सत्यमेव जयते
Ministry of Housing and Urban Affairs
Government of India

Azadi Ka Amrit Mahotsav

स्वच्छ भारत
एक कदम स्वच्छता की ओर

GOVERNMENT OF KARNATAKA

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BRIDGING THE KNOWLEDGE GAP
WASH INSTITUTE

Proceedings

SBM 2.0
Capacity Building workshop on Used Water Management

16th – 18th NOV 2022 | **Bengaluru**

ACKNOWLEDGEMENTS

We extend our sincere gratitude to the Ministry of Housing and Urban Affairs (MoHUA), Government of India (GoI) for conceptualising and supporting WASH Institute with organising this workshop. We also would like to thank the Government of Karnataka for being a host state for this workshop.

We would like to extend our gratitude to *Smt Roopa Mishra,* Mission Director SBM 2.0, Joint Secretary -MoHUA*, GoI, Shri Rakesh Singh*, Additional Chief Secretary, Government of Karnataka (GoK), *Shri Ajay Nagabhushan*, Secretary Urban Development Department- GoK, *Smt. SMD Manjushree,* Director of Municipal Administration – Bengaluru, GoK and their teams for their honourable presence and involvement in the workshop and the World Toilet Day event held between 16th -19th November 2022. We thank the donor entities USAID and Bill & Melinda Gates foundation for their continued support that helped mobilize the efforts towards organizing the workshop.

Our heartfelt thanks to the state representatives for their presence and the contextual perspectives and learnings they brought along to the workshop.

Contents

Capacity Building Workshop on SBM 2.0 Used Water Management

16 November to 18 November 2022

I. Brief about the workshop

a. Objective

The capacity building workshop on Used Water Management (UWM) under Swachh Bharat Mission –Urban 2.0 was aimed at assembling sector experts and state level functionaries on a single platform to share experiences and learnings. The workshop was intended to facilitate an open dialogue on UWM implementation, provide space to pose questions, raise doubts, and discuss obstacles faced by the participants so far from their efforts in implementing UWM initiatives. Each session (agenda in Annexure A) was curated with the intention of providing decision makers with knowledge on various possible approaches and technologies under SBM-U 2.0, case studies of successful models in UWM that can inspire the momentum of the states and local bodies towards achievement of ODF++ and Water + milestones.

b. Participant details

More than 130 key state level functionaries from 27 states participated in the workshop. State Mission Directors from 5 states, Chief Engineers, Superintending Engineers, Executive Engineers, and other technical personnel formed the core of the participants. In addition, State Secretaries, Nodal Officers, representatives of state sanitation initiatives as well as consultants and research associates from various organisations/institutions and some journalists registered for the workshop. This profile of participants brought in a broad range of perspectives to the discussions.

The Detailed list of participants and organizers are listed in the Annexure B. The number of participants/ representatives from respective states are illustrated below:

The overall schedule and agenda for the workshop is given below:

Session No.	Timings	Session Title	Speaker
Day -I	**16th November 2022**		
	09.30-10.00	Registration of Delegates	
	10.00-10.10	Welcome Address	Shri VK Chaurasia, Joint Advisor CPHEEO
	10.10-10.25	Keynote Address	Smt. Roopa Mishra, Mission Director SBM, Joint Secretary, MoHUA
	10.25-10.40	Context Setting	Shri VK Chaurasia, Joint Advisor, CPHEEO
	10.40-10.45	Vote of thanks	Shri. Sasanka Velidandla, Advisor, WASH Institute
	10.45-11.15	Tea Break	

Session No.	Timings	Session Title	Speaker
Technical Session: Principles, Planning and SBM 2.0 Approach			
1	11.15-12.00	Used Water Management- Principles and Management Options	Prof. S. R. Asolekar, Professor, IIT Mumbai
2	12.00-13.15	City Used Water Management Planning	Shri VK Chaurasia, Joint Advisor, CPHEEO
	13.15-14.15	Lunch Break	
3	14.15-14.45	Planning and Project Management on Sewerage Systems	Shri Devang Shah, Sewerage specialist, MD, Himadri Enviro-protection
4	14.45-15.45	Steps to accelerate Used Water Management, Guided Plenary	Shri. Sasanka Velidandla, Advisor, WASH Institute
Presentation by States, Approaches, Strategies and learning in implementing UWM			
5	16.15-18.00	Haryana on Rapid implementation of STPs across state	
		Madhya Pradesh on Integrated approach for UWM	
		Gujarat on sewerage systems for small and medium towns	
		Case of Uttarakhand	
Day -II	**17th November 2022**		
6	09.30-09.45	Recap and Preview of the day	Shri. Sasanka Velidandla, Advisor, WASH Institute
Used Water: Treatment and Reuse options in small and medium towns			
7	09.45-10.15	Scaling up Decentralised Wastewater Management and its Reuse in Small and Medium Towns	Shri. Rajesh Pai, Technical Advisor, WASH Institute
8	10.15-10.45	Managing Onsite Sanitation System, Co-treatment of Faecal Sludge in STPs, Reuse	Shri. Sasanka Velidandla, Advisor, WASH Institute
9	10.45-11.15	Management of Used Water Flow Through Open Channels/ Drains	Shri. P.G.Ganapathy, Advisor, CDD Society

Session No.	Timings	Session Title	Speaker
		and Reuse of Treated Used Water	
	11.15-11.30	Tea Break	
10*	11.30-11.45	Bangalore Water Supply and Sewerage Board: Reuse Water Outlook	Rajiv KN, Chief Engineer, BWSSB
11	11.45-12.30	Presentation on the Ready Reckoner on Municipal Used water Treatment Technologies for Medium and Small Towns	Shri. V.K. Chaurasia, Joint Advisor, CPHEEO
12	12.30-13.15	Wastewater Management and Integration with Irrigation; National Perspective of Israel	Dr. Lior Asaf, Water Attaché Israeli Embassy, New Delhi, India
	13.15-14.00	Lunch Break	
Experience sharing of the States			
13	14.00-15.00	Approach, Learnings and Challenges in SBM initiatives for states of Jammu & Kashmir, Goa and Mizoram	
14	15.00 -16.30	Way forward and discussion with participants and Recap of State presentations	Smt. Roopa Mishra, Mission Director SBM, Joint Secretary, MoHUA
15	16.30-17.45	Exhibition of Technologies	
16	18.00-18.15	Vote of Thanks and Briefing on the exposure visit	Shri. Sasanka Velidandla, Advisor, WASH Institute
Day -III	**18th November 2022**		
	09.00-17.30	Field visits to:	
		Devanahalli Faecal Sludge Treatment Plant	
		Mahadevpura Lake – Wastewater Treatment System	
		Horamavu Agara Sewage Treatment Plant	
	17.30-18.15	Regroup and Refreshments	

II. Session Wise Proceedings

Day -1

The workshop was inaugurated in the presence of Shri Rakesh Singh, Additional Chief Secretary, Government of Karnataka. He stated the importance, timeliness of the workshop and also highlighted cases from Karnataka on Wastewater Management. This was followed by a keynote address from Smt. Roopa Mishra, Joint Secretary, Ministry of Home and Urban Affairs stating the very purpose of the workshop being '*Gaining complete clarity regarding Used Water Management under SBM 2.0'*, while setting the overall outcome of the mission; states to ensure that all ULBs (< 1 lakh population) have means to manage used water. She further added that the 3-day workshop is meant for sharing learnings, challenges, and exchange perspectives on the same, thereby inviting active participation to make it successful.

Shri VK Chaurasia, Joint Advisor, CPHEEO began with setting the context to the Swachh Bharat Mission initiatives, reiterating that SBM 1.0 targeted achievement of Open Defecation **Free (ODF) status across ULBs**, while SBM 2.0 targets **treatment and circularity to waste.** He further added that the program is targeted towards elimination of untreated used water discharge on land/water.

Session 1:

Used Water Management - Principles and Management Options

Prof. S. R. Asolekar, Professor, IIT Mumbai

The key message of this session was to set the approach right in terms of the targeted treatment levels offered by the potential solutions for used water management. Instead of meeting the prescribed standards, the aim should be to go even further and attain the highest quality of treated used water. This would open up myriads of reuse possibilities for treated used water, especially if we also want it to be widely reused.

This transition, although, would require due acknowledgement and symbiosis between the urban water cycle and the natural ecological cycle, especially because both of them cannot be mutually exclusive. The practice of excess extraction of freshwater and disposing untreated used water into freshwater sources like rivers, lakes, etc. is consistently reducing the carrying capacity of these resources, thereby reducing the quality of water sources that we are dependent on. However, such practices and their impacts vary from context to context. This makes the principle of subsidiarity very relevant, suggesting that solutions needs to be more contextual and thus localised.

Queries and Discussions

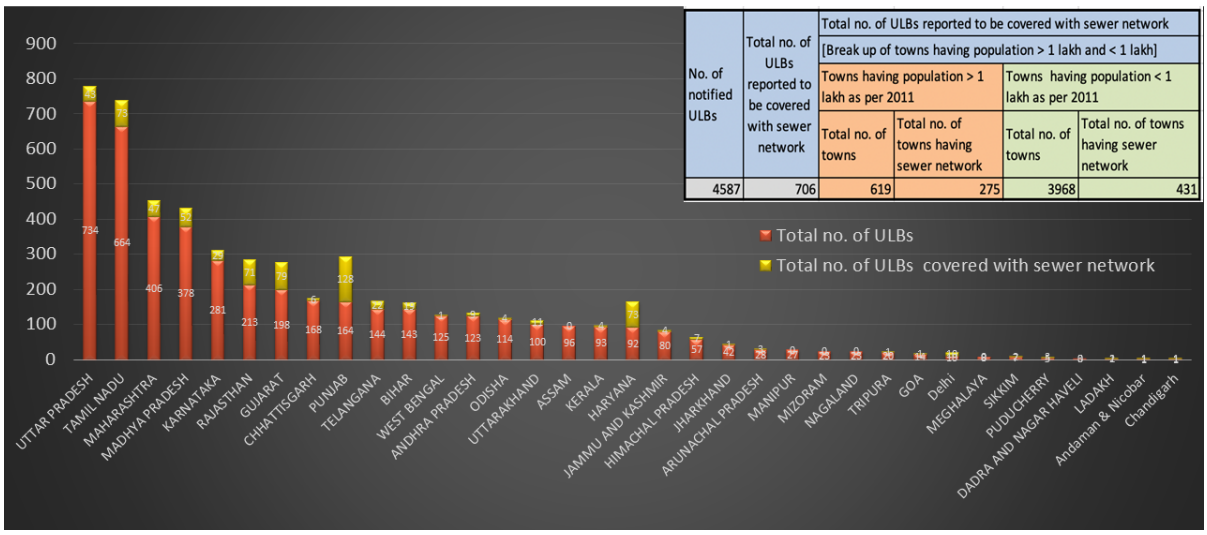
Q: Shri Shailendra Singh, Chief Engineer, PHED Haryana posed the question of whether the Waste Stabilization Pond technology would be able to attain such competitive quality standards of treated used water?

A: Shri Asolekar responded in terms of using a incremental approach to improving standards where resources are a constraint. Even if we begin with one solution it should allow addition of higher level of treatment in the future to make the solution adaptable and future proof.

Session 2:
City Used Water Management Planning
Shri VK Chaurasia, Joint Advisor, CPHEEO

The session involved detailed discussion on the options and the reference literature that can be used by the participants. The topics covered Off-site and Onsite Used water management, Faecal sludge and septage management approaches, Regulatory compliance criteria that must be kept in mind. This was followed by discussions on the broad approaches prescribed by SBM-U 2.0, covering: sewer network design, Interception & Diversion of drains, Co treatment of Faecal Sludge at STP, Funding support, etc.

Status of sewer network coverage in States and UTs



No. of notified ULBs	Total no. of ULBs reported to be covered with sewer network	Total no. of ULBs reported to be covered with sewer network			
		[Break up of towns having population > 1 lakh and < 1 lakh]			
		Towns having population > 1 lakh as per 2011		Towns having population < 1 lakh as per 2011	
		Total no. of towns	Total no. of towns having sewer network	Total no. of towns	Total no. of towns having sewer network
4587	706	619	275	3968	431

To bring into perspective, the gaps that SBM-U Used Water Management initiatives aim to fill, the existing sewer network coverage in ULBs with >1 Lakh and ULBs with <1 Lakh population (w.r.t. Census 2011) were shown. It was also highlighted that the Swachh Survekshan toppers are utilizing combination of technologies to achieve the outcomes.

Many technology options and their respective decision making criteria/matrix was discussed with the participants, to connect the choices to contextual differences. It was also highlighted that STP with facility to co-treat septage, Interception & Diversion, Desludging vehicles are eligible components under the Central share while funding for the construction of sewer network, strengthening municipal drains and diversion of used water to nearby drains have to be sourced by the state from 15th FC/Stat funds/ULB/Pvt sector funds.

Sewage Treatment Technologies

On-Site Sewage Management Systems	Off-site Sewage Management Systems
Conventional Septic tank	Waste Stabilisation Ponds (WSP)
Up-Flow Anaerobic Filter	Phytorid Processes/ Constructed Wetland
	Upflow anaerobic sludge blanket (UASB)
Package septic tank-Contact aeration type system	Activated Sludge Process (ASP)
Bio-Digester	Extended Aeration Process (EAP)
	Moving Bed Biological Reactor (MBBR)/Fluidized Aerated Bed (FAB)
	Sequencing Batch Reactor (SBR)
	Membrane Bioreactors (MBR)

LEGEND / Colour Coding

Low cost	Medium cost	High Cost

Comparison of Treatment Technologies along Critical Parameters

Technology	Land requirement	Capital cost	O&M cost	Electricity required.	Effluent Quality	
	Ha/ MLD	INR lakh / MLD	INR lakh / MLD	kWh/ ML treated	BOD, mg/ lit	TSS/ SS, mg/ lit
Nature Based Technologies						
Waste Stabilization Pond (WSP)	0.5 - 1.0	30 –60	0.6 –2.5	negligible	15-50	75-125
Root Zone Aeration/ Contructed Wetland	0.6-1.5	30-150	1.2-3.0	negligible	20-30	60-90
Mechanised Treatment Technologies						
Extended Aeration (EA)	0.15 - 0.25	90-200	7.0-12.0	180 - 225	20-30	50-100
Aerated Lagoon (AL)	0.27 – 0.4	40-60	1.5-3.0	15-20	25-50	40-150
Sequencing Batch Reactors (SBR)	0.10 - 0.15	150-300	10.0-20.0	150 - 200	<5	< 10
Moving Bed Biofilm Reactor (MBBR)	0.04 - 0.05	170 - 230	8.0-12.0	200 - 250	<10	<20
Activated Sludge Process (ASP)	0.15 - 0.25	80 - 170	6.0-10.0	180 - 225	20-30	20-50
Trickling Filter (TF)	0.25-0.50	50-80	2.0-5.0	150-180	25-30	---
Up flow Anaerobic Sludge Blanket (UASB)	0.2 - 0.3	40-60	2.0 -3.5	10.0-15.0	70-100	75-100
Onsite treatment Technologies						
Decentralised Treatment System (DTS/DEWATS)	0.13 – 0.14	80 - 200	2.0 – 2.5	negligible	<30	<10

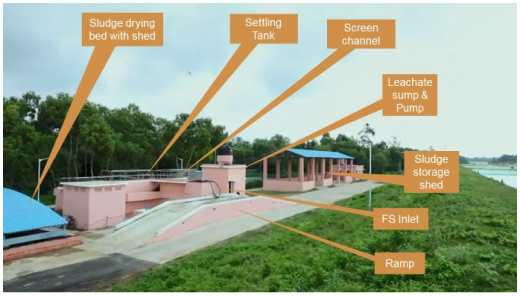
The aspects that need to be given due consideration whenever decision about a solution to used water management is being considered are as follows:

1. **Capacity of plant**
2. **Land requirement**
3. **Electricity requirement**
4. **Manpower requirement**
5. **Effluent quality**
6. **Topographical and geological conditions**
    - Hilly areas, coastal areas
7. **Financial sustainability**
    - CAPEX and OPEX both
    - Avg. cost and O&M cost for each component per MLD
    - Civil cost, electro-mechanical, manpower, maintenance and energy cost
8. **Reliability of the technology**
    - Should be stable and resilient against shock loading
9. **Institutional manageability**
    - Agencies to have appropriate technical and managerial expertise
10. **Application in reuse schemes**

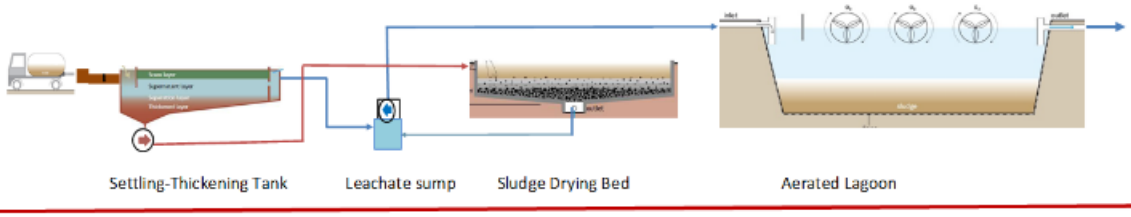
Furthermore, it was reiterated that resource recovery contributes to environmental as well as financial sustainability. Therefore, states should also focus on reuse of used water and not just its treatment. The standard designs for on-site sewage treatment and faecal sludge and septage management were discussed in detail. The two key takeaways from this discussions are as follows:

a. In case of on-site sanitation systems at the source, (where blackwater and greywater are separately managed), untreated greywater discharged into the stormwater/municipal drains can be assumed to be similar in quality to that of sewage. Therefore, these treatment plants can be designed as per CPHEEO manual.

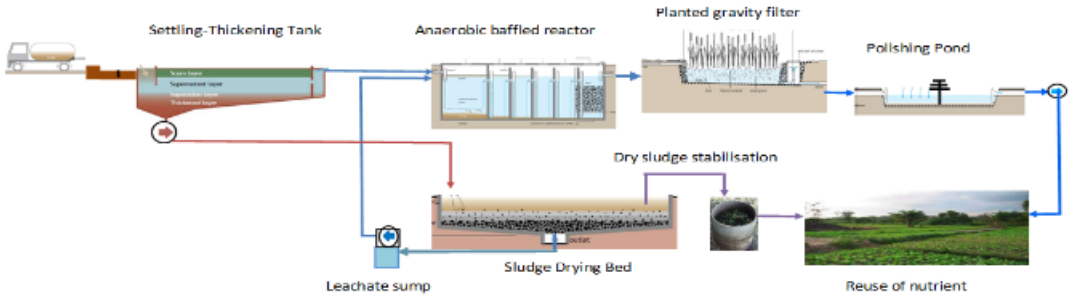
FSTP integrated with STP at Puri



FS & Septage Co-treatment Process in Existing STP



FS & Septage Treatment Process FSTP



b. The design standards set by CPHEEO are a suggestion, it is encouraged to adopt higher treatment standards as per the reuse needs or requirements set by state pollution control boards.

It was stressed that '**Any approach can be taken as long as the outcomes are achieved**', for which enough guidance and literature has been provided to help out the decision makers and stakeholders in the online mission portals as well. I&D initiatives can help cities achieve treatment of used water entering into water bodies before having the entire population covered by sewerage.
Example of Puri STP and FSTP integration was praised. Participants were encouraged to copy but smartly and in a contextualised way, as examples as good as this have made it easier than starting from scratch.

As a lot of this infrastructure caters to a long-time horizon, emphasis was laid on spending a good amount of time on planning the initiatives and its activities well at the initial stages itself, to ensure that tax payers money are meaningfully utilised.
Improper used water management attracts huge penalties from NGT. Sewage Management must be hence taken seriously.

Regulatory Compliance of Hon'ble Supreme Court/ NGT directions

- Hon'ble Supreme court directions 22.02.2017
- NGT orders dated 3.08.2018, 19.2.2019, 28.8.2019, 21.5.2020 and 20.9.2020 etc., makes
  - **Sewage management** mandatory for all ULBs in the country.
  - Prosecution to authorities on Non-compliance

Penalty - NGT Order vide OA no. 593/2017 dated 28.08.2019

Class of the City/Town	Mega-City	Million-plus City	Class-I City/Town and others
Minimum and Maximum values of EC (Total Capital Cost Component) (crores Rs.)	Min. 20 Max. 200	Min. 10 Max. 100	Min. 1 Max. 10
Minimum and Maximum values of EC (O&M Cost Component) (Lacs Rs./day)	Min. 2 Max. 20	Min. 1 Max. 10	Min. 0.5 Max. 5

Launch of SBM-2.0 for funding support to sewage management

Order of NATIONAL GREEN TRIBUNAL PRINCIPAL BENCH, NEW DELHI on April 30th, 2019


14. Accordingly, we accept the report of the Expert Committee with the modification that the standards recommended for Mega and Metropolitan Cities will also apply to rest of the country. We also direct that the standards will apply not only for new STPs but also for existing/under construction STPs without any delay and giving of grace/extra time stands disapproved.

CPCB & CC may issue an appropriate Notification in the matter within one month from today.

The Application is disposed of.

NATIONAL GREEN TRIBUNAL, NEW DELHI

Mukesh Kumar Goel, CP
K. Ramakrishnan, JM
Dr. Nagin Nanda, EM

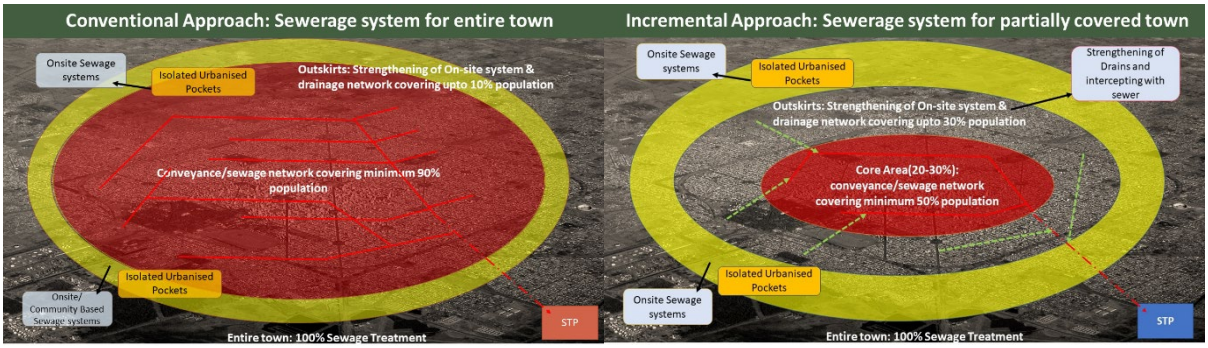
April 30, 2019
Original Application No. 1069/2018
SN

Fines imposed by Hon'ble NGT on 7 States

States	Amount (in Crores)
Maharashtra	Rs 12,000
Punjab	Rs 2,080
Rajasthan	Rs 3,000
Delhi	Rs 900
West Bengal	Rs 3,500
Telangana	Rs 3,800
Karnataka	Rs 2,900

The compensation for untreated liquid waste (sewage) is determined @Rs 2 crore per (MLD)

On above lines, for UP it works out to Rs 11,500 cr



Comparison of both the Approaches

	Class 2: Population 60,000		Class 3: Population 20,000		Class 4 and below: population 10,000	
Per capita cost (in Rupees)	Capital Cost	O&M Cost	Capital Cost	O&M Cost	Capital Cost	O&M Cost
Conventional	8,855	445	9,415	380	11,075	445
Incremental	5,450	275	5,490	220	3,000	120

Advantages over conventional approach

- Saving in Capital Cost
- Less Operational Cost
- Ease of Implementation without any capacity building
- Less Implementation time
- Affordable O&M

The discharge standards from 1986 still hold good, stricter standards could only derail the movement to unrealistic standards, thus defeating the purpose of regulating the pollution. Towns can adopt an incremental approach towards improving the treated water quality over time.
States were advised to prepare a comprehensive state used water management strategy, detailing the approach and pathways each ULB will take to ensure that all used water is treated in a reasonable timeframe. This strategy should also explore various funding options, beyond the national and state government schemes.

Targets

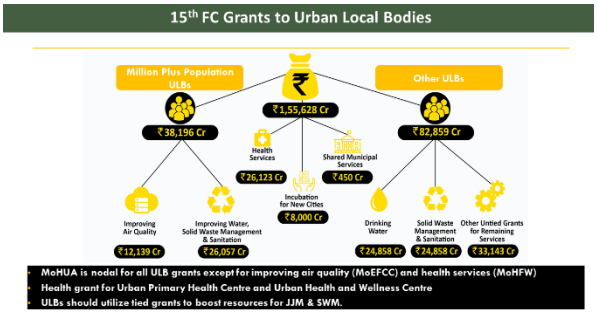
- No usedwater disposal in water bodies without treatment
- 50% town water+
- All town ODF++

Fund allocation (₹ in crores)

Component	Total Cost (Central + State/ULB/Pvt share)	Central Share	State / ULB/ Pvt share
Total Estimated Cost	1,41,600	36,465	1,05,135

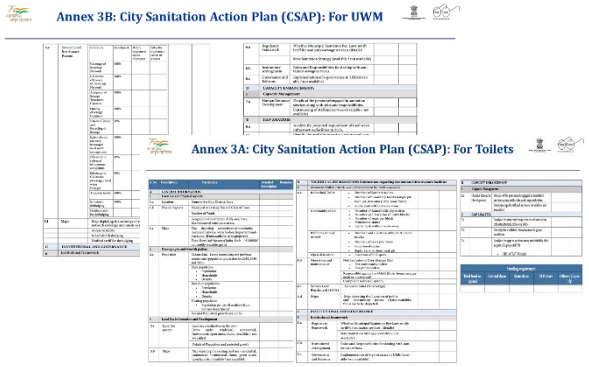
SBM 2.0 Funds Distribution between Centre, States, 15th FC and Private	
Total Central Share	26,051
15th Finance Commission	27,329
Effective amount to be borne by states (including ULB share/CSR/external aid)	36,945

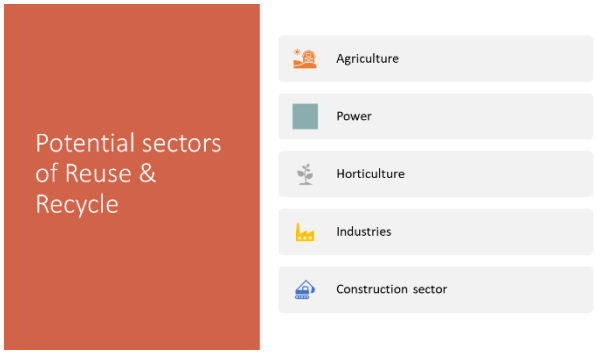
Effectively only about 40% of total funds approved under Mission to be borne by States/UTs



Funds availability summary for Implementation of SBM-U 2.0

Used Water Management		Solid waste Management	
Particular	Amount in Cr	Particular	Amount in Cr
Total Estimated Amount for UWM component (under SBM-U 2.0)	₹ 8,055	Total Estimated Amount for SWM component (under SBM-U 2.0)	₹ 1,603
Central Share	₹ 2,117	Central Share	₹ 1,236
Balance (State + 15th FC + ULB + other)	₹ 5,938	Balance (State + 15th FC + ULB + other)	₹ 367
		Total Balance (State + 15th FC + ULB + other)	₹ 6,305
		15th FC Allocation(SWM+Sanitation)	₹ 4,445
		Effective amount to be borne by State	₹ 1,859
		Annual Expense to be borne by State for SBM-U 2.0 for 5 years period	₹ 372





Shri Rohit Kakkar, introduced the concept of Emergency Response Sanitation Unit (ERSU), which are specialised task force with equipments and training to handle O&M of sewer lines and septic tanks, where otherwise manual scavenging would have been practised. ERSU aims to mechanise sewer and septic tank cleaning as much as possible. States should set up functional ERSU teams, made accessible to every ULB and district.

