Building a new water future for resilience in the age of climate change

Sunita Narain

Centre for Science and Environment

New Delhi

Climate and Water

Need action; At scale; with a difference

- Climate change is adding to water stress in our world; we will get more rain in fewer number of rainy days; this is leading to floods and then droughts
- Climate change is also adding to heat stress, which in turn adds to the demand for water
- But we must remember that climate change is an exacerbating factor; our water crisis is about our inability to build an affordable system of water management to supply clean water to all; take back and recycle the used water of all
- **Resilience is about reworking current practices for a water wise and water secure future**

India is seeing in **almost one extreme weather event a day**

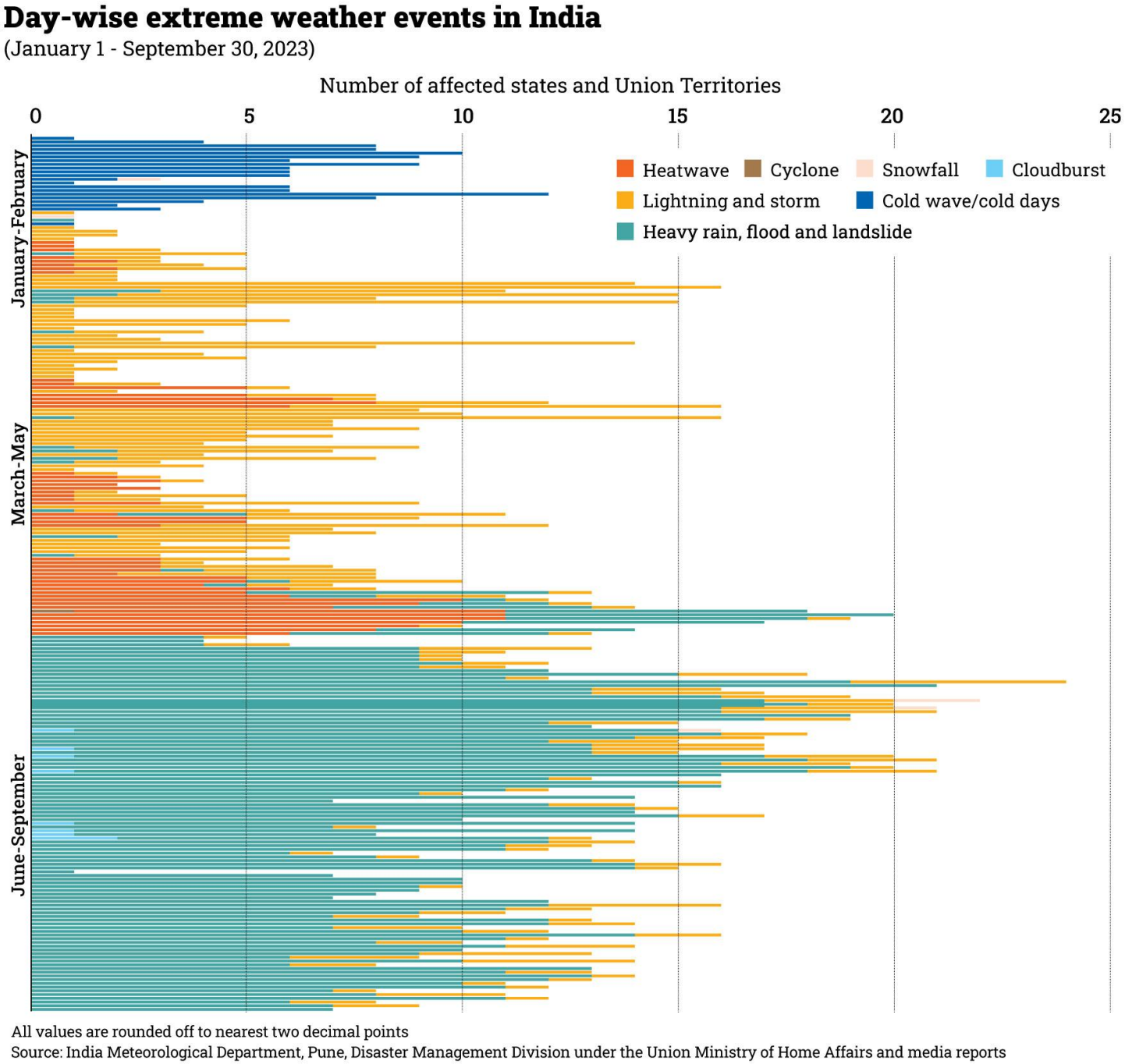
Extreme cold; heat; extreme rain
Cyclones…

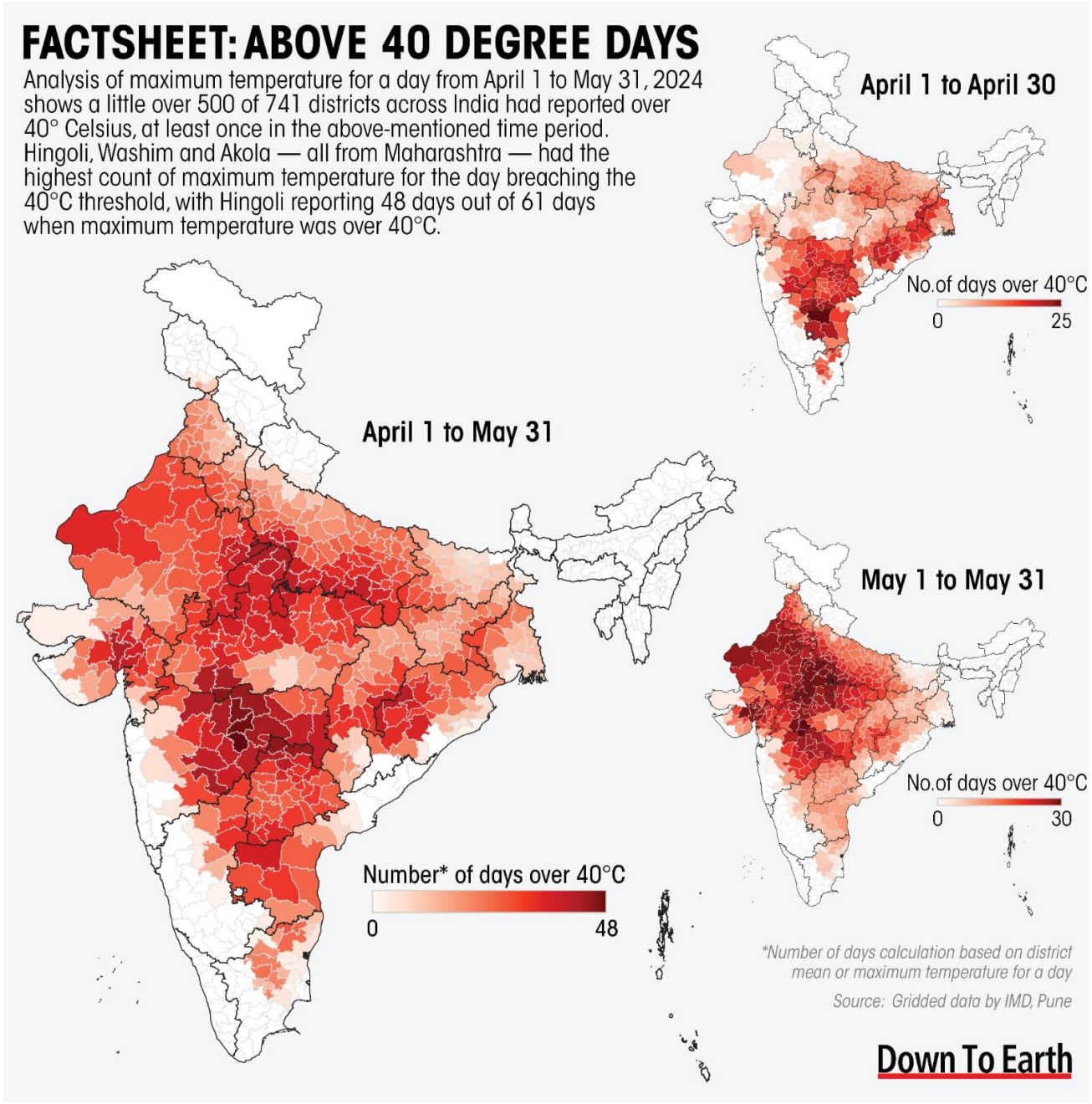
This has huge impact on the poorest in our world; most vulnerable and those who have not contributed to the stock of greenhouse gases

It makes them poorer; it makes them more insecure

It takes away the development dividend

As extreme events become frequent, people lose the ability to cope; they have no options but to migrate. This adds to global insecurity





Rising heat adds to water demand

Dry moisture in soils – increase the need for irrigation; add to land degradation and dust formation

