



Water Security and Climate Adaptation Conference (WSCA 2023)



Reuse of treated wastewater and sludge in Maharashtra, India

Center for Water and Sanitation, CRDF, CEPT University



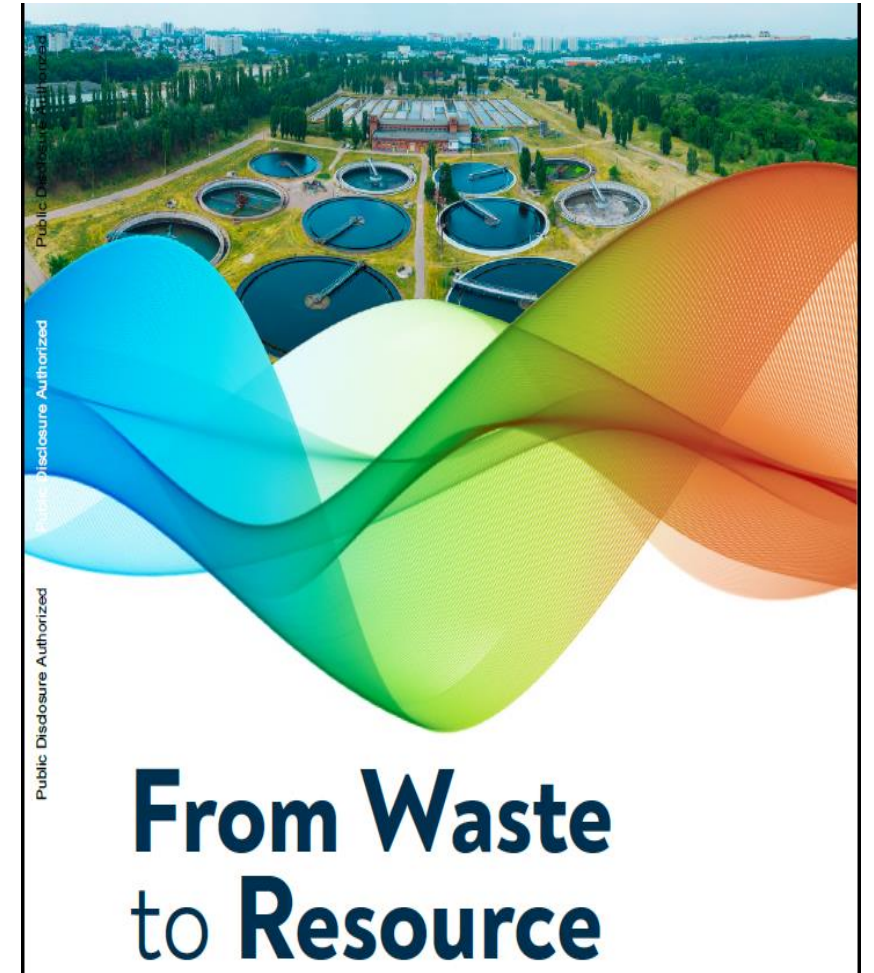
Why WasteWater?

Indian Cities generate 72 Billion litres of wastewater every day

Only 28 percent of wastewater is treated and discharged in waterbodies of fields

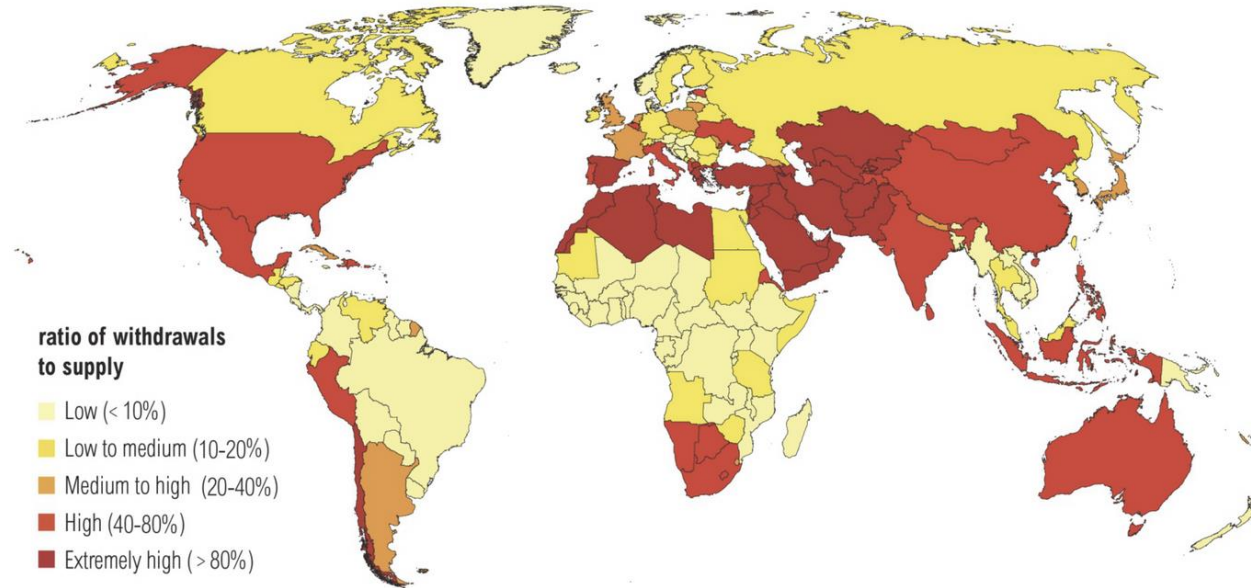


Wastewater re-use is the solution to India's water woes !!

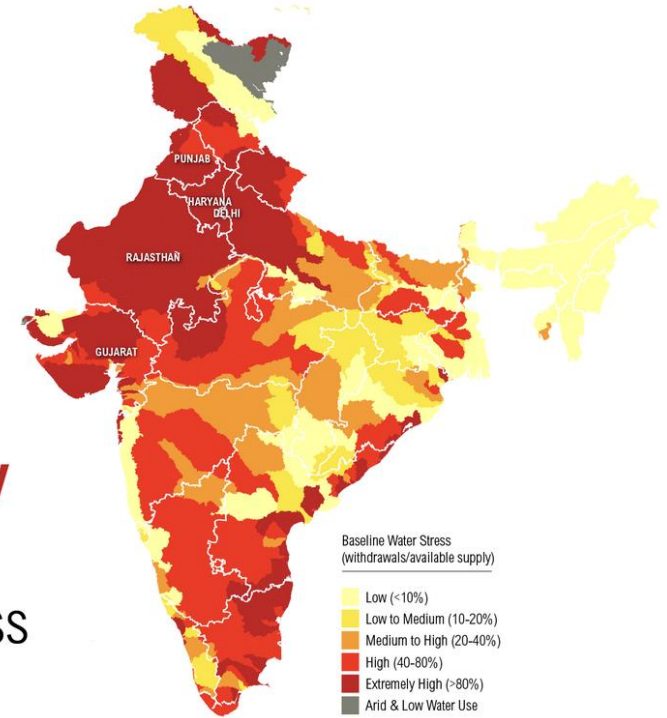


Day zeroes are closer than we think!