Session 3:

Planning and Project Management on Sewerage Systems

Shri Devang Shah, Sewerage specialist, MD, Himadri Enviro-protection

Devang shah explained the stages of implementing a UGD system on ground in chronological order:

a. Contemplating the development pattern and identification of component
b. Conceiving the project and its' planning, design engineering
c. Funding and implementation
d. Operation and maintenance
e. Regulation of asset to assure desired performance
f. Upgradation of assets to meet with the challenges at different stages and assuring project rational, preventive maintenance, remedial maintenance

In terms of deciding the capacity of the infrastructure, critical consideration to factors like design horizon and population forecasting must be given. States can also contextualise the design to match

their needs. They need to reflect from their past implementation and update their assumptions, calculation tools etc for more efficient planning. This stresses on the fact that CPHEEO manual for sewerage and sewage treatment only provides guidance which needs to be contextualised with meticulous analysis. Ground conditions, primary survey and 'common sense' must be key drivers to design a functioning solution.

Incremental evolution of the sewerage system can be carried out as the population increases, over the likely constant factors like road width, existing sewer system, etc. Devang Shah went on to further delve into a list of Do's and Don'ts of designing an underground sewerage system as given below:

	Do's	**Don'ts**
1	Study CDP and terrain with detailed survey	Lower depth at initial stretch
2	Permit connection through inspection chamber only and introduce solid trap at two locations, one at machine hole/ rob hole (MH/RH) and other at house connection point. Assure connection from house to inspection chamber (IC) and IC to MH/RH	Restrict direct connection from house to MH/RH without solids trap
3	Depth up to 4.5 m maximum, except stretches up to length of 300 m due to local hump	Depth beyond 6 m
4	Maintain slope as per design and Prefer S & S joint rather than collar joint	Never compromise on design slope, Avoid collar joint
5	Ventilating column, Drop mechanism	Never eliminate, preferably with ventilating column
6	Road reinstatement after hydrostatic test	Repair of road after rainfall or time lapse
7	Length of farthest stretch up to 2-3 km for plain, 8-10 km in hilly terrain, Max Travel time 2-2.5 hrs	Long patches yielding travel time of more than 6 hours to avoid septicity
8	Prefer trunk sewer, if terrain is flat	Series of pumping for sewage transmission.
9	Provision of Grit accumulation in pumping wet well, separate pumps of appropriate capacity & head	Depth below lowest sewer to pumping wet well below 3 m shall not be permitted
10	Form a comprehensive contract in a single bid so as to assure accountability and Start execution from tail to head, remove dummy constructed at initial stage with long O & M period	Never split contract for civil, E & M, SPS, STP works.

11	Analyse the sewage parameters and select energy efficient system for treatment plant	Avoid assumption on parameters and avoid monopoly works for treatment plant
12	Level based sensor operated pumping with dual control (manual/ automatic, SCADA)	Manual operation only
13	Monitoring of various parameters pH, BOD, SS and viscosity	Manual sampling
14	Maintain power factor for pumping system	Manual mode
15	Separate control room for placing panel etc due to inflammable nature of gases generated in wet well	Placing on top of wet well

Policies like 'Polluter Pays' need to be enforced to imbibe ownership and a sense of responsibility among the citizens. An example of solid trap was given where if households did not have any stake in O&M, would throw solid waste through sewerage networks leading to blockages. However, if fined or made to contribute to the implementation, householders would be more mindful about the Do's and Don'ts of the infrastructure. He also highlighted the key issues and challenges that are encountered during implementation and Operations & maintenance of an underground sewer system (USS);

Implementation	**Operations and Maintenance**
a) Maintaining slope and drop as per design, workmanship, diverting old soak well flow to new network b) Underground utilities like water supply, electric/ telephone cable, OFC, Gas pipeline, old soak well c) RoU, land acquisition & permissions from various authorities d) Foundation of existing houses on narrow street, collapse of earth, dewatering e) Refilling of trenches and compaction of narrow patch to avoid future settlement	a) Clogging, Overflowing sewers, Odor (lack of ventilating columns) b) Crown corrosion and cave-in c) Interconnectivity of sewerage and storm water drainage d) Energy consumption, Lack of generator to operate pumps during staggering e) Admitting waste from local home product based industrial waste {jaggery/ sugar/ namkeen/ sweets/ local food} f) Connectivity to household from level perspective and flow generation

The Cost aspects in context of sewerage implementation in Gujarat were discussed, with the highlights given as below:

- **Primary connection:**
  HH inspection chamber to road: Rs.1000-2500 per capita
- **Secondary connection:**
  Inspection chamber to Manhole- to trunk sewer: Rs. 6000-18,000 per capita depending on terrain
- **Sewage treatment:**
  Rs .1000 per capita
- **Road re-instalment:**
  Rs 500 per sq meter for asphalt and Rs. 1000 per square meter of concrete
- **OPEX:**
  2.5% of CAPEX
- **Overall time for commissioning:**
  2-3 years

Queries and Discussions

Q: How to go about sewer network implementation in low population-low density areas?
A: As sewerage network and STPs are concerned, ULBS must focus on the high-density area first, and cover as much population as possible in a cost-effective manner, as suggested under the SBM 2.0 approach.

Shri Chaurasia reiterated the direct relationship between self-cleaning velocity and overall depth of the sewer system and thus the overall cost of the system. Self-cleansing velocity should be adapted to match the ground conditions

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Q: Apart from the standard jetting and sucking equipment are there any cheaper alternatives that can be used for larger diameter sewers?
A: The larger sewer pipes have less tendency for clogging, as the flow velocity is usually much higher than self-cleaning velocity. However, before purchasing any such equipment a third-party entity with equipment and capability should be engaged for the operations and maintenance, so that even the ULB gets a better understanding of management methods.

Session 4:

Steps to accelerate Used Water Management, Guided Plenary

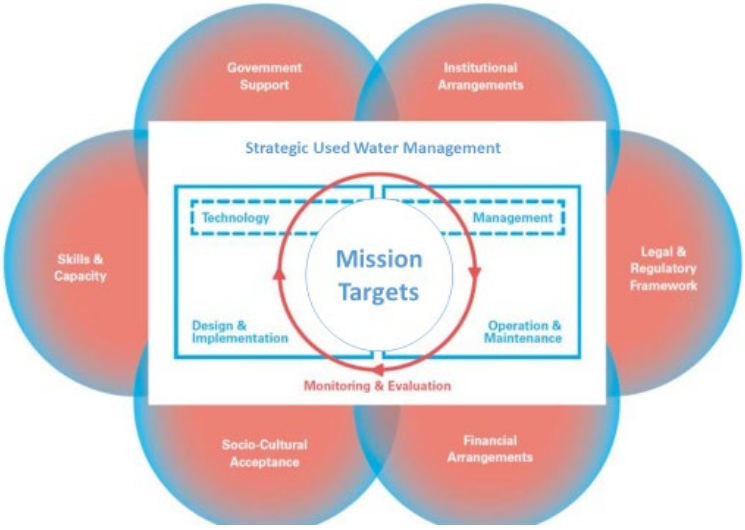
Shri. Sasanka Velidandla, Advisor, WASH Institute

This session started with discussion of approaches for all ULBs to achieve 100% ODF ++ and 50 % Water+ standard by 2026. Strategic Used Water Management involves integration of many aspects: Government support, Institutional Arrangements, Legal and Regulatory framework, Financial Arrangements, Socio cultural Acceptance, Skills, and Capacity, etc.

Queries and Discussions

Q: Mr. Sasanka engaged the participants to reflect and discuss on the obstacles faced in UWM interventions so far

A: Funding limitations are always pointed out; however we need to reassess the existing funding and start connecting it to the desired outcome. Participants from Haryana, Goa, Tripura and Uttar Pradesh further added that the current situation and gaps must be assessed and a line of action should be prepared, and then take one step at a time, carefully utilizing the available funds. Participants from Uttar Pradesh reiterated an incremental approach to wastewater management planning.



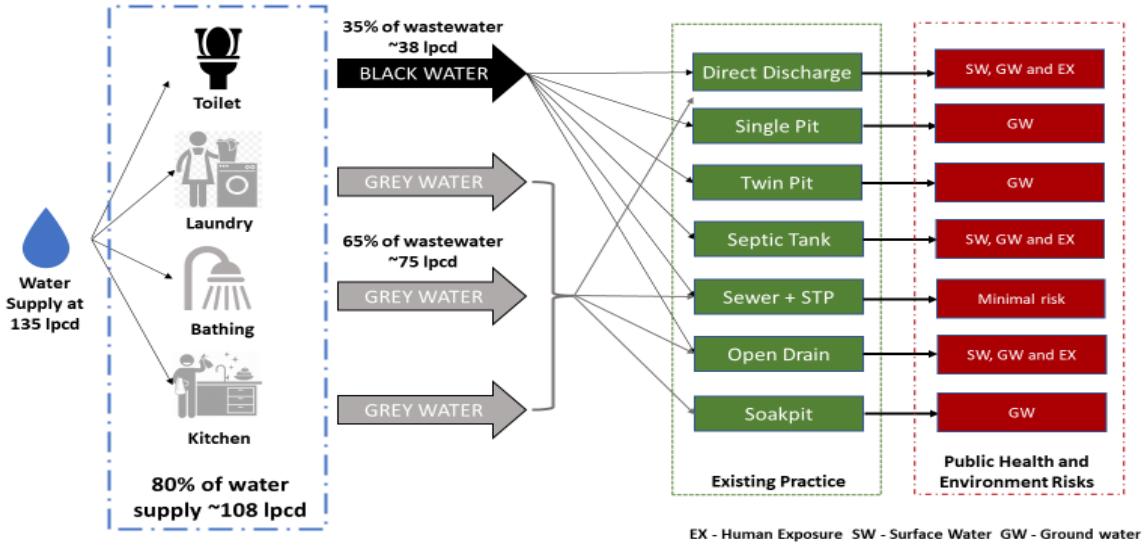
Queries and Discussions

Q: Shri Sasanka encouraged the participants to discuss challenges and learnings from their respective states that have helped them build upon the strength and weaknesses of their strategies. The participants actively contributed to the discussion.

A: The key learnings can be summarised as follows:

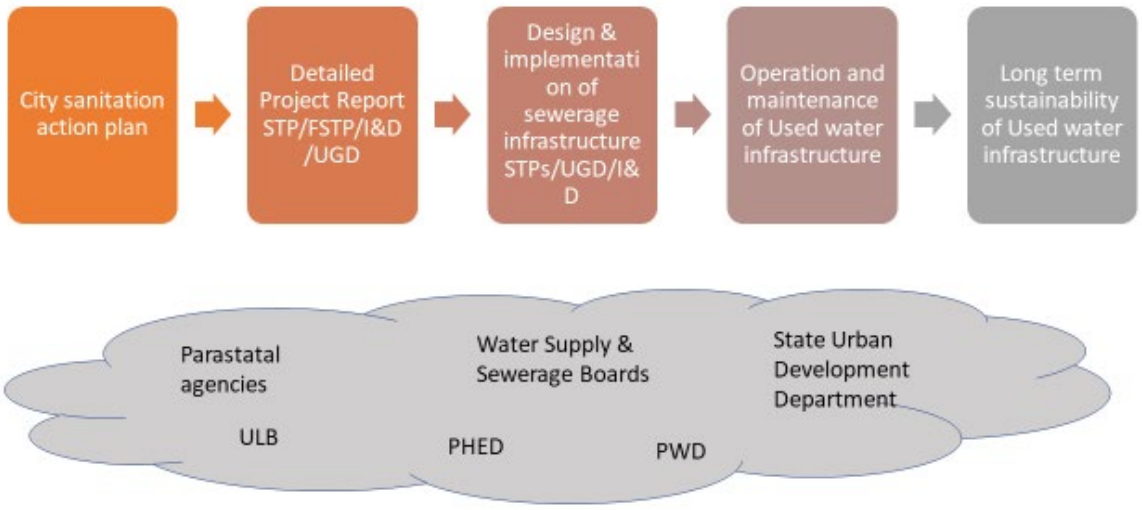
- Identify and remove/reduce bottlenecks
- One size and type doesn't fit all; Decision makers need to take a good understanding of the baseline and contextualize the solutions that have proven to be effective
- Every solution has an associated set of risks and management protocols with respect to Environmental and Public Health
- Shri Sinha, Superintendent Engineer, Bihar further added that **aiming for lower risks means higher is the investment required**. However, these investments are essential to keep moving ahead, to which representatives from Karnataka added the need for a granular planning approach.
- Shri Jain, Chief Engineer, Madhya Pradesh added that good planning can reduce risks
- This brought the discussion on suitability criteria for sewer system to various context, and the key factor that was agreed upon was Population density. The states were requested to suggest the value ranges identified so far in such interventions.
- Shri Praveen, Director, Suchitva Mission, Kerala suggested 1500 persons/km^2; above which sewer network shall be preferred and below which on site sanitation systems should be opted for.
- Shri Mohapatra conveyed that Odisha still goes by the metric of population where if it is greater than 1Lakh, sewer network is opted for in ULBs lower than 1Lakh population, OSS systems combined with proper FSSM are opted. This makes collection of user fees for O&M easier.
- Shri Kakkar suggested that a population density of greater than 4000/km2 brings the length of sewer to 1m per capita, which is reasonable investment.
- Representatives from Meghalaya stated the challenges to implement sewer system in hilly terrains, thus FSSM being the go-to solution. However narrow roads still hold up as a challenge.

Furthermore, Shri Praveen, Suchitwa Mission Kerala added that Affordability and Equity both play a strong role to imbibe inclusivity in the SBM2.0 initiatives.



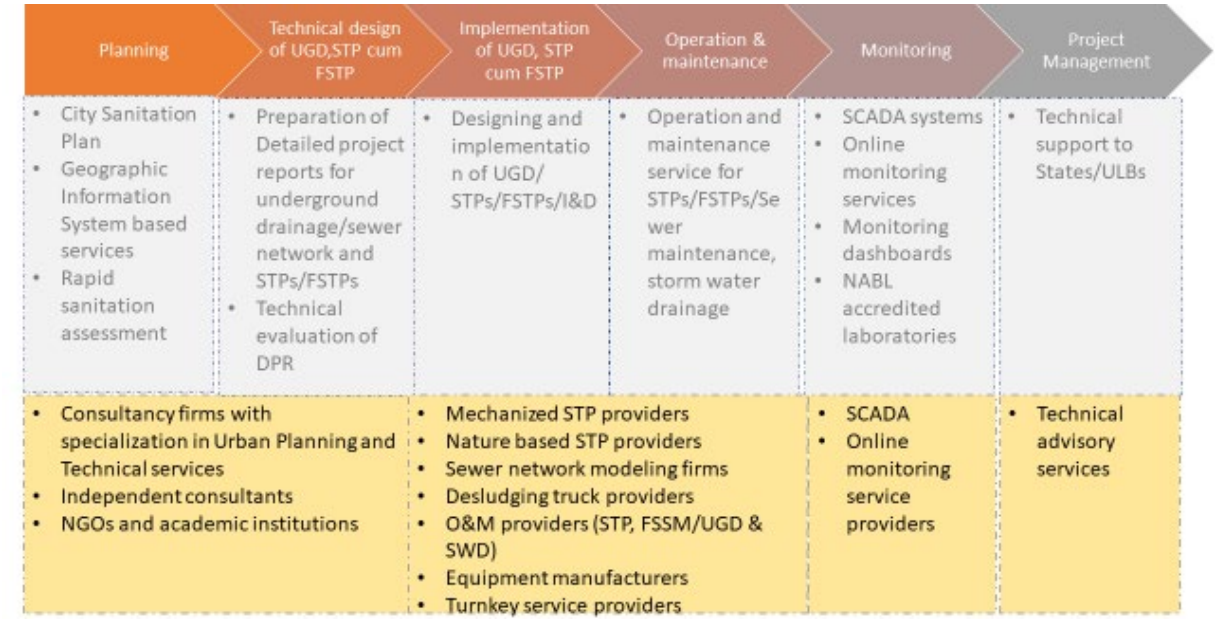
Shri Sasanka carried on to share his own understanding of the entities and their role in the field of urban Used water Management. After listing out the entities, he requested participants to quote examples from their states on the roles various institutions play and how they have helped in UWM implementation in the past.

What roles are institutions to play in UWM?



The capacities that are required to be built to accelerate UWM are as follows:

What Capacities are required to accelerate UWM?



States added their suggestions to accelerate the UWM initiatives.

- Chief Engineer, PHED, Andhra Pradesh suggested that minimizing the number of interdepartmental transfers of the project in the whole process starting from design to implementation would cut down on the delays

- Smt. Archana from DMA, Bangalore suggested that engagement of a special cell that bridge across the required regulatory bodies could bring more focus and momentum to the mission initiatives at a state level.

- It was agreed by the entire plenary that the overall cost of establishing the sewerage network is typically much higher than that of the sewage treatment plant, making the total capital cost of conveyance infrastructure for used water is higher than the capital cost of its treatment infrastructure. Therefore, careful and thorough planning should be utilized to design and phase the implementation of the sewerage network.

Key takeaways summarized from the discussion by Shri Sasanka from the session were as follows:

- Multiple solutions have to be planned in every town to achieve desired outcomes
- The key decision is to arrive at the right mix of solutions for each town based on local context and allocate resources accordingly
- A state level technical strategy that caters to towns of different hydrogeological and other contexts is therefore important to formulate
- Institutional structures and roles/responsibilities for various aspects of UWM project implementation should be clear in a state
- Successful UWM implementation will mean "multi-solution", multi-stakeholder" approach that balances public health and environmental risks against costs to achieve ODF+ outcomes

Shri Sasanka closed this session with a glimpse of the fund release mechanism for the UWM initiatives of SBM U 2.0.

Used Water Management – Fund Release

First installment (40%)

i. Responsible Sanitation Authority (RSA)
ii. Submission of City Sanitation Action plans (CSAP)
iii. Receipt of SLTC approved proposals for a city along with at least 5 years' O&M contract post commissioning, and its funding arrangements;
iv. Annual progress plan of State/UT of ODF++ and Water+ cities;
v. Action plan for revamping all non-functional existing STPs/FSTPs in
vi. ULB has provided for encumbrance free land for setting up STP/ STP-cum- FSTP.

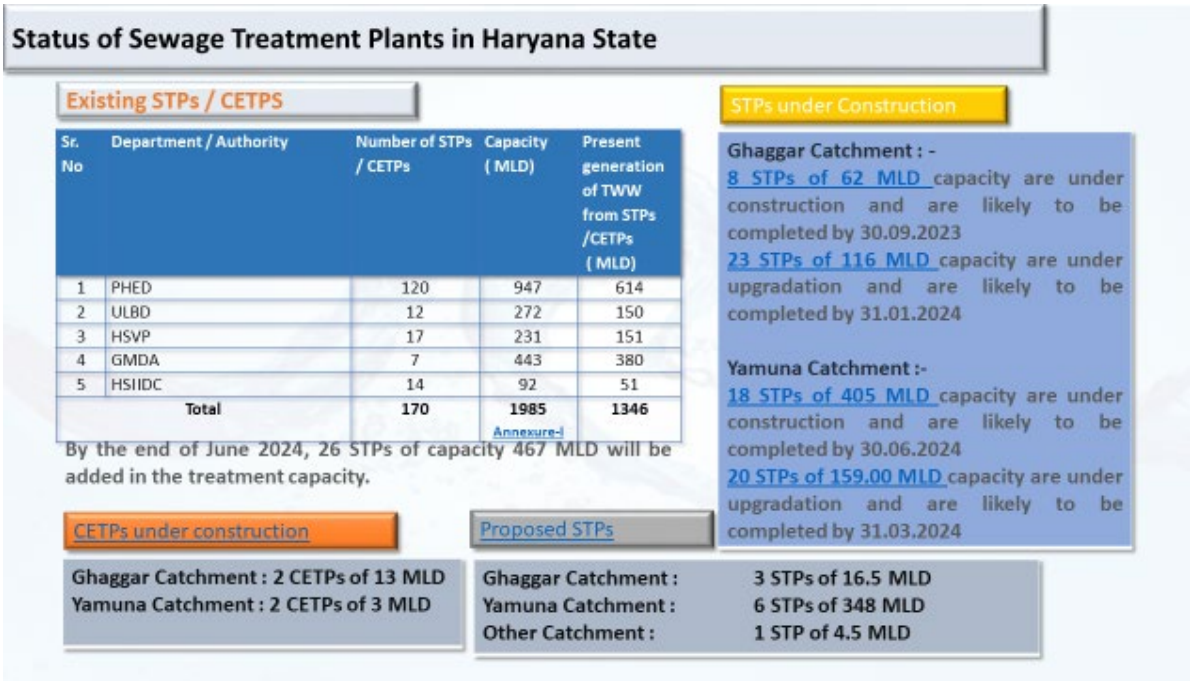
Second installment (40%) :

i. Functional Sanitation Response Units (SRU) set up;
ii. Portion of O&M being recovered through user charges;
iii. City is certified ODF+ at least once;
iv. The STP/FSTP (in case of co-treatment) sub-project has achieved at least 10% physical progress on ground.
v. Existing STP/FSTPs are made functional
vi. Work awarded for non-functional STPs/ FSTPs requiring major repairs/ rehabilitation

Third installment (20%)

i. UC submitted for 75% of second installment
ii. The Interception & Diversion drain & related conveyance work has been completed to the extent of at least 80% of physical process;
iii. STP sub-project work has been completed to the extent of atleast 60%;
iv. Non-functional STPs/FSTPs made functional

Session 5: Presentation by States, Approaches, Strategies and learning implementing UWM -Haryana on Rapid implementation of STPs across state:



Status of Sewage Treatment Plants in Haryana State

Existing STPs / CETPS

Sr. No	Department / Authority	Number of STPs / CETPs	Capacity (MLD)	Present generation of TWW from STPs /CETPs (MLD)
1	PHED	120	947	614
2	ULBD	12	272	150
3	HSVP	17	231	151
4	GMDA	7	443	380
5	HSIIDC	14	92	51
	Total	**170**	**1985**	**1346**

Annexure-I

By the end of June 2024, 26 STPs of capacity 467 MLD will be added in the treatment capacity.