Increased evaporation rate – water stored in surface structures will be depleted

Drive up the use of water – from drinking to irrigation to fighting fires in forests and building

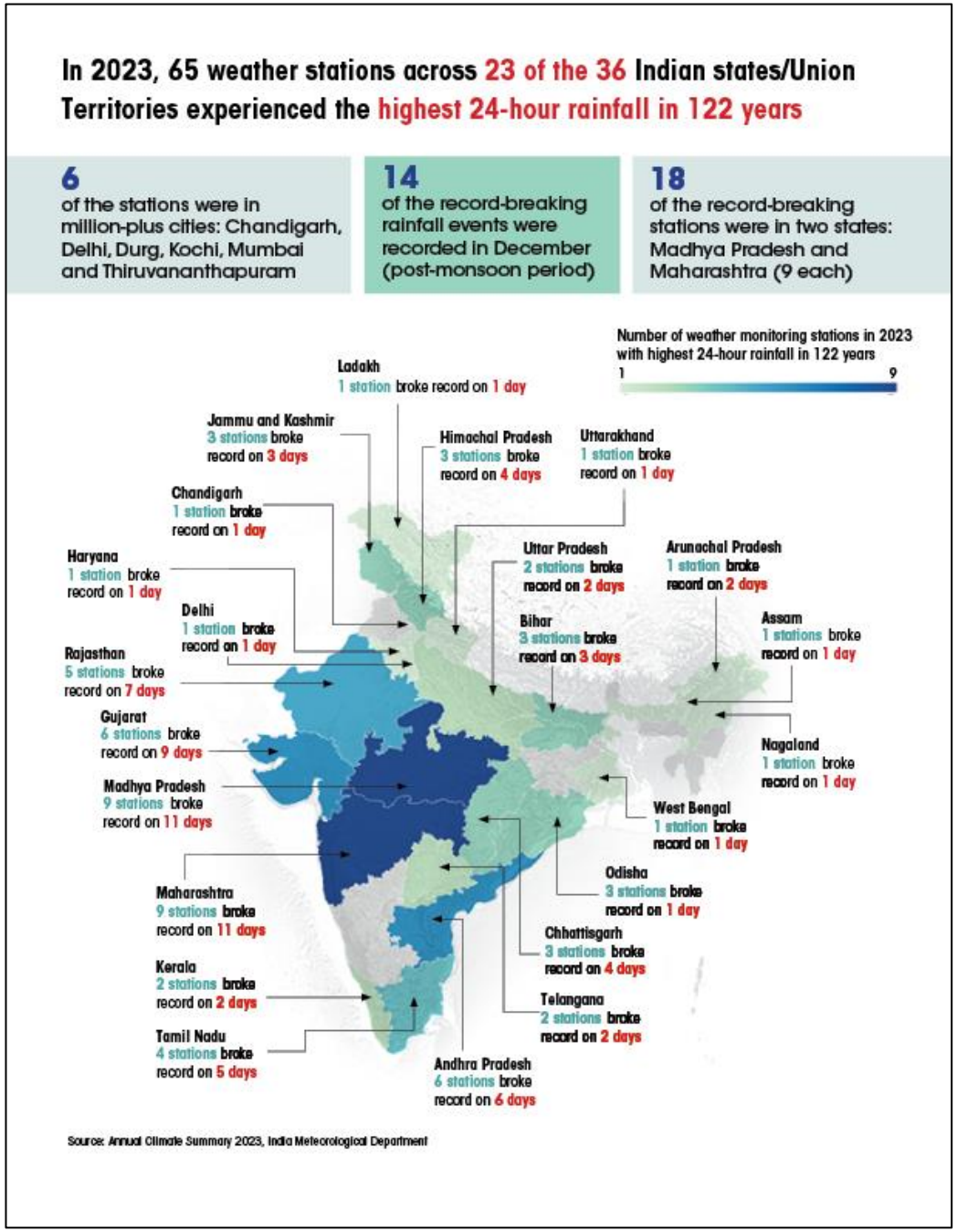
Water management will be crucially important in the age of climate change

Climate change will lead to more rain in fewer number of rainy days

Already, extreme rain events across India and across the world are growing

Regions are getting an entire year's rain in a matter of hours/day

This means that we must enhance our ability to hold the water; to recharge it; to minimize its use and to recycle and reuse every drop



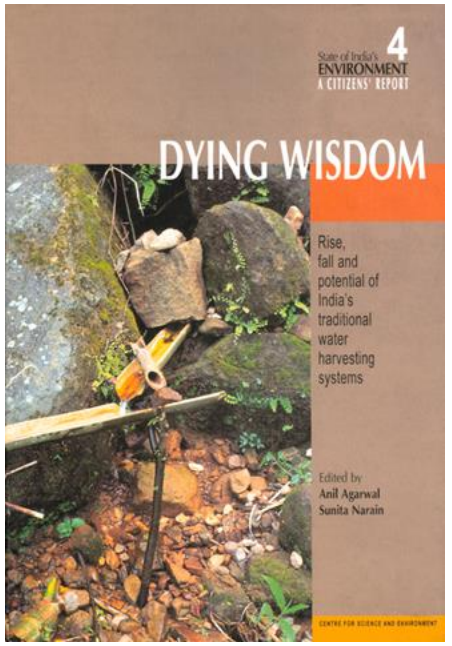
Agenda for our water future

- **Management of competing demands by augmenting supply.** Need to focus on rainwater harvesting to mitigate flood risk and recharge groundwater. This will build resilience of rural communities to deal with variable rain and for cities to deal with water stress
- **Management of water demand so that it is efficient** – need more water per drop – not just in agriculture but also in urban and industrial water management.
- **Management of pollution** – ensure water is not degraded and so unusable. Every drop of waste must be reuse and recycled. Join the dots with the excreta management so that all sewage is intercepted and treated

- **We need to reinvent the paradigm of water-waste so that it is affordable and so sustainable and resilient**

New practice of water is possible

- **Augment water**
- Learn from traditional practices: harvest rain in millions of **decentralized** lakes, ponds and other structures
- This will mean a deepening democracy as communities will need to take control of their water system
- In our report *Dying Wisdom* we found every region of India had an engineering sophistication to live with water
- This is now being practiced across the country through watershed management; through rooftop rainwater harvesting and rejuvenation of water bodies



Cities need to relearn the art of local water and waste management

- Water stress is growing across cities in the South
- Current paradigm of bringing water long distances adds to cost of supply; distribution losses; adds to inequity in supply
- Current practice of wastewater management through infrastructure for intercepting sewage at each household is capital and resource intensive; adding to inequity in sanitation and then pollution
- **Opportunity to reinvent is now an imperative**

Where pipeline does not reach
People depend on groundwater
Falling groundwater levels tell us about inequity

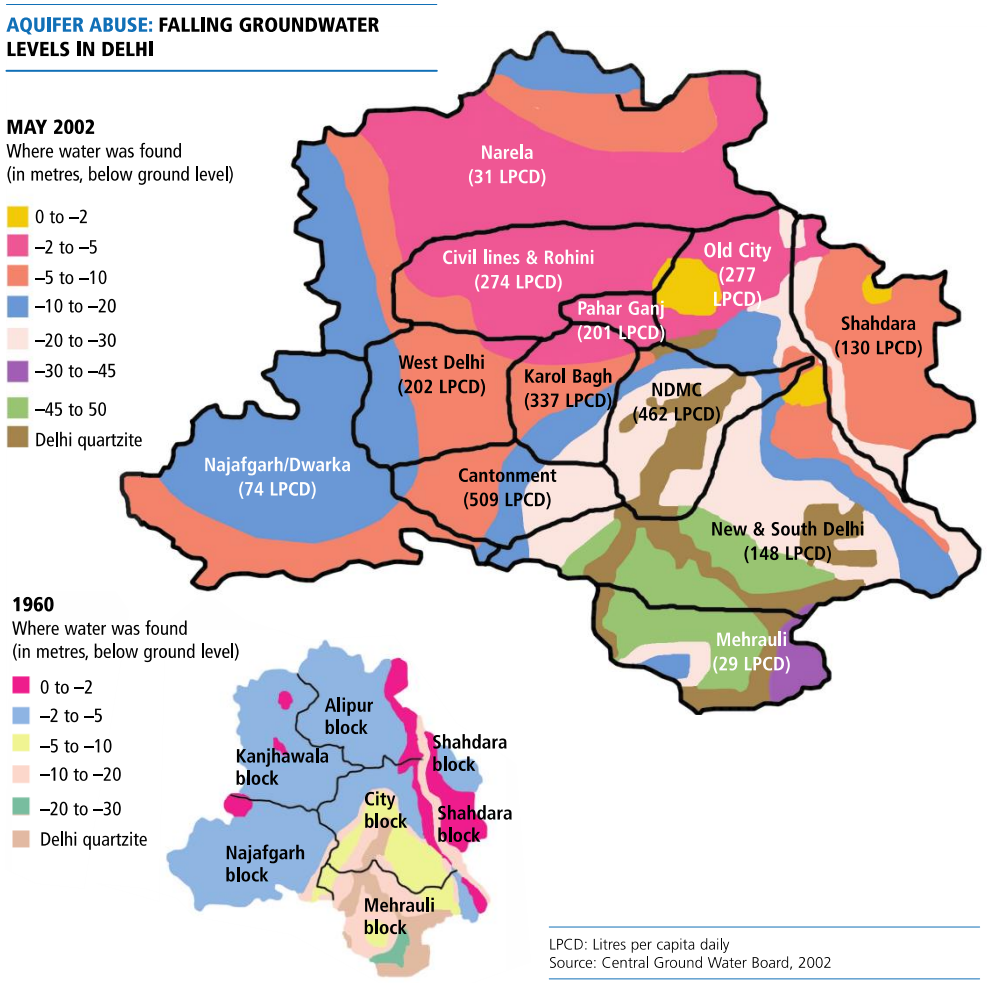
Groundwater: critical for city's water security