Water Stress by Country: 2040



54%
of India
Faces
**High to
Extremely
High
Water Stress**



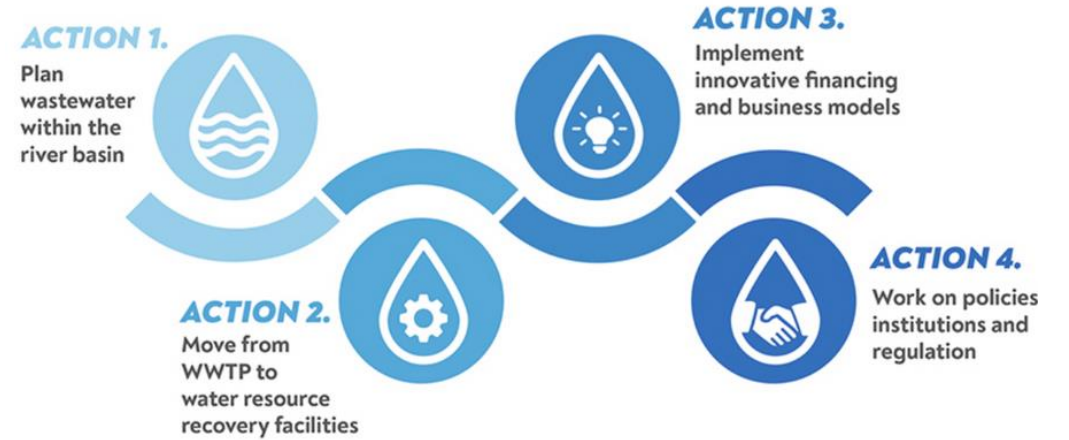
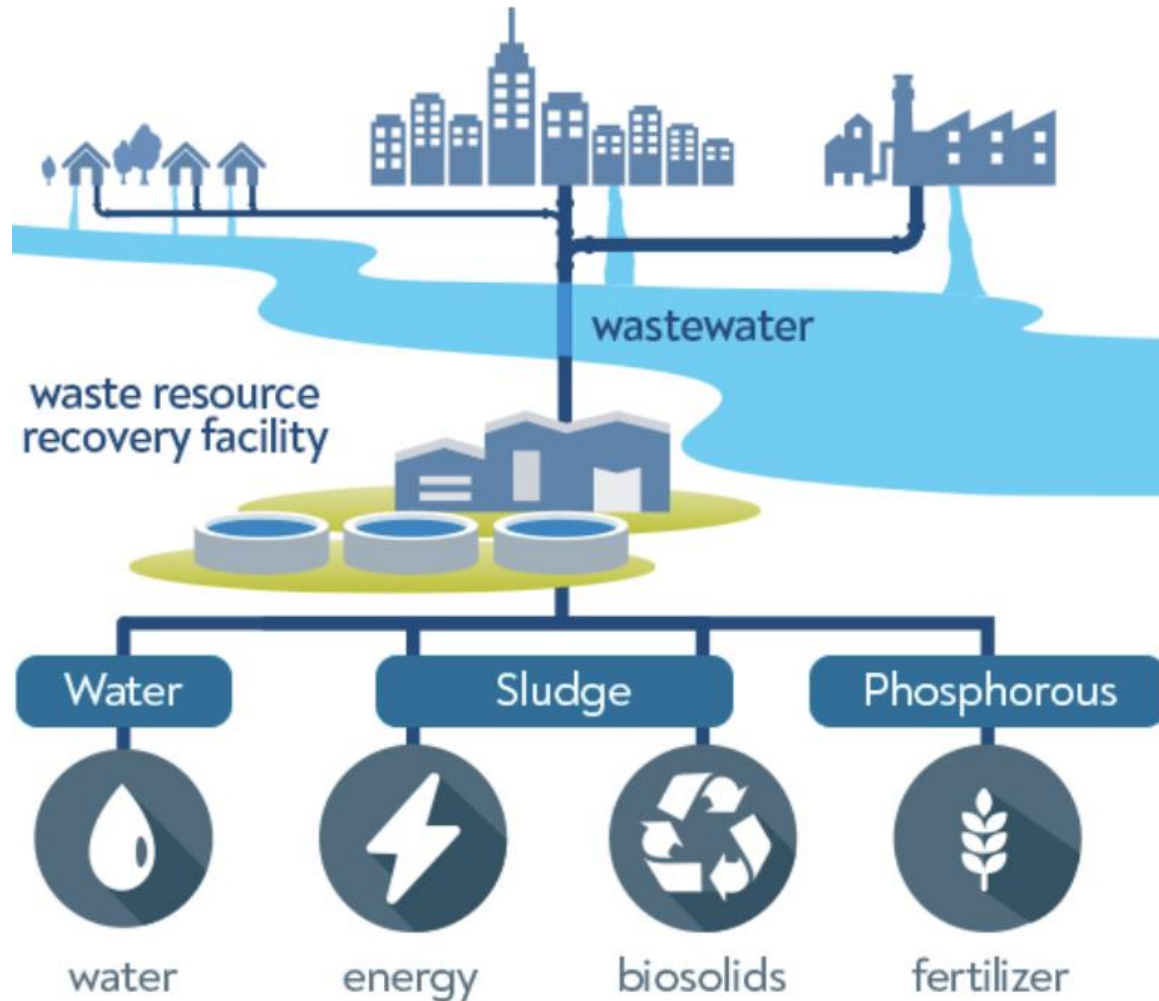
NOTE: Projections are based on a business-as-usual scenario using SSP2 and RCP8.5.

www.indiawatertool.in

 WORLD RESOURCES INSTITUTE

India has 18% of the world's population, but only 4% of its water resources, making it among the most water-stressed in the world (World Bank, 2022). Nearly 600 million people are facing high to extreme water stress; and about 200,000 people were dying every year due to inadequate access to safe water (NITI Aayog, 2018).

Used water management can combat challenges of water stress.



Used water is seen as a burden, where it is a resource to tackle water scarcity and security challenges. Not just used water, but it's byproducts can also be used for many residential, industrial, and agricultural uses (World Bank, 2020).