STPs under Construction

Ghaggar Catchment : -
8 STPs of 62 MLD capacity are under construction and are likely to be completed by 30.09.2023
23 STPs of 116 MLD capacity are under upgradation and are likely to be completed by 31.01.2024

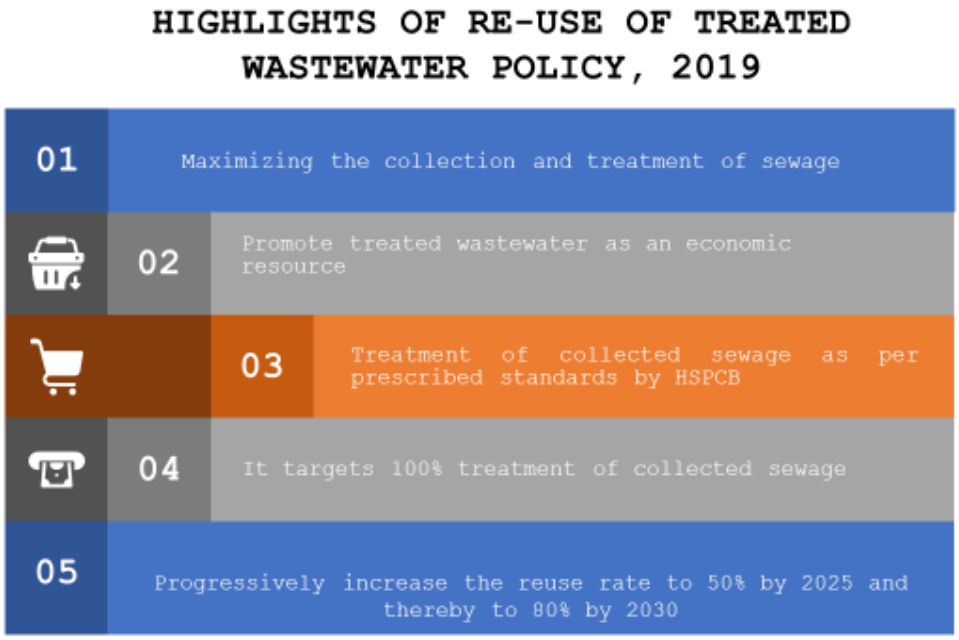
Yamuna Catchment :-
18 STPs of 405 MLD capacity are under construction and are likely to be completed by 30.06.2024
20 STPs of 159.00 MLD capacity are under upgradation and are likely to be completed by 31.03.2024

CETPs under construction

Ghaggar Catchment : 2 CETPs of 13 MLD
Yamuna Catchment : 2 CETPs of 3 MLD

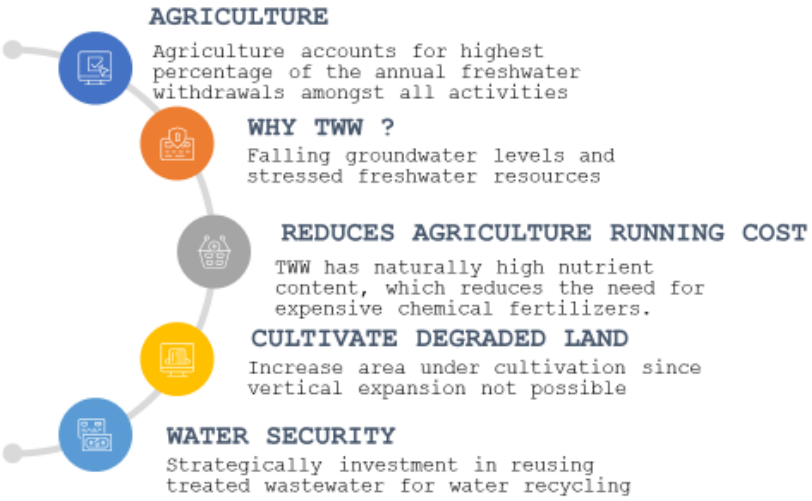
Proposed STPs

Ghaggar Catchment :	**3 STPs of 16.5 MLD**
Yamuna Catchment :	**6 STPs of 348 MLD**
Other Catchment :	**1 STP of 4.5 MLD**

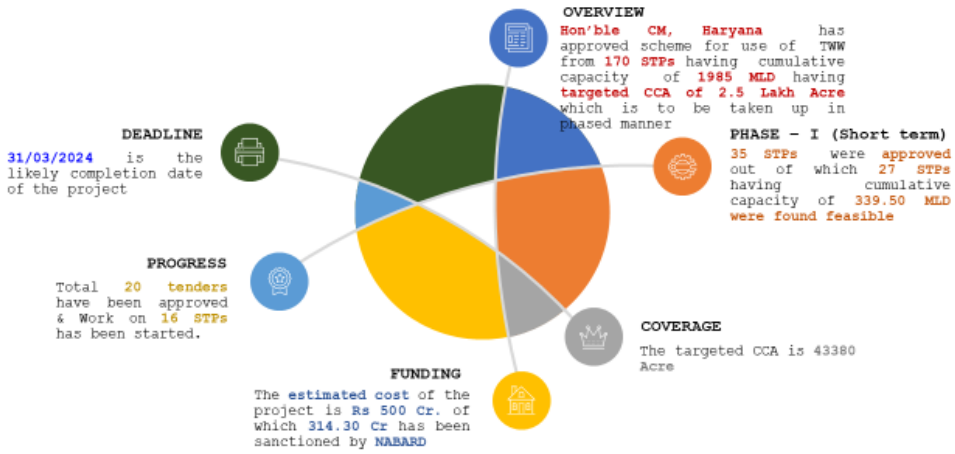


- State has drafted Wastewater policy, 2019 with aim to use 80% treated wastewater
- State has excess treatment capacity: 170 Existing STP/CETP comprising 1985 MLD capacity, with current generation at 1346 MLD.
- Dept/Authority involved: PHED, ULBD, HSVP, GMDA, HSIIDC
- Stricter norms prescribed by HSPCB, and adopted to achieve high quality treated water, and thus improve the reusability

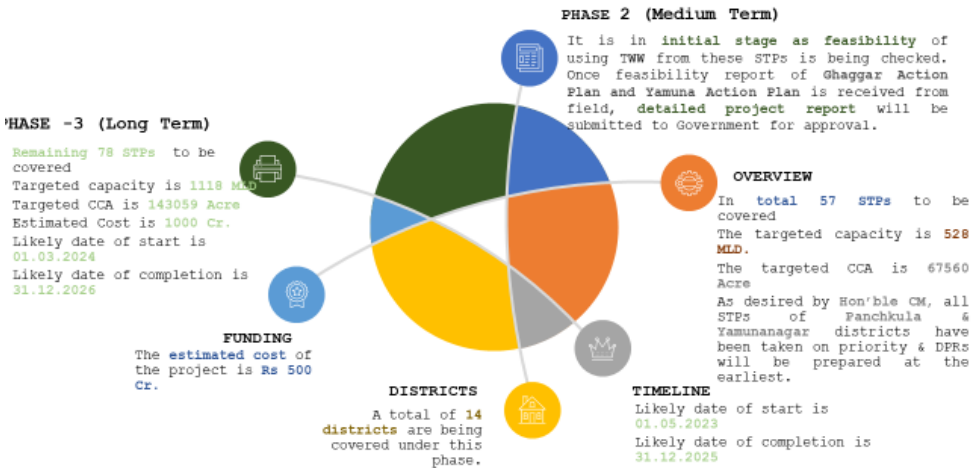
IMPORTANCE OF TWW IN IRRIGATION



PROGRESS MADE IN INTRODUCING TWW IN MICRO-IRRIGATION



WAY FORWARD USING TWW THROUGH FLOW IRRIGATION



To achieve higher quality treated used water SBR/MBBR + Ultra filtration and MBR have been found to be reliable, thereby catering to farmers, industries and institutional buyers

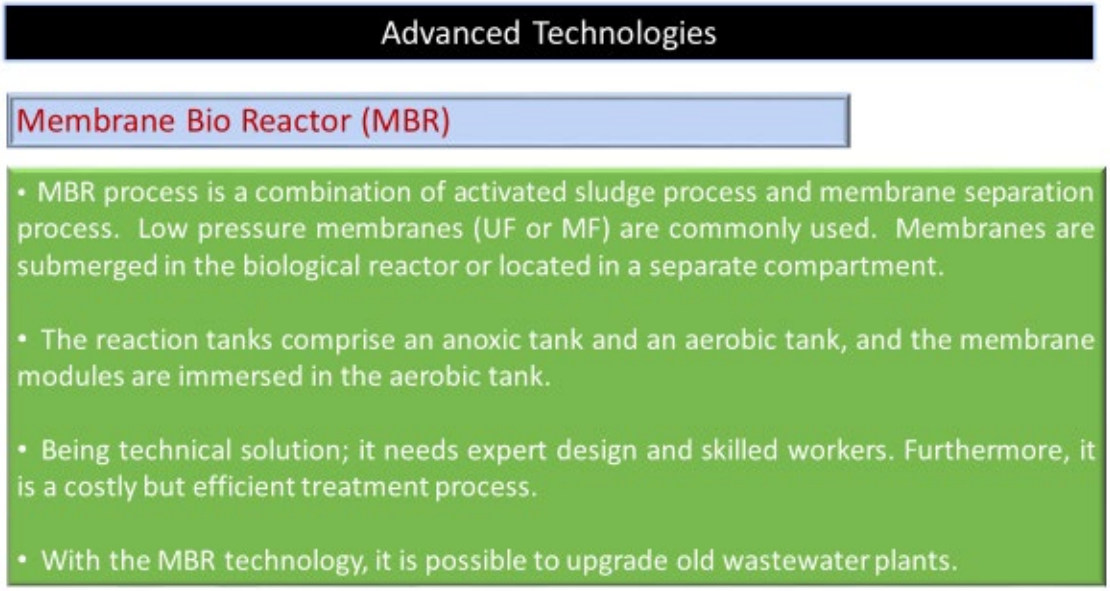
Comparison of key treatment technologies along critical parameters

Technology	Land requirement	Capital cost	O&M cost	Electricity required.	Effluent Quality	
	Ha/ MLD	INR lakh / MLD	INR lakh / MLD	kWh/ ML treated	BOD, mg/ lit	TSS/ SS, mg/ lit
Nature Based Technologies						
Waste Stabilization Pond (WSP)	0.5 - 1.0	30 –60	0.6 –2.5	negligible	15-50	SS: 75-125
Root Zone Aeration/ Contructed Wetland	0.6-1.5	30-150	1.2-3.0	negligible	20-30	SS: 60-90
Mechanised Treatment Technologies						
Extended Aeration (EA)	0.15 - 0.25	90-200	7.0-12.0	180 - 225	20-30	SS: 50-100
Aerated Lagoon (AL)	0.27 – 0.4	40-60	1.5-3.0	15-20	25-50	SS: 40-150
Sequencing Batch Reactors (SBR)	0.10 - 0.15	150-300	10.0-20.0	150 - 200	<5	TSS< 10
Moving Bed Biofilm Reactor (MBBR)	0.04 - 0.05	170 - 230	8.0-12.0	200 - 250	<10	TSS: <20
Activated Sludge Process (ASP)	0.15 - 0.25	80 - 170	6.0-10.0	180 - 225	20-30	SS: 20-50
Trickling Filter (TF)	0.25-0.50	50-80	2.0-5.0	150-180	25-30	---
Up flow Anaerobic Sludge Blanket (UASB)	0.2 - 0.3	40-60	2.0 -3.5	10.0-15.0	70-100	TSS: 75-100
Onsite treatment Technologies						
Decentralised Treatment System (DTS/DEWATS)	0.13 – 0.14	80 - 200	2.0 – 2.5	negligible	<30	TSS <10

Advanced Technologies

SBR/MBBR followed by Ultra Filtration

- UF is a pressure driven membrane separation process that removes suspended particulate matter from water.
- In addition, it removes some dissolved compounds with high molecular weight, including organics and colloids.
- Microfiltration – pore size 0.1 – 1 micron, Ultra Filtration – pore size .005 - .05 micron, Nanofiltration – around .001 micron, RO – let water get through and reject almost all salts.
- The membrane provides an absolute barrier, protecting the public from pathogens. As well, disinfection requirements are greatly reduced as dosing rates of chlorine, UV and/or ozone are much lower since there is essentially no suspended solids left in the filtered water.



Queries and Discussions

Q: What measures are taken to achieve the standards for F. Coliform?

A: Effective Chlorination

Q: Are there any lower cost alternatives to the solutions adopted by Haryana?

A: Considering the demand for higher quality of water application for drip irrigation, higher order treatment is sought. The treatment technologies adopted are according to the quality standards that the reuse market is demanding, and these were found to be the most cost effective.

Q: What are the risks involved with using chlorinated water for irrigation?

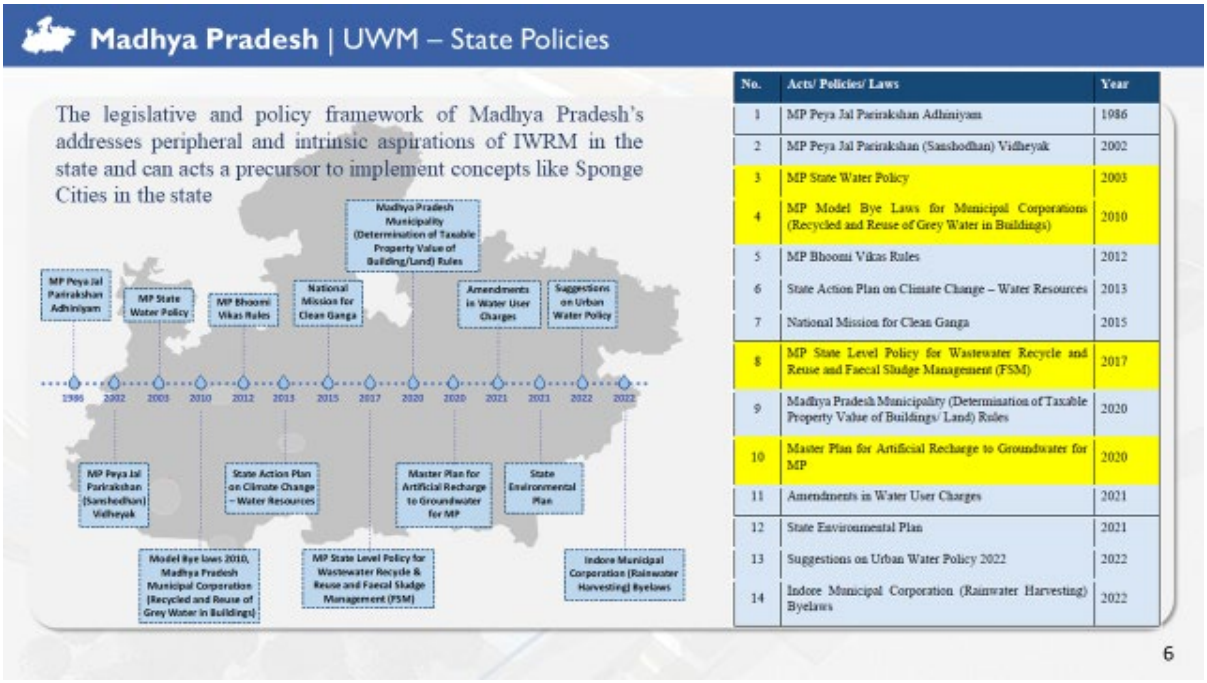
A: The quality of treated water is achieved with due consideration of the demand from the farmer's end. The treatment process is designed to achieve higher acceptability.

Madhya Pradesh on Integrated approach for UWM

- Sewage generation: **2184 MLD**
  Operational STPs: **1312 MLD**; Utilized: **696 MLD**
  Treatment capacity gap: **1488 MLD**

- 315 FSTP of 16.06 MLD in 315 ULBs + 3 Bioremediation plants in 2 ULBs

- Timeline of State Policies that aspire to achieve Integrated Water Resourced Management are as follows:



No.	Acts/ Policies/ Laws	Year
1	MP Peya Jal Parirakshan Adhiniyam	1986
2	MP Peya Jal Parirakshan (Sanshodhan) Vidheyak	2002
3	MP State Water Policy	2003
4	MP Model Bye Laws for Municipal Corporations (Recycled and Reuse of Grey Water in Buildings)	2010
5	MP Bhoomi Vikas Rules	2012
6	State Action Plan on Climate Change – Water Resources	2013
7	National Mission for Clean Ganga	2015
8	MP State Level Policy for Wastewater Recycle and Reuse and Faecal Sludge Management (FSM)	2017
9	Madhya Pradesh Municipality (Determination of Taxable Property Value of Buildings/ Land) Rules	2020
10	Master Plan for Artificial Recharge to Groundwater for MP	2020
11	Amendments in Water User Charges	2021
12	State Environmental Plan	2021
13	Suggestions on Urban Water Policy 2022	2022
14	Indore Municipal Corporation (Rainwater Harvesting) Byelaws	2022

The treated used water reuse across various ULBs of Madhya Pradesh are as follows:
Treated water is reused in Gardens, Road& Vehicle Cleaning, Construction, Horticulture & Filling of Ponds , industries & fire fighting.

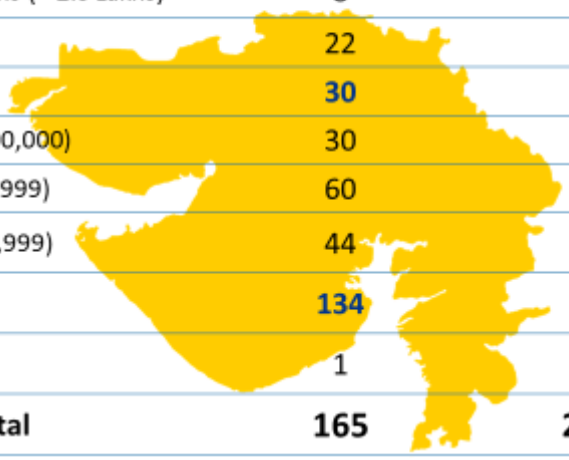
Out of a total STP capacity of 251.53 MLD, about 105 MLD is being utilized and 22 MLD is getting reused, thus a lot of scope still remains to connect the market to the available treated water resource.

Madhya Pradesh added that the selling process/tariff of treated used water need to be made attractive to the potential buyers. It was made cheaper than freshwater for farmers to improve on the sale. It was agreed by the panel that the tariff should not be made to recover the Capital cost invested for treatment in the current scenario, instead they should be designed to improve acceptability and sale of the same.

Gujarat on sewerage systems for small and medium towns

Classification of ULBs - Gujarat State

S. No	ULB Classification	No. of ULBs	Total Urban Population (2011)
1	Municipal Corporations (> 2.5 Lakhs)	8	1,46,02,138
2	Class A > 1 Lakh)	22	33,62,261
		30	**1,79,64,399**
3	Class B (50,000 to 1,00,000)	30	20,27,478
4	Class C (25,000 to 49,999)	60	20,06,030
5	Class D (15,000 to 24,999)	44	8,43,193
		134	**48,76,671**
6	Cantonment	1	7,588
	Total	**165**	**2,28,48,688**



- The total sewage treatment capacity is about 3378 MLD against a total estimated sewage generation of 5013 MLD leaving about 32.6 % (1635 MLD) of gap that the future STPs need to accommodate. Out of the existing treatment capacity about 796 MLD sewage generated is reused.

- **O&M:** State assistance for O&M is tapered down across five years as 90%-75%-50%-25%-0%; transitioning to 100 % municipal run O&M;
  O&M components include Energy charges, manpower, repairing works and fuel.

- **Policy for Reuse of Treated Waste Water (TWW), 2018**: Maximize collection and treatment of Sewage and reusing the treated wastewater sustainably; Reduce dependency on freshwater and promote treated water as an economic resource
  - Targets 80% coverage and collection of sewage in all towns
  - 100% treatment of collected sewage
  - 25%freshwater consumption to be offset from treated wastewater
  - Reuse 70% of TWW by 2025
  - Reuse 100% of TWW by 2030

- **Reuse , Recycle and Rejuvenate concept for Used water Management:**
  1. Prevent contamination by treating to discharge standards or higher
  2. Adopt treated wastewater as an additional source of water
  3. Develop financially sustainable sewage treatment projects
  4. Promote treated wastewater as an economic resource

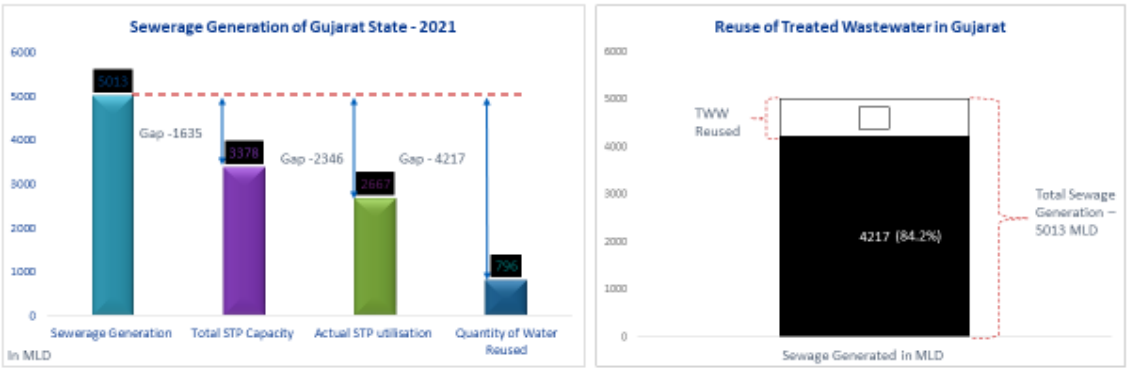
- **Implementation timeline**

Targeting a minimum of 25% of freshwater consumption to be replaced with treated used water or the entire treated used water, the time allocated to ULBs differ on basis of scenarios:

- **Scenario 1:** Both UGD and STP present: Maximum of 1 year to achieve target stated above
  Scenario 2: Only UGD exists but no STP: Maximum of 6 months from date of operations
  Scenario 3: No UGD or STP: Maximum of 4 years

2.3 Existing Scenario in Gujarat

Existing Sewage generation and STPs Capacity in Gujarat



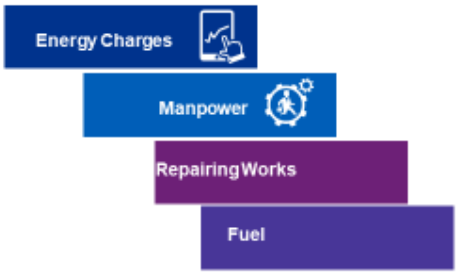
Note

- There is 32.6% (1635 MLD) gap in Total STP Capacity compared with Total Sewage generated
- 15.8% (796 MLD) of Sewage generated is Reused

Source: STP - CPCB Report - 2021

Operation & Maintenance

- To ensure safe and optimal function of sewerage system GoG is providing financial assistance to the ULBs for operation and maintenance of sewerage system



Financial Assistance

Year	Assistance from State Government for management and maintenance expenses	Share of the municipality
1st Year	90%	10%
2nd Year	75%	25%
3rd Year	50%	50%
4th Year	25%	75%
5th Year	0%	100%

The following assistance is provided by the State Government for O&M to the population of the year 2011 as follows:

Class of Nagarpalika	UGD has been completed with STP (in Rs per capita)	UGD has been completed without STP (in Rs per capita)
A	290	153
B	290	138
C	207	120
D	145	120

Policy for Reuse of Treated Wastewater, Gujarat 2018

Government of Gujarat has launched a policy for reuse of Treated Waste Water on 28th May, 2018

VISION

- Maximize **collection and treatment of Sewage Reusing the treated wastewater** sustainably
- Reduce **dependency** on freshwater
- **Promote treated water** as an economic resource.

Objectives

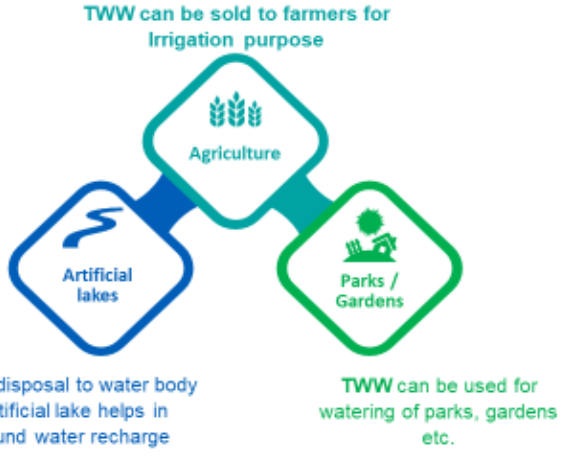
- To reach **minimum 80% coverage** and collection of sewage in all municipal towns.
- To reach a level of 100% treatment of collected sewage as per the prescribed standards.
- To reuse at least **25% of total freshwater** consumption from Treated Wastewater (TWW) **within the time limit** set under policy by every municipal body.
- To reuse **70%** of TWW by **2025.**
- To reuse **100%** of TWW by **2030**

Sustainable Used Water Management in Small Towns

Used Water scope in Small Towns

- Small towns create a **unique challenge** as they exist at the nexus of **urban and rural dynamics** hence play a **strategic role** in bridging the gap in access to safely managed sanitation services, as well as the **gap between wastewater collection and final treatment.**
- Small towns are **growing rapidly** and struggling to meet the **increased demands of wastewater collection and treatment**.
- Smaller towns are close to the ideal market for end-use products of wastewater treatment such as treated wastewater for **irrigation or biosolids for fertilizer** as compared to larger towns.

Sustainable use of Treated Wastewater in Small Towns



Case Study – Reuse of Treated Wastewater in Anjar and Gandhidham ULBs of Gujarat

- Anjar & Gandhidham ULBs are located adjacent to each other in drought-prone Kutch District of Gujarat
- Welspun India Limited, 40 MLD is required, They have set up STP
- Reduced burden on freshwater from the Narmada River

S. No	Municipality	Treated Wastewater Quantity (MLD)	User	Present Status
1	Gandhidham	20	WELSPUN Ltd.	• Welspun Ltd. Is lifting raw sewage from pumping station in Gandhidham and Oxidation Pond in Anjar • Wellspun pays Rs 0.424 per KL to the ULBs based on quantity lifted (Rs. 61.9 Lakhs per annum revenue for 40 mld)
2	Anjar	3		

Case of Uttarakhand

Uttarakhand has about 20% of population connected to sewers, while the steep slopes prove to be a major challenge in gaining higher coverage. The other challenge faced is the unavailability of suitable land parcels for treatment infrastructure.

Therefore, Onsite sanitation systems have been adopted and due consideration to solutions like FSTPs and Mobile Treatment Units is being given.

Considering the hilly terrain and sparse habitation, it was highlighted by the representative that the sewered approach is a challenge.

Creation of Infrastructure

- Connecting all the urban areas is not suggested in Uttarakhand due to following reasons:
  - Capex and Opex of sewerage systems is very high.
  - Economic condition and affordability of urban population is comparatively lower in Uttarakhand to pay for high O&M cost of sewerage systems.
  - Decentralized solutions with a combination of sewerage and septage management is preferred for states like Uttarakhand.

- Following low cost sewerage systems can be adapted for Indian cities:
  - Faecal Sludge Treatment Plant (FSTP): to cater the OSS dependent population.
  - Co-treatment in STP: to utilize the existing infrastructure.
  - Mobile treatment units (MTU): to serve the areas where generation is low.
  - Septic tanks and soak pits: to ensure no waste water is disposed directly and unsafely into the environment and that it is contained and treated scientifically.

Vision and Way Forward

- Challenges and strategies:
  - Laying sewer line in hilly area is a big challenge. Evacuation of septage from individual septic tank is also A big challenge because of lead of up to 200 meter and lift up to 50 - 60 meter with respect to approach road.
  - High suction vehicle for septage suction were designed with the help of septage vehicle supplier costing about 35 lakhs and with extreme case MTU (mobile treatment unit).

- Learning from the state experience
  - Co-treatment
  - Cluster approach
  - MTU (mobile treatment unit)

It was agreed that Used water management requires a multi-stakeholder, multi solution approach and there is an urgent need to address it, as the consumption of freshwater needs to be reduced as soon as possible. Greywater flowing through drains cannot be considered to be low strength wastewater, as different loads of pollutants enter into these unregulated drains.