When water supply does not reach all people have no alternative but to move to **groundwater**

Millions depend on private wells, tanker mafia, bottled water

Water supply shortfalls show up in the groundwater table of the city

But as groundwater is not part of 'official' water system we do not plan for its sustainbility



‘Unofficial’ groundwater means no attention to recharge

Indian cities are building over waterbodies

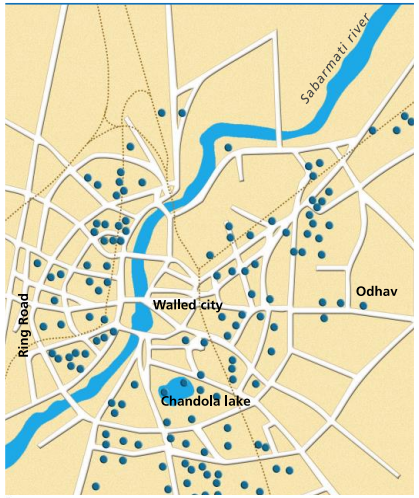
We see land, not water

But in this age of climate change we will have to plan for harvesting rain, holding it for recharge

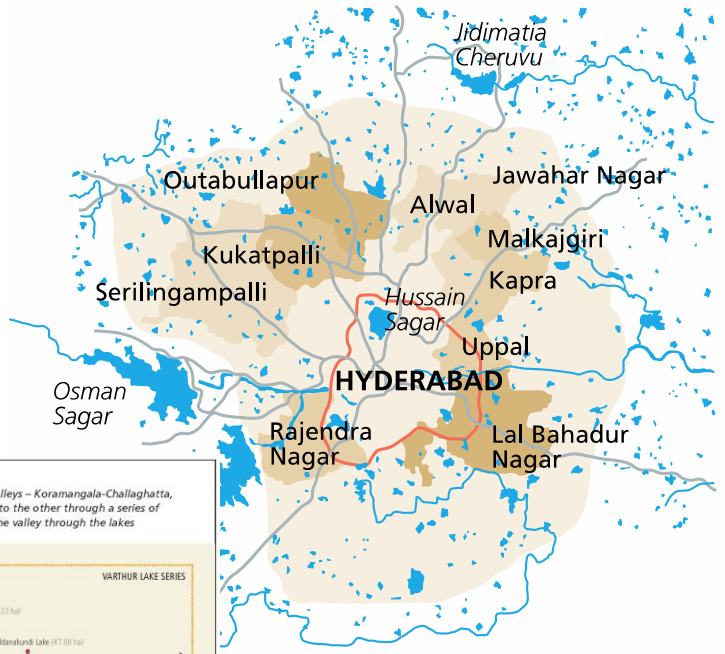
Otherwise, we will see drought and then floods

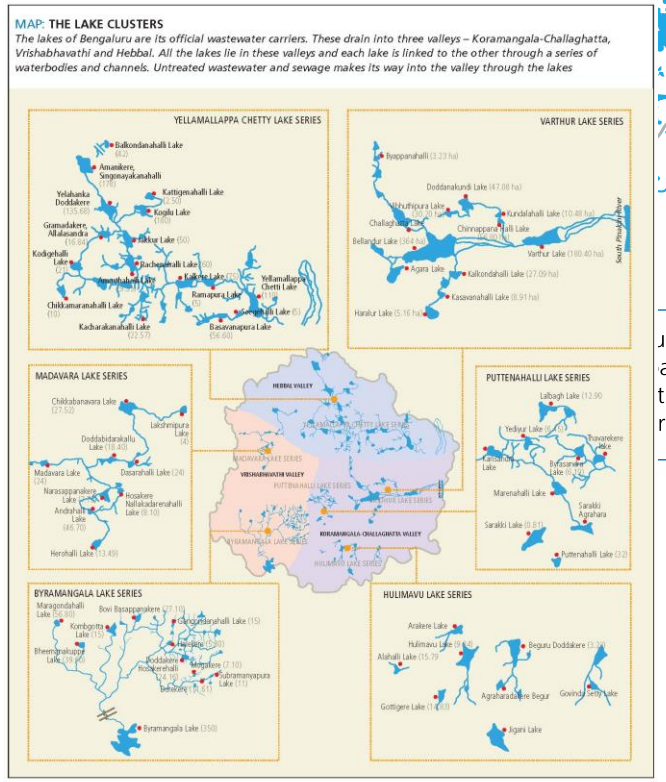
Cities need sponges

CITY OF LAKES AND FAKES
The 137 lakes of Ahmedabad, as listed by the collector’s office. 65 of these are already been built upon, found the AMC



HYDERABAD: LOST GLORY





upati Ramachandraiah and Manikoda Vedakumar
ad’s Water Issues and the Musi River: need for
tions’, paper presented in the International Water
rlin, September 1-4, *mimeo*

Water to waste to water

- Cities do not ‘consume’ water; they use and discharge
- Problem today is that cities, industries take clean water and discharge effluents;
- Our rivers/streams/lakes are degraded – this is hydrocide – losing rivers so that they become drains
- Adds to health burden and economic costs
- Downsteam cities have to invest massive amounts to clean water – Agra downsteam of Delhi has installed WTP which is more expensive than STP
- Learnt that we cannot clean rivers with the conventional hardware: build STP and connect to underground sewage approach
- Not our reality

