Madeira River in the State of Amazonas, as an open-air laboratory and a state-of-the-art bench test for a whole range of science and technology.

There are four main reasons for undertaking this project:

1. **Natural asset valuation:** The digitisation and fractionalisation of the Reserve allows for a more accurate reflection of the value of natural assets on our balance sheet.
2. **Advanced measurement, reporting & verification:** The application of digital technologies will help us to gain a far greater insight into the health of flora and fauna across the Reserve, plus the status and any changes across a range of parameters including water quality, soil health, carbon sequestration rates and overall climatic effects on the rainforest.
3. **Technology commercialisation and export:** We are using the Amazon to develop new technical solutions for environmental applications and to stress test and further develop them, for export back into the world's cities. We are incubating young technology companies from around the world and accelerating them into new markets.
4. **Breathing life into MetAmazonia:** Building on our digital twin of the Reserve, we are creating MetAmazonia, our gamified and photorealistic platform for long-term revenue generation. The conversion GIS data into Land NFTs, with accompanying economic rights, allows anyone, anywhere to support both Amatech's work and our social, environmental, climatic and economic projects.

DIGITISATION AND
fractionalisation of the Reserve allows fora more accurate reflection of the value of natural assets on AMATECH LABS balance sheet

Technology & Innovation

Bioremediation is a well-known technology. Other companies have met with limited success. Also, how does bioaugmentation will help in cleaning a running drain or rivulet is one for further studies under Indian conditions.

Bioremediation Technology

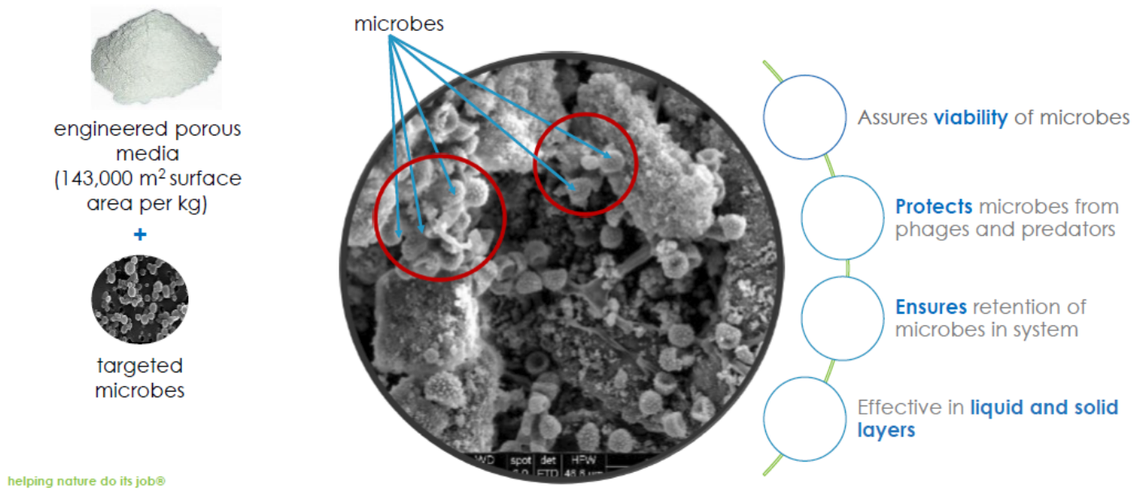
Malcolm Fabiyi, DRYLET, USA

They use bio-augmentation strategies using normal microbes and they showed some case studies and the patented formulations are natural bacteria. There are other companies who are working in this area in India.