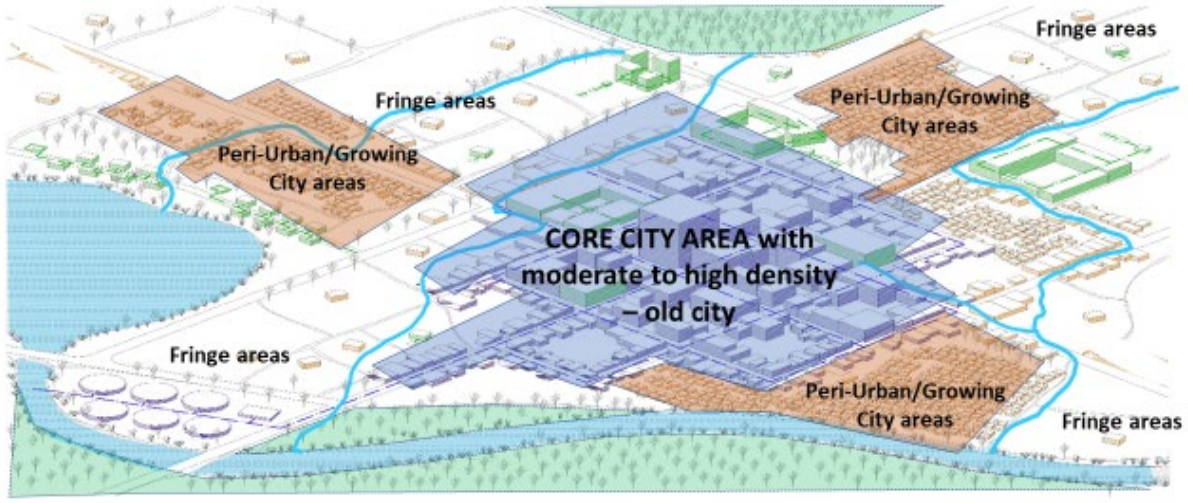
Day -2

Session 7:

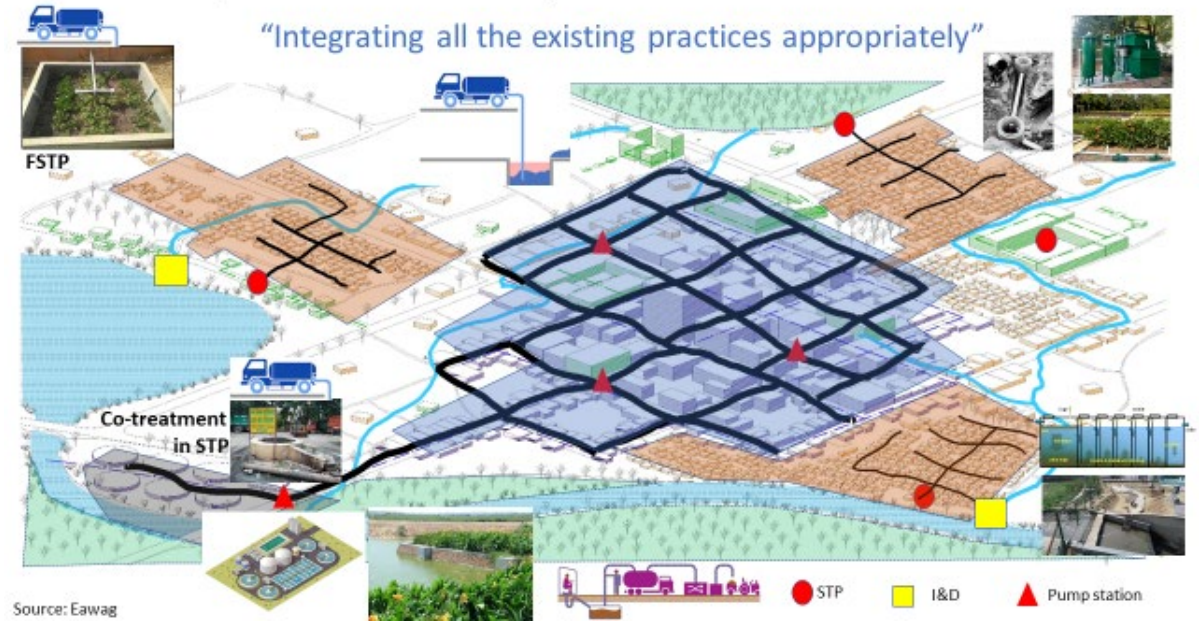
Scaling up Decentralised Wastewater Management and its Reuse in Small and Medium Towns

Shri. Rajesh Pai, Technical Advisor, WASH Institute

Typical Urban Landscape



Proposed solutions for Citywide UWM to achieve Water Plus



With the due acknowledgement and learnings from the work done so far in the field of Used Water Management, Shri Rajesh Pai highlighted that the solution for UWM can be classified into 4 approaches:

- **Large cluster:** Centralized network system and STP for core/ high population density area
- **Small cluster:** Decentralised network system and STP
- **Management of faecal sludge from on-site containment system:** STP by co-treatment/ FSTP
- **Management of used water flowing in the drain:** Intercept and divert to STP

All approved technologies can be utilized to employ these approaches. Decentralized approach has a lower scale and thus cost of construction, which reduces the risk involved in each decentralized system when compared to a centralised system. The lower costs also give decision makers the flexibility to improve their UWM coverage. The factors leading to failure of Decentralised systems are as follows:

- **Financial Issues:** Cash flows and its uncertainty, No earmarked funds for O&M
- **Quality Issues:** Under/Overdesigned systems; Low quality components
- **HR Issues:** Lack of skilled operators and job perception
- **Regulatory issues:** Consent process uninformed, Negligible inspections; Corruption in lab testing; Periodic tests not enough-real time monitoring; Low accountability and alignment among actors

Enabling Factors for Scaling up DUWM

- Availability of Informed choice material/know-how for technology planning, selection and implementation
- Appropriate finance for implementation, operation and maintenance
- Involving key stakeholders, partnerships and ensuring responsibilities are fulfilled
- Developing and regularly updating knowledge and skills (social/technical/managerial)
- Adapting governance and management measures (Institutions, Policies, Regulations)

Why do systems fail?

Financial Issues	• Cash flow and interruption during construction • No earmarked funds for O&M • Seen as a cost center, little benefit
Quality Issues	• Under-designing systems • Cheap/low quality components
HR Issues	• Lack of skilled operators and Job Perception • Low pay attracts low quality players
Regulatory Issues	• Consent process is uninformed • Negligible inspections • Corruption in lab testing • Periodic tests not enough—real-time monitoring • Low accountability and alignment among actors

Financial support from Government & Private sector

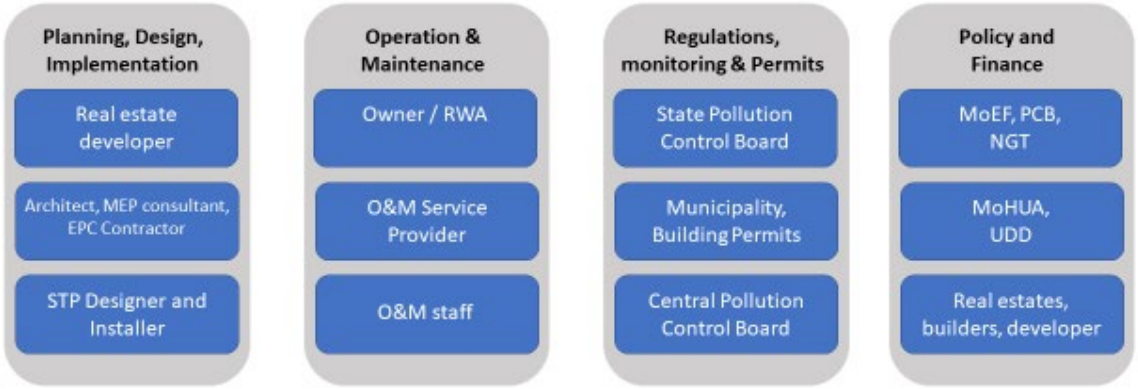
Typical costing for DUWM - Cluster level/neighborhood level (100KLD, 1000pop)

Collection / Conveyance through pipes (BW+GW)	INR 4000 – 7000 per capita (includes all components)
Treatment / Reuse / Disposal	INR 30 – 50 Lakhs - nature-based, 20 – 30 Lakhs -electro-mech
O&M Cost	0.5 – 2% nature-based, 6 – 8% for electro-mech, 1% for sewer network (capex)

Funding opportunities from various sources:

Main Urban Programs	Dedicated Sanitation Programs	Programs of other Ministries	Finance Commission	Private Finance
AMRUT	Swachh Bharat Mission	Namami Gange	Finance Commission	CSR funds
HRIDAY				Loans from commercial banks
Smart City Mission				MFI
Housing For All				Crowd sourcing

Key Stakeholders and Responsibilities



The possible measures for scaling up decentralized used water management as described by Shri Pai are as follows:

- Licence Vendors who design, implement and operate the system
- Prepare informed material choices and design guides – Technology fact sheets, CPHEEO manual and other technical manuals
- Create incentives for decentralised systems – Concession in property tax, development taxes, water tariff
- Standardise procedures for approval of technology choice and design – accountability of all the service providers

- **Standardise procedures** for handing over plants to end-users – Systematic transfer of information, user-friendly O&M manual, minimum requirements of technology-specific design information
- Plan and locate sludge management facilities
- Appointment of O&M operators with appropriate **training and certification**
- Reuse/disposal-centred **discharge standards**
- **Market development** with supporting measures
- A robust system for **quality assurance** including monitoring and data collection and management

Key Discussion Points:

- Covering the entire ULB with either a centralized or decentralised approach would require the same Capital Cost, however the Centralised system gives higher control. Although, each decentralized unit brings the Capital and operational expenses down for each system.
- Shri Mahapatra from Odisha highlighted the usage of non-standardised packaged treatment technologies; and requested CPHEEO to make due consideration and examination of such systems.
- While some participants claimed facing difficulties in selling treated used water; It was highlighted by representatives from Maharashtra and Haryana that a consumer base can be built and there is a demand for treated used water especially in industrial and agricultural sectors.
- Hilly regions' perception of needing to pump all the treated used-water back in every scenario was discouraged, the pumping and reuse must be taken rationally. Other usages could be found downstream to cut down freshwater needs

Key takeaways

from the session as summarized by Shri Rajesh Pai were as follows:

There are 4 possible solutions to UWM in a town –

(i) sewerage in large clusters with treatment
(ii) sewerage in small clusters with small treatment plants
(iii) FSM
(iv) treatment of wastewater from drains

Solutions (i) and (ii) are independent and can be implemented for both all wastewater streams. Solutions (iii) and (iv) have to be implemented together to address used water in entirety as each solution caters to specific waste stream

The key challenge in every town is to plan for all 4 solution approaches in the right proportion to achieve ODF+ within the resources available

Any technology will function as it is designed if appropriate O&M, institutional, and monitoring resources are provided for its functioning

Session 8:

Managing Onsite Sanitation System, Co-treatment of Faecal Sludge in STPs, Reuse

Shri. Sasanka Velidandla, Advisor, WASH Institute

To manage onsite sanitation, ULBs need to start by understanding the types, sizes and structure of the onsite systems used by households. This can be done by conducting primary surveys. Though standard designs exist for septic tanks, in practice we see large deviations, including the prevalence of single pits in many states/towns. It was discussed that many septic tanks, in fact, are not water tight and hence function as single pits leaching used water into the soil.

The difference between septic tanks and single pits in terms of desludging requirements and user experience was explained. It was highlighted that septic tanks require periodic desludging while single pits can be emptied when they fill up. The drawbacks of long desludging intervals - hardening of sludge, scum formation etc., were also explained, and participants were urged to encourage desludging at appropriate intervals in their states.

Need-based or on-demand desludging was discussed as a simple way to start FSM services. Scheduled desludging can occur through a natural transition over the years.

Three approaches were discussed to estimate the quantity of FS generated in a town, and it was stressed that a well-judged estimate based on all three methods should be arrived at for determining capacity of FS treatment required. A simple formula for estimating truck capacity requirements was also shared. Further to this, the two approaches for co-treatment of Faecal sludge at an STP, by Direct addition and addition with pre-treatment were discussed with general diagrams (as shown below).

Faecal sludge quantity estimation

FS generated – population method

= (projected population x FS generated per capita per day)

- CPHEEO – Chapter 9: Onsite sanitation systems, Manual on Sewerage and sewage treatment, 2013
- 0.00032 KLD per person for septic tanks and 0.00018 KLD per person for single pits

FS generated – volumetric method

= (projected population x Average volume of containment systems)
(mean desludging frequency x family size)

- Household Survey of OSS
- Determine average volume of containment systems as per types
- Determine the desludging frequency

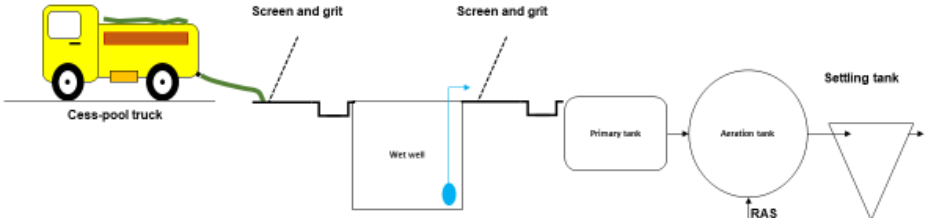
FS generated – survey of desludging operators (practical method, reality check)

= average volume of FS collected per day

Estimation for trucks required

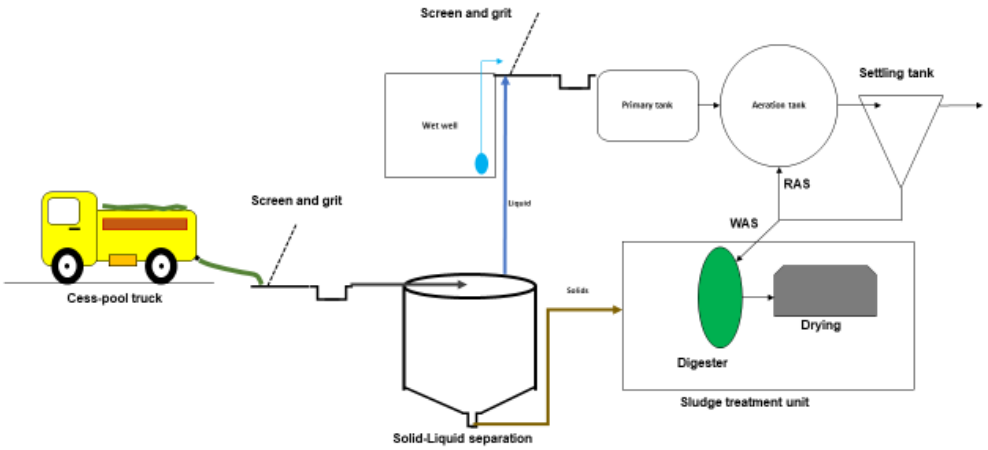
Sr.no	Particulars	Calculation/ Notation	Estimates
A	Number of households in the town	A	
B	Number of households where there is limited access	B	
C	Remaining households in the town	A-B	
D	Average desludging frequency at the household level	D	
E	Average volume of containment unit	E	
F	Volume desludged everyday	F = (A x E)/(365 x D)	
G	FS volume that is accessible by medium vehicles	G = (C x E)/(365 x D)	
H	Number of trips per vehicle - medium	H	
I	Capacity of medium vehicles (in Kilo liters)	I	
J	Number of medium vehicles	J = G x 1.2/(H x I)	
K	Number of trips per vehicle - small	K	
L	Capacity of small vehicles (in Kilo liters)	L	
M	Number of small vehicles	M = (F-G) x 1.3/(L x K)	

Co-treatment of FS in Sewage Treatment Plants

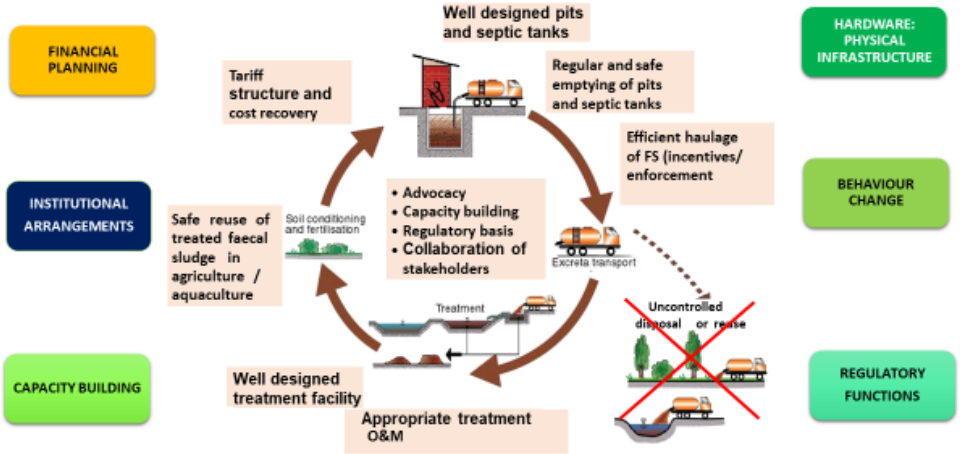


1. High concentrations of COD and TN in FS
2. Increase in Oxygen demand in aeration
3. Surplus sludge production in STP
4. Difference in quality of secondary sludge and FS
5. Need for Sludge handling facility in STP
6. Contractual Issues (O&M) at STP

Co-treatment of FS in STP, with pre-treatment



Components of FSM



The general components that constitute an ecosystem for Faecal Sludge and Septage management were illustrated. This highlighted that for FSSM to work, several key initiatives in addition to infrastructure were required.

Key Discussion Points:

- Shri Chaurasia highlighted that the Centre is pushing for the transition to standardised and safe containment systems. Furthermore, Shri Sasanka highlighted the importance of awareness among the people to be able to know a good system over poor system, in terms of visible design elements and their implications over time.
- Co treatment examples of Puri was discussed, while Shri Kakkar also highlighted the Direct Addition approach having a high scope when faecal sludge is of low strength.
- Volute Press was specifically mentioned to be of great use for solid liquid separation in a co-treatment situation.
- It was reiterated that FSM is more of a service than just an infrastructure, thus needing an enabling ecosystem which again is context specific.

Key takeaways
from the session as summarized by Shri Sasanka were:

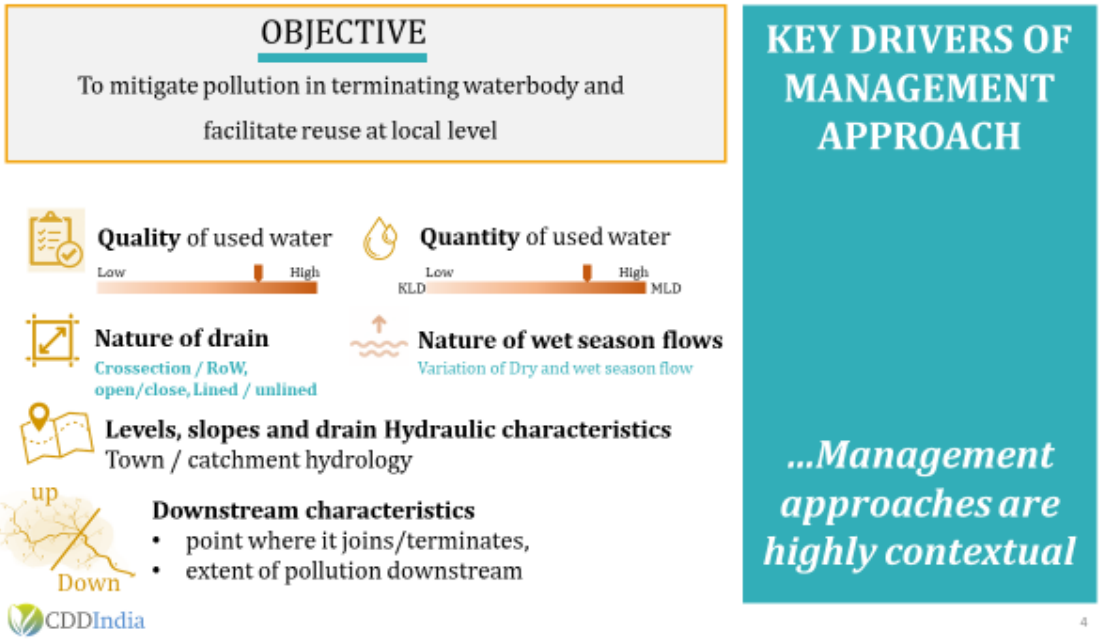
- FSM is a critical component of SBM(U) 2.0 since 100% sewerage coverage may not be feasible in most towns
- Large variations exist in nature and type of containment units, including prevalence of single pits in many States
- FSM is a service and not just infrastructure - it requires keen attention to affordability, reliability of service, behaviour change, and regulations all implemented cohesively for successful service delivery
- FSM must be implemented with treatment of used water from Drains to ensure complete used water management and hence ODF+ outcomes
- Therefore, STPs with co-treatment are the simplest solution for treating FS. However, in cases where STPs are not accessible for any reason standalone FSTPs may be implemented.

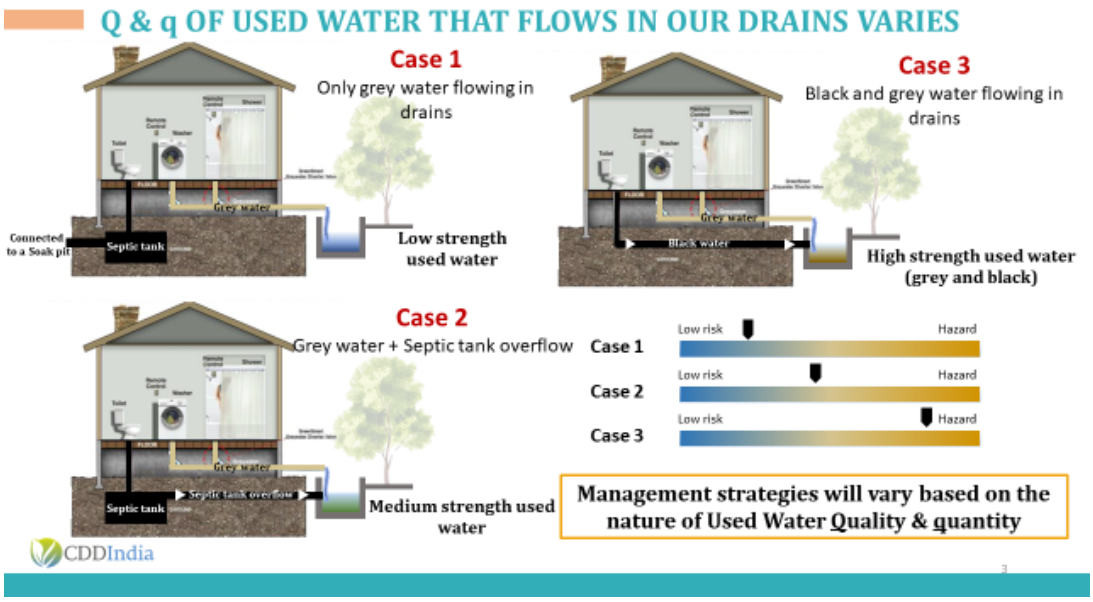
Session 9:

Management of Used Water Flow Through Open Channels/ Drains and Reuse of Treated Used Water

Shri. P.G.Ganapathy, Advisor, CDD Society

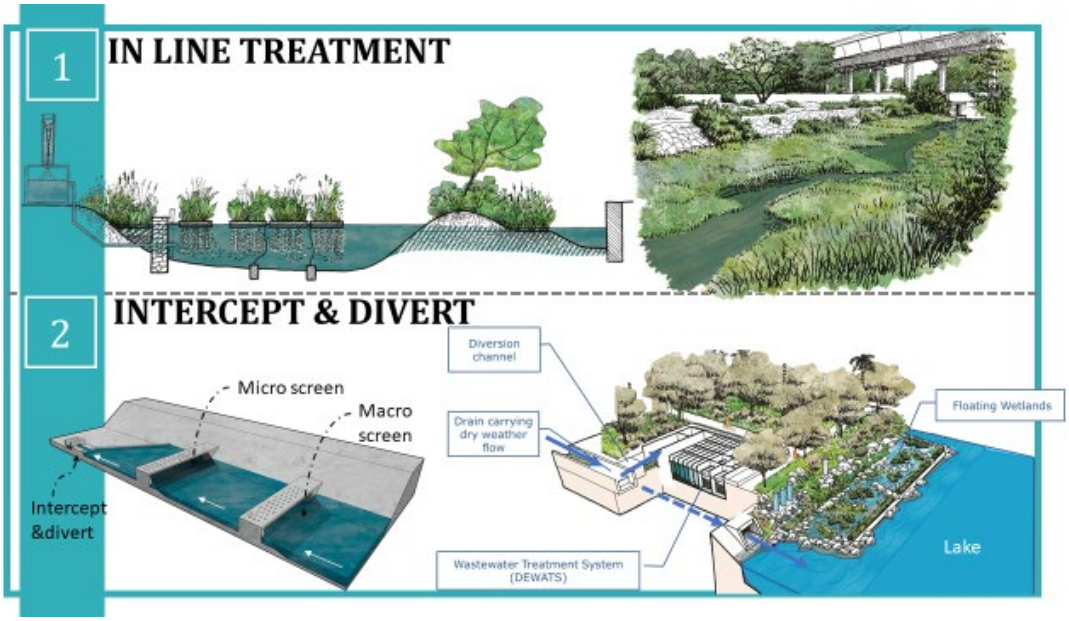
Shri Ganapathy started with laying out the risks posed by used water in areas of Public Health, Environmental in general. The two important parameters in used water management by I&D in drains are Q & q: Quantity and quality. The objective of UWM in drains is to mitigate pollution in the terminating waterbody of the drain channel, and at the same time, facilitate reuse at a local level.

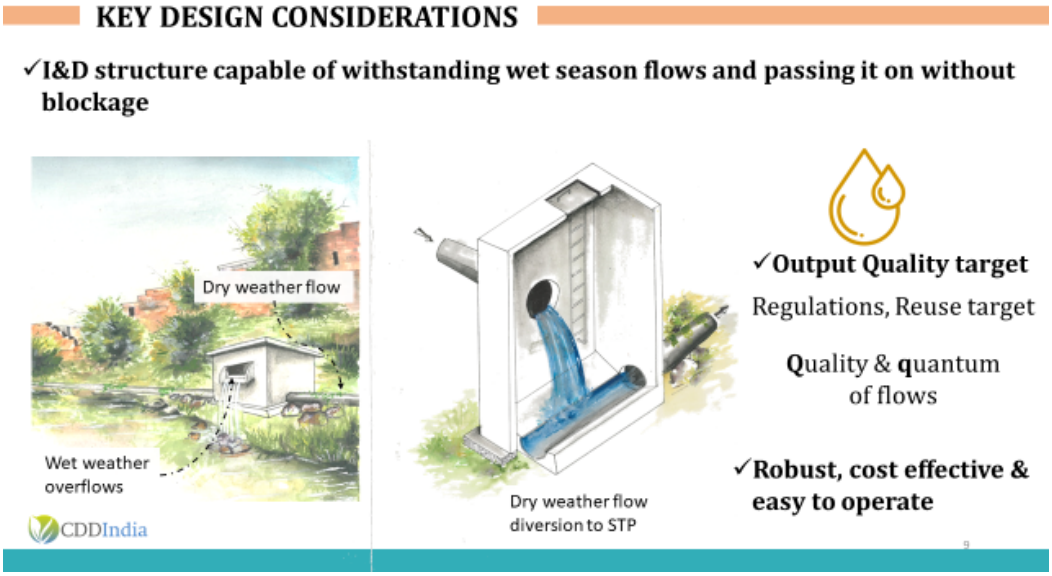




An example of Mahadevpura I&D and Lake Rejuvenation initiative was discussed. The key design considerations are as follows:

- The drain width is an important parameter for selection of approach
- Above 6m width, an inline approach can be taken while below 6m drain width an interception and diversion approach can be adopted considering the space availability.