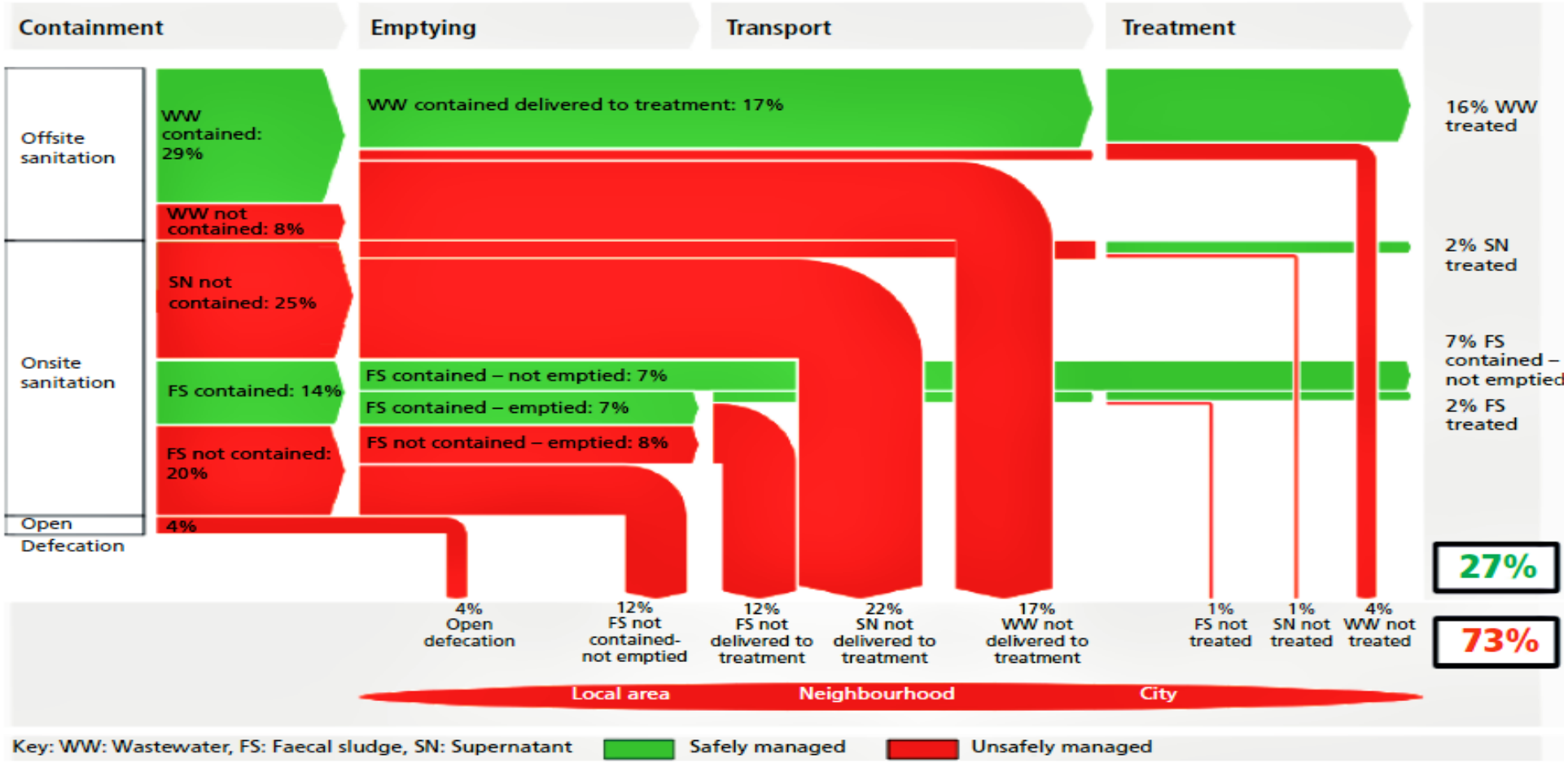
Waste-wise is water-wise

- When we mapped excreta flows in our cities, we found majority were not connected to official sewage systems
- They have ‘on-site’ treatment
- But river cleaning is designed to intercept sewage from underground/connected households
- Sewage of these millions of non-sewered households is collected and dumped in the same waterway or drained directly
- As a result ‘treated’ sewage of the minority gets mixed with the ‘untreated’ sewage of the majority = pollution

Uttar Pradesh (Urban), India

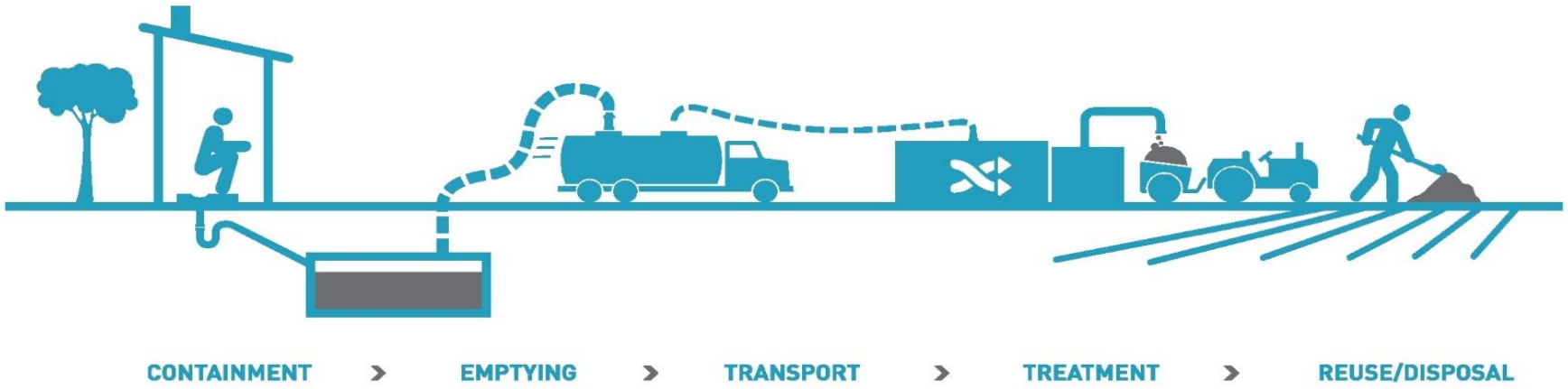
SFD Level: 2 - Intermediate SFD

Date prepared: 23 December 2018
Prepared by: CSE



Key: WW: Wastewater, FS: Faecal sludge, SN: Supernatant Safely managed Unsafely managed

Note: This SFD is done based on study of 66 towns and cities, representing 60% of urban population in UP



Faecal Sludge and Septage "Management"

Learnings: Make old the new

3. Majority cities are **unsewered**;

4. Shit Flow Diagrams found majority use **on-site systems**; connected to septic tanks: drains or/and informal collection systems

5. This reality was then reimagined for the future

6. FSTPs/Co-treatment STP built; to treat the faecal sludge that would be brought from the existing on-site systems by overground methods like tankers/decentralized technologies for in-situ

7. India (and other countries) leapfrogged: like the satellite cellphone not going the landline (or land based pump and pipe) route

Indian government has evolved policy

Policy has learnt from reality:

1. **Affordable sanitation is critical for sustainability**. If we cannot intercept the excreta of all, we cannot clean our rivers

2. **Conventional systems of sewage management are capital intensive and resource intensive**; we cannot play catch up anymore; even after

50% increase in sewage capacity in country (2014-2020)

- STP capacity 35,000 mld in 2020
- STP utilization 20,000 mld
- STP meeting standards 12,000 mld

Gap between wastewater generated and treated is growing

Policy brings paradigm shift

- **GOI SBM 2.0 guidelines (2021)**: *To ensure that no untreated faecal sludge or used water is discharged into the environment, and all used water (including sewerage and septage, grey water and black water) is safely contained, transported and treated, along with maximum reuse of treated used water, in all cities with less than 1 lakh population.*
- *Cities can invest in STP or FSTP to achieve the above*
- **Not technology prescriptive but emphasis is on treatment of all used water/faecal sludge and on reuse of this treated water**

2023: Policy has made practice change

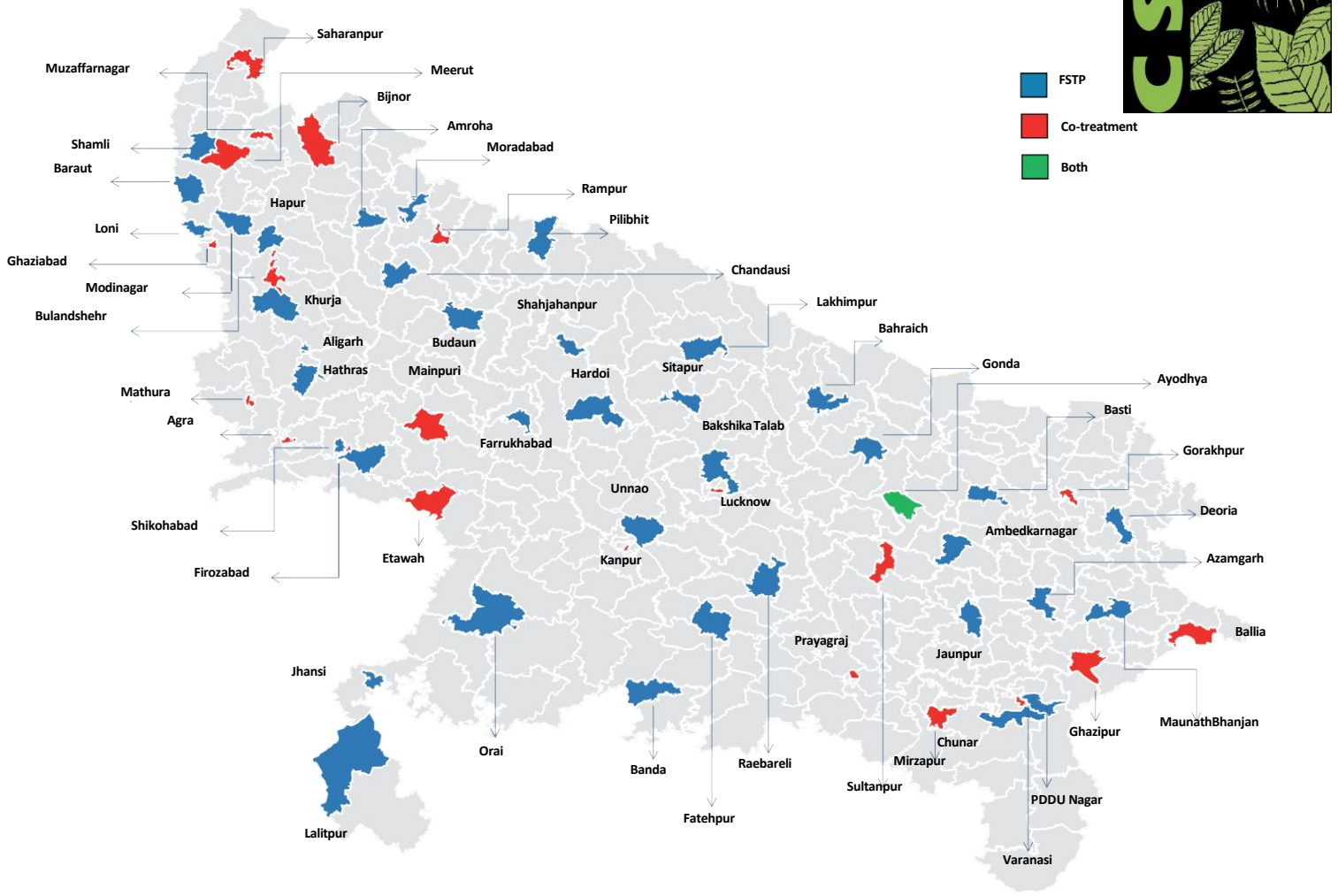
- States are now building FSTPs/Co-Treatment plants so that excreta from households is conveyed in tankers for treatment
- Many states are moving towards a total sewage-pollution control revolution
- ***Odisha has made it a statewide transformation***
- *UP, Tamil Nadu, Telangana, Madhya Pradesh…*
- ***The scale and speed is amazing****. It will lead to massive changes in river/water quality as more and more faecal sludge is taken in tankers to be treated and then reused*