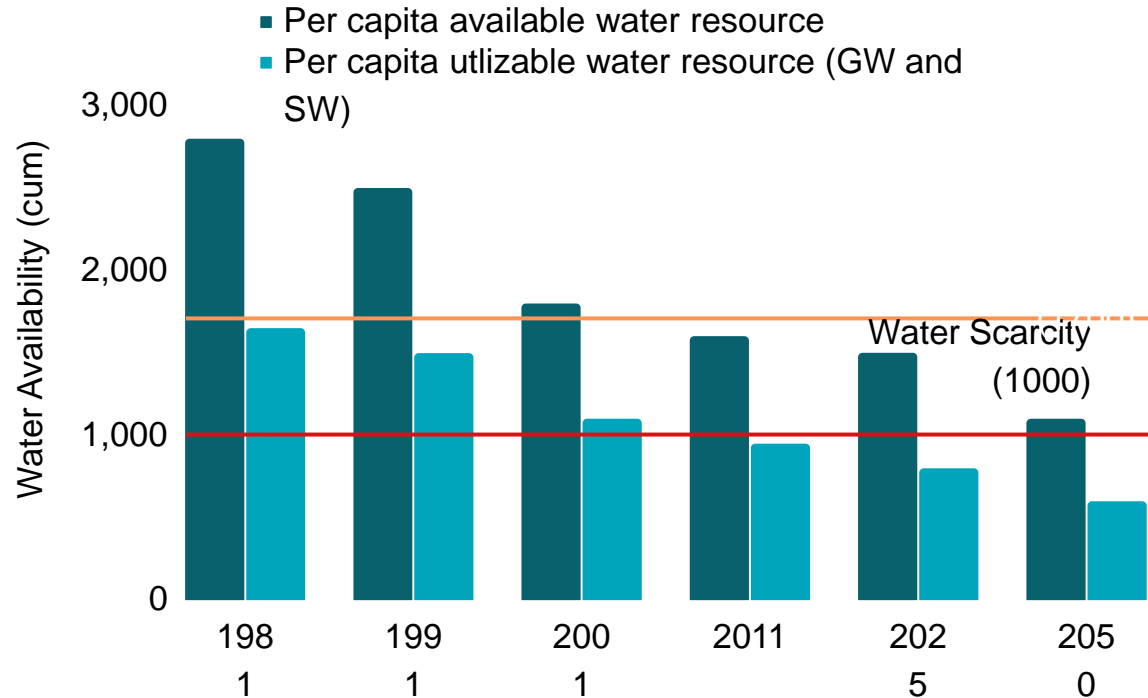
Box 1

The cause of urban used water!

Urban areas are the main source of pollution. A large proportion of wastewater is released directly into the closest surface water or informal drainage channels, with very little or no treatment at all before being discharged. There is an urgent need to identify and implement low-cost, low-technology, and energy efficient nature-based wastewater treatment solutions that can be effectively managed with limited human, technical, and financial resources (ADB, 2021).

We need to reconsider our strategy towards used water management!

Per capita water availability in India



The social, economic, and ecological effects from wastewater open up a plethora of challenges, which has the power to not only cripple the economy and leave the country in shambles but also pose major health risks and cause mayhem to the environment. We already know why and how to reuse. Now, let's ENSURE reuse!

In order to ensure reuse of used water, there are three major areas of concern.



Enabling Ecosystem

It will help us to understand the challenges with existing policy provisions, mandates for roles of actors, and whom to be held accountable for actions.



Demand Drivers

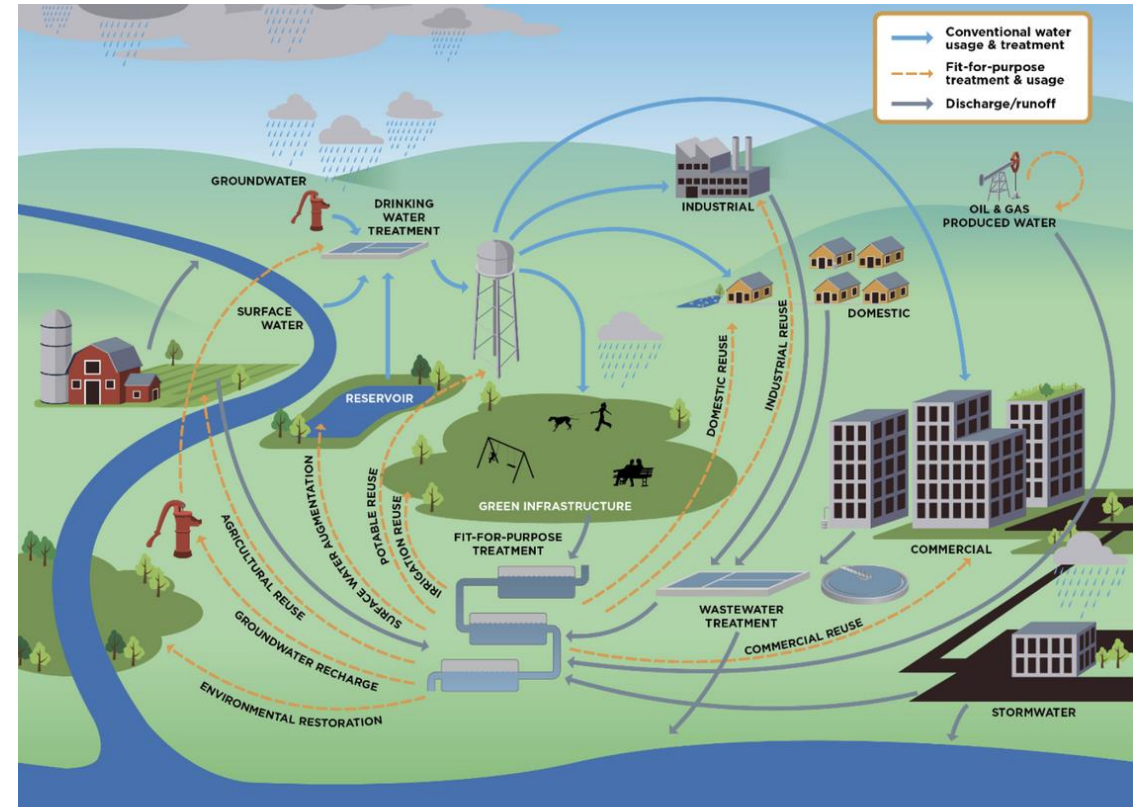
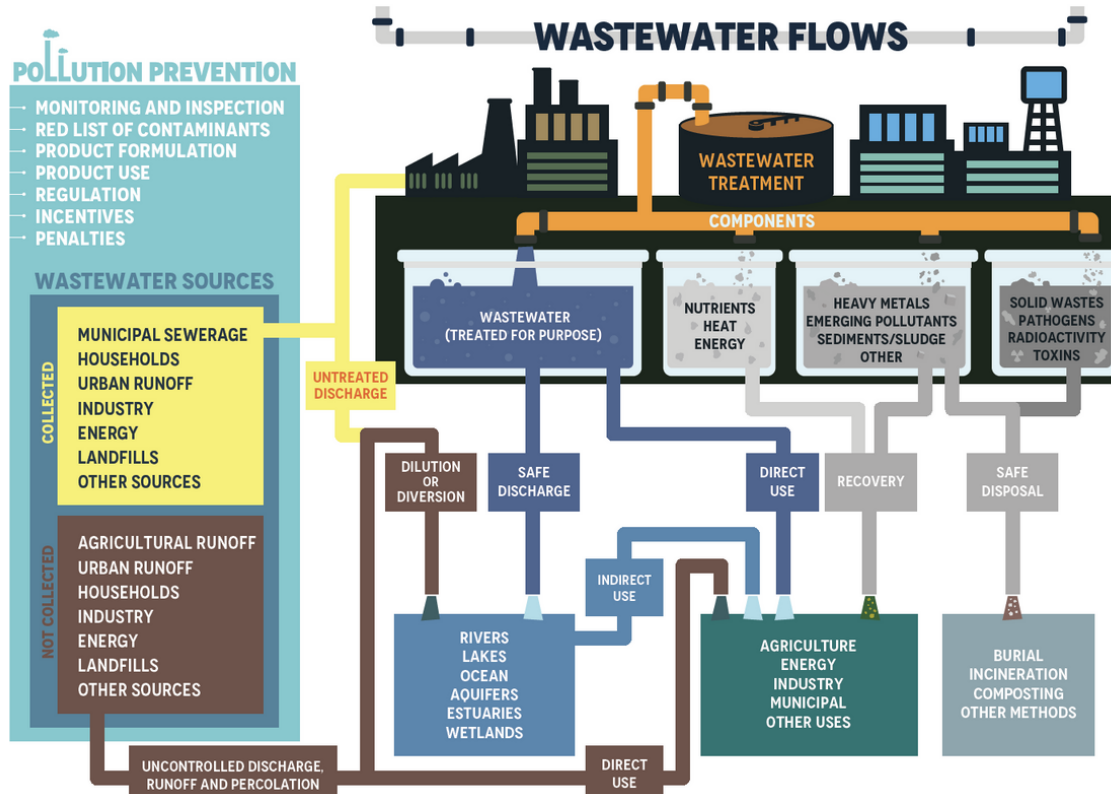
This will help us to understand the factors of consumption or demand in the used water market scenario.