Queries and Discussions

Q: In case of Mahadevpura Lake rejuvenation project, is the intervention a permanent one or a temporary one? What precautions are necessary while managing such projects?

A: It can be considered intermediate, however the timeframe that lies between this intervention and a permanent one could range between 2-20 years. Thus, acting on a problem before it gets serious is key. In terms of precautions, data quality and temporal variations must be carefully taken. Furthermore, overlaps with other systems, e.g solid waste, surrounding environmental conditions, etc. must be given careful consideration.

Other important factors to be considered were highlighted as Land identification and selection criteria, Solid waste management for drains and Wet weather storm flow. These factors pose as great challenges to the drainage system.
In case of coastal regions, consideration should be given to seasonal sea level rise which may fill up the major drains.

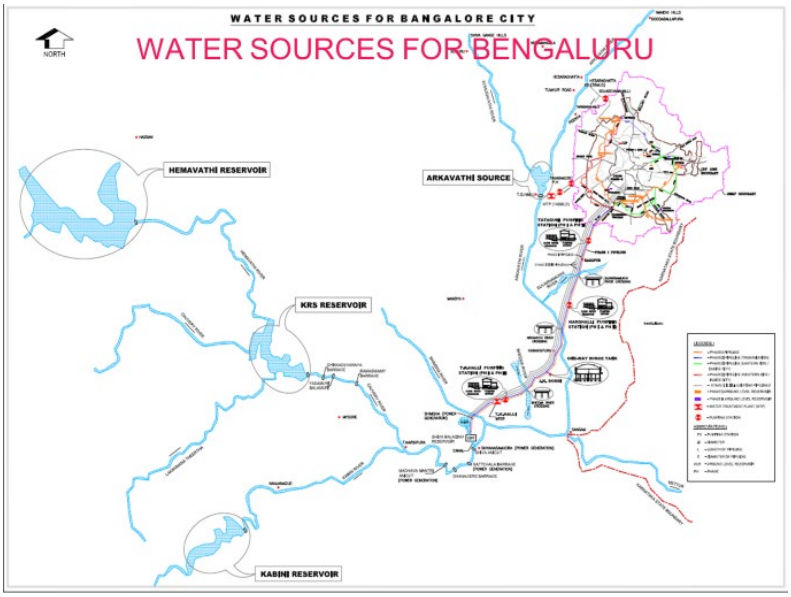
Session 10*:

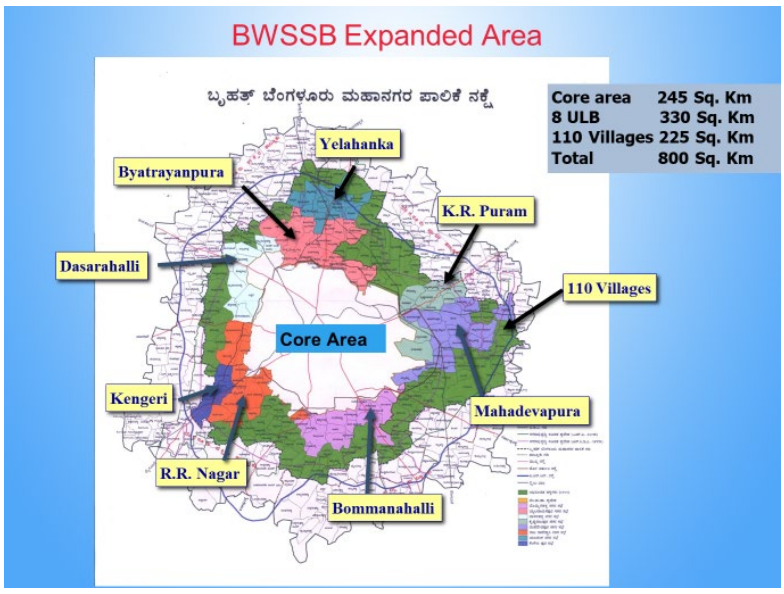
Bangalore Water Supply and Sewerage Board: Reuse Water Outlook

Rajiv KN, Chief Engineer, BWSSB

- Water resources for Bangalore are under stress and incur a high resource investment as it is being pumped from a distance of 120 kms. The total supply from Cauvery being 1455 MLD and additional 400 MLD from private and public borewells, making the total water supply as 1855 MLD.

- Examples of reusing tertiary treated water across many areas around Bengaluru were discussed. The case of K&C Valley which supplies over 300MLD of secondary treated water to fill lakes in nearby districts . The once dried up borewells in and around these lakes are now filled, and used to irrigate agricultural land.



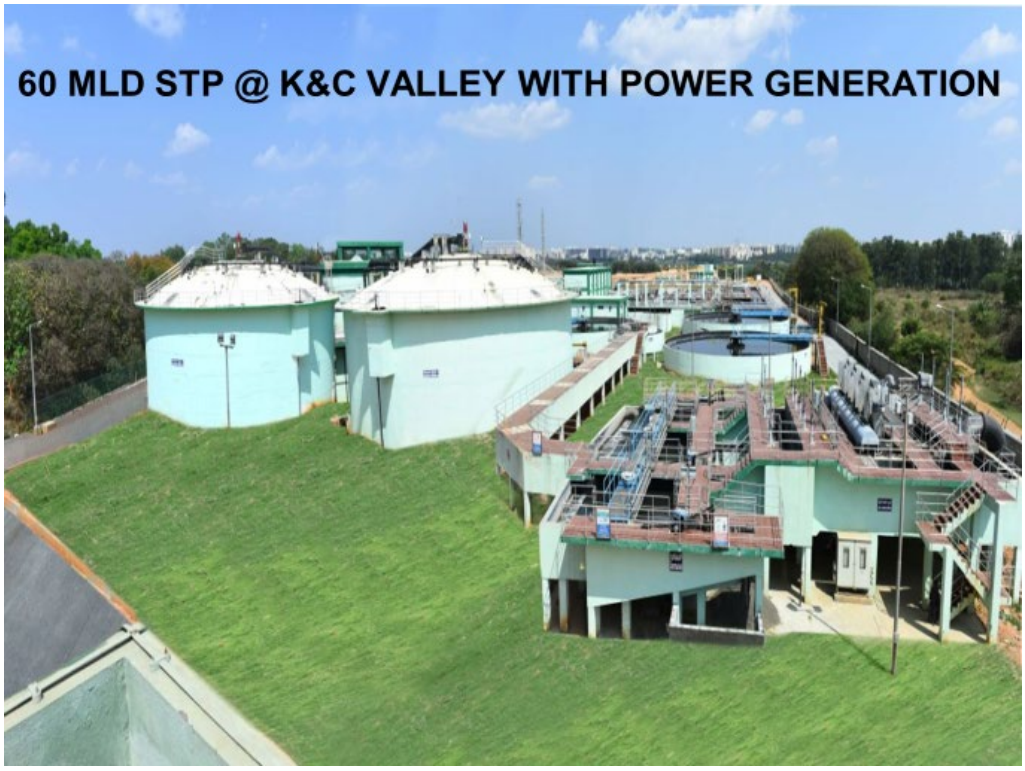


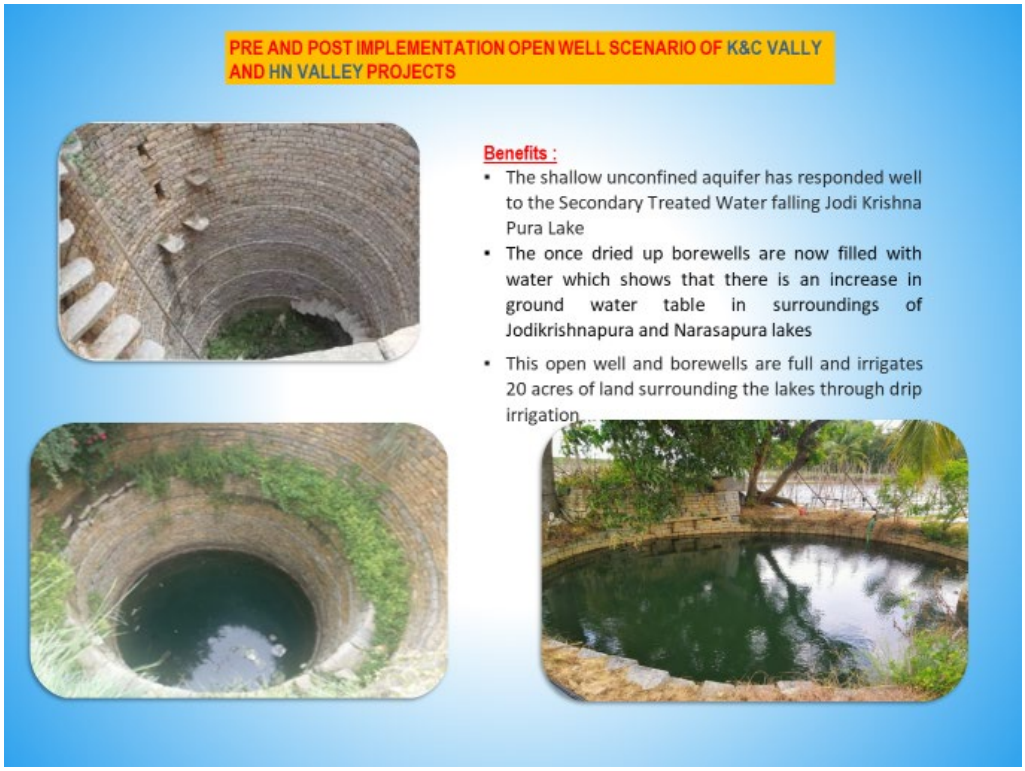
BULK WATER SUPPLY

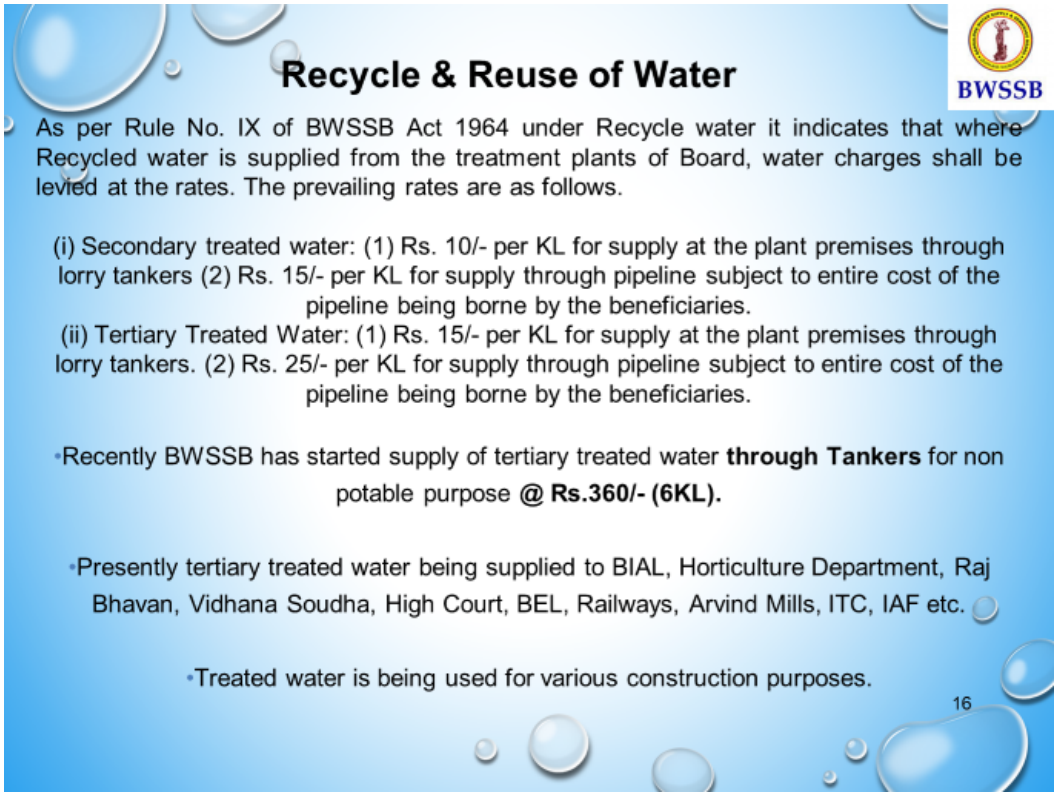
Projects	Year of commissioning	Installed Capacity (MLD)	Present Supply (MLD)
Arkavathy (TG Halli)	1933	Nil	NIL
Cauvery stages			
I	1974	135	140
II	1982	135	140
III	1993	325	325
IV, Phase – I	2002	300	300
IV, Phase – II	2012	550	550
Total Supply		1445	1455
Private and Public borewells			400
Grand Total Supply			**1855**

- Tertiary treated water is being sold at Rs.360 per tanker (6 kilolitres); Also tertiary treated water is being supplied to BIAL, Horticulture department, RajBhavan, Vidhan Soudha, High Court, BEL, Railways, Arvind Mills, ITC, Indian Air Force, etc. as well as many construction projects thereby encouraging the fact that there are many buyers of treated used water

- Upon the question of conveyance of treated used water for irrigation purposes, Shri Rajiv clarified that it is the Department of Minor irrigation that takes the responsibility.







State presentations:

The participants from different states were asked to bring in their respective cases and highlight the challenges and learnings. The key takeaways from respective state representatives are as follows:

- Jammu & Kashmir: -Sanitation initiatives taken up in a zonal manner; with zones defined by rivers –examples of Jhelum in Srinagar and Tavi in Jammu were discussed.

A total of 10 MLD of I&D project and 13.8 MLD of STPs are undergoing Technical Appraisal.

Suggestions made:

a) Need of an Appraisal Authority to approve DPRs/Plans;
b) Preparatory time to be taken before execution in the mission; as a direct execution could lead into more problems than solutions.
c) Capacity building for the relatively smaller ULBs need to be taken up actively so that their pace is improved.

Future Projects

JICA /ADB Funding

75 ~~[illegible]~~ MLD Sewerage Scheme Jammu 1250 INR in Cr.

125 ~~[illegible]~~ MLD Sewerage Scheme Srinagar 1302 INR. in Cr.

CSS = NRCP

Udhampur Town

↓

Pollution abatement of Rivers Devika and Tawi.

501 polluted river stretches identified by CPCB

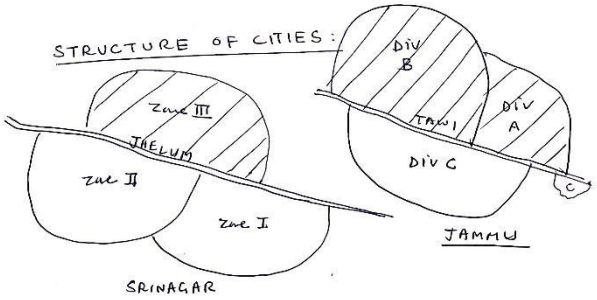
9 belong to J&K.

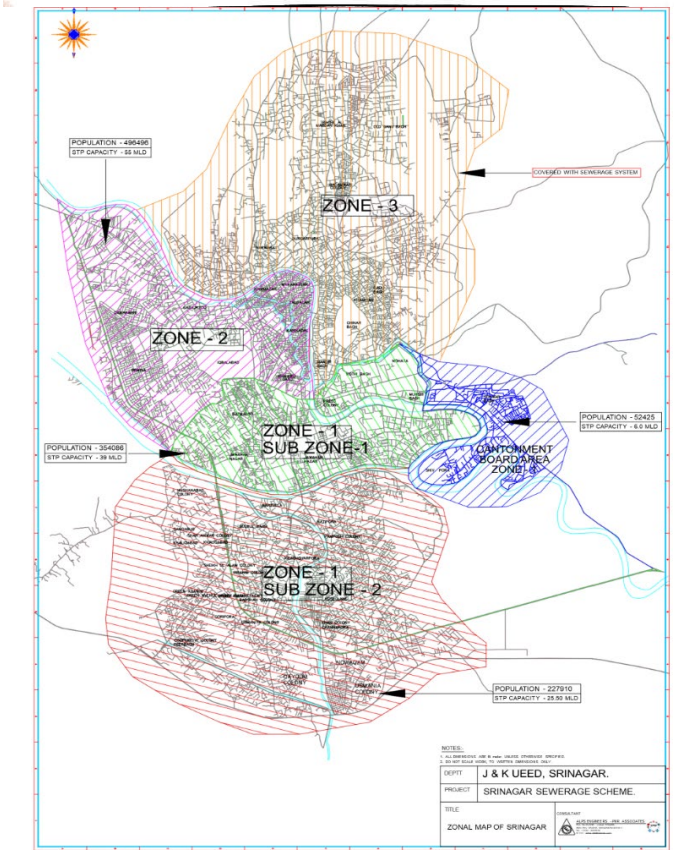
3 STPs 8 MLD, 4 MLD, 1.6 MLD } 13.6 MLD Entire Udhampur Town. } ₹ 186.74 Cr.

+ 60 KLD FSTP.

2 Components – Beautification of Devika Ghats.

– Modern Crimetoria



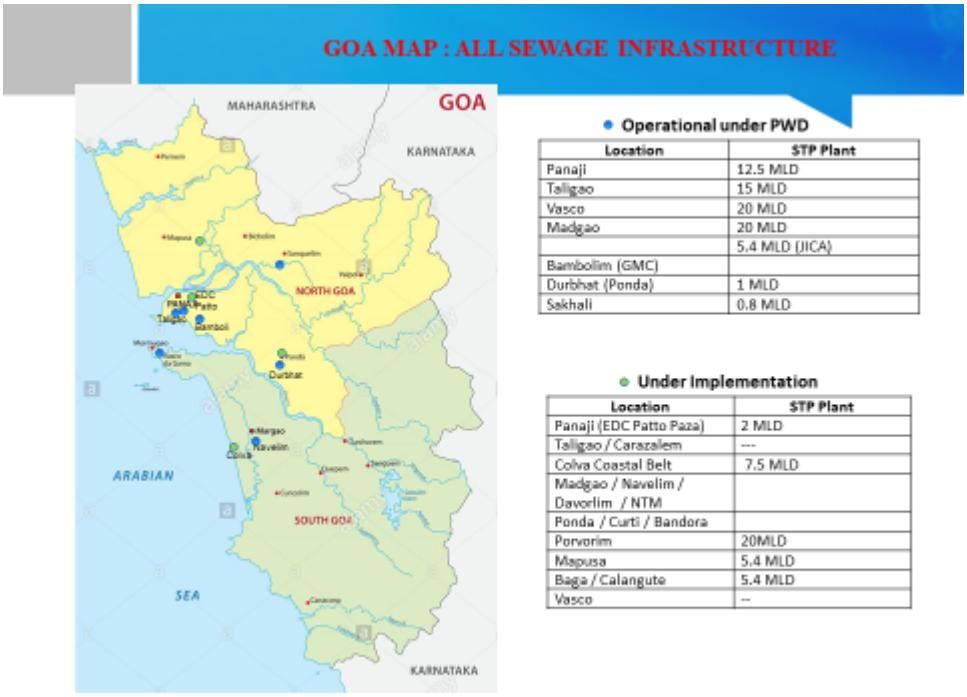


- **Goa:** -14 Lakh Population (2011); however floating population brings it to about 20 lakhs

  -No STPs in western part of Goa because of hilly terrain and low density settlements; the only STPs are at hotels, resorts and similar commercial establishments.

  - Per capita cost of solution is high, as the population generating the used water includes floating population, while missions provide funds as per only the resident population.

  -Land availability were highlighted as a limitation; which was responded to by the example of Delhi and other high density areas where finding land is even more challenging, have managed to find land and implement STPs. So Goa could adapt to similar means and reforms.



Operational under PWD

Location	STP Plant
Panaji	12.5 MLD
Taligao	15 MLD
Vasco	20 MLD
Madgao	20 MLD
	5.4 MLD (JICA)
Bambolim (GMC)	
Durbhat (Ponda)	1 MLD
Sakhali	0.8 MLD

Under Implementation

Location	STP Plant
Panaji (EDC Patto Paza)	2 MLD
Taligao / Carazalem	---
Colva Coastal Belt	7.5 MLD
Madgao / Navelim / Davorlim / NTM	
Ponda / Curti / Bandora	
Porvorim	20MLD
Mapusa	5.4 MLD
Baga / Calangute	5.4 MLD
Vasco	--

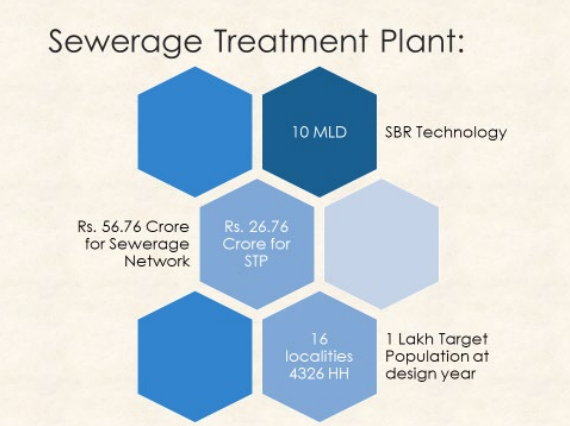
Proposed Sewage Schemes by SIDCGL

Sl No	Location	Network Length	STP capacity
1	Sanvordem Sewage Scheme	15.54 KMS	1.1 MLD 6 Nos Packged STP 150 to 270 KLD
2	Mapusa Sewage Scheme (Phase II)	47.60 KMS	7.5 MLD
3	Candolim Coastal Belt Sewage Scheme	41.40 KMS	7.5+7.5 MLD
4	Porvorim / Saligao Phase II Sewage Scheme	28.00 KMS	
5	Sakhali Phase II Sewage Scheme	19.00 KMS	2.4 MLD

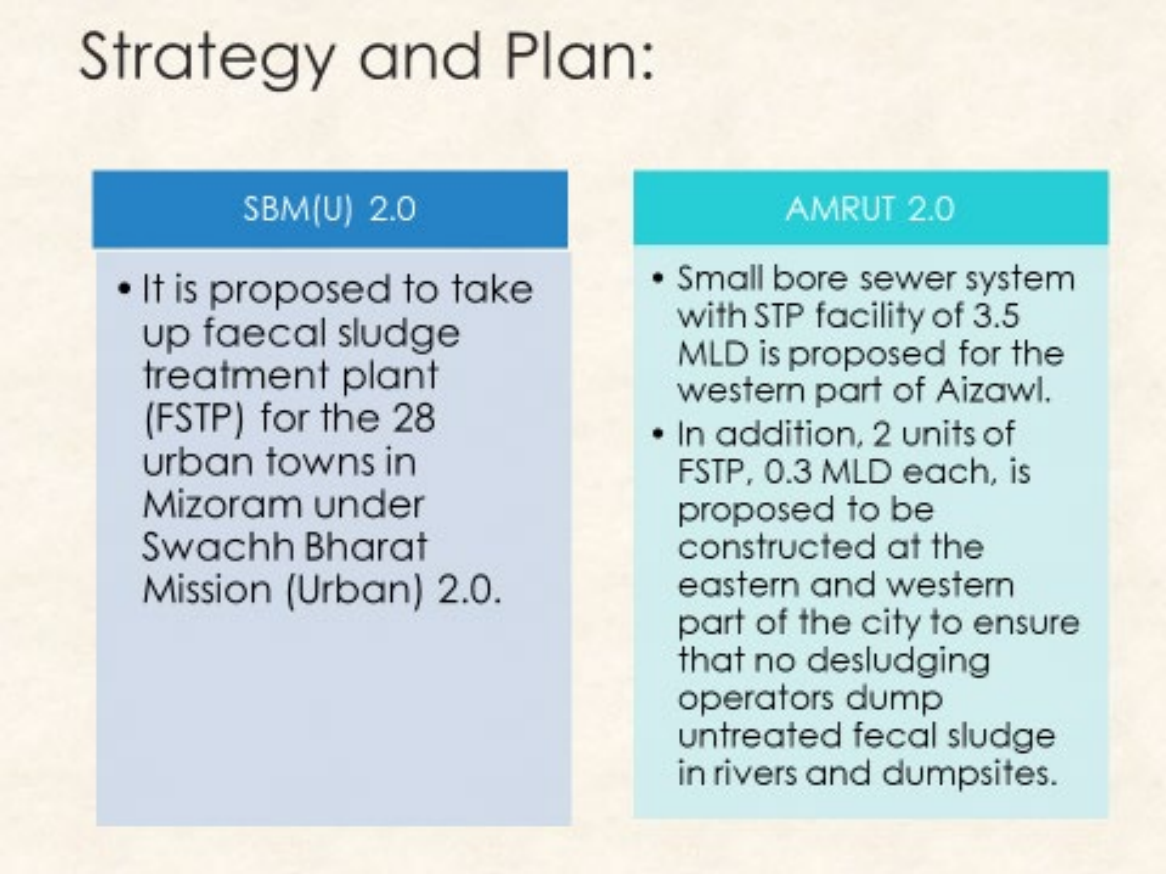
- **Mizoram:** Have adopted FSSM for most of the areas, as they have found onsite management of black water to be a suitable option.

  -Laying of sewers is challenging due to narrow roads and unavailability of suitable land. Due to topography, multiple STPs per city could be required.

  -The panel reiterated that the approach could undertake a combination of solutions, it could be a mix of sewered and non-sewered solution, while the city/town ensures all used water is safely managed.