UP: Building new treatment systems

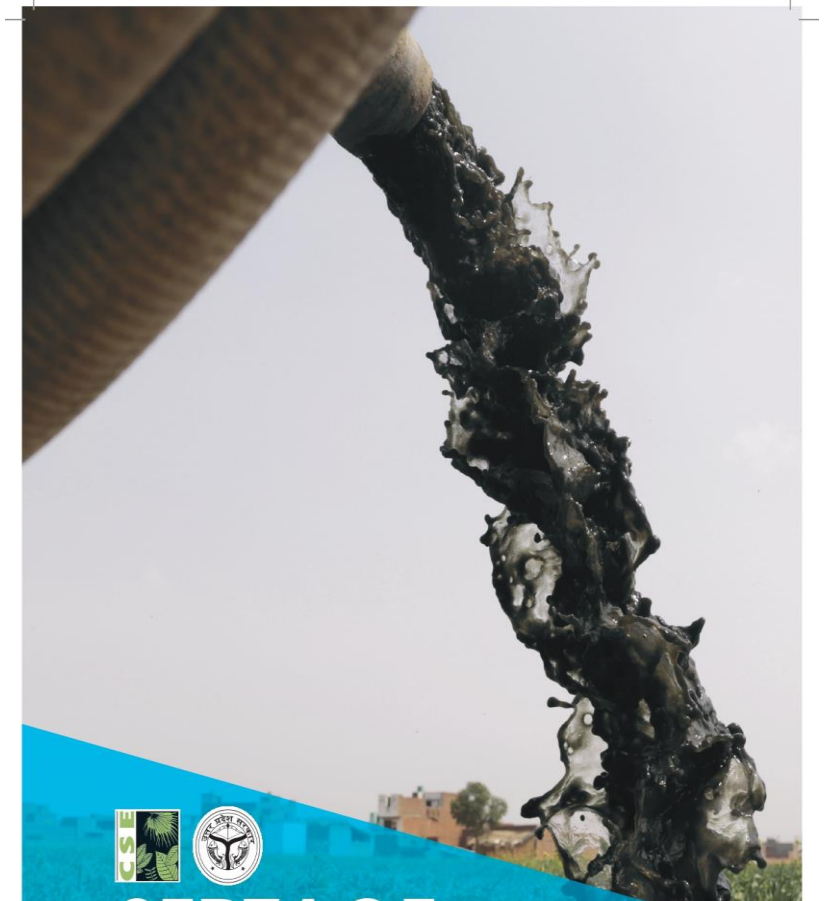
62 FSSM plants being built; of which 40 FSTP and 22 co-treatment

In March 2023 state commissioned many plants; more underway

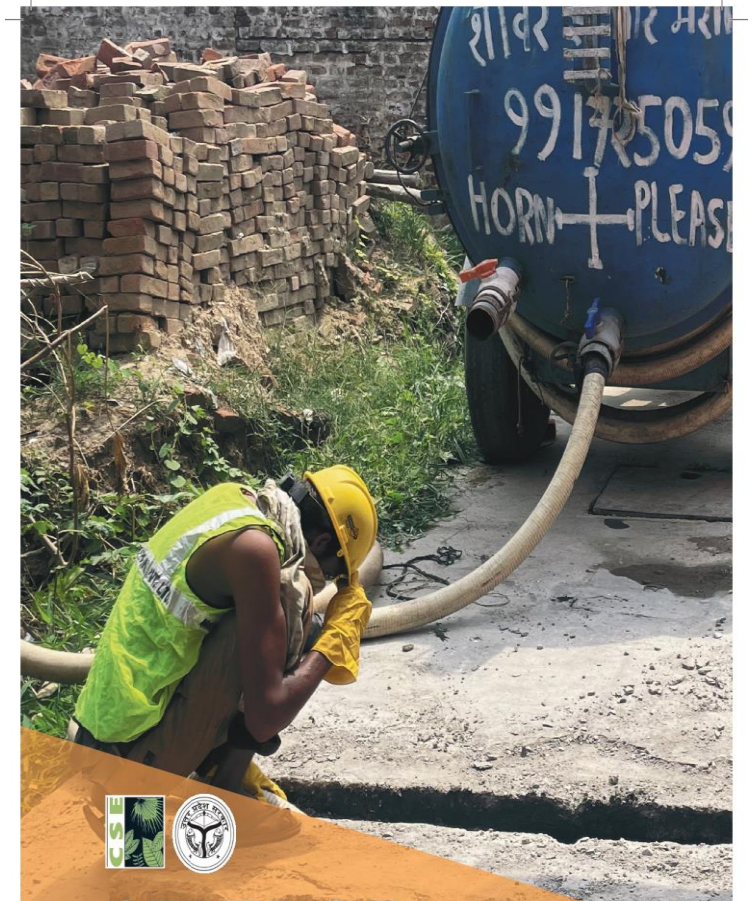
Map : FSSM projects in UP



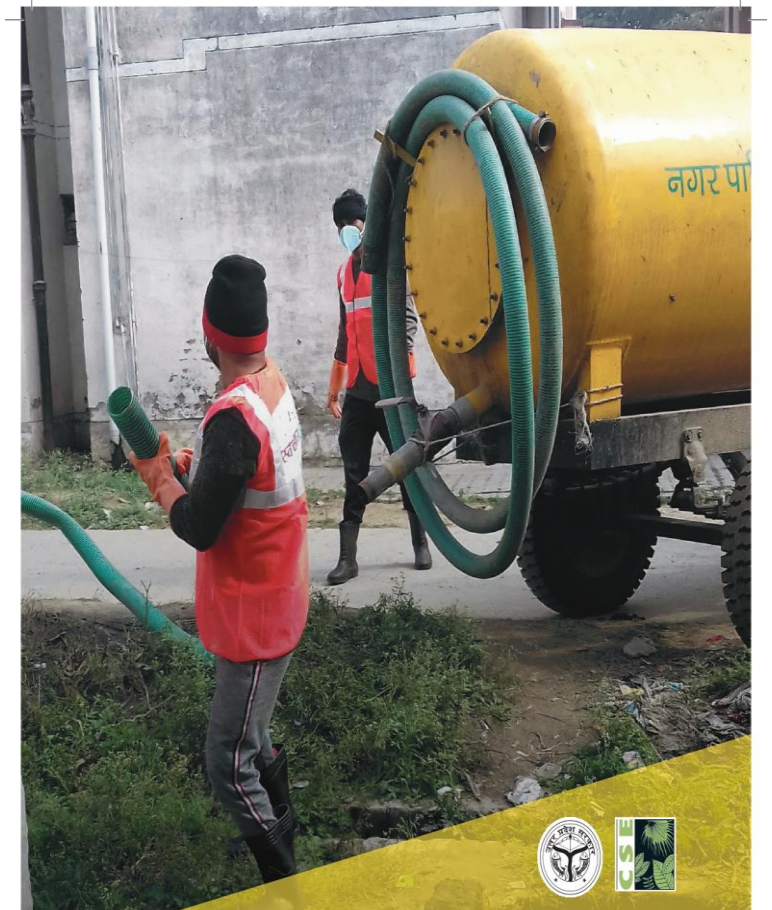
Source: Uttar Pradesh Jal Nigam



SEPTAGE MANAGEMENT
IN JHANSI TOWN
Towards Inclusive Urban Sanitation in Uttar Pradesh