Supply Drivers

This will help us to understand the factors of production or supply in the used water market scenario.

Understanding used water flows and reuse cycle.



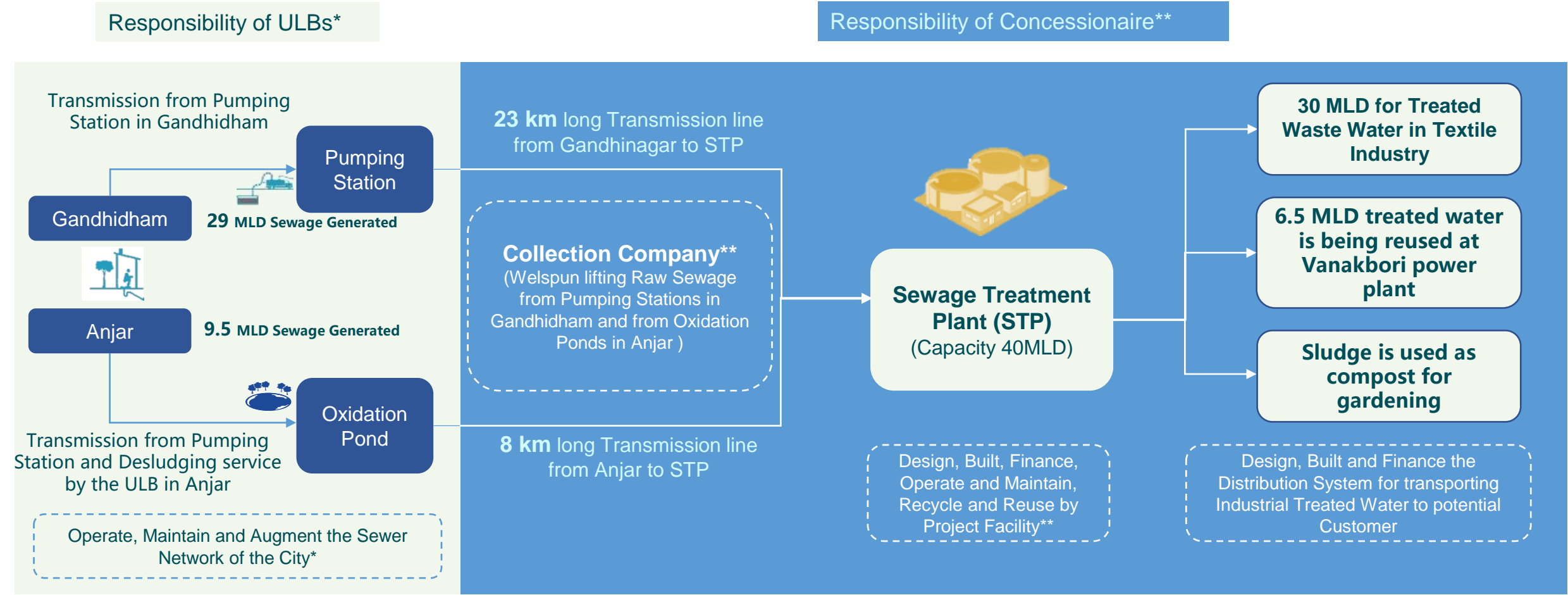
Treated Used water Flow Diagram

The figure provides an overview of the main used water flows, from their generation at the source to their fate. Uncollected used water ultimately ends up in the aquatic environment. This is also the case for used water that is collected and disposed of without treatment.

Treated Used water Reuse Diagram

The figure provides an overview of the used water reuse cycle. It shows examples of reuse for treated used water in different areas like agriculture and irrigation, domestic non-potable uses, industrial uses, groundwater recharge, environmental restoration, etc.