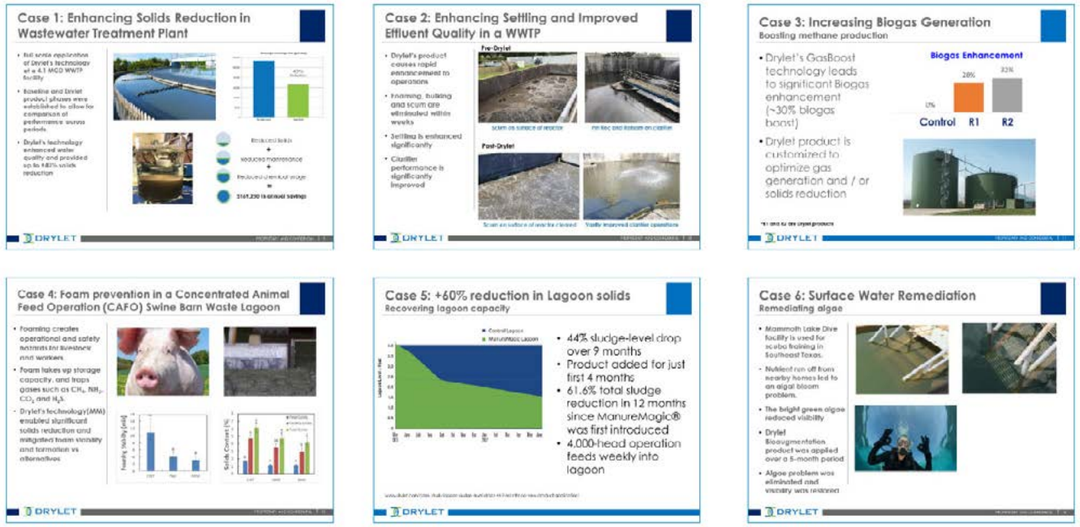
Bioaugmentation is a term used for inoculation of bio organisms to improve Bioremediation. The whole concept manages to augment the capability of microbes to function effectively in trying conditions.

BIOAUGMENTATION DRYLET

Drylet's biocatalyst technology



Case studies – wide range of applications



Technology & Innovation

Space Remote Sensing/AI

High end satellite imagery, application of 4IR. Continuous monitoring and reporting of water, air and land parameters. Shall help in determining accurate data trends, decision making and economic forecasting. Disaster Management is another area of interest. cGanga can work with them on specific water courses that feed main rivers. Data can help in supporting all five pillars of Samarth Ganga- Aviral, Nirmal, Arth, Jan and Gyan Ganga.

Gagan Agrawal, CI-Metrics, India/Luxembourg

SPACE ENGINEERS-
first of its kind Computational Imaging Lab in India. Upstream Data Processing Pipeline Steps technology available in very few places. Downstream work is powered by deep convolutional neural network

1. Implement and apply algorithms to solve problems.
2. Space Engineers. First of its kind Computational Imaging Lab in India. Upstream Data Processing Pipeline Steps – technology available in very few places. Downstream work is powered by deep convolutional neural network.
3. Used for Agri underwriting, Infra-insights and index forecasting. Change detection – monitoring and temporal trends.
4. Water resource mapping and river basin forecasting – time lapse created using google earth.
5. Monitoring parameters like turbidity, water masks, width of river, bifurcations in rivers, moisture in nearby areas, flood prone areas, algal bloom, surface temperature.
6. Baseline used – UNESCO powered research: graphs showing variation of chlorophyll – A, turbidity, surface temperature.
7. Base resolution – 10 m. For high-alert areas, platform equipped with drone images.
8. In-situ parameters measured- turbidity, total dissolved solids, electrical conductivity, pH, total hardness, alkalinity, chloride, fluoride, dissolved oxygen, BOD, COD – parameters used to train the ML model.
9. Generate LIDAR data for Survey of India for 10 kms on either side of the river.

OUTPUTS:
Automatic alerts for parameter abnormal behaviour, dashboard for visualizing ML gridded outputs, Continuous monitoring with Gridded RS data along with select forecasts.

OTHER OBSERVATIONS:
Sensitivity of image quality affected by pollution – aerosol optical depth change: winter season images are less bright and of lower contrast. There are ways to correct the inaccuracies. Limitation: noticing the width of the channel? If water filled channel, it is difficult

SOLUTION:
LiDAR (only if there is no water in the river).

Gas emissions can be captured for pollution measurement. Methane emissions prominent from permafrost and oceans can also be measured.

Technology & Innovation

Promising technology and applications. A deeper analysis may be done. Data from IITs and PCB Punjab, ICRISAT may be analysed and probed further. Prima facie nano technology applications have been used on may areas of pollution abatement and further research is going on across the globe. cGanga may study and take some projects for more pilots.