House Connection works & Pipe laying over-ground on RCC support structures along nallah alignment



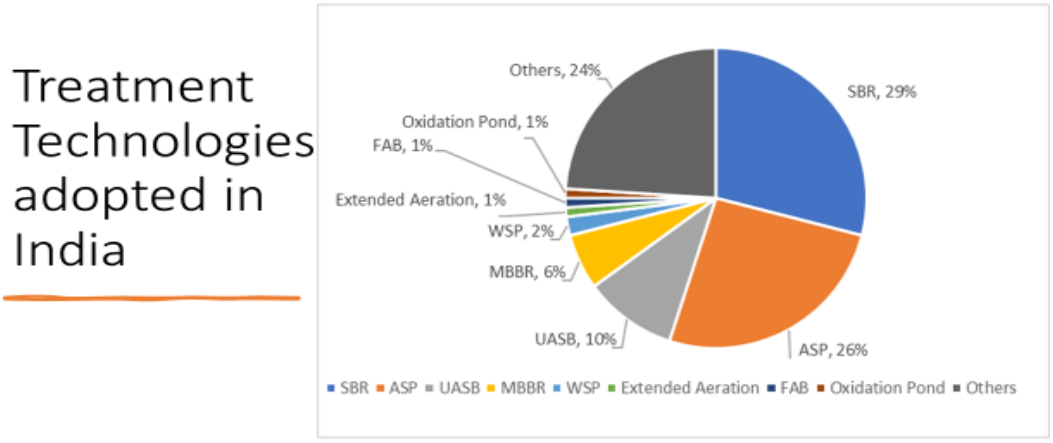
Session 11:

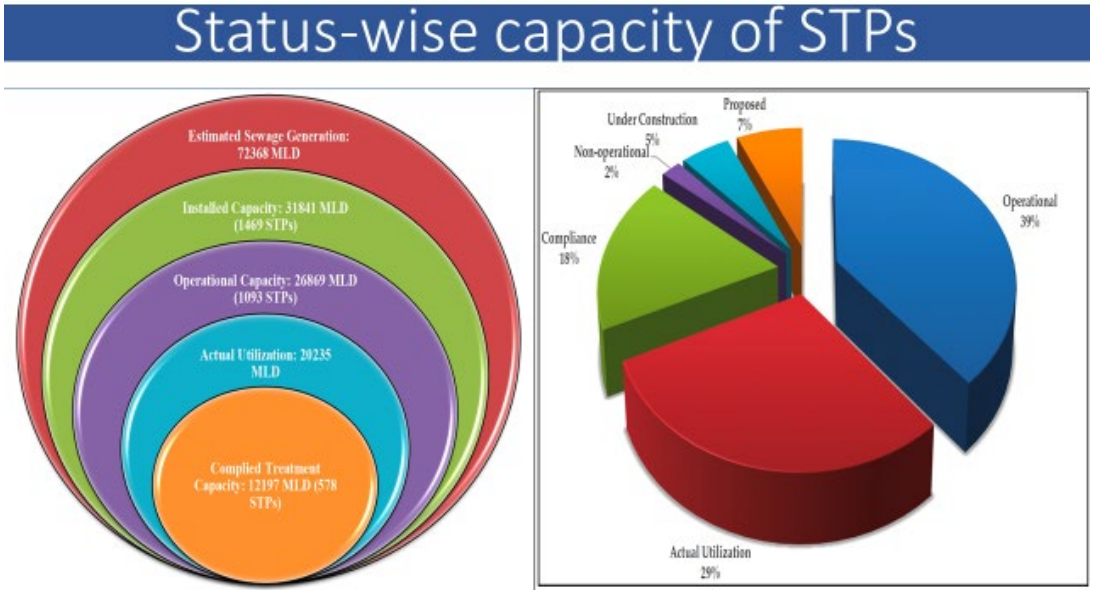
Presentation on the Ready Reckoner on Municipal Used water Treatment Technologies for Medium and Small Towns

Shri. V.K. Chaurasia, Joint Advisor, CPHEEO

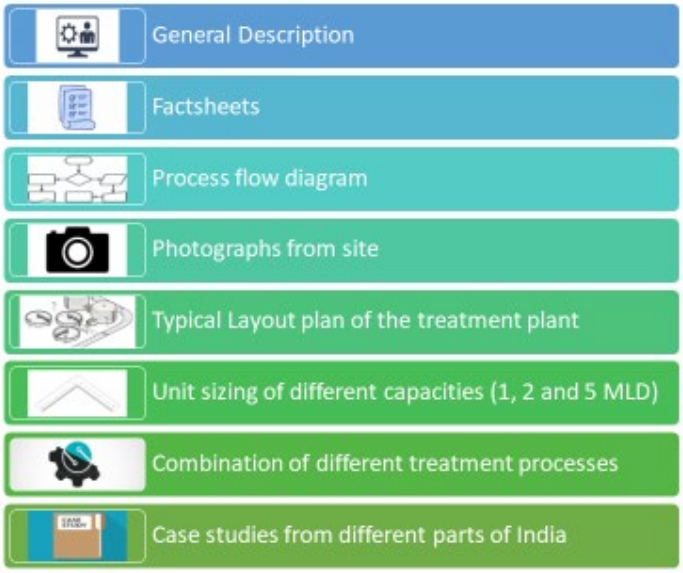
The structure of the ready reckoner was introduced and detailed out by Shri Chaurasia, stating the approaches and the technology options under each of them covering Nature based to mechanical treatment options. Guidance on small scale STP for low population ULBs and technology selection matrix were highlighted as being very useful for decision makers and practitioners alike.

CPCB study of STPs states the utilization gap of already existing and operational STPs, highlighting challenges in HH-connections as well as overdesign of STPs. Case study of Brazil was cited to push the idea of using multiple technologies instead of just staying inclined to one or two, and drive towards the outcome. The case of Germany was stated to reiterate the need to improve treated used water quality in an incremental manner over time. ULBs should target producing more and more tertiary treated water, while finding and encouraging users for the same.





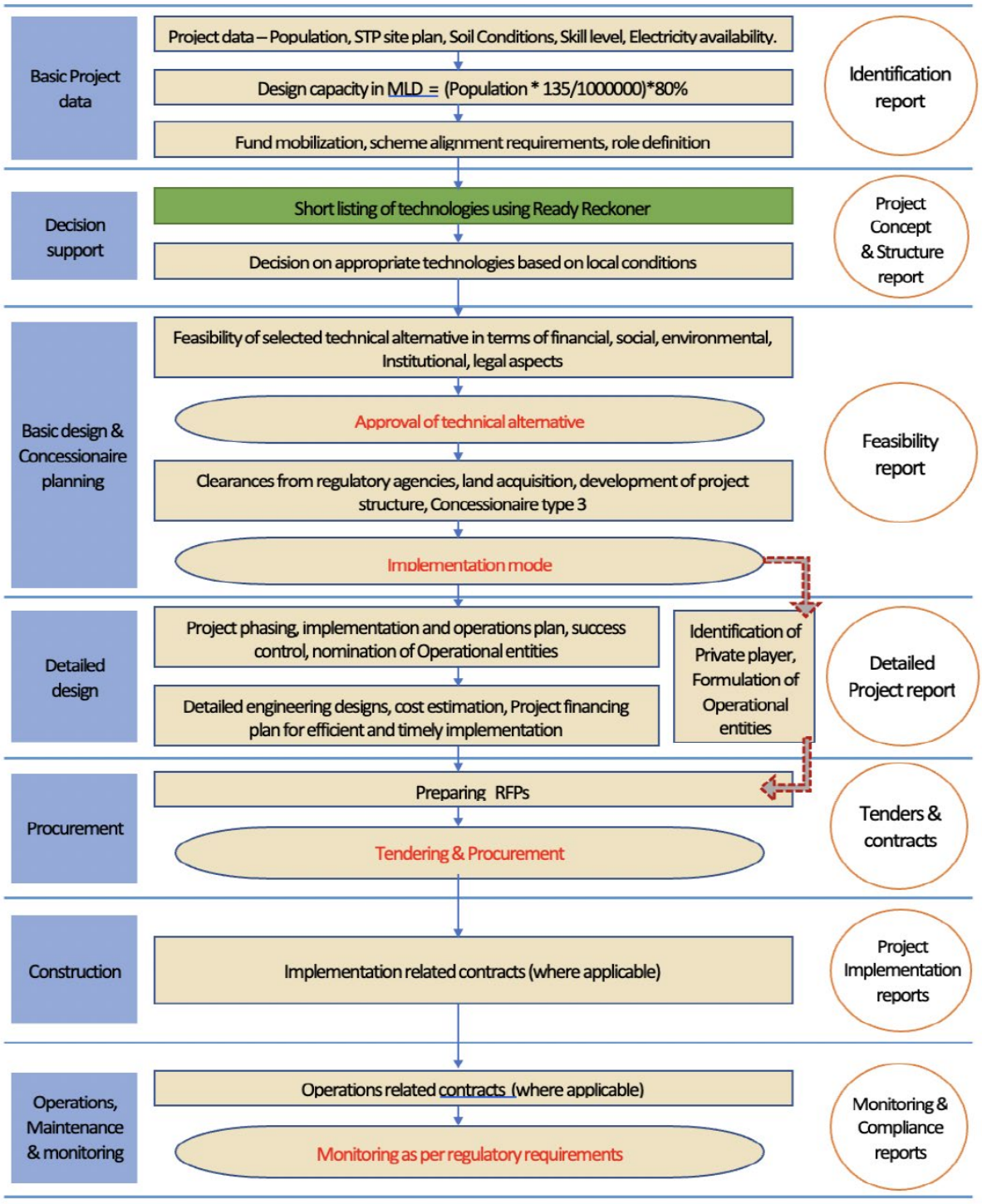
FEATURES AND DETAILS OF TECHNOLOGIES COVERED IN THIS DOCUMENT



Comparison of Treatment Technologies along Critical Parameters

Technology	Land requirement	Capital cost	O&M cost	Electricity required.	Effluent Quality	
	Ha/ MLD	INR lakh / MLD	INR lakh / MLD	kWh/ ML treated	BOD, mg/ lit	TSS/ SS, mg/ lit
Nature Based Technologies						
Waste Stabilization Pond (WSP)	0.5 - 1.0	30–60	0.6–2.5	negligible	15-50	SS: 75-125
Root Zone Aeration/ Contructed Wetland	0.6-1.5	30-150	1.2-3.0	negligible	20-30	SS: 60-90
Mechanised Treatment Technologies						
Extended Aeration (EA)	0.15 - 0.25	90-200	7.0-12.0	180 - 225	20-30	SS: 50-100
Aerated Lagoon (AL)	0.27 – 0.4	40-60	1.5-3.0	15-20	25-50	SS: 40-150
Sequencing Batch Reactors (SBR)	0.10 - 0.15	150-300	10.0-20.0	150 - 200	<5	TSS< 10
Moving Bed Biofilm Reactor (MBBR)	0.04 - 0.05	170 - 230	8.0-12.0	200 - 250	<10	TSS: <20
Activated Sludge Process (ASP)	0.15 - 0.25	80 - 170	6.0-10.0	180 - 225	20-30	SS: 20-50
Trickling Filter (TF)	0.25-0.50	50-80	2.0-5.0	150-180	25-30	---
Up flow Anaerobic Sludge Blanket (UASB)	0.2 - 0.3	40-60	2.0 - 3.5	10.0-15.0	70-100	TSS: 75-100
Onsite treatment Technologies						
Decentralised Treatment System (DTS/DEWATS)	0.13 – 0.14	80 - 200	2.0 – 2.5	negligible	<30	TSS <10

The reckoner provides fact sheets, technology processes and example layout plans for multiple treatment solutions and approaches, along with case studies different technologies in varying capacities.


Basic Project data
Project data – Population, STP site plan, Soil Conditions, Skill level, Electricity availability.
Design capacity in MLD = (Population * 135/1000000)*80%
Fund mobilization, scheme alignment requirements, role definition
Identification report
Decision support
Short listing of technologies using Ready Reckoner
Decision on appropriate technologies based on local conditions
Project Concept & Structure report
Basic design & Concessionaire planning
Feasibility of selected technical alternative in terms of financial, social, environmental, Institutional, legal aspects
Approval of technical alternative
Clearances from regulatory agencies, land acquisition, development of project structure, Concessionaire type 3
Implementation mode
Feasibility report
Detailed design
Project phasing, implementation and operations plan, success control, nomination of Operational entities
Detailed engineering designs, cost estimation, Project financing plan for efficient and timely implementation
Identification of Private player, Formulation of Operational entities
Detailed Project report
Procurement
Preparing RFPs
Tendering & Procurement
Tenders & contracts
Construction
Implementation related contracts (where applicable)
Project Implementation reports
Operations, Maintenance & monitoring
Operations related contracts (where applicable)
Monitoring as per regulatory requirements
Monitoring & Compliance reports

Cost per capita for sewer line laying by GWSSB

Sr. No.	District	Name of ULB	Implementing Agency	Population			Expenditure (Rs. Lakhs)	Per capita expenditure (Rs./capita)		
				Current Population (as per 2017) (Execution year)	Intermidiate Population (2026)	Ultimate Populaton (2041)		wrt Current Population (as per 2017) (Execution year)	wrt Intermidiate Population (2026)	wrt Ultimate Populaton (2041)
1	Anand	V V Nagar	GWSSB	27,113	32,107	40,431	405.63	1,496.08	1,263.35	1,003.25
2	Anand	Anklav	GWSSB	23,943	28,354	35,705	570.84	2,384.13	2,013.27	1,598.77
3	Banaskantha	Bhabhar	GWSSB	24,959	29,557	37,220	2257.46	9,044.61	7,637.67	6,065.21
4	Kheda	Dakor	GWSSB	29,250	34,638	43,619	1678.37	5,738.00	4,845.42	3,847.84
5	Sabarkantha	Idar	GWSSB	48,229	57,113	71,920	3560.11	7,381.70	6,233.44	4,950.08
6	Vadodara	Karjan	GWSSB	34,662	41,047	51,689	2339.64	6,749.93	5,699.94	4,526.43
7	Junagadh	Manavadar	GWSSB	35,169	41,648	52,445	3590.82	10,210.19	8,621.94	6,846.83
8	Kutchh	Mandvi (K)	GWSSB	58,569	69,358	87,339	1515.23	2,587.11	2,184.67	1,734.88
9	Sabarkantha	Prantij	GWSSB	26,899	31,855	40,113	1964.58	7,303.43	6,167.34	4,897.59
10	Gir-Somnath	Talala	GWSSB	24,008	28,431	35,802	2364.48	9,848.57	8,316.57	6,604.34
							Average	**6274.38**	**5298.36**	**4207.52**

Cost per capita for sewer line laying by GWSSB

Sr. No.	Name of projects	Cost of sewer network (in Lacs)	STP cost with O&M (in Lacs)	Population	Per capita cost in Rs.					
					Sewer Network	STP	Sewer Network	STP	Sewer Network	STP
11	Tharad UGD	2,739	1,144	31,200	8,780	3,668	6,385	2,667	4,619	1,930
12	Dahegam UGD	704	1,285	48,100	1,463	2,671	1,103	2,013	837	1,527
13	Prantij UGD	1,965	849	26,591	7,388	3,193	6,301	2,723	5,004	2,163
14	Boriyavi UGD	532	1,027	21,600	2,465	4,752	2,032	3,918	1,679	3,238
15	Kanjari UGD	1,417	1,002	17,908	7,912	5,594	5,186	3,667	3,738	2,643
16	Karjan UGD	2,340	1,126	33,701	6,942	3,342	5,091	2,451	3,813	1,835
17	Idar UGD	3,560	1,360	46,690	7,625	2,912	5,416	2,068	4,153	1,586
18	Una UGD	3,574	1,984	65,438	5,461	3,031	3,871	2,148	2,681	1,488
19	Kheralu UGD	1,748	975	20,300	8,612	4,804	6,698	3,736	5,188	2,894
20	Bareja UGD	2,469	668	20,066	12,306	3,330	9,132	2,471	6,777	1,834
21	Padra UGD	1,801	1,429	40,600	4,435	3,519	3,483	2,763	2,805	2,225
22	Dhandhuka UGD	4,065	1,408	51,722	7,860	2,722	6,133	2,124	5,421	1,877
23	Umreth UGD	843	1,464	41,350	2,038	3,540	1,547	2,686	1,151	1,998
24	Ode UGD	666	845	18,209	3,656	4,642	2,735	3,472	2,311	2,934
25	Thara UGD	1,870	1,125	21,460	8,715	5,243	6,154	3,702	5,058	3,043
26	Bhabhar UGD	2,257	1,105	23,400	9,647	4,724	7,329	3,589	5,574	2,729
27	Rapar UGD	619	1,352	30,998	1,998	4,360	1,355	2,957	974	2,125
28	Harij UGD	1,875	917	20,511	9,142	4,471	7,660	3,746	6,232	3,048
29	Thangadh UGD	5,824	1,850	48,800	11,935	3,791	7,745	2,460	5,065	1,609
30	Mansa UGD	3,009	1,327	33,000	9,120	4,020	7,234	3,189	5,754	2,536
				Average	**6,875**	**3,916**	**5,130**	**2,928**	**3,942**	**2,263**

Key Discussion Points:

- With reference to Gujarat's case, Shri Chaurasia estimated the cost of laying sewer line ranges between Rs.1000-10,000 per capita, however an average of Rs. 5000 per capita could be considered for estimation in CSAPs.
- The case of Varanasi was discussed, where a mix of right technical solutions along with administrative support could clear bottlenecks quickly.
- Bioremediation as a solution, as explained by Shri Chaurasia, provides only 15-40% BOD reduction, which is not enough as a standalone long-term solution. He further insisted that established and reliable entities like CPHEEO must be entrusted with the responsibility of examining and approving technologies before encouraging new untested vendors.

Session 12:

Wastewater Management and Integration with Irrigation; National Perspective of Israel

Dr. Lior Asaf, Water Attaché Israeli Embassy, New Delhi, India

Takeaways from the Presentation

- There are clear contextual differences in terms of scale and solutions, between scenarios in Indian and Israel, however in terms of initiative and reforms there is a lot to share and learn in common.
- Even though there is considerable amount of freshwater resources available to India, a considerable amount is unusable and at the same time current usage pattern also needs to be analysed and checked as it is only adding stress. The largest groundwater level dips since 1988 have been observed in Punjab, Haryana and Madhya Pradesh.
- The example of an Israeli law was cited, which establishes water resources as public property and thus public responsibility, where the definition of water resources explicitly includes both sewage and freshwater sources. This makes policies and reforms equally inclusive towards used water and freshwater resources, thus making missions and grants more focussed towards all water resources, instead of separating out for used and freshwater resource.
- The key intervention with used water reuse was integrating it with agriculture. 99% of sewage is collected centrally, 97% is treated and about 82% of the treated used water is reclaimed for re-usage.
- The parallel with Indian scenario is not from the technology perspective or in terms of experience, instead it is in terms of Vision and Drive. The land under irrigation in India is about 20 times higher than that of Israel, if Israel could achieve such a high proportion of treated used water reuse, it should be very much possible for India.
- Suggestions made were in terms of Water Source Creation and connection to farmers, Elimination of uncertainty (by guaranteed provision of treated used water) and Smart Agricultural initiatives. Examples of Jodhpur sewage reuse and Ahmedabad's target of bringing NRW to <10% and maximizing sewage usage by farmers are beginning to take the indicated direction.
- Upon questions on Tariff and costs of treated used water, Dr Asaf clarified that the farmers are only buying the product/output but not the infrastructure. The tariff should not be designed in a way that it targets recovery of CAPEX, instead it must target competing with the existing freshwater tariffs/prices and adopt this alternative with due acknowledgement to factors like affordability and willingness

III. Closing and summary

Shri VK Chaurasia welcomed Smt. Roopa Mishra, Joint Secretary, MoHUA. He also summarised the proceedings of the workshop, describing takeaways of each session, queries and their responses from the expert panel. Brief presentations were made summarizing the discussions of the two days in the form of key takeaways to be shared with the Joint Secretary from the states of Haryana, Jammu & Kashmir, Uttar Pradesh, Odisha and Bihar. All of them highlighted their work so far, the challenges experienced, the learnings from the workshop, and the way forward for them. States that are relatively at the initial stages of adopting Used water Management appreciated the workshop as an exposure to the 'wheel' instead of inventing one, and are carrying back a basket of options to try and plan for SBM 2.0 Used water Management initiatives. Shri Chaurasia then invited Joint Secretary, MoHUA to share her thoughts.

Smt Mishra began with appreciating the participation of many states and UTs of India in the workshop. She went on to highlight the fact that Government is just an enabler and all institutional mechanisms are collaborative efforts towards the greater good for the community. Water is looked upon as a resource, Sanitation as a subject, Environment as an aspect, but now we must look at the entire thing as a whole because engineering alone does not attain the desired outcome here, a combination of social, managerial, socio –economic factors come into play (e.g tariffs and behaviour patterns can make or break a solution at times).

The Joint Secretary, MoHUA further stressed on **the Outcome being a higher priority than the approach to be adopted to achieve it.** She stressed on relooking and using the existing tools and instruments like the Chief Secretary Forum for Used water management initiatives and to pull the many departments together to make due progress. These forums can be used for more than just approvals, making better use of the valuable experience on the table.

Formation of a Joint Committee of senior experts to look at Used water management and Drinking water supply initiatives collectively is the need of the hour. There is a need to start planning across the subjects and departmental boundaries. States were encouraged to take this year for planning initiatives properly and use the next 3 years for execution. Meanwhile similar workshops can provide forums for discussions with the learnings and problems brought back by the States after due applications and experiments, which can be held in 2-3 month intervals.

The Joint Secretary, MoHUA added that states must not be limited by mission boundaries, instead use as many mission instruments and funding as possible and achieve their vision. She went on to suggest 4 action points:

1. A Network of Chief engineers from all states need to be initiated that will have bi-monthly regional discussions and form a used water management chapter for continuous knowledge and experience sharing

2. A formalized Core committee structure for scientific validation and advisory for new technologies, utilizing experts from across the country. Furthermore, the State High Powered

Committees (SHPC) holds expertise that should be utilized for planning the Used water management initiatives instead of only DPR approvals.

3. Procurement works well when as many considerations and options are on the table from the beginning. Planning must begin as comprehensively as possible, and planning with private partnership could very well make procurement better.

4. The Honourable Prime Minister has posed the challenge of waste circularity in case of both solid and liquid from all sources including domestic and Industrial. A change of perspective would be required where the waste is monetized and revenue models make the most of the potential market. Once few states start, others will follow but this needs to be set as a target.

Moreover, mindful convergence of urban and rural SBM initiatives must be carried out, especially to pool the available resources for achieving complete used water management objectives for the population and its region.

States need to have an economic, environmentally sustainable and futuristic view with respect to solutions and their operations and maintenance, so they are able to sustain the solutions without the mission support. Smt Mishra appreciated the efforts and support of Government of Karnataka and WASH Institute to organize the workshop to such scale and success. She encouraged researchers, knowledge partners to do their part and inform the sector as much as possible while the State must form understanding and partnerships between organisations working in this sector to build on their individual knowledge and expertise.

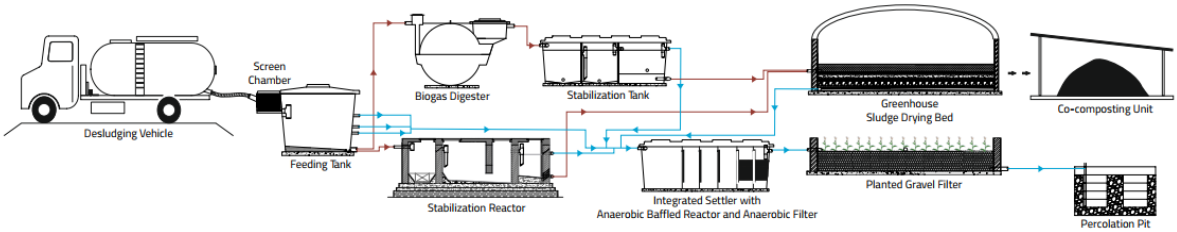
Day -3

Field visits: The third day of the workshop involved a guided tour through 3 unique best practices examples in Bengaluru, which were: a. Horamavu STP (Small scale STP), Mahadevpura Lake STP (I&D with Nature based treatment) and Devanahalli FSTP (City scale Faecal Sludge treatment Plant). This allowed them to observe working examples of used water management solutions with experts being available to clarify and guide any queries and doubts. The cases are as follows:

1. Devanahalli Faecal Sludge Treatment Plant

Context and Problem Statement	-Devanahalli is a town located 39 Km North-East of Bangalore, with a population of 49,517 (as per Census 2011) residents. -All the households have access to toilets with septic tanks/pits (on-site sanitation systems). The absence of underground drainage system requires a modern solution with minimal cost.
Intervention	Therefore, the Town Municipal Council (TMC) – Devanahalli with support from NGOs[1] decided to build a fecal sludge treatment plant (FSTP) instead of connecting the whole town to a centralized sewage treatment plant (STP). Although there are many reasons, the major one being, non-availability of sufficient water for consumption and funds for operation and maintenance (O&M). This is a first-of-its-kind town-scale FSTP in India.