Reuse of treated wastewater in Anjar and Gandhidham in Gujarat



Revenue: 61.9 Lakh per Annum at the rate of Rs. 0.4/KL Sewage Collection

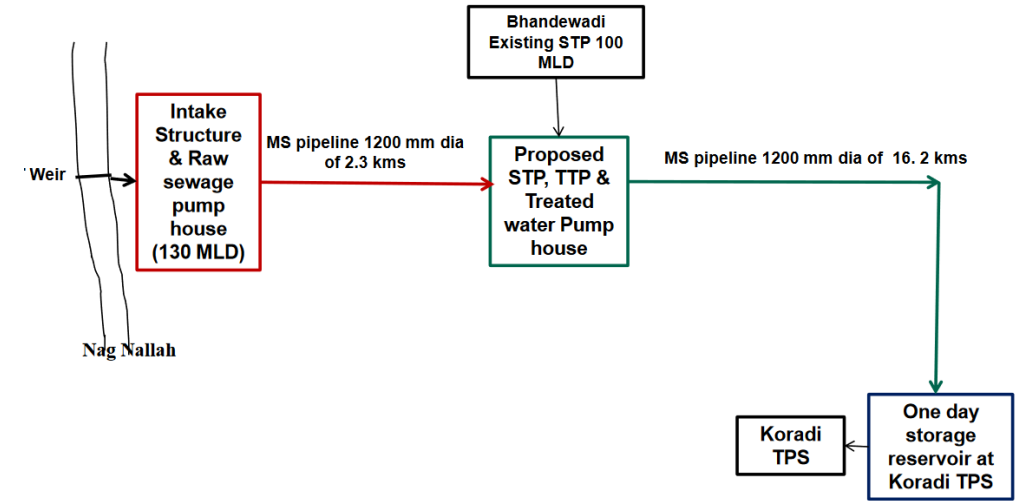
- The respective ULBs* ensure that Sewer generated by citizens is free from Industrial waste, hazardous material, prohibited and restricted material
- **Welspun Infrastructure Ltd** and Technology Providing Partner **Ion Exchange Ltd** (Concessionaire**).
- Sewage Pumping Station other than GNP Facility, network of bulk transmission of sewage from Designated location to STP proposed by Concessionaire.

Reuse at Nagpur Municipal Corporation

- 86% of wastewater is reused by Nagpur Municipal Corporation
- MOU signed with Maharashtra state power generation company (MAHAGENCO) for reuse of treated water at khaparkheda thermal power plant and Koradi thermal power plant (Dated-29 December 2017)
- Khaparkheda Thermal powerplant = 100 MLD
- Koradi Thermal powerplant = 50 MLD
- MAHAGENCO have further demanded to NMC for more 40MLD treated water at Koradi thermal powerplant
- Additional demand of 40 MLD of Tertiary Treated Water for the Koradi Thermal PowerPlant
- Charges Rs.1000 per day (190 MLD)
- Total revenue Collection = 55 lakh per annum

IAGENCO

PROJECT LAYOUT



Maharashtra Context

Maharashtra is home to 9% of India's population. The urban and rural areas, along with agriculture and industries are dependent on freshwater and groundwater resources. Agriculture is the major consumer of water with net demand of 84 billion cubic meters (bcm) per year which is about 95% of the total water demand, followed by potable water demand (urban and rural) at about 4%, and industrial sector demand at 1%.

Maharashtra is facing a water emergency of unprecedented proportions. Following years of drought, the rivers' currents have ebbed, water in dams and reservoirs has depleted and over-exploitation of groundwater has raised concerns over the long-term availability of water. Record number of tankers are sole source of water in large parts of state. It has resulted in late monsoons following a deficit year, depleting groundwater in 279 talukas, under 10% live storage in 13 key reservoirs.



24 of 34 districts face water shortage in Maharashtra



2,500+

Tankers deployed in water scare regions

Only 5.5%

Of the live capacity of 17 major reservoirs (14.073 bcm) is stored.



3m lesser than average

Out of Maharashtra's 353 talukas, 279 have experienced depletion in ground water levels.



27%

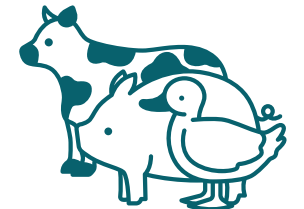
Rainfall shortage experienced in Maharashtra.

15,000+

Villages and hamlets affected

Over 11 lakh

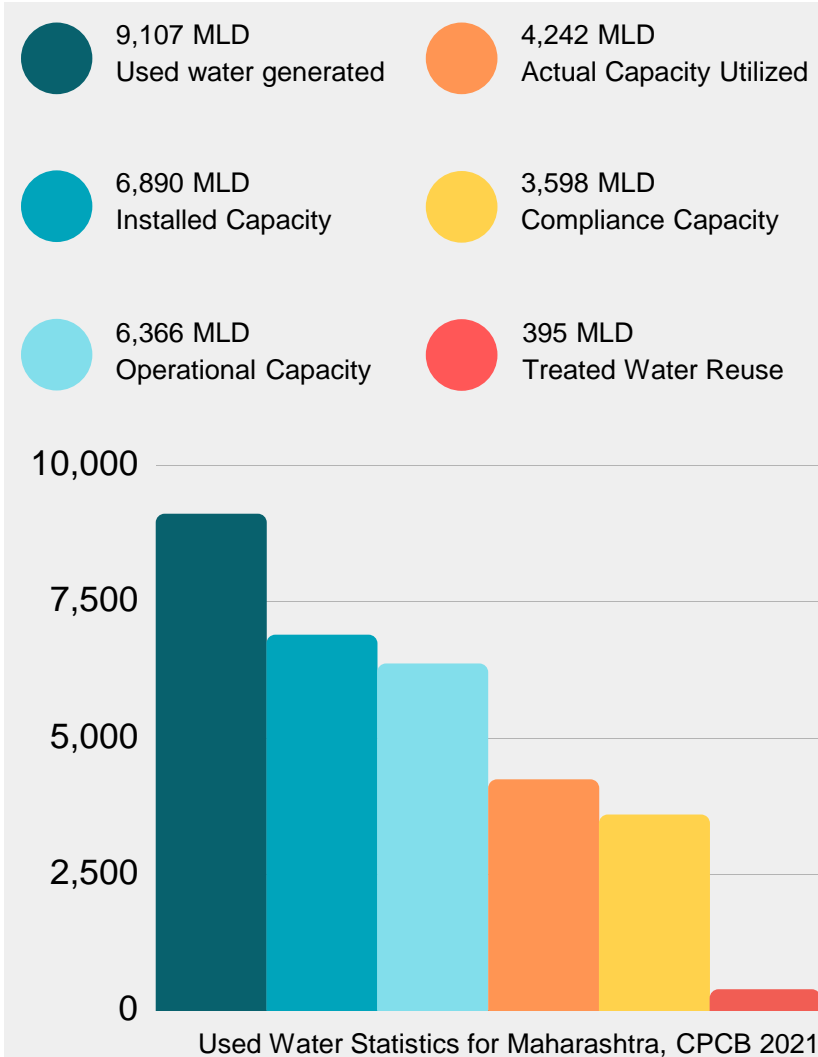
Livestock affected due to water shortage



Infrastructure and Facilities for Used Water Management in Maharashtra

Maharashtra collects and treats only 46% of total generated sewage, and reuses a mere 4%! This means that 54% of sewage is dumped in natural water bodies. The collection coverage is only 30%, meaning a lot of households still dump used water into natural drains. The total capacity of STPs still only cover 75% of sewage, but more are proposed.