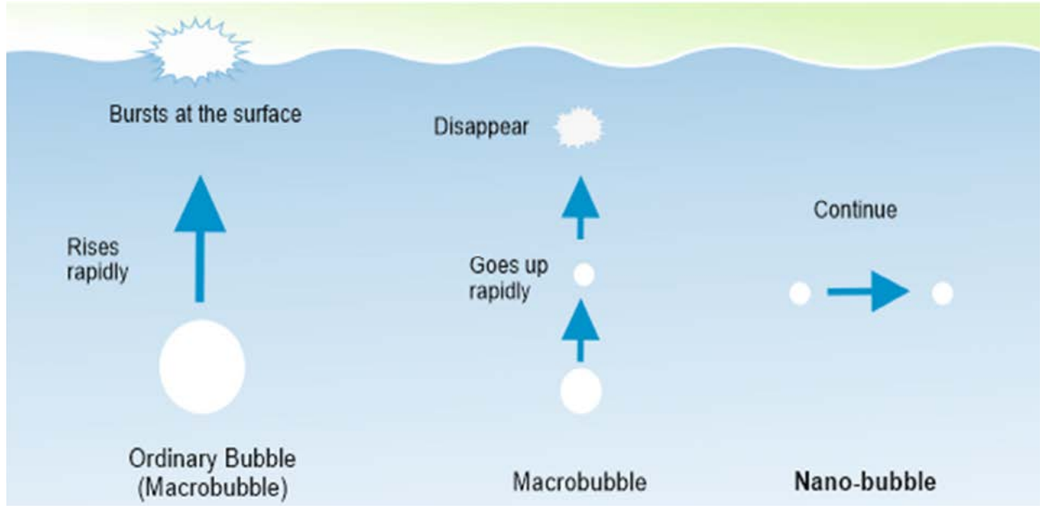
Wastewater Treatment

Jagjit Singh Kochar, KBK Environ, India

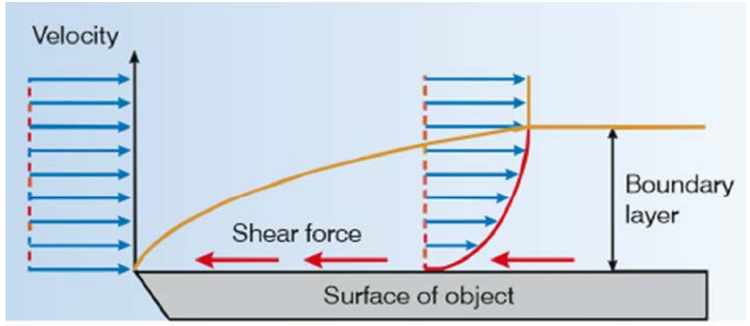
The company presented a theme of engineering nanobubbles revolution for in-situ remediation and waste water management, a technology developed in Korea.

PERFORMANCE FEATURES:

- Increases Dissolved Oxygen (DO) levels rapidly
- Removes bad smells
- Decomposes sludge at the bottom of the water body
- Stimulates self-purification to recover clean water environment
- Degradation of organic compounds, reduction of excess nutrients and elimination of floating algae
- Kills anaerobic microbes and promotes aerobic microbes
- Nanobubbles are miniature gas bubbles in liquids, less than 200 nm in diameter, which have several unique physical properties
- Longevity, virtual disappearance of buoyancy, high internal pressure, extremely large surface/volume ratio, high oxygen dissolution rate and generation of free radicals are the important features of nanobubbles
- Nanobubbles remain stable in water for a long period because of their negatively charged surface (zeta potential)



THE PROCESS OF NANO BUBBLE GENERATION:

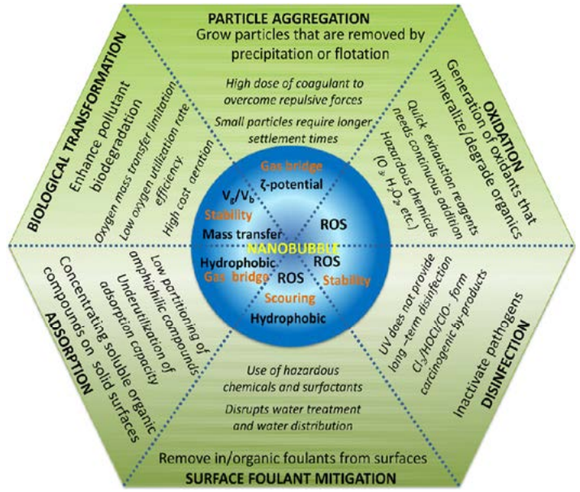


Generated Velocity gradient by shear force at interface

Nanobubbles are developed by applying the shear resistance relationship between the interface of the object and the adjacent area. When gas (e.g., oxygen) is splitted into nanosized by the shear force generated at the interface of the object, dissolved gas is increased. Nano-sized bubble (gas) exists in water for a long time without degassing, and dissolved gas is maintained high for a long time.