Treatment Process

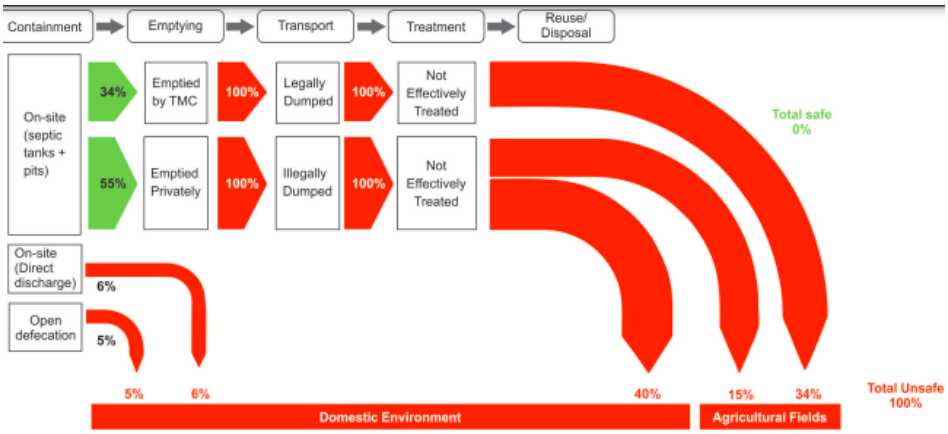


The treatment modules for solid components are: Feeding Tank with screen chambers, Biogas Digester, Stabilization Reactor, Sludge Drying Beds with Green House Solar Drier Roof (GHSD). Treatment modules for liquid components are: Integrated Settler, Anaerobic Baffled Reactor with filter chambers, Planted Gravel Filter and Percolation pit. The treatment system also consists of a co-composting unit where the dried sludge from the SDB is composted along with municipal organic solid waste

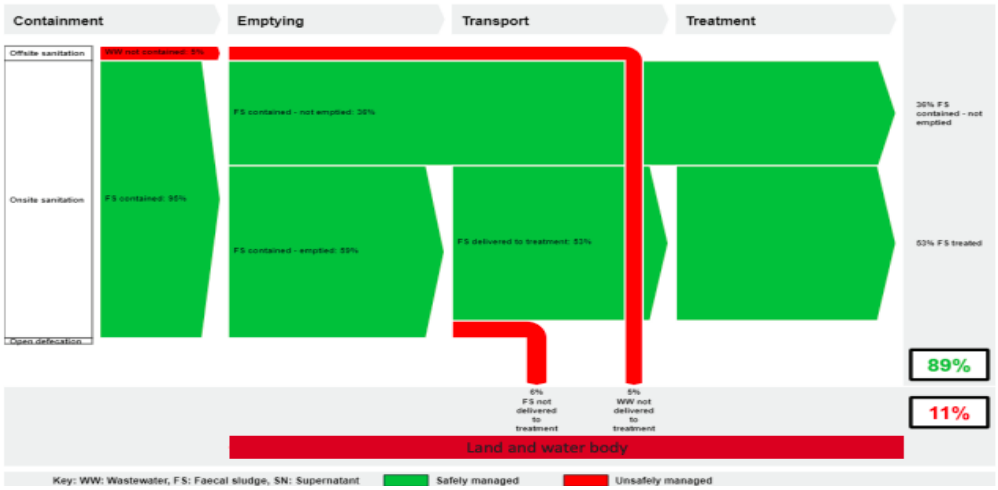
[1] Consortium for DEWATS Dissemination Society (CDD Society), The Bill and Melinda Gates Foundation (BMGF) and Bremen Overseas Research and Development Association (BORDA)

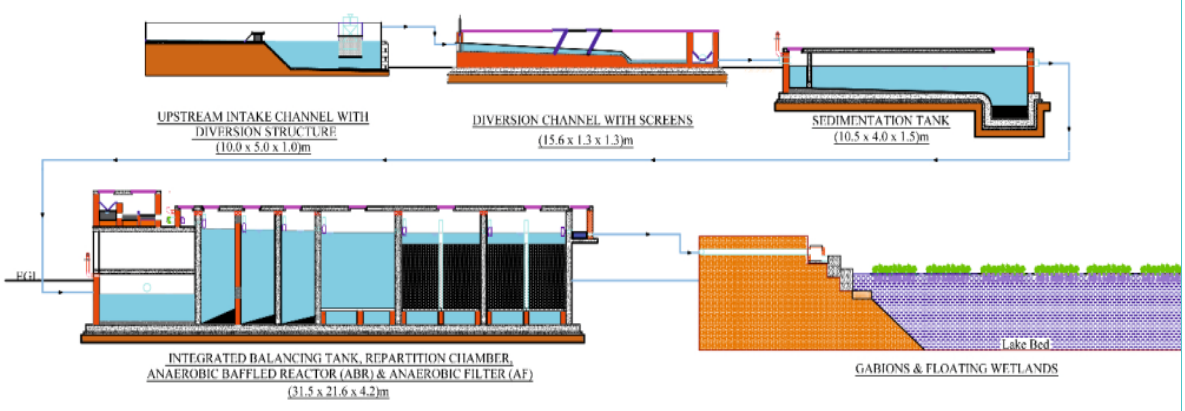
Cost Aspects	
Expenses	• Implementation Cost: Rs. 70 Lakhs • Operations and Maintenance Cost: Rs. 21.41 Lakhs [Desludging vehicles (45%) + FSTP(25%)+ Co-composting(30%)]
Revenue	Total revenue: Rs. 13.2 Lakhs [User Fees(38%) + Sale of co-compost & vegetables(41%) + Advertisement & Land Lease(15%) + Tipping Fees & Registration of trucks (6%)
Impact	The shit flow diagram (SFD) in the years 2014 and 2020 shows the difference between the sanitation situation of the Devanahalli town. In 2014, 100% of untreated fecal waste was dumped to the environment, whereas in 2020, 89 percent of the waste is treated and safely managed. Currently, the households have access to on-time and professionally-managed desludging services.

Devanahalli Shit Flow Diagram -2014



Devanahalli Shit Flow Diagram 2020



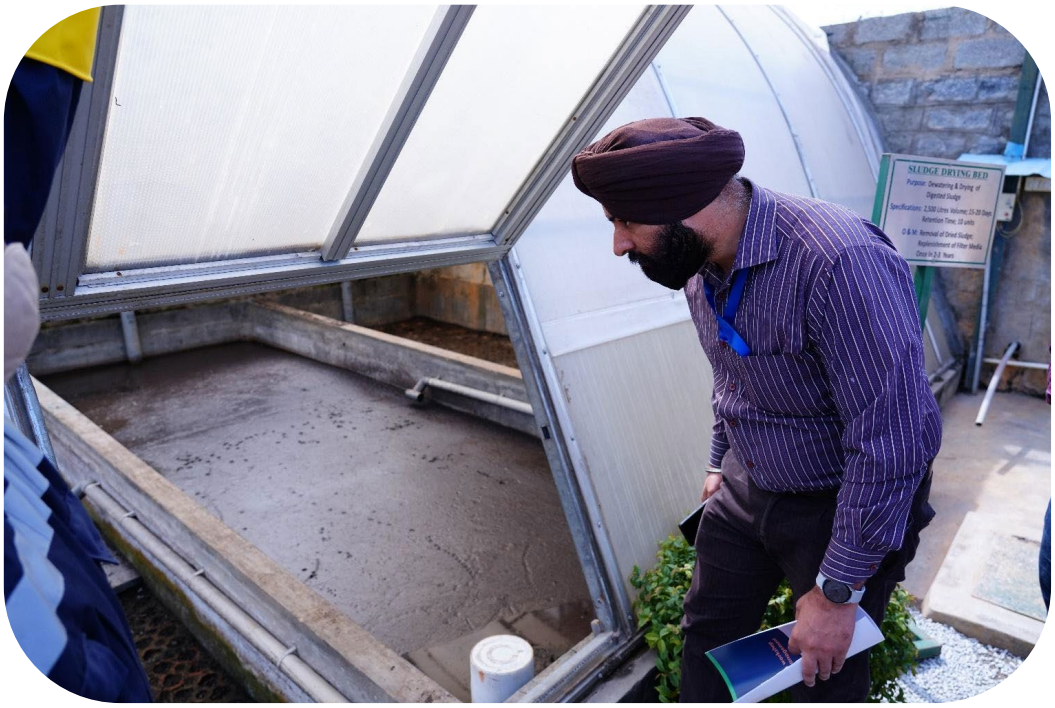
2. Mahadevpura Lake – Wastewater Treatment System	
Context and Problem Statement	The Mahadevapura lake, located adjacent to Bagmane Tech Park is under the custody of BBMP. This lake is part of the Varthur lake series that drains southward to its downstream Doddanekundi lake. According to water quality report released by Karnataka State Pollution Control Board (KSPCB) in the year 2011, the lake was listed under Category D, which made it conducive only for the propagation of wildlife and fisheries. Over time the area around the lake developed and got sewerage connection. A few areas in the upstream catchment areas are not sewered and therefore the wastewater flows through open drains into the lake. In 2016, the Bruhat Bengaluru Mahanagara Palike (BBMP), built hydraulic structures to divert wastewater entering the lake. Thus, the water in the lake dried up.
Intervention	A consortium of CSR and Social sector agencies studied the lake, understanding its water balance and flows. A STP was conceptualized, which would treat the wastewater being diverted, thereby ensuring that the lake received water throughout the year and did not dry. A 1 MLD nature based STP was established inside the lake, to treat the wastewater.
Treatment Process	
 An 85m long earthen drain was constructed to channelize water from inlet-3 into the STP, followed by a 1 MLD STP of DEWATS approach, gabions for distribution of water flow and floating wetlands.	
Cost Aspects	
Expenses	• Implementation Cost: Rs. 2.01 crores • Operations and Maintenance Cost: Treats 1MLD of used water @Rs. 1 per KLD

Impact	About 1 MLD wastewater is treated before discharge into the lake, thus replenishing the water body with the benefits of leveraging lake for water storage. This, in turn, aids groundwater recharge, enhances micro climate benefits in the area and improves urban aesthetics.

Mahadevpura Lake: Before intervention

Mahadevpura Lake: After intervention

3. Horamavu Agara Sewage Treatment Plant	
Context and Problem Statement	The sewage treatment plant (STP) is located in Horamavu, Bangalore. The STP is planned, designed and implemented by Bangalore Water Supply and Sewerage Board (BWSSB) for the treatment of wastewater flowing in the Raja canal.
Intervention	In this context, the STP built treats the wastewater and disposes the treated water into the nearby Horamavu lake for replenishing the lake water as well as help in maintaining the water balance. This STP has been commissioned in 2018 by the BWSSB, with a total capacity of 20 MLD at 833 m^3/hr.
Treatment Process	
1. The treatment of wastewater is based on the sequential batch reactor (SBR) technology. 2. There are 4 operating C-tech basins in the plant. 3. Pre-treated wastewater after the screen (Fine and Corse screen) and grit chambers enter the SBR basins. 4. These basins work in sequence and the influent flow is distributed using the automatic gates provided at the inlet. 5. The SBR basins are equipped with blowers, diffusers, return-activated sludge pumps, surplus-activated sludge pumps, and decanters. 6. The excess sludge from the basins is taken for dewatering in a sludge dewatering machine. 7. The dewatered sludge is then subjected to further drying within the plant area and then disposed of at the designated location as per the direction of BWSSB. 8. The clarified water from the SBR basins is further subjected to disinfection through chlorination in the chlorination tank. The chlorinated water is finally discharged into the nearby Horamavu Lake.	
Cost Aspects	
Expenses	• Implementation Cost: Rs. 42.98 crores • Operations and Maintenance Cost: Rs. 33.45 Lakhs [Rs.22 Lakhs for Power charges, Rs.11.45 Lakhs for other expenses]


SLUDGE DRYING BED


FAECAL SLUDGE TREATMENT PLANT


ADMIN CUM SCADA BUILDING

IV. Testimonials

@Shri Shailender Singh, Chief Engineer, Haryana:
Thanks a lot to the organisers for successful completion of the capacity building. I have enhanced by knowledge from the learned speakers. Special thanks to Sh Chaurasia, Sh Kakkar, Sh Rajesh, Sh Shasanka and others for their valuable inputs and clearing our doubts. Thanks to the participants for sharing the best practices in their States and for the quality time spent with them. Thankful to WASH for such a good host and taking care and pain in getting the training done so meticulously. Warm Regards.

@Hetal Sorathia, Manager (Projects), Swachh Bharat mission-Urban Gujarat, Urban Development and Urban Housing Department:
Thanks to Shri V K Chaurasia sir and to all senior speakers for knowledgeable training for Used water Management, Gujarat. Thanks to Wash-I team. Aapno khub khub Aabhar.

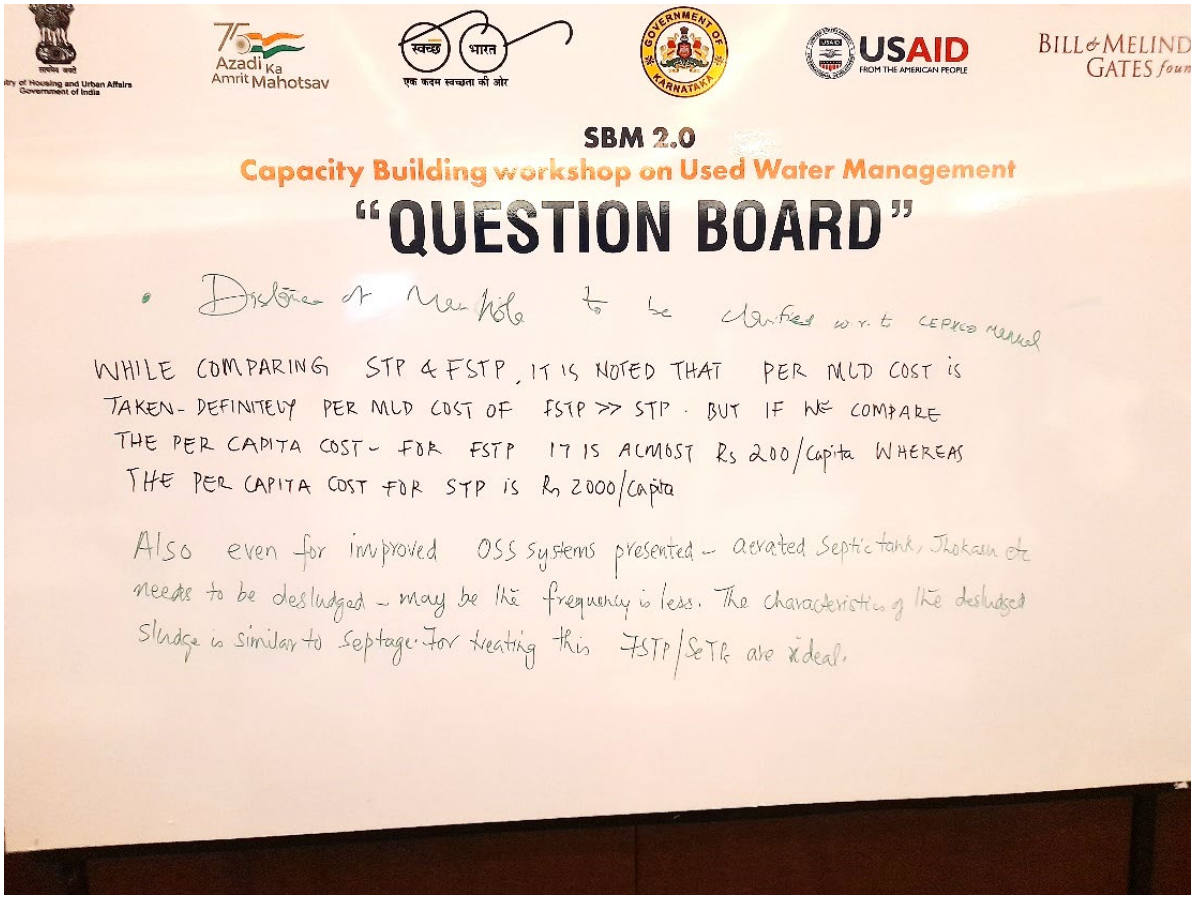
@Shri. Andrew Lalhruaia, Nodal Officer UWM, Govt of Mizoram:
Thanks to MOHUA, CPHEEO and WASHi.
The speakers, the setting of program, the performance of host etc. are one of the best I have ever attended during more 20yrs of my service in the Govt. Good luck all.

@Shri Koushik Das, AE, Tripura Jal Board:
It's indeed great capacity building training program conducted by MoHUA, CPHEEO n WASH-I...we all are honoured to be a part of this beautiful training program...looking forward to attend more of such great capacity building programmes in future.

@Smt. Bindu Sugunan, Dy Chief Engineer (Sewerage PPD and WASCON), Govt of Kerala:
It was a very wonderful programme and I lack words to express my gratitude to each one who strived to make this a grand success.

@Jaswant Singh, Superintending Engineer, PHED, Haryana:
Thanks a lot to the organisers for successful training program. Thanks to all participants for sharing the best practices in their States and for the quality time spent with them. It was a very wonderful programme and I lack words to express my gratitude to each one who strived to make this a grand success. Thanks and Regards.

A board was placed at the venue to invite questions and discussions. Although most of the discussions occurred in person or on the Whatsapp group covered above. The discussion on the board is shown below:



V. Annexures: Agenda and Bio of key Speakers

सत्यमेव जयते
Ministry of Housing and Urban Affairs
Government of India

Azadi Ka Amrit Mahotsav

स्वच्छ भारत
एक कदम स्वच्छता की ओर

GOVERNMENT OF KARNATAKA

USAID
FROM THE AMERICAN PEOPLE

BILL & MELINDA GATES foundation

BRIDGING THE KNOWLEDGE GAP
WASH INSTITUTE

Agenda Schedule

SBM 2.0
Capacity Building workshop on Used Water Management

16th–18th NOV 2022 | **Bengaluru**

Day 1 | 16th Nov 2022

09.30 – 10.00
Registration of Delegates

Inaugural Session

10.00 – 10.10
Welcome Address
Shri. V.K.Chaurasia
Joint Advisor, CPHEEO

10.10 – 10.25
Keynote Address by Mission Director – SBM 2.0, MoHUA
Smt. Roopa Mishra
Joint Secretary, MoHUA

10.25 – 10.40
Context Setting and Outline of Deliberations
Shri. V.K.Chaurasia
Joint Advisor

10.40 – 10.45
Vote of Thanks
Shri. Sasanka Velidandla
Advisor, WASH Institute

Tea Break | 10.45 - 11.15

Technical Session 1: Principles, Planning and SBM 2.0 Approch

11.15 – 12.00
Used Water Management – Principles and Management Options
Prof. S. R. Asolekar
Professor, IIT Mumbai

12.00 – 13.15
City Used Water Management Planning
Shri. V.K.Chaurasia
Joint Advisor, CPHEEO

Lunch Break | 13.15 - 14.15

14.15 – 14.45
Planning and Project Management of Sewerage Systems
Shri. Devang Shah
Sewerage specialist, MD, Himadri Enviro-protection

14.45 - 15.45
Steps to accelerate Used Water Management, Guided Plenary
Shri. Sasanka Velidandla
Advisor, WASH Institute

Tea Break | 15.45 - 16.15

16.15 - 18.00
Presentation by States; Approaches, strategies and learning in implementing UWM
Haryana; Rapid implementation of STPs across state
Madhya Pradesh; Integrated approach for UWM
Gujarat: sewerage systems for small and medium towns
Uttarakhand: Interception and Diversion

Experience sharing by states on Used Water Management

About the Speakers

Smt. Roopa Mishra
Joint Secretary, MoHUA

IAS officer from Odisha, Smt. Roopa Mishra has been appointed Joint Secretary, Ministry of Housing and Urban Affairs. She is the mission director for SBM 2.0 at MoHUA, Government of India.

Shri. V.K.Chaurasia
Joint Advisor, CPHEEO

V. K. Chaurasia, is Joint Adviser (PHEE) at Central Public Health and Environmental Engineering Organization, MoHUA, GOI. He is having Graduation in Civil engineering and Post-Graduation in Environmental Engineering from IIT Roorkee and has over 23 years of experience in public health engineering and is currently involved in implementation of Swachh Bharat Mission 2.0 (Urban), AMRUT & Smart cities Programmes. He was technical Expert Member of "Task force Report on Waste to Energy" published by NITI AYOG in 2014. He was also Member Secretary of Revised manual of Municipal Solid waste management published in Aug 2016. He has been member of drafting committee of MSW Rules 2016 and C & D waste Rules 2016. He is presently actively associated in various programmes and policies formulation/ implementation in MoHUA related to solid waste management, Water supply, Sewerage and Storm water drainage.

Shri. Sasanka Velidandla
Advisor, WASH Institute

Mr. Sasanka velidandla is currently Advisor, Program and Management with Wash Institute. Prior to this, he was advising the Department of water supply and sanitation, GoI, building their capacities on FSM for rural areas. He has recently lead efforts in conceptualising and developing a quality framework for FSM. The framework is intended to help governments and practitioners maintain quality while planning or implementing FSSM service models.

Prof. S. R. Asolekar
Professor, IIT Mumbai

Dr. Shyam R. Asolekar is Professor at the Centre for Environmental Science and Engineering at the Indian Institute of Technology, Bombay. Dr. Asolekar has been a member of the "Dahanu Taluka Environmental Protection Authority" (since 1997) as well as the "Expert Committee on Conversion of Municipal Solid Wastes to Energy" (since July 2005), both constituted by the Honorable Supreme Court of India. Recently, Prof. Asolekar has been appointed as a core-team member for a project envisaged and conducted by the consortium of seven IITs entrusted with the responsibility of preparing Ganga River Basin Management Plan (GRBMP) by the Ministry of Environment and Forests (MoEF), GOI, New Delhi. Dr. Asolekar has also been advising the MoEF on the projects undertaken by the National River Conservation Directorate (NRCD), Hazardous Substances Management (HSM) Division, and Environmental Information System (ENVIS). His book " Wastewater treatment for pollution control and reuse" is one of the widely read publication in this domain.

Shri. Devang Shah
Sewerage specialist, MD, Himadri Enviro-protection

Mr. Devang P Shah is currently working as Managing Director, Himadri Enviro-Protection Consultants Pvt. Ltd. Has done his graduation and post graduation in Civil Engineering with specialization in Environmental Engineering. He has managed wide variety of projects involving comprehensive planning, designing of urban water supply and underground sewerage, storm water drainage projects. Previously he worked with prestigious companies like Tata Consulting Engineers (7 years) and Multi Media Consultants Pvt. Ltd. He has designed water supply and sewerage system for major Corporations, State Level Nodal Agency, Gujarat Water Supply & Sewerage Board, Urban Development Authorities and others. His firm, Himadri Enviro-Protection Consultants Pvt. Ltd. has been empanelled with Urban Development and Urban Housing Department, Government of Gujarat since 2006 for sector of water supply, sewerage and storm water drainage projects in Gujarat state.

Day 2 | 17th Nov 2022

09.30 – 09.45
Recap and Preview of the Day
Shri. Sasanka Velidandla
Advisor, WASH Institute

Used Water: Treatment and Reuse options in small and medium towns

09.45 – 10.15
Managing Onsite Sanitation System, Co-treatment of Faecal Sludge in STPs, Reuse
Shri. Sasanka Velidandla
Advisor, WASH Institute

10.15 - 10.45
Scaling up Decentralised Wastewater Management and its Reuse in Small and Medium Towns
Shri. Rajesh Pai
Technical Advisor, WASH Institute

10.45 - 11.15
Management of Used Water Flow Through Open Channels/ Drains and Reuse of Treated Used Water
Shri. P.G.Ganapathy
Advisor, CDD Society

Tea Break | 11.15 - 11.30

11.30 - 12.15
Wastewater Management and Integration with Irrigation; National Perspective of Israel
Dr. Lior Asaf
Water Attaché Israeli Embassy, New Delhi, India

12.15 – 13.00
Presentation on the Ready Reckoner on Municipal Used water Treatment Technologies for Medium and Small Towns
Shri. V.K.Chaurasia
Joint Advisor, CPHEEO

Lunch Break | 13.00 - 14.00

Regional Experience sharing by State on UWM

14.00 – 15.00
Thematic Discussion 1
Experience sharing for Cold and Hilly areas
States to present:
• J&K • Himachal
• Mizoram • Sikkim

Thematic Discussion 2
Experience sharing for Plains
States to present:
• Telangana • Uttar Pradesh
• Karnataka • Rajasthan
• Goa

14.30 – 15.00
Summary of thematic discussions and Q&A
Respective session facilitators

15.00 – 17.00
Exhibition of technologies

Tea Break | 16.30 - 17.00 (to be served at exhibition venue)

18.00 - 18.15
Vote of Thanks & Briefing on the Exposure Visit
Shri. Sasanka Velidandla
Advisor, WASH Institute

17.00 - 18.00
Way forward and discussion with participants
Smt. Roopa Mishra
Mission Director SBM, Joint Secretary, MoHUA

About the Speakers

Shri. Rajesh Pai
Technical Advisor, WASH Institute

Rajesh Pai Halaje has more than 20 years of experience in the implementation of sanitation projects and programmes. Rajesh is a bachelor's in civil engineering and has a professional certification in Urban Infrastructure Planning. Rajesh's domain expertise is in the planning, engineering design, capacity building and implementation of projects related to decentralized wastewater management, fecal sludge management and greywater management. Rajesh designed and supervised construction of India's first FSTP in Devanahalli, Bangalore, which has been the blueprint for numerous other FSTPs built in the country. Rajesh has worked in Bangladesh, Nepal, Bhutan, Mexico, Iraq, Tanzania, Zambia, Germany, and Cambodia. Rajesh has designed more than 65 FSTPs and over 200 nature based decentralised wastewater systems. As a technical advisor to several organisations in India and internationally, Rajesh guides them in planning sanitation projects. He serves on the technical committee for Karnataka state government for the review of detailed projects reports on FSM.

Shri. P.G.Ganapathy
Advisor, CDD Society

Mr. P.G. Ganapathy, an infrastructure and sustainability professional with around 25 yrs of experience, is a Mechanical Engineering Graduate from IIT Madras and a PGDBM from IIM Ahmedabad (1993). Currently, as Senior Advisor at CDD, he supports strategic initiatives, innovation and program management. In the past, he has been a Senior Advisor and adjunct faculty at IIHS, an Advisor to the Infrastructure Development Corporation of Karnataka (iDecK), an external infrastructure specialist consultant at Mckinsey & Co., etc. He was the Founder and Director-in-charge at Ecofirst Services, a sustainable design consultancy which offers infrastructure and services design to large buildings and township projects. He has also worked as an individual consultant with the World Bank and the ADB in the urban sector.

Dr. Lior Asaf
Water Attaché Israeli Embassy, New Delhi, India

Dr Lior Assaf is the first-ever Water Attache to the Embassy of Israel in India. He is a hydrogeologist from Israel. He has an M.Sc in hydrology from the Hebrew University of Jerusalem, and a Ph.D from the Arava Institute for Environmental Studies. He has over 20 years of experience in groundwater hydrology, surface water hydrology, soil investigation, and environmental impact analyses for a variety of projects throughout Israel, USA and Sri Lanka.

Shri. Rohit Kakkar
Speaker

Rohit Kakkar has about 25 years of experience in water supply and sanitation in Army, wherein he had designed many water supply and sanitary components in various Army installations. He has a master's in environmental science and public health engineering from IIT, Bombay.