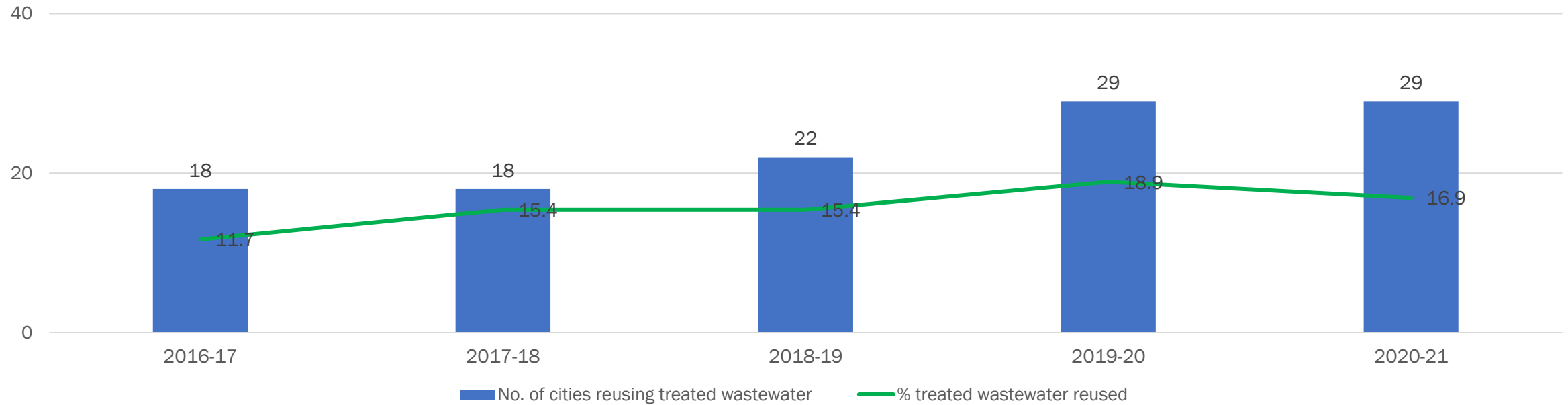
Used Water Overview	Total Used Water Generated	9,107 MLD
	Total Used Water Treated	4,242 MLD
	Total Used Water Reused	395 MLD
Conveyance and Network	Existing Sewer Network	7,410 km
	% Network Coverage	30%
Sewage Treatment Plants	Total STPs	154
	Total Installed Capacity	6,890 MLD
	Proposed STPs	41
	Proposed Capacity	2,929 MLD
	Installed + Proposed	9,819 MLD



There are existing gaps and inefficiencies with STPs. The installed capacity can only collect 76% of total used water generated. Only 92% of installed capacity is operational. Only 66% of operational capacity is actually utilized. Only 84% of actual treated used water (105 STPs) is compliant with MPCB norms.

Unaccounted Reuse!
In Maharashtra, there are instances of raw used water being reused by farmers, and some treated used water being used by industries. However, this reuse is currently unaccounted for.

~18 percent of treated wastewater is reused in Maharashtra



- With 7.5 ML of wastewater generation, ~50% of it gets treated at treatment plants
- 29 cities of Maharashtra practice reuse of treated wastewater
- There is a huge potential for the state to tap alternate resource of treated wastewater

Maharashtra wastewater policy

TECHNOLOGY

- Along with traditional technology, **innovative technology developed by IIT/NIRI** should preferably be used when implementing the wastewater recycling and reuse projects.

INSTITUTIONAL AND ADMINISTRATIVE ARRANGEMENTS

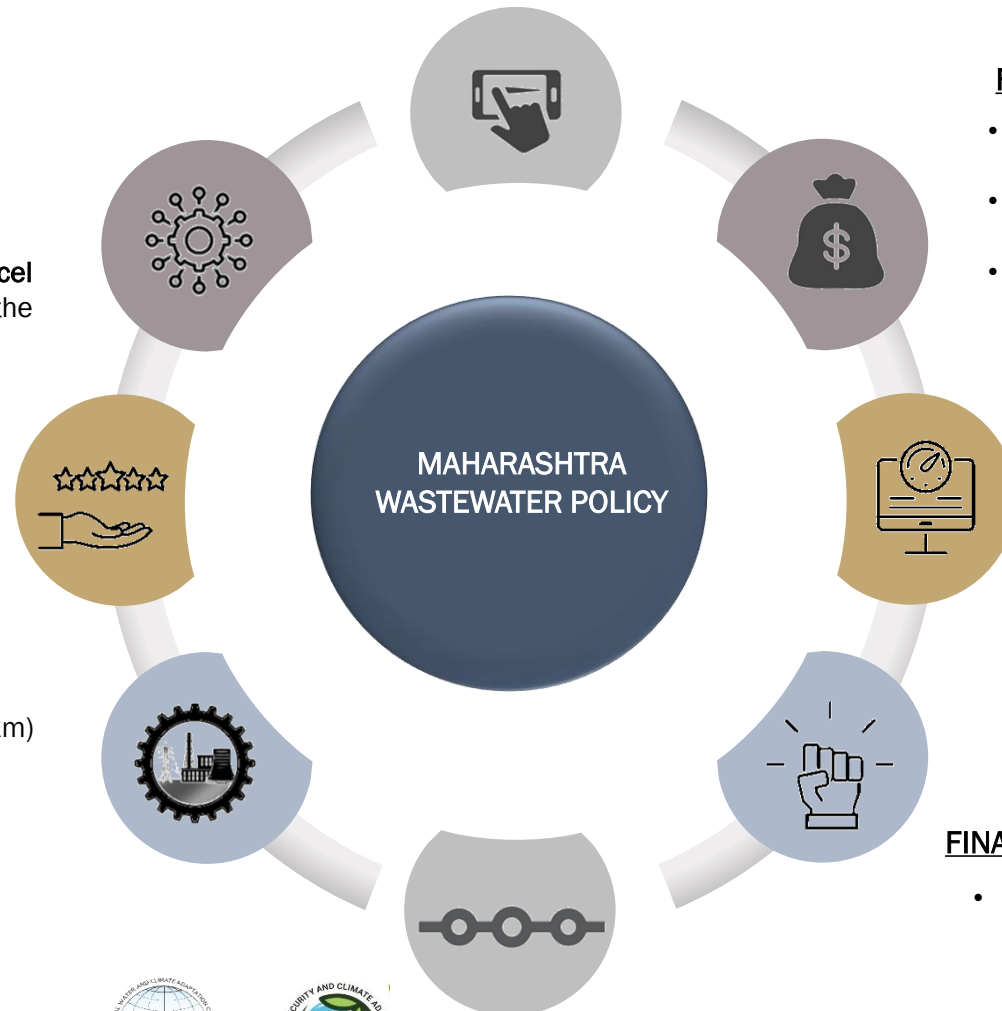
- ULB's to **recycle and reuse the wastewater**.
- The **Water Resources Department** should **cancel** the natural water supply for industries who use the treated wastewater