- The internal pressure of nanobubbles in liquids is much higher than that of their environment, which helps in very efficient dissolution of the gas into the liquids
- While rising in water, the collapsing nanobubbles generate free radicals that catalyze chemical oxidation reactions
- These remarkable properties of nanobubbles have led to many applications in the various fields of science and technology, including industrial, biological and medical fields

WHAT CAN IT DO?



Many case studies with IIT Ropar, ICRISAT, Govt. of Punjab etc. were showcased.

Technology & Innovation

NMCG knows this company as per the 2019 letter shown in the presentation. cGanga could create a water quality map for the river basins at granular level.

Nationwide Water Quality Monitoring Dashboard

Torunika Roy, PIQUANT, South Korea

PiQuant is already in India and has a relationship with NMCG since 2019.

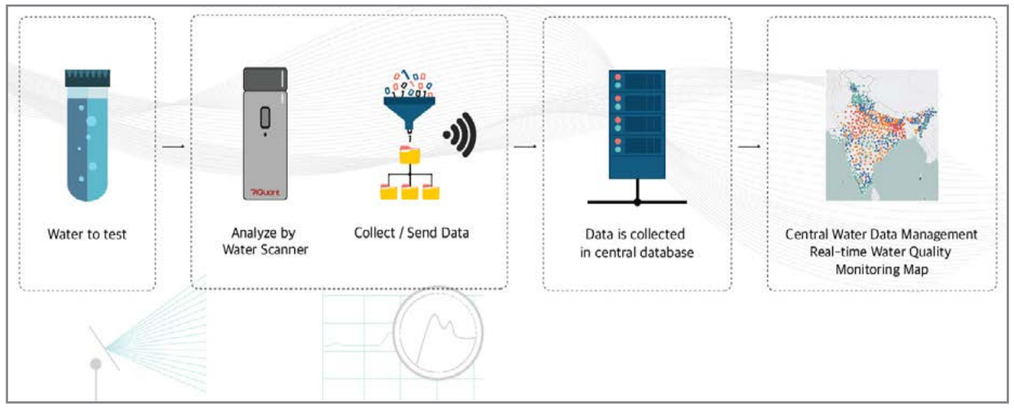
The portable devices use spectrophotometry to detect bacteria, heavy metals, pesticides etc. It also measures air pollution parameters.

Accuracy and Capability can help real time detection of pollutants. A data set for water quality could be generated across India.

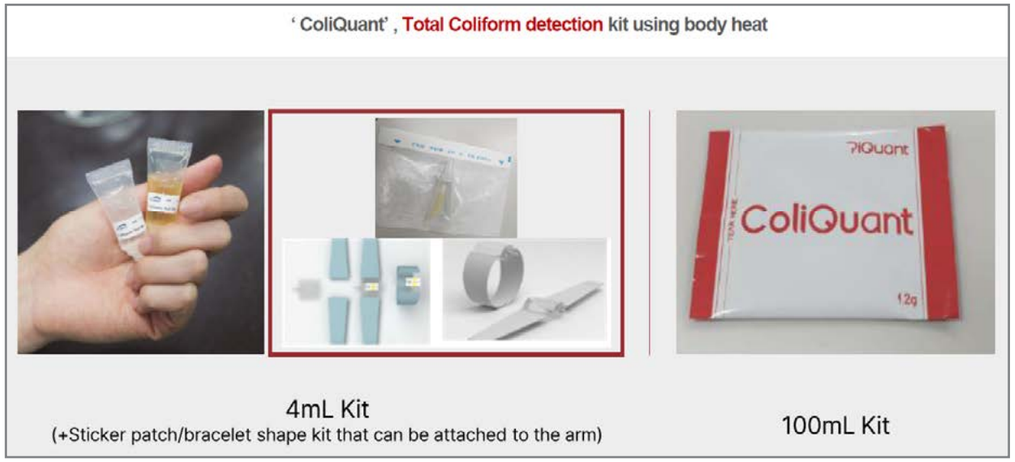
ColiQuant – Total *E. coli* detection using body heat. *E. coli* is the most common water borne disease causing bacteria.