SEPTAGE MANAGEMENT
IN BIJNOR TOWN
Towards Inclusive Sanitation in Uttar Pradesh



SEPTAGE MANAGEMENT
IN CHUNAR TOWN
Towards Inclusive Urban Sanitation in Uttar Pradesh

Challenges: agenda new gen-reform

- A. Increase of **capacity utilization in treatment plants**/Build new models for O&M; we need to work on this and ensure financial and operational sustainability

- B. Ensure plants are **effective in treatment**; this needs focus on operations of plants so that treated used water is designed for reuse

- C. Increase in **reuse of treated water and biosolid**; needs work to understand best options and this will determine quality of treatment and technologies

- D. Focus on lakes and drainage so that water supply can be made more secure; also lakes can be used for discharge of treated wastewater

अमृत 2.0
Atal Mission for Rejuvenation and Urban Transformation

उत्तर प्रदेश सरकार

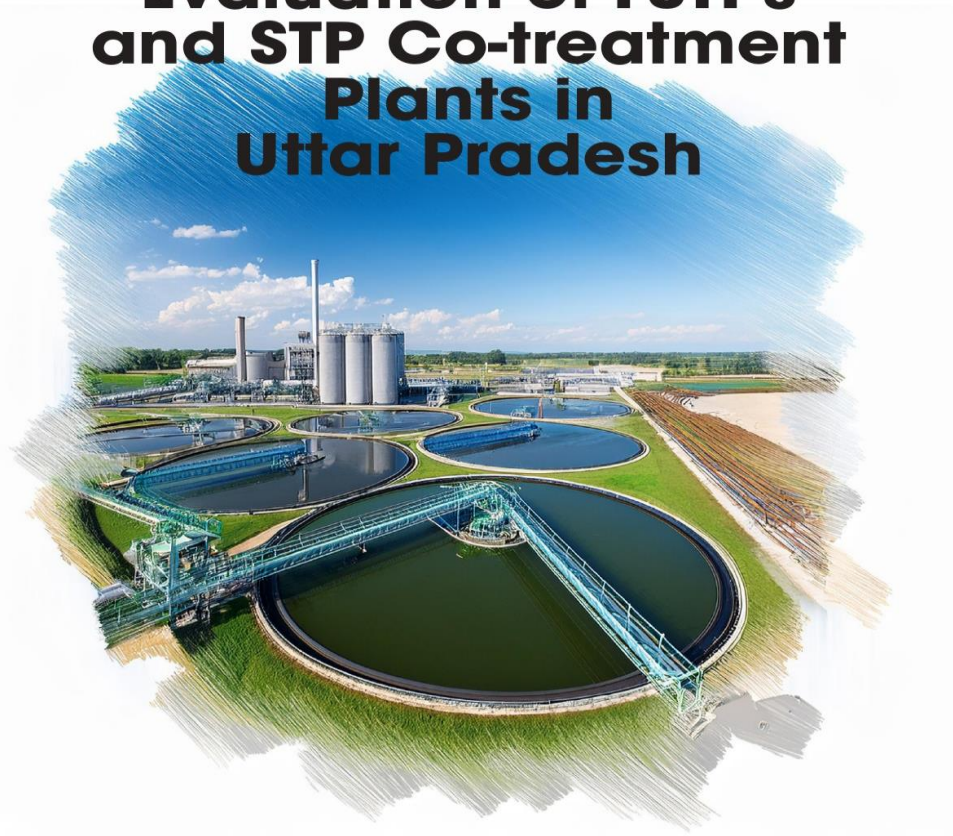
स्वच्छ भारत
एक कदम स्वच्छता की ओर

DEPARTMENT OF URBAN DEVELOPMENT, GOVERNMENT OF UTTAR PRADESH