REUSE MANAGEMENT

- **Special areas** shall be **identified** for priority implementation.

PRIORITY OF REUSE

- **Thermal electricity plants** (Mandatory within 50 km)
- **MIDC** (Mandatory within 50 km)
- **Railways or other bulk buyers**.
- **Agriculture**.
- **Non-potable components** (as per MPCB).



FINANCING PLANS

- **Stage wise implementation of STP's** due to limited availability of funds
- Funds shall be raised through the various schemes of **Central as well as State Government or through PPP**.
- **Funds to be allocated to the ULB** after the wastewater reuse plan is completed

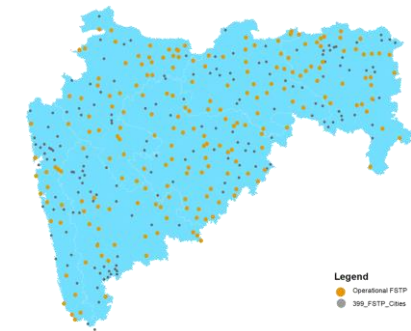
MONITORING AND EVALUATION

- State committee to **check the feasibility and cost effectiveness** of the wastewater recycling and reuse projects **before the execution** of these new projects
- If the ULB's bear **100% of the cost**, no need for the committee to do the checking.

FINANCIAL RIGHTS OF WASTEWATER

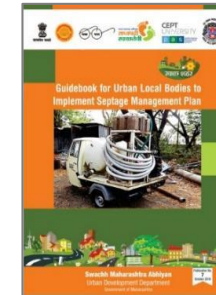
- **ULB's treating the water** have the financial right to it.

Maharashtra has taken up FSSM in a big way



- Maharashtra is one of the most urbanised states in India
- 350+ cities in Maharashtra are dependent on onsite sanitation systems
- After becoming Open Defecation Free in 2017, the state issued a 7-point ODF-Sustainability charter that mentions FSSM as an area of focus.

Step by Step Guide for ODF+



Septage Management Guidelines



Government Resolutions

ODF, ODF+ and ODF++ framework

Utilizing Incentive grants and 14th FC funds for sanitation/ ODF+ /++ activities

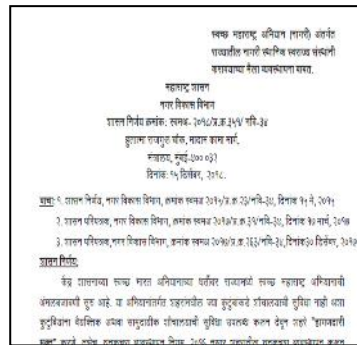
70+ cities Co-treating of FS at own or nearby STP

311 independent FSTPs Construction

More than 220 FSTPs are operational

70 ULBs practicing co-treatment and have achieved ODF++

Government resolution on co-treatment of Septage – Own STP and Cities within 20 km of a nearby STP city

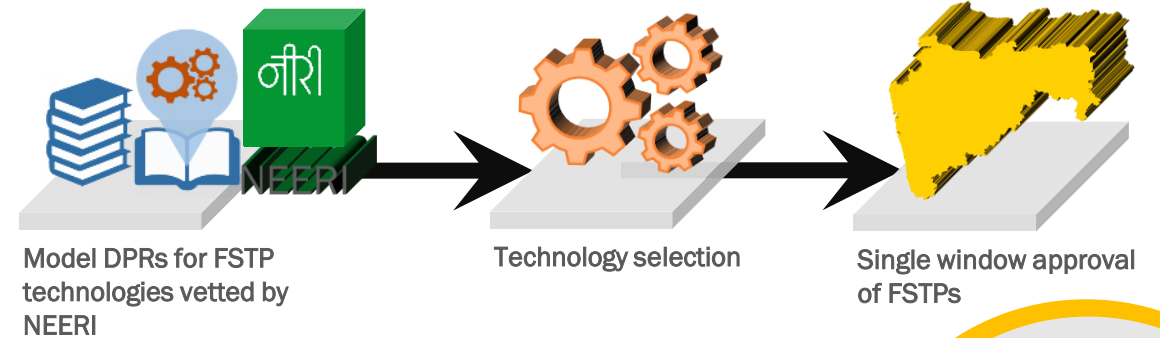


Institutionalize FS co-treatment through MoU between sending and receiving cities

Designated FS discharge point (at wet well at pumping station/STPs or maintenance hole)



220+ independent FSTPs are functional



Adoption of cost effective and less mechanized technology for setting up FSTPs



Many cities have already taken up reuse practices

- **Used water reuse** : Many cities in Maharashtra use treated wastewater and dried sludge for landscaping and plantation purposes
- **Aesthetic developments** in the form of landscape and plantations add value to FSTP infrastructure and around city
- **Dried sludge**: Cities using the by-product in the form of compost and fertilizer for gardening purposes
- **Harit Brand**: 119 cities Harit brand certified. Maharashtra Govt. SWM initiative,. Cities mixing sludge from FSTP for compost
- **Non-food farming**: Dried sludge also being given to farmers for their use. Mostly the reuse of dried sludge is carried out for non-food crops
- **Quality control**: Regular monitoring of the treated wastewater samples



In a small town of Sinanr ~70 million liters treated wastewater reused (1/2)

- More than 7,000 trees covering 16,300 sq.m. area are planted in all four cities
- Treated wastewater for maintaining the urban forest and landscape saving over ~70 million litres of fresh water
- The barren land of around 16,322 sq.m. converted with forest cover
- Treated water is used for watering the plants through a drip irrigation system
- Sludge used as fertilizers at the urban forest or taken away by farmers.