PIQUANT

PIQUANT'S PRODUCT WATER SCANNER



COLIQUANT CONFIGURATION



STRENGTHS COLIQUANT

Technology & Innovation

There is a requirement for in pipe inspection across underground water assets. cGanga may call them for further discussions.

Pipe Assessment Using Digital

Amanda Siqueira, VAPAR, UK

Cloud platform that automates condition assessment directly from pipe CCTV footage

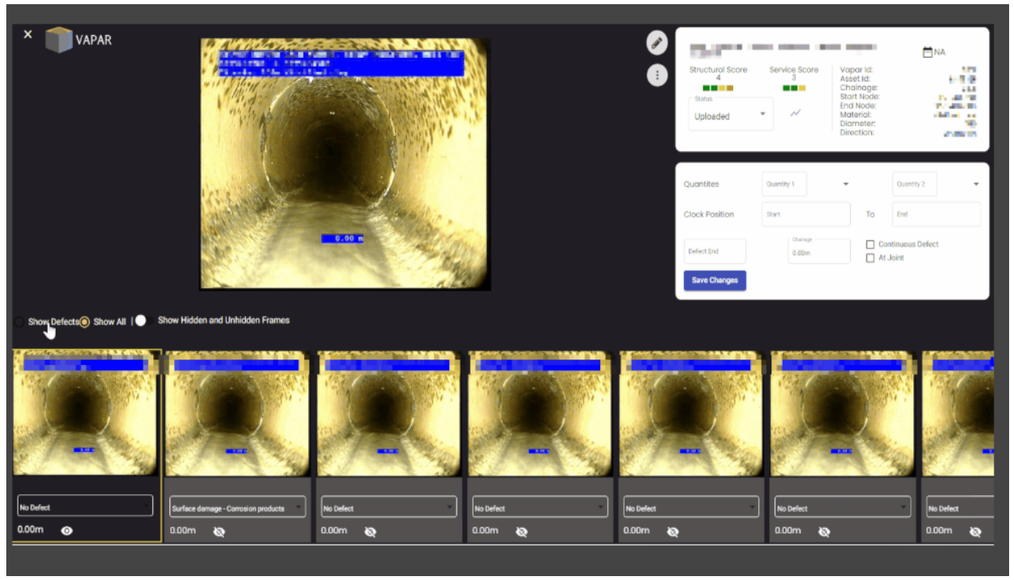
5 years old Australia based (HQ - Sydney)

The company claims it helped eliminate unplanned pipe repairs globally and could attract and retain talent in critical services industry.

UNITED UTILITIES CASE STUDY:
Maintaining a network of 78,000 km of wastewater pipes. Defect detection and Defect Classification accuracy increased over time
Strategic partnership with minicam.

COST COMPONENT MISSING IN THE PRESENTATION:
Lower data availability in India, as compared to those in UK, Australia. Visual inspection done manually here in India. This technology necessitates a video input to work. Videos are analysed using 4 IR technologies.

VAPAR



DIGITISE AND CENTRALISE YOUR PIPE ASSESSMENT AND REPAIR PROCESS
With intuitive still frame view and drop-down options, the review process is faster than examining a full inspection video.

CLOUD-BASED SECURE STORAGE SHARING:

SESSION C-5

Day 3 (17th December 2022)

Technology & Innovation

Predictive AI for Digital Water

In realm of 4IR applications. Dr Jawed requested them to contact regarding Arsenic detection in the NE states. cGanga can explore possibilities for establishing a centre for development of advanced robotics for water value chain applications in IIT Kanpur/ Guwahati.