SOP FOR OPERATIONS AND MAINTENANCE OF FSTPs AND CO-TREATMENT PLANTS IN UTTAR PRADESH

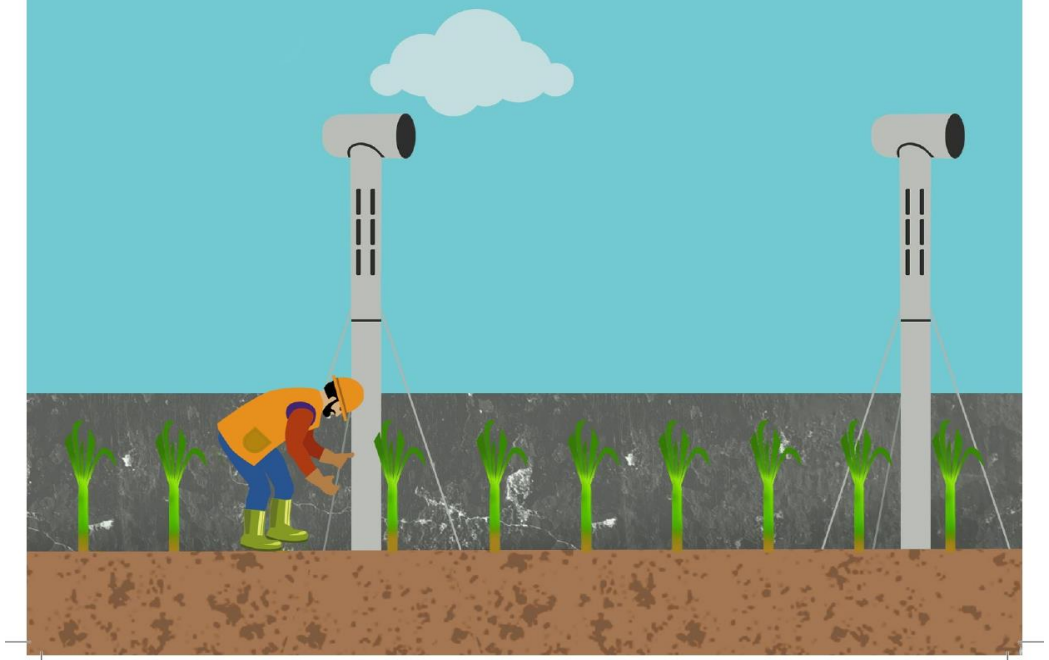
CSE

Monitoring and Evaluation of FSTPs and STP Co-treatment Plants in Uttar Pradesh



OPERATION AND MAINTENANCE COST OF FAECAL SLUDGE TREATMENT PLANTS

IN UTTAR PRADESH



Sab ke liye swasth shahar

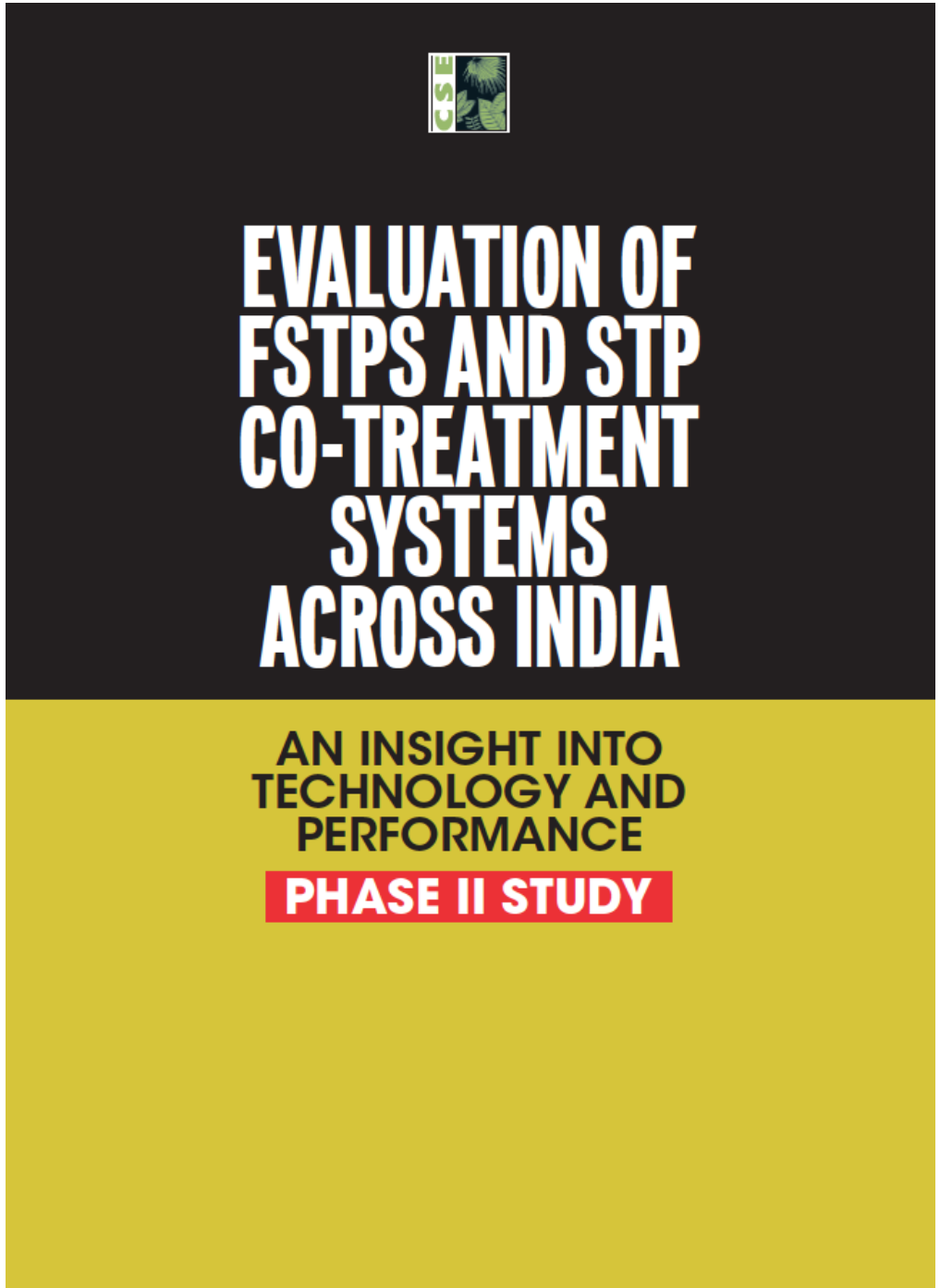
Swachhta ki nayi lehar

SEPTAGE MANAGEMENT FOR CITY-WIDE INCLUSIVE SANITATION IN UTTAR PRADESH

Different technologies evaluated
69 treatment plants
8 states

Challenge is not technology but operations/SOPs for management and oversight on operations

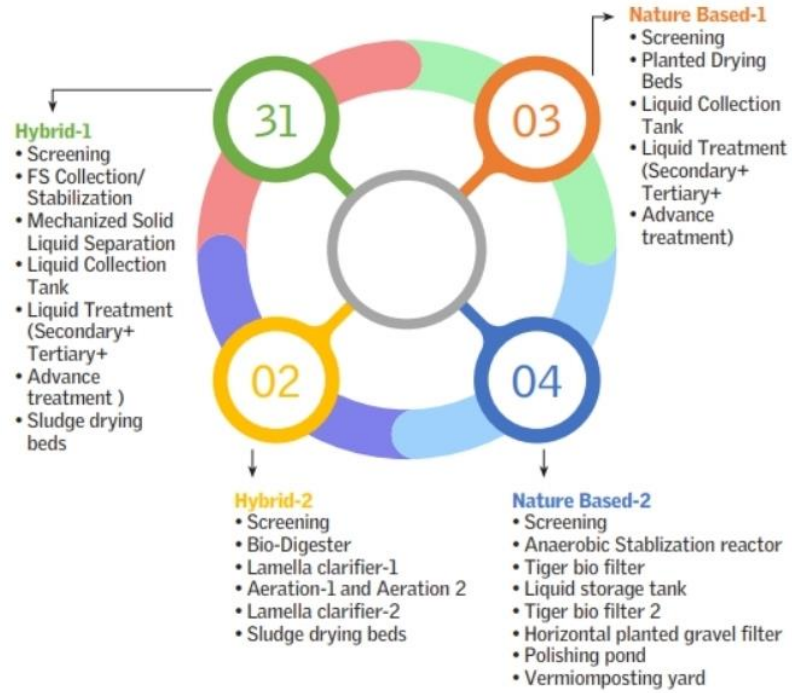
Challenge is to ensure standards for water quality are designed for reused



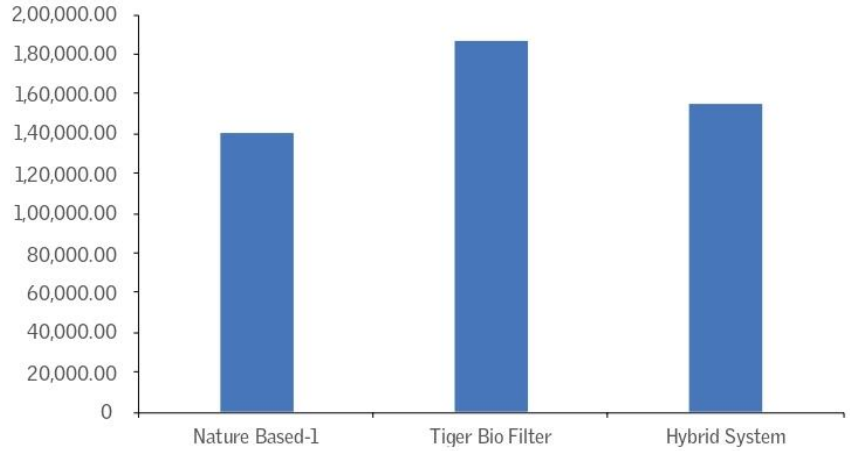
Technology/costs/operations Affordability and inclusion

- Technology choices should depend on what is needed where; land availability or need for compact systems; quality on inflow; what is reuse of treated water/sludge