Day 3 | 18th Nov 2022

	Batch 1	Batch 2	Batch 3
09.00	Travel | 09.00 - 09.30		
09.30			
10.00	**Horamavu STP** Small scale STP	**Mahadevapura Lake STP** I&D with nature-based treatment	**Devanahalli FSTP** City scale faecal sludge treatment plant
10.30			
11.00	Travel | 11.00 - 11.30		Travel | 11.00 - 12.00
11.30		Travel | 11.30 - 12.00	
12.00	**Mahadevapura Lake STP** I&D with nature-based treatment		
12.30		**Horamavu STP** Small scale STP	Lunch | 12.30 - 13.00
13.00			
13.30	Travel | 13.30		
14.00	Lunch | 14.00 - 14.30	Lunch | 14.00 - 14.30	**Horamavu STP** Small scale STP
14.30			
15.00	Travel | 15.00 - 15.30	Travel | 15.00 - 15.30	Travel | 15.00
15.30			
16.00	**Devanahalli FSTP** City scale faecal sludge treatment plant	**Devanahalli FSTP** City scale faecal sludge treatment plant	**Mahadevapura Lake STP** I&D with nature-based treatment
16.30			
17.00	Travel | 17.00 - 17.30		
17.30			
18.00	Arrive at Hotel | 18.00		

Exhibitors and their Briefs

S No.	Exhibitor entity/institute	Introduction
1	**Consortium of DEWATS Dissemination (CDD) Society**	CDD Society is a not-for-profit organization, registered in 2005, that innovates, demonstrates and disseminates decentralized nature-based solutions for the conservation, collection, treatment and reuse of water resources and management of sanitation facilities.
2	**Open Water**	Openwater.in is a spinoff from the Flexible electronics Lab, Indian Institute of Science, Bangalore with an aim to make water treatment and wastewater management hassle-free. Their patented technology helps achieve smart, reliable and sustainable water treatment by enabling individual users to treat water from any source with a treatment unit.
3	**Kam Avida**	Kam Avida Enviro Engineers Pvt Ltd is India's leading manufacturer of waste handling equipment, with professionals committed to the task of bringing about mechanization in the areas of cleaning and maintenance that traditionally have been carried out manually; using improvised tools and tackles.
4	**WASH Institute**	WASH Institute is a registered non-profit organization that provides technical, training, research and development services to a wide range of stakeholders - Governments, industry, DFIs, philanthropic organizations, and other NGOs. The organization is a sector partner of National Jal Jeevan Mission and supports the Ministry of Housing and Urban Affairs (MoHUA) and Ministry of Drinking Water and Sanitation (rechristened Ministry of Jal Shakti) in implementing Swachh Bharat Mission (Urban and Gramin) and Jal Jeevan Mission.
5	**NFSSM Alliance**	The National Faecal Sludge and Septage Management (NFSSM) Alliance was established with support from the Bill and Melinda Gates Foundation in 2016 to support safe sanitation at the national, state and city level. The Alliance is recognized as the collaborative body that drives the discourse of faecal sludge and septage management (FSSM) forward in India. The NFSSM Alliance in collaboration with the

		Ministry of Housing and Urban Affairs (MoHUA) and the Department of Drinking Water and Sanitation (DWS) has been instrumental in the passage of India's first national policy on FSSM in 2017.
6	**Gen Robotics Innovations Pvt. Ltd.**	Genrobotics, the leading Robotics company in India, primarily focusing on designing and development of Robotic solutions to address the most relevant social issues like manual scavenging, headquartered in Trivandrum, Kerala. Developing tailor-made products and services have keen importance in a Nation's prospering progression.
7	**Satsense Solutions**	Satsense Solutions uses satellite remote sensing technology and geospatial analytics to develop business and governance solutions for the Natural Resources and Infrastructure sectors.
8	**BlueDrop Enviro Pvt. Ltd.**	BlueDrop Enviro is a Sustainable Green solutions environmental company fully focused on the single objective of Waste Water Treatment and expert in Construction Wetlands solution in the world.
9	**Banka BioLoo Ltd.**	Banka BioLoo Limited is a pioneer in Water, Sanitation, and Hygiene (WaSH) infrastructure focusing on sanitation infrastructure and turnkey, human waste management solutions and services.
10	**Urban Management Center (UMC)**	UMC has been working closely with local governments by providing tailor made solutions in professionalising urban management. With our understanding of adult learning pedagogies, capacity building and training, we work towards building individual and systemic capacities of cities.

11	**Daiki Axis India Pvt. Ltd.**	Daiki Axis India Pvt. Ltd. is part of Daiki Axis Japan, the environment division of Daiki Japan, and is the largest manufacturer of decentralized STPS in the world. Daiki Axis Japanese Packaged STP (Johkasou), is a ready to install STP delivers performance conforming to the global discharged norms in an energy efficient manner. These products come in a modular construction and can be installed above or below the ground. The treated water can be further used for gardening, flushing, cooling towers etc.
12	**Villgro Innovations Foundation**	Villgro is India's foremost and one of the world's largest social enterprise incubators, established in 2001, its mission is to make innovative, impactful businesses succeed in Health, Agribusiness, and Climate Action. Over the years, Villgro has supported 340 social enterprises that have raised over INR 4.28 billion in investments, created 5646 jobs and impacted over 20.8 million lives. Villgro was awarded the Top Incubator Award by the Department of Promotion of Industry and Internal Trade (GoI) in 2020 and the DivHERsity awards in 2022.

Smt. Veena Reddy, Mission Director-USAID visiting the exhibition accompanied by WASH Institute

Smt. Roopa Mishra, Joint Secretary, MoHUA and Mission Director-SBM 2.0, MoHUA

Details of Attendees:

SBM 2.0: SBM 2.0 Capacity Building workshop on Used Water Management

Registration / Attendance Form for the Participants

November 16-18, 2022

Bengaluru, Karnataka

S. No.	Name	State	Organization	Designation	Phone number
1	**Sh. Harish Kumar Kansal**	UP	UP Jal Nigam U	Chief Engineer	9473942625
2	**Sh. Vipin Patel**	UP	SBM U	Divisional Manager	9669358569
3	**Sh. Pawan Kumar Agarwal**	UP	UP Jal Nigam U	Superintending Engineer	9971139915
4	**Dr. Radha Krishna Lal**	UP	SBM U	Executive Engineer	6394139837
5	**Sh. Devendra Kumar Meena**	Rajasthan	Municipal Corporation Jodhpur	Chief Engineer	8112202227
6	**Mr. Sameer Unhale**	Maharashtra	Govt of Maharashtra	State Mission Director	9867672412
7	**Mr. Prashant Janabandhu**	Maharashtra	Govt of Maharashtra	Chief Engineer, Directorate of Municipal Administration	8669041788
8	**Hans Kumar Jain**	MP	Govt of MP	Chief Engineer UDD, Bhopal	NA
9	**Mr. Rakesh Rawat**	MP	Govt of MP	Executive Engineer, UADD, Bhopal	9425310660
10	**Shri Robert Singh Kshetrimayum**	Manipur	MUDA	State Mission Director SBM (U)	9402607716
11	**Shri Naorem Ramchandra Singh**	Manipur	MUDA	Executive Engineer	9856175528
12	**Mr Sunil Kumar Yadav**	Bihar	Govt of Bihar	Mission Director & Addl Secretary	9931445362
13	**Sh. Surendra Kumar Sinha**	Bihar	Govt of Bihar	Superintending Engineer	9431254442

S. No.	Name	State	Organization	Designation	Phone number
14	**Dr. P Sampath Kumar, IAS**	Andhra Pradesh	Govt of Andhra Pradesh	State Mission Director	9985103333
15	**Mr. P Anand Rao**	Andhra Pradesh	Govt of Andhra Pradesh	Engineer in Chief, PHME	9000051148
16	**Ms. S Suhasini**	Andhra Pradesh	Govt of Andhra Pradesh	Deputy Executive Engineer	9390109919
17	**Mr. Chandra Mohan**	Andhra Pradesh	Govt of Andhra Pradesh	Executive Engineer	8897311538
18	**Sh.N.Srinivas Rao**	Telangana	Govt of Telengana	S.E, O/o ENC	9704601864
19	**Sh. G.Vijaya Bhaskar Reddy**	Telangana	Govt of Telengana	E.E, O/o ENC	7330690190
20	**Satinder Kumar**	Punjab	Govt of Punjab	Superintending Engineer Amritsar,	NA
21	**Sri Praveen.K.S**	Kerala	Govt. of Kerala	Director	9447341500
22	**Smt. BinduSugunan**	Kerala	Govt. of Kerala	Deputy Chief Engineer (Sewerage PPD & WASCON)	8547638021
23	**Sri Vivek Rai**	Uttarakhand	Govt. of Uttarakhand	Municipal Commisioner, Kashipur	9411102121
24	**Krishn Kumar**	Jharkhand	Govt. of Jharkhand	Deputy Director, SUDA	9431725252
25	**Ashish Kumar**	Jharkhand	Govt. of Jharkhand	Assistant Director, SUDA	8210988835
26	**Mr. Aniruddh Jevlikar**	Maharashtra	Govt of Maharashtra	Deputy Secretary, UDD	9867221432
27	**Mr. Devidas Jadhav**	Maharashtra	Govt of Maharashtra	Chief Engineer Selu	9422936699
28	**Debasis Singh**	Odisha	Govt of Odisha	Additional Secy	NA
29	**Durgesh Nandini Sahoo**	Odisha	Govt of Odisha	Additional Secy	NA
30	**Shailendra Singh**	Haryana	PHED Haryana	Chief Engineer	9216486225
31	**Jaswant singh**	Haryana	PHED Haryana	Superinteding Engineer	9466155801
32	**Hemanta bhuyan**	Assam	Govt of Assam	JS & MD	7636068792
33	**Narendra Ajmera**	Rajasthan	RUDSICO	Addl Chief Engr	NA
34	**Ms. Viyanka Dhanapune**	MP	Govt of MP	Executive Engineer, UADD, Bhopal	7.35E+09
35	**Mr. Gagandeep Singh Luthra**	Punjab	Govt of Punjab	SDO MC Jalandhar	9814224554
36	**Ekjot Singh**	Punjab	Govt of Punjab	XEN MC Moga	9780013004

S. No.	Name	State	Organization	Designation	Phone number
37	**Gaurav Raheja**	Speaker	No Information	No Information	NA
38	**Devang Shah**	Speaker	Himadri	Himadri Enviro	9825444159
39	**AK Sir**	WASHI	WASHI	Executive Director	9868888870
40	**Sasanka**	WASHI	WASHI	Advisor	9538444828
41	**Er. Zungatemba Jamir**	Nagaland	Govt of Nagaland	JE	7005458379
42	**Sh. Manhunbeitki Passah**	Meghalaya	Govt of Mehgalaya	AE, Jowai Municipal Board	9863024731
43	**Sh. Salnoop K Marak**	Meghalaya	Govt of Mehgalaya	JE, Resubelpara Municipal Board	8414077151
44	**Sh. Peaceful Roy Lyngdoh**	Meghalaya	Govt of Mehgalaya	SWM Expert, SBM PMU	9774944837
45	**Shri Tarnajit Okram**	Manipur	MUDA	MIS Expert SBM	7640541542
46	**Ms. P Sunanda**	Andhra Pradesh	Govt of Andhra Pradesh	Project Associate	9491975371
47	**Mr. K Raghunath Reddy**	Andhra Pradesh	Govt of Andhra Pradesh	Project Manager	9000633808
48	**Er. Rinchin Norbu**	Arunachal Pradesh	Govt of Arunachal Pradesh	JE, Bordumsa	9612150863, 7005125145
49	**Ms. Mitasha Pillay**	Arunachal Pradesh	Govt of Arunachal Pradesh	Program Manager SBM PMU	8882365869
50	**Mr Er.Andrew Lalhruaia**	Mizoram	Govt. of Mizoram	Nodal Officer UWM	9436157267
51	**Ms Er. R. lalmuanpuii**	Mizoram	Govt. of Mizoram	Engineer`	8974397849
52	**Sri.Vipin.S**	Kerala	Govt. of Kerala	Sanitation expert	9446252758
53	**Sri.Akhilesh Ramesh**	Kerala	Govt. of Kerala	IEC Specialist	8921111374
54	**Sheik Mohammed Shibl**	Kerala	Govt. of Kerala	FSSM Wastewater Specialist	9176376275
55	**Sri Rakesh Jakhmola**	Uttarakhand	Govt. of Uttarakhand	AE, UDD, Uttarakhand	9634061481
56	**Kartikey Tiwari**	MP	MP- State PMU - KPMG	Consultant, KPMG	9099952842
57	**Ashna Rathore**	MP	MP- State PMU - KPMG	Consultant, KPMG	9310444625
58	**Shri Swapan Kumar Sinha**	Manipur	MUDA	Consultant UWM	9435115209

S. No.	Name	State	Organization	Designation	Phone number
59	**Sh. Donlang K Baney**	Meghalaya	Govt of Mehgalaya	Technical Assistant SMB, Consultant	7975557683
60	**Prashant Mahaparta**	Odisha	Govt of Odisha	EIC	NA
61	**Suryabarti Majhi**	Odisha	Govt of Odisha	Project Engineer	NA
62	**Hetal Sorathiya**	Gujarat	Govt of Gujarat	Manager, Project	83474 39595/ 98256 98358
63	**Kirti Nath Talukdar**	Assam	Govt of Assam	AE	NA
64	**Indra Sarmah**	Assam	Govt of Assam	AEE	8638674102
65	**Dipanjoy Vasumatary**	Assam	Govt of Assam	Waste water Specialist	8860566208
66	**Mr. Babubhai Choutubhai Patel**	Gujarat	Govt of Gujarat	Gujarat Urban Development Mission Chief Engineer	909938716
67	**Hemalatha**	Tamil Nadu	Govt of Tamil Nadu	UWM expert	8667612874
68	**Saravannan**	Tamil Nadu	Govt of Tamil Nadu	AEE	8925809239
69	**Jaya Prakash**	Tamil Nadu	Govt of Tamil Nadu	PIU, consultant	8883421732
70	**Sajal Debnath**	Tripura	Govt. of Tripura	JE, Urban Development Dept.	9862970296
71	**Koushik Das**	Tripura	Govt. of Tripura	AE, Tripura Ja Board	7085917580
72	**Mihir Jariwala**	Tamil Nadu	Govt of Tamil Nadu	SWM Expert	9898194264
73	**Roopa Mishra**	JS	MOHUA	JS	NA
74	**Naseer Ahmed Kakroo**	J&K	Govt of J&K	No Information	NA
75	**Mr.Hussain Hasamwala**	Gujarat	Govt of Gujarat	Project Officer	NA
76	**Omkar Kane**	Maharashtra	CEPT	Senior Research Associate	8600375593
77	**Chirag Patel**	Maharashtra	CEPT	Senior Research Associate	9833937821
78	**Saurabh Sharma**	Chattisgarh	Govt of Chattisgarh	Chief Project officer	8770306395
79	**Devvrat Singh**	Chattisgarh	Govt of Chattisgarh	Assistant Project Officer	9981627860
80	**Mayank Sahu**	Chattisgarh	Govt of Chattisgarh	Assistant Project Officer	7869096365
81	**Er. Waloniba Longkumer**	Nagaland	Govt of Nagaland	Nodal Officer UWM	8974707343
82	**Vijaya V**	Team Lead National PMU	KPMG	Team Lead National PMU	NA

S. No.	Name	State	Organization	Designation	Phone number
83	**Himanshu Chaturvedi**	Consultant National PMU	KPMG	Consultant National PMU	NA
84	**Pooja Ravi**	Consultant National PMU	KPMG	Consultant National PMU	NA
85	**Siriesha Darbha**	Consultant National PMU	KPMG	Consultant National PMU	NA
86	**Sehrish Hazarika**	Consultant National PMU	KPMG	Consultant National PMU	NA
87	**Manish Kandpal**	Consultant National PMU	KPMG	Consultant National PMU	NA
88	**Prabal Bhardwaj**	Consultant National PMU	KPMG	Consultant National PMU	NA
89	**Praveen Chature**	Consultant National PMU	KPMG	Consultant National PMU	9845903183
90	**Rohit Chandragiri**	Consultant National PMU	WASHI	Consultant National PMU	7899454455
91	**Ashish Sharma**	Consultant National PMU	WASHI	Consultant National PMU	NA
92	**Swagata Kainthola**	Consultant National PMU	KPMG	Consultant National PMU	NA
93	**Bhawani Shankar Tripathi**	Consultant National PMU	KPMG	Consultant National PMU	NA
94	**V K Chaurasia**	Joint Adviser PHEE CPHEEO	CPHEEO	Joint Adviser PHEE CPHEEO	NA
95	**J B Ravinder**	Joint Adviser PHEE CPHEEO	CPHEEO	Joint Adviser PHEE CPHEEO	NA
96	**Rohit Kakkar**	Dy Adviser PHE CPHEEO	CPHEEO	Dy Adviser PHE CPHEEO	NA
97	**Sravanthi Jeevan**	Assistant Adviser CPHEEO	CPHEEO	Assistant Adviser CPHEEO	NA
98	**Charul**	Consultant National PMU	KPMG	Consultant National PMU	NA

S. No.	Name	State	Organization	Designation	Phone number
99	**Sucharita**	Consultant National PMU	KPMG	Consultant National PMU	NA
100	**Sathish Kumar S**	Assistant Adviser CPHEEO	MOHUA	Assistant Adviser CPHEEO	NA
101	**Tarun Rajvanshi**	Consultant National PMU	KPMG	Consultant National PMU	NA
102	**Vivekanand Desai**	Goa	Govt of Goa	State Mission Manager	NA
103	**Pranav Pasari**	Exhibitors	Satsense	NA	NA
104	**ganges reddy**	Exhibitors	Blue Drop	NA	NA
105	**Remya Rajan**	Exhibitors	Bandicoot	NA	9840811308
106	**Jeremiah Andrew**	Exhibitors	DASRA	NA	NA
107	**Drishti Basi**	Exhibitors	DASRA	NA	NA
108	**Prerana Somani**	Exhibitors	UMC	NA	NA
109	**Priyambda Tripathi**	Exhibitors	UMC	NA	NA
110	**Shubham Vishvakerma**	Exhibitors	Villgro	NA	NA
111	**Bhavik Gupta**	Organiser	WASHI	NA	7678626287
112	**Praveen N**	Organiser	WASHI	NA	9743892359
113	**Nitin**	Organiser	WASHI	NA	9810800219
114	**Akanksha**	Organiser	WASHI	NA	9557488816
115	**Abhishek**	Organiser	WASHI	NA	8860940876
116	**Nivedita**	Organiser	WASHI	NA	9909312088
117	**Priyanka**	Organiser	WASHI	NA	7982800129
118	**Robin**	Organiser	WASHI	NA	8980790240
119	**Sharika**	Organiser	WASHI	NA	7006159568
120	**Rajesh Pai**	Organiser	WASHI	NA	9900050800
121	**Abraham Lingam**	Organiser	WASHI	NA	8144605566
122	**Gaurav**	Organiser	WASHI	NA	9529569791
123	**Abesh**	Organiser	WASHI	NA	7827781358
124	**Ashok. I Shirur**	Karnataka	KUWS & DBD	AEE	NA

S. No.	Name	State	Organization	Designation	Phone number
125	**Gangadhara. T**	Karnataka	KUWS & DBD	EE	NA
126	**Pavithra**	Karnataka	KUWS & DBD	EE	NA
127	**Rajshekar**	Karnataka	DMA	HQA	NA
128	**Vikas**	Karnataka	DMA	Consultant National PMU	NA
129	**Ravikumar**	Karnataka	Shimoga City Corporation	AEE	NA
130	**Sh. K. P. Mohanraj, IAS**	Karnataka	Karnataka Urban water Supply and Drainage Board	Managing Director	NA
131	**Sh. S. B. Siddanaik**	Karnataka	Karnataka Urban water Supply and Drainage Board	Chief Engineer	NA
132	**Sh. R. Ramesh**	Karnataka	Karnataka Urban water Supply and Drainage Board	Chief Engineer	NA
133	**Sh. Muddurajnna**	Karnataka	Karnataka Urban water Supply and Drainage Board	Chief Engineer	NA
134	**Sh. V. L. Chandrappa**	Karnataka	Karnataka Urban water Supply and Drainage Board	Chief Engineer	NA
135	**Sh. G. M. Nagaraju**	Karnataka	Karnataka Urban water Supply and Drainage Board	Superintendent Engineer	NA
136	**Smt. Deepa Cholan, IAS**	Karnataka	KUIDFC	Managing Director	NA
137	**Smt. Manjula N. Rao**	Karnataka	KUIDFC	DGM (SWM)	NA
138	**Sh. C. Kartikeyan**	Karnataka	KUIDFC	Assistant Executive Engineer	NA
139	**Sh. Jayaram, IAS**	Karnataka	BWSSB	Chairman	NA
140	**Sh. Sathish Reddy**	Karnataka	BWSSB	(Environment)	NA
141	**Sh. Chandan**	Karnataka	BWSSB	Assistant Executive Engineer	NA
142	**Sh. Pawan**	Karnataka	BWSSB	Assistant Engineer	NA
143	**Sh. Vinay**	Karnataka	Tumkur City Corporation	Executive Engineer	NA
144	**Sh. Sudindra Nayak**	Karnataka	Tumkur City Corporation	Assistant Executive Engineer	NA
145	**Sh. Manjunath**	Karnataka	Ballari City Corporation	Assistant Executive Engineer	NA
146	**Sh. Ravi Kumar**	Karnataka	Shimoga City Corporation	Assistant Executive Engineer	NA

S. No.	Name	State	Organization	Designation	Phone number
147	**Sh. Nagraja Gowda**	Karnataka	Shimoga City Corporation	Assistant Executive Engineer	NA
148	**Sh. Vittal Honnali**	Karnataka	Vijaypura City Corporation	Executive Engineer	NA
149	**Sh. Teju Prasad**	Karnataka	DMA	Assistant Executive Engineer	NA
150	**Sh. Archana**	Karnataka	DMA	Environment Engineer	NA
151	**Sh. Gowtham S. K.**	Karnataka	DMA, KPMG (Suwasi)	Assistant Manager	NA
152	**Sh. Gautam Talukdar**	Karnataka	DMA, KPMG (SBM PMU)	Manager	NA
153	**Sh. Kovidh Dhyani**	Karnataka	DMA, KPMG (SBM PMU)	Consultant	NA
154	**Smt. U. Sushmita**	Karnataka	DMA, KPMG (SBM PMU)	Consultant	NA
155	**Manjunatha**	Karnataka	City Corporation	Superintendent Engineer	NA
156	**Viraj. K**	Karnataka	Vishwavani	Senior Sub Editor	NA
157	**Bharuth Gowda**	Karnataka	The Hindu	Reporter	NA
158	**Oskadu**	Karnataka	No Information	Media person	NA
159	**Rohini. K**	Karnataka	DIPR	SAD	9448953304
160	**Sunitha.G**	Karnataka	BWSSB	NA	9951834300
161	**Anil**	Karnataka	Vasthabharthi	NA	9916678190
162	**Avinash. MR**	Karnataka	No Information	NA	9632269291
163	**Rahaman. HS**	Karnataka	Aam Admi Daily Paper	NA	9480301198
164	**Navya**	Karnataka	The Hindu	NA	7619612116
165	**Ramesh**	Karnataka	Press News of India	News Editor	9449751916
166	**Dipu**	Karnataka	TOK Press	NA	NA
167	**Ritesh Kumar Suman**	Karnataka	Karnataka PMU	NA	NA
168	**Prof Sadashiva Murthy**	Karnataka	JSS Science & Technology University	Professor	9900504023
169	**Puttaiah J**	Karnataka	KUWS & DBD	AEE	9480813160
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174	**Mahalakshmi KN**	Karnataka	KUWS & DBD	AEE	9108972621
175	**Santhosh Raghavan K V**	Tamil Nadu	IIHS	NA	9880030182
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177	**Subrata Chakraborty**	UP	CSE	Sr. Program Manager	9433229438
178	**Madhusudhan CR**	Karnataka	DMA	State IEC	9743226470
179	**Pavan Kumar**	NA	CSE	Program Manager	9945366045
180	**Sri. P.G Ganapathy**	NA	CDD	Advisor	NA
181	**Smitha R**	Karnataka	Information Department	Information Assistant	6361786306
182	**Narayana**	Karnataka	BWSSB	AEE	9816179260
183	**R K Srinivasan**	NA	USAID	NA	9717690707
184	**Kumar Saket**	NA	KPMG	PMU Program Director SUWASI	8527914777
185	**Mr Mohan Kumar**	NA	Tv 23 Kannada	Reporter	9019078263
186	**Rohini**	NA	CDD Society	NA	8105528900
187	**Manohar krishna**	NA	Satsense	NA	9822025166
188	**Rashid k**	NA	Kam avida	NA	NA
189	**Agil Ajith**	NA	Gen robotics	NA	9946008707
190	**Nabin k nair**	NA	Gen robotics	NA	8590016493
191	**Prabha Nagaraja**	NA	Open Water	NA	9740919842
192	**Drishti Basi**	NA	NFSSM	NA	9582741337
193	**Mr.SRINATH LANKA**	NA	Daiki	NA	9963771111
194	**Mr. Jenish Jeykumar**	NA	Daiki	NA	9940532272
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196	**Mr. Krishna Prasad**	NA	Daiki	NA	NA
197	**Ms. Simmar Kohli**	NA	Daiki	NA	NA
198	**Pratim Raha**	NA	Villgro	NA	9886156956

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200	**Oshin Shaji**	NA	Villgro	NA	9600678868
201	**Rakesh Kasb**	NA	Villgro	NA	NA
202	**Abhijit Sath,**	NA	Villgro	NA	9930125888
203	**Rahul Vishvakerma,**	NA	Villgro	NA	NA
204	**Shubham Vishvakerma,**	NA	Villgro	NA	8109487614
205	**Chandrasekhar Nandigama**	NA	Villgro	NA	8142909004
206	**Parul Rana**	NA	Villgro	NA	7876617431
207	**Hari Kumar**	NA	NA	NA	9080395012
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209	**Aparna Unni**	NA	NA	NA	9995081619
210	**S. Saravanan**	NA	NA	NA	7904518447
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214	**Dhannu Dhanpalan**	NA	NA	NA	9495084469
215	**Ajay Sharma**	NA	NA	NA	9590772816
216	**Sashikenth**	NA	NA	NA	7070181785
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