Meena Sankaran, KETOS, USA

- A US based company now launching a new office in Chennai
- Clear water does not mean clean water. Use Water Intelligence for Safer, Smarter and Sustainable Future
- Revolutionized how people look at water monitoring. Robotic system manufactured in USA
- Goal – Manufacture in India by 2024
- Continuous water monitoring – self calibrate and self-clean itself
- First system in the world to detect 35 compounds. Can detect 1ppb of heavy metals
- Robust software platform that does all the ML predictions
- Do NOT sell hardware. Business model based on software only as SaaS model. Sell only data
- Deployed in 7 countries
- 12-15% savings seen within a week
- Applications: Industrial, Municipal and Agricultural
- 2018 – Deployed in first 25 smart villages
- Making impacts in Peru, Israel but India seems to be the biggest market
- Distributed team in Ukraine, India, Ethiopia, USA
- Currently a 70-member team. Ethnically diverse company

TRACK D

DAY 1:
Thursday, December 15, 2022
16:30 – 18:00 hrs

CHAIR:
Debashree Mukherjee [Special Secretary, Ministry of Jal Shakti]
Vinod Tare [Professor, IIT Kanpur and Founding Head, cGanga]

MODERATOR:
Sanmit Ahuja [Expert Member, cGanga]

PANELISTS:
Cristian Valdes Carter [Country Director India, Innovation Norway]
H.E. Dr Philipp Ackermann [German Ambassador to India]
H.E. Ms Mateja Vodeb [Slovenian Ambassador to India]
Seppo Nurmi [Minister Counsellor, Deputy Head of Delegation, European Union Delegation to India]

D: International Partnership

KEY POINTS RAISED

Water is a global Issue

It is a forgone conclusion that managing water as a resource is very important but doing so at a global level has become even more imperative. The fact that there isn't a Conference of Parties (UN-COP meetings) for water and that the UN is convening a global water conference after 30 years highlights the low levels of global diplomacy in the water industry.

As many downstream nations grapple with natural water resources particularly if they are disadvantaged as a result of upstream activities, strong voices are needed for water at a global level when it definitely relates to trans-boundary cooperation.

India – EU Views

India and EU have a shared vision for more sustainable management of water resource and tackling the challenges posed by water management in the context of growing population and consumption, competing water demands and climate change. EU highly values India EU partnership with Ministry of Jal Shakti which aims to strengthen the technological, scientific and management capabilities of India and EU in the field of water Management on the basis of water quality, reciprocity and mutual benefits. EU and India are working together on a number of issues including:

- Investing in green transition
- Zero pollution package
- Energy neutrality
- UN SDG 6 – "Ensure availability and sustainable management of water and sanitation for all"

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D: International Partnership

India-Germany Views

European rivers such as Danube, Rhine and Sava, all of which are trans-boundary in nature, have committees which monitor quality and flow. A similar level of cooperation is needed on the Indian side between various national, state and district institutions.

As the Namami Gange programme becomes a success, the more it will serve as an example for other countries and river basins around the world.

India-Slovenia Views

Slovenia puts a very strong emphasis on water security through its Water Diplomacy programme:

1. Water is vehicle for Cooperation and Peace.
2. Water like climate change doesn't recognise water change, Climate crisis is essentially water crisis.

The basic principles on which the water diplomacy programme rests are:

1. Water is everybody's basic human right
2. Water is everybody's Business

INDIA - SLOVENIA WATER COOPERATION

The two countries are already collaborating significantly and there are many opportunities for further cooperation starting with Remote sensing where India and Slovenia have a partnership between cGanga/IIT Kanpur and Space.SI.

Further areas of collaboration include: River Twinning (Ganga- Sava), water-science-art cooperation, multilateral level and EU India water partnership.

The countries would like to come together to share good practices, offer expertise in transboundary water cooperation, Integrated water resource management, building financial and human resource framework, building resilience and flood management (Drought preparedness).

D: International Partnership

India-Norway Views

Norway has been collaborating with India particularly in the area of Sludge Management. A joint policy research study on how to establish a sludge management programme in India was initiated between Norwegian and Indian experts.

The study is expected to be completed in early-mid 2023 and would go a long way in addressing the problems created by sludge.