Figure 1. Treatment chains



O&M cost comparison of 3 types of treatment systems



Source: Compiled by CSE, 2022

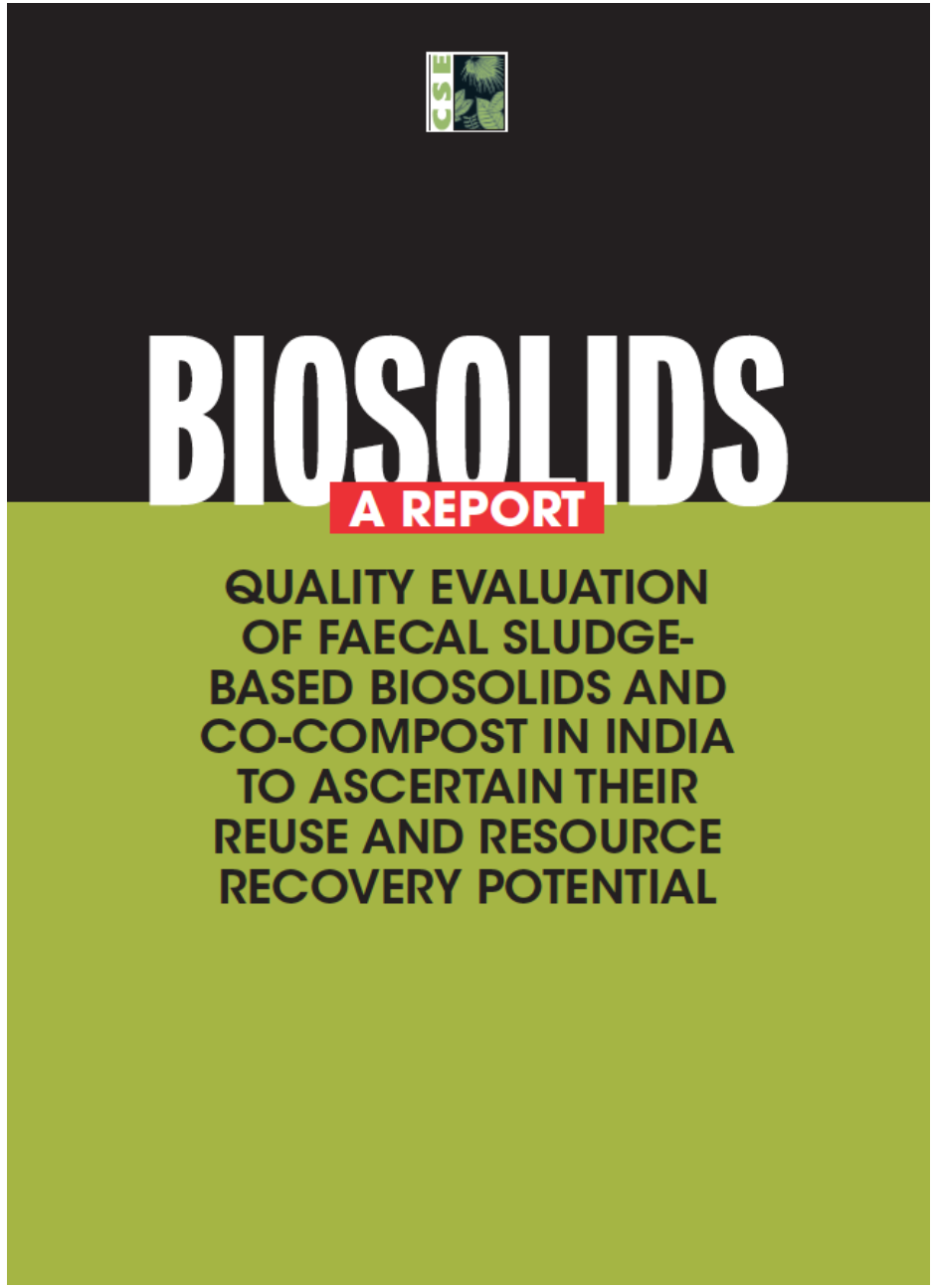
Standards for discharge: need review

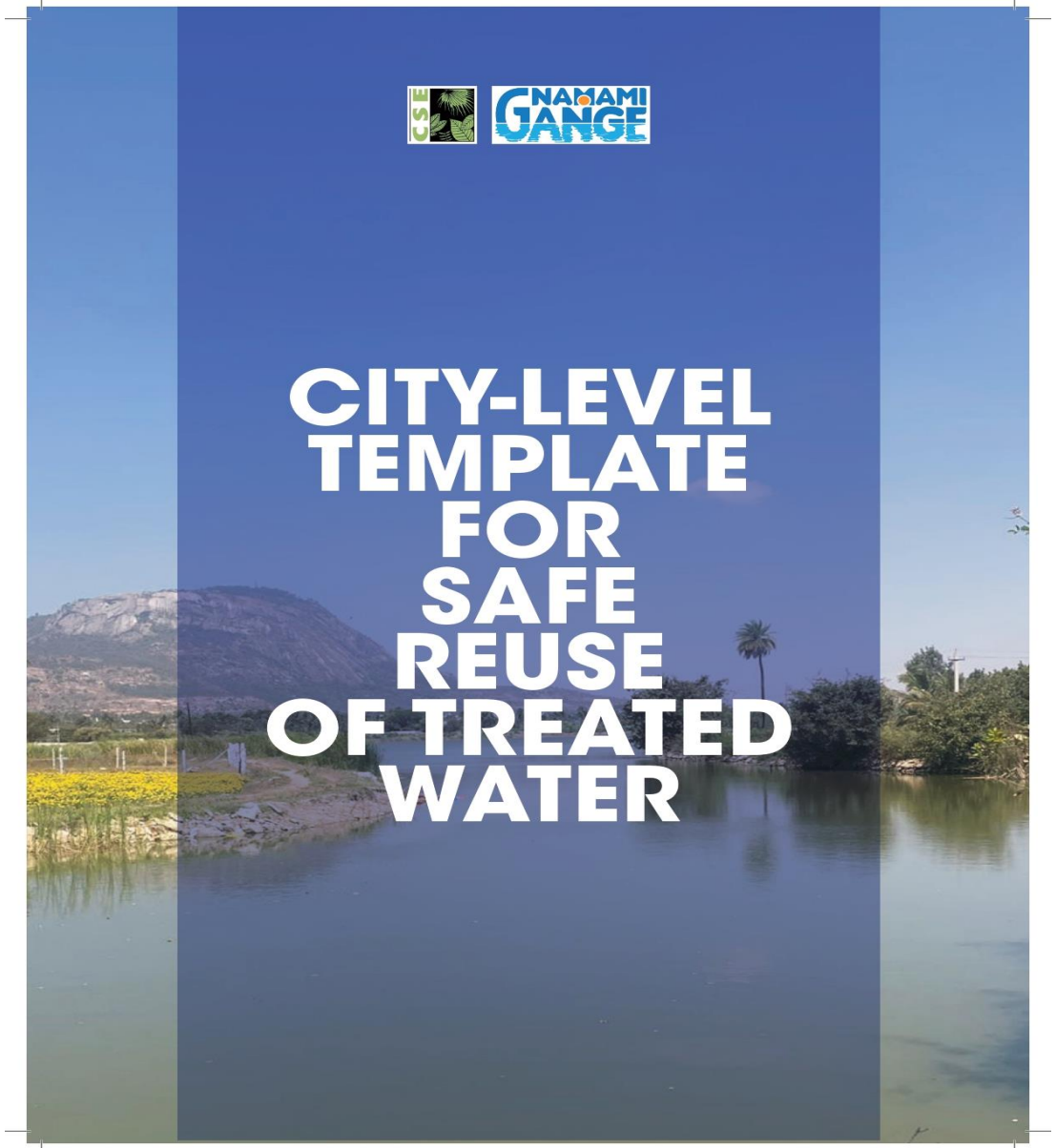
- Current water quality discharge standards are designed for water-based systems that discharge into waterways
- As waterways (rivers/lakes) have little assimilative capacity, standards are made stringent so that clean water is discharged
- But **land based discharge** for reuse needs different standards
- Current wastewater technologies are designed for removal of **nitrogen/phosphorous** before discharge
- But land-based applications/reuse of treated water for agriculture needs nutrients

Existing effluent discharge standards

Parameters in mg/L (except pH)	MoEF&CC Notification, 13th October, 2017	NGT Order 2019* (Mega and metropolitan cites)
pH	6.5 – 9.0	-
Biochemical Oxygen Demand (BOD)	<20 Metro Cities*	<20
	<30 Other than Metro Cities	
Chemical Oxygen Demand (COD)	<50	<50
Total Suspended Solid (TSS)	<50 Metro Cities*	<20
	<100 Other than Metro Cities	
Ammonical Nitrogen	<5	-
Total Kjeldahl Nitrogen (TKN)	<10	<10
Dissolved Phosphorus (P)	-	<1
Fecal coliform (MPN/ 100ml)	<1000	<230

In most STPs and FSTPs
Biosolid after drying are being stored; how to use?
Analysis of sludge from 47 FSTP + 14 co-treatment STP
Nitrogen rich sludge; needs reutilization
But current compost standards may need to be reviewed for reuse
Need better operations for pathogen management

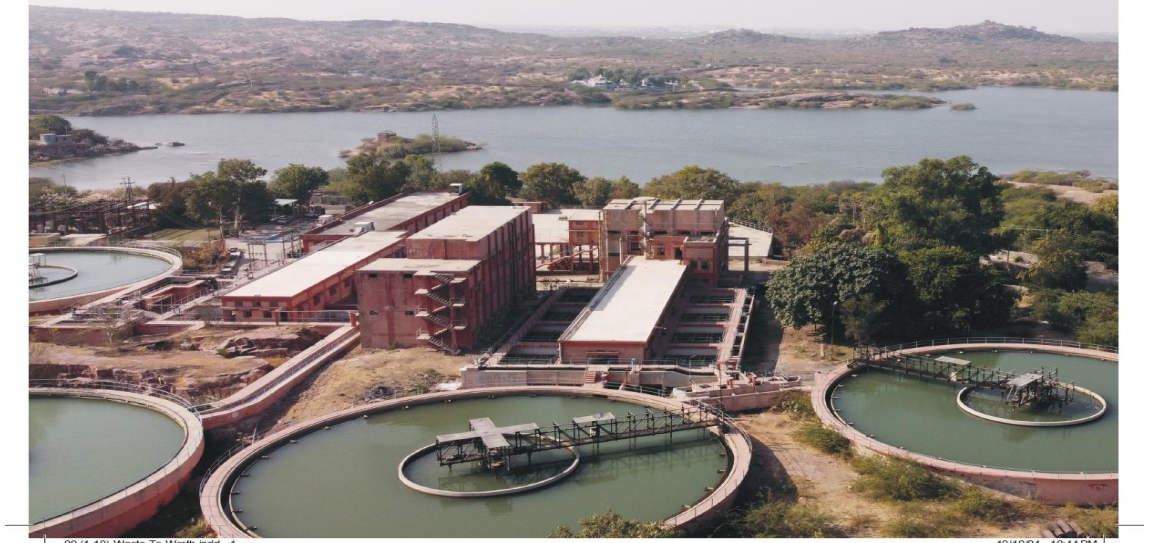




CITY-LEVEL TEMPLATE FOR SAFE REUSE OF TREATED WATER

WASTE TO WORTH

MANAGING INDIA'S URBAN WATER CRISIS THROUGH WASTEWATER REUSE



Reality: Landline or mobile?

- 20 years ago, India was building landlines to connect people with phones
- Today, we go through satellites – mobile phones
- 10 years ago, world was building energy grids to connect people with electricity
- Today, people are installing solar systems on rooftops
- If we can **jump-skip-leapfrog** the landline-grid route in connectivity in telephones and energy access then **why not in sanitation**?

Joining the water-wastewater practice for climate resilience

- Water supply to be more affordable by **increased dependence on local water sources**; groundwater recharged through sponges (lakes-ponds-rainwater harvested in underground wells)
- Wastewater to be more affordable by **interception and treatment designed for all –** not waste time and money in building infrastructure
- **Wastewater to be replenished for reuse**
- **Extreme rain events will be mitigated** because of sponges; more water available for scarcity
- Treated wastewater is used for **recharge in local waterbodies** and increasing water availability
- **Treated bio-solid** is used for nutrient improvement in soils

We all live downstream