Treated wastewater is reused to create carbon sinks in these cities (2/2)

- The urban forests developed act as carbon sinks and have supported in capturing the carbon dioxide emissions
- This will contribute to reducing the greenhouse effect and enrich the biodiversity.
- At its full potential, the forest and landscaped areas have the ability to absorb over ~566 tonnes of CO2 annually



Values of CO2 absorption derived from studies- [Sharma, R. et. al., 2021](#) and [Crisil Foundation, 2021](#); Formula considers- species of tree, tree height and girth and their CO2 equivalents

On moving towards clean energy usage, the treatment plants use solar power systems (1/2)

- Wai, Sinnar, and Satara have installed solar panels of total 68 kW
- The Solar FSTPs have reached net energy positive stage which helps to mitigate tons of CO2 emissions
- These activities have led to use of 68 kW of alternative energy in three cities which has led to reduction of 84 metric tons of CO2 emissions annually
- These activities will help in reduced recurring expenses for city governments and improved environment.



Calculation based on- [National Portal for Solar Rooftop tool](#), Ministry of Renewable Energy (MNRE), Govt. of India

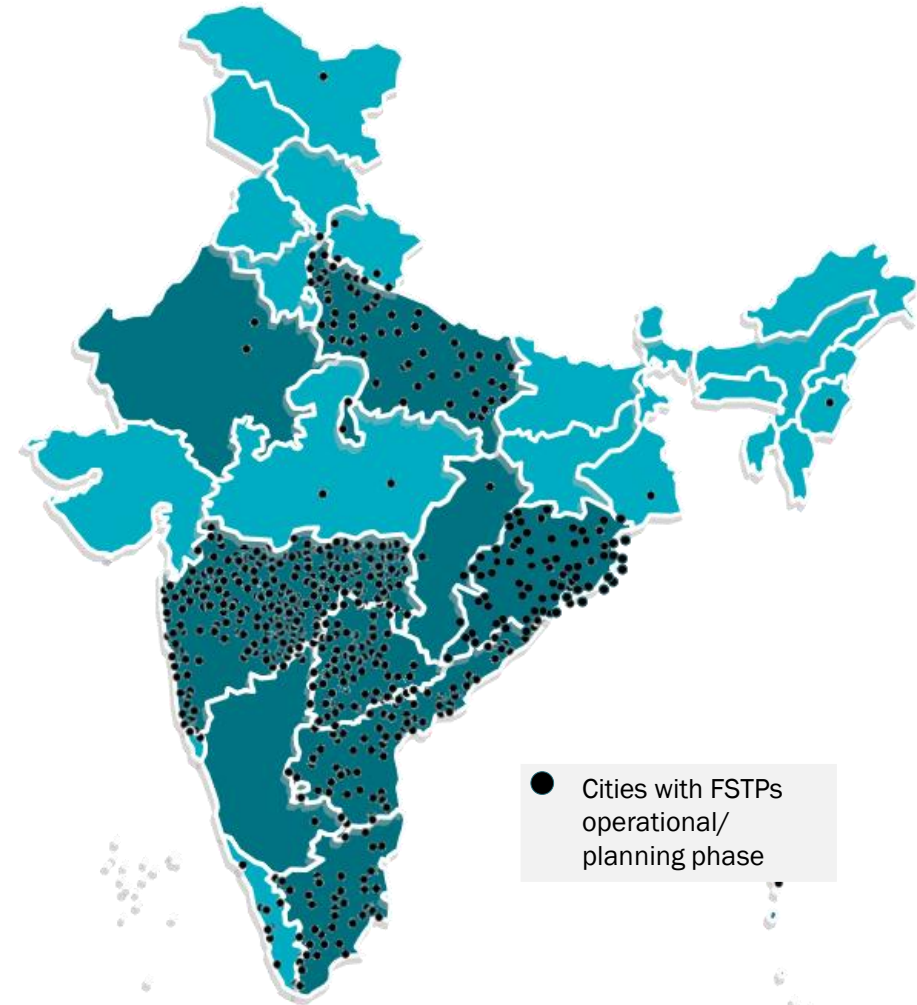
On moving towards clean energy usage, the treatment plants use solar power systems (2/2)

	Wai	Sinnar	Satara
Solar Power capacity (kW)	30	15	30
Renewable energy generated (till June 2023, Mwh)	46.4	25.7	18.5
CO2 emissions mitigated (Metric ton/ annum)	~37	~10	~37



Great potential of replicating the systematic approach wastewater reuse efforts in various cities in India

- Learnings from these cities is being scaled up across 300+ FSTPs coming up in Maharashtra
- With various FSTPs coming up across India, replicating and adopting sustainable reuse practices is highly feasible.
- Scaling-up to other cities will occur through linkages with programmes like Swachh Bharat Mission, AMRUT mission, Majhi Vasundhara (Scheme in Maharashtra state focusing on climate change).



● Cities with FSTPs operational/ planning phase

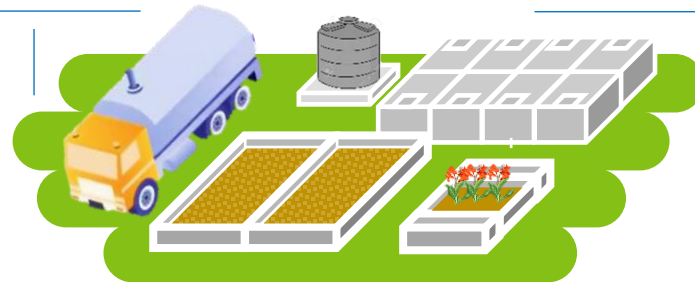
Benefits of treating wastewater and its reuse potentials contributing to SDG 6

Sustaining freshwater supply

Improved green cover in urban areas

Energy efficient, self sustained FSTPs

Treatment of excreta to enable safe disposal and reuse



Contributing towards reducing water and soil pollution

CWAS CENTER
FOR WATER
AND SANITATION

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AND DEVELOPMENT
FOUNDATION

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**Thank
you**

About us

The Center for Water and Sanitation (CWAS) is a part of CEPT Research and Development Foundation (CRDF) at CEPT University. CWAS undertakes action-research, implementation support, capacity building and advocacy in the field of urban water and sanitation. Acting as a thought catalyst and facilitator, CWAS works closely with all levels of governments - national, state and local to support them in delivering water and sanitation services in an efficient, effective and equitable manner.



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