India's Views on Water Security and Diplomacy

- Everyone recognises the huge challenges of water security around the world and also the fact that climate change is aggravating the challenges that water security poses. We are already seeing this in India while the overall amount of water that we receive that is available is predicted to remain the same over the next 50 years at least. We are expecting longer dry spells, more extreme precipitation events and we are expecting the spatial and temporal disparities to be aggravated. These challenges posed by climate change, the issues of water security disproportionately affect the poor, underprivileged, the most vulnerable women and children. I think India is cognizant of the challenges.
- In the water sector India is investing billions of dollars via various programmes: Namami Gange programme, Jal jeevan mission, Swachh Bharat Mission the huge flagship water and sanitation programmes which is trying to provide access to drinking water and sanitation to every household in the country. We are also working on large mitigation programmes for instance we are also running the largest dam rehabilitation and improvement programs in the world to try and ensure that our water infrastructure is more fit for purpose, extend its life and enhance storage without having to invest in more infrastructure. The other big thing we are trying to do is to focus on ground water management that is part of overall water management. There is big storage available under our feet, how do we ensure that the storage is recharged every year. For that there is a national call to action since 2019, which is called the Jal Shakti Abhiyan where large investment is going towards water storage and recharge at local level.
- Without partnerships, without learning from each other we are condemned to sort of reinventing the wheel so this is where a forum such as the India Water Impact Summit, where we all come together where we all have forged partnerships there is lot of knowledge available that we'd like to bring together but in a structured manner.

The IIT Kanpur led consortium is leading on bringing the right technologies, the most appropriate technologies, technology that can take to scale but technology that is also regionally relevant so those are choices that we have to make and finally also we cannot forget the fact that technology has to be grounded. There is work to be done with communities, with local groups to be able to demonstrate the technology and that is our big challenge.

AREAS OF COLLABORATION:

River Twinning (Ganga-Sava), Water-science-art cooperation, Multilateral level, EU India water partnership

D: International Partnership

Several priorities identified by India are:

(a) Integrated river basin management plans - The effort in rejuvenating Ganga is actually our first step towards looking at integrated river basin management. We have had discussions on integrated water resource management at basin level and one of the big challenges that we were talking about is how in a federal system where water is a state subject and you bring together different states to participate in river basin management with at least minimising the politics of water sharing, what are our mechanisms and how can we do it. The Namami Gange institution which started off with river cleaning and is now moving into other areas of water and land management is a very appropriate institution where we can start taking steps towards integrated water resource management.

(b) The second issue is about circularity. Water is multisectoral- urban, rural, agriculture, health and nutrition are all areas that get interconnected via water. There are so many stakeholders in water that frequently we leave out and we say oh we sorry we forgot the environment and forest people. We have to figure out a system of value such as ecosystem services. So the treated water will not necessarily go to an industry that pays for it. The treated water can go to recharge groundwater, but then we have to find a way to value it so that the municipality is incentivized to do it. So those are the questions that we need to deal with.

(c) The circularity also extends to waste management, for instance due to a significant rise in number of sewage treatment plants (STP) that have been built in the last few years and will be built in the coming few, the volume of STP sludges has also increased significantly. Until now these were being predominantly diverted to landfill or disposed off on agricultural lands, but those processes are no longer sustainable. India has a great opportunity to address two problems with one stroke, which is to establish a national top-soil regeneration programme. The STP sludges can be processed and treated and distributed to rejuvenate the top-soil in the country which is depleting at an accelerated rate. cGanga and NMCG are working together on this front and plan to roll out a strategy imminently.

(d) The other issue also is and I know, we've not talked about this is we're grappling with is improving water use efficiency particularly in agriculture. So that's another major challenge.

(e) Human resource is also a major challenge and as we move towards sustainable living, we also have to re-skill our existing workforce and simultaneously develop new curriculum for the people that are still going through the schools and higher education system.

(f) Areas related to development of artificial intelligence and big data for information services in the field of water resources.

(g) Management of Sludge and effective reuse of treated waste water.

(h) Nature based solutions which have been implemented successfully for peri urban and rural areas.

(i) Successful community size basin approaches for water resource management.

WE HAVE TO FIGURE OUT

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D: International Partnership

India and G20 Presidency

With India's G20 presidency we would also like to place water management centre stage and give it a significant prominence. India would like to invite all our friends to be part of the G20 effort to try and put water at centre of deliberations.

India will launch the global river twinning programme during it's G20 presidency whereby knowledge on river basin management can be gathered from various partner nations and experts to then disseminate it to countries who do not have such knowledge and capability.

India will also launch a Global River Basin Command Centre that is being established at a new building at IIT Kanpur.

TRACK E

E1: Decentralised Wastewater Management for Sustainability of Sewerage Assets

DAY 2:
Friday; December 16, 2022
09:30 – 11:00 hrs

PANELISTS:
Depinder Singh Kapur [PD, CSE, New Delhi]
K E Seetharam [Professor, University of Tokyo]
Mantesh Kumar Meena [Norther Railways, Delhi]
Ohm Meher [IRSE, Director (Station Development), Railway Board, Ministry of Railways, New Delhi]
Ram Avtar [Professor, University of Hokkaido]
Victor Shinde [Sector Coordinator, NIUA]

In rural or peri-urban areas the conventional centralized wastewater management have generally failed to address the needs of communities for collection and disposal of domestic wastewater and faecal sludges. There are opportunities for implementing wastewater management systems based on a decentralized approach that may offer opportunities for wastewater re-use, identification of total generated sludge and resource recovery as well as improvements in local environmental health conditions. Decentralized approaches will offer increased opportunities for better planning and decision-making. In this session various initiatives on Decentralized Waste Water Treatment Systems and success stories/practices, and support to Urban Local Bodies (ULBs) for better management of wastewater were presented and discussed.

E1: Decentralised Wastewater Management for Sustainability of Sewerage Assets

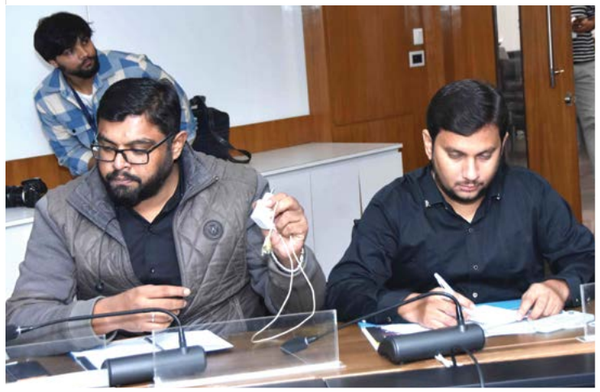
SESSION E1

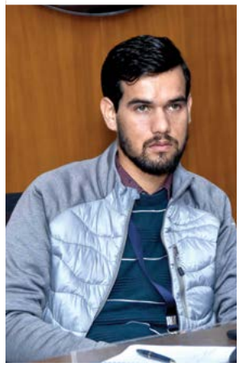
SESSION E2

E2: Impact of Land use on Rejuvenation of Small Rivers

DAY 3:
Saturday; December 17, 2022
09:30 – 11:00 hrs

PANELISTS:
Bal Krishna Tripathi
[DM Amroha, UP]
Chandra Prakash Singh
[DM Buldanshahr, UP]
Himanshu Badoni
[Former ED (Projects), NMCG]
M Arunmozhi
[CDO, Farrukhabad, UP]





The flow of river is generally contributed by the various rivulets; therefore, the health of the smallest stream has a ripple effect on the next order stream until it finds its way to large river. The small rivers not only carry water to large river but also bring rich variety of aquatic biodiversity. To preserve the riverine ecosystem, the preservation, conservation, and rejuvenation of springs, nallahs and other streams is significantly important. With the growing urbanization and haphazard development and land use planning, the survival of small rivers is at a high risk. Hence, it is important to draft policies, interventions, and strategies to safeguard the small rivers from destruction due to poor land use planning and development.

CONTACT DETAILS

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Executive Officer–Outreach
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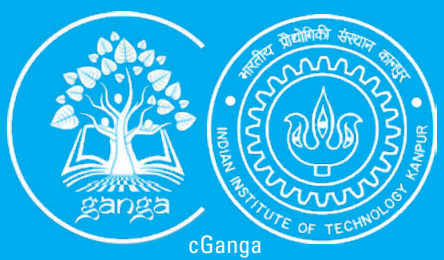
For Media Enquiries:
media@cganga.org



cGanga

Centre for Ganga River Basin Management and Studies