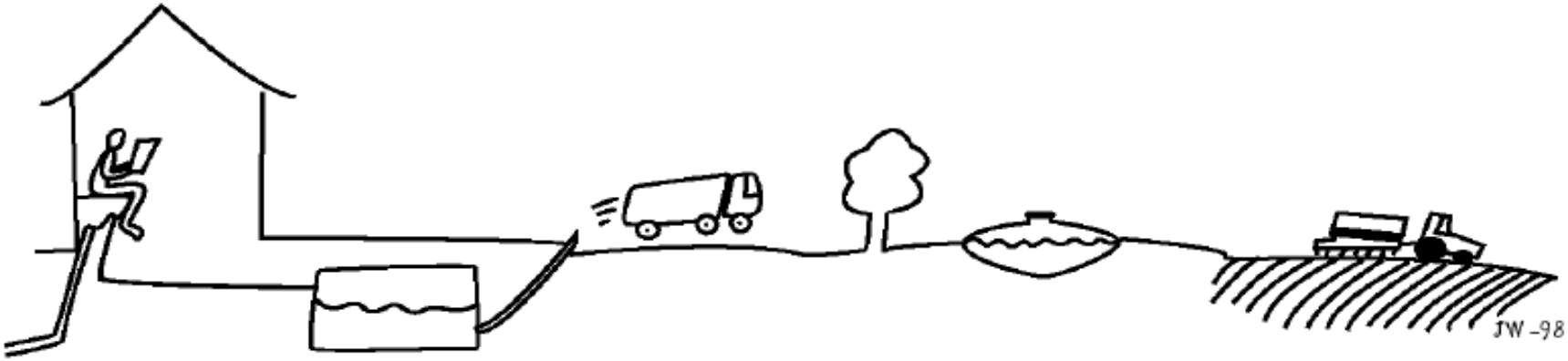


Training Module on

Septage Management Plan

MEETRA, Nashik

15th September, 2015

pas performance assessment system

PAS Project, CEPT University, INDIA

Structure of MODULE

Sessions

Module 1: Introduction to Septage Management

- Key Sanitation facts from Census 2011 – India & Maharashtra
- What is septage and need for septage Management
- Various types of sanitation systems
- Overview of sanitation situation in Maharashtra
- Components of Septage management plan as per MoUD Advisory

Module 2: Key activities involved in Septage Management Plan

- *Septage management activities related to Infrastructure creation*
  - Assessment of existing toilets and septic tanks through surveys and creation of database
  - Design and construction / refurbishment of septic tanks
  - Desludging of septic tanks
  - Scheduled septic tank emptying services
  - Treatment of faecal sludge / septage

Group work: Planning for septage management for a case city – Participants will plan for the infrastructure that is required for implementing the setpage plan in terms of number of septic tanks to be emptied, number of trucks required and their capacity , treatment options with size and capacity.

Lunch

Module 3: Institutional and governance aspects in Septage Management Plan

- *Septage management activities related to Governance and Financing*
  - Regulations for septage management systems
  - Awareness generation and capacity building activities
  - Record-keeping , reporting (MIS), monitoring and feedback systems
  - Sources of revenues for septage management

Group work: Implementing septage management plan for the cities – Participants will discuss issues related to institutional and governance aspects of septage management plan, challenges, the nature of support required from government and financial institutions, costing , financing aspects and operational aspects etc

Module 4 : Private sector participation for septage management activities

- Exploring private sector participation for septage management
- Six processes in structuring a PSP option for septage management

Wrap up and close

Module 1 – Introduction to Septage Management

Key Sanitation facts from CENSUS 2011 - INDIA

18.6% URBAN HHs HAVE REPORTED **NO** TOILETS

32.7% OF URBAN HHs HAVE ACCESS TO **PIPED SEWER**

38.2% HHs HAVE **SEPTIC TANKS**

6% OF HHs DEPEND ON **PUBLIC TOILET**

12.6% OF HHs RESORT TO **OD**

Key facts for Maharashtra (Urban)

29% URBAN HHs HAVE **NO** LATRINE FACILITY

56% OF URBAN HHs TOILETS HAVE ACCESS TO **PIPED SEWER** SYSTEM

37% HHs TOILETS HAVE **SEPTIC TANKS**

22% OF HHs DEPEND ON **PUBLIC TOILETS**

7% OF HHs RESORT TO **OD**

64% OF Wastewater is **UNTREATED**

Onsite sanitation and septage management – emerging questions

37% URBAN HHs TOILETS HAVE SEPTIC TANKS

Are septic tanks linked to soak pits

Are they built as per Codes / Specifications ?

How often are they cleaned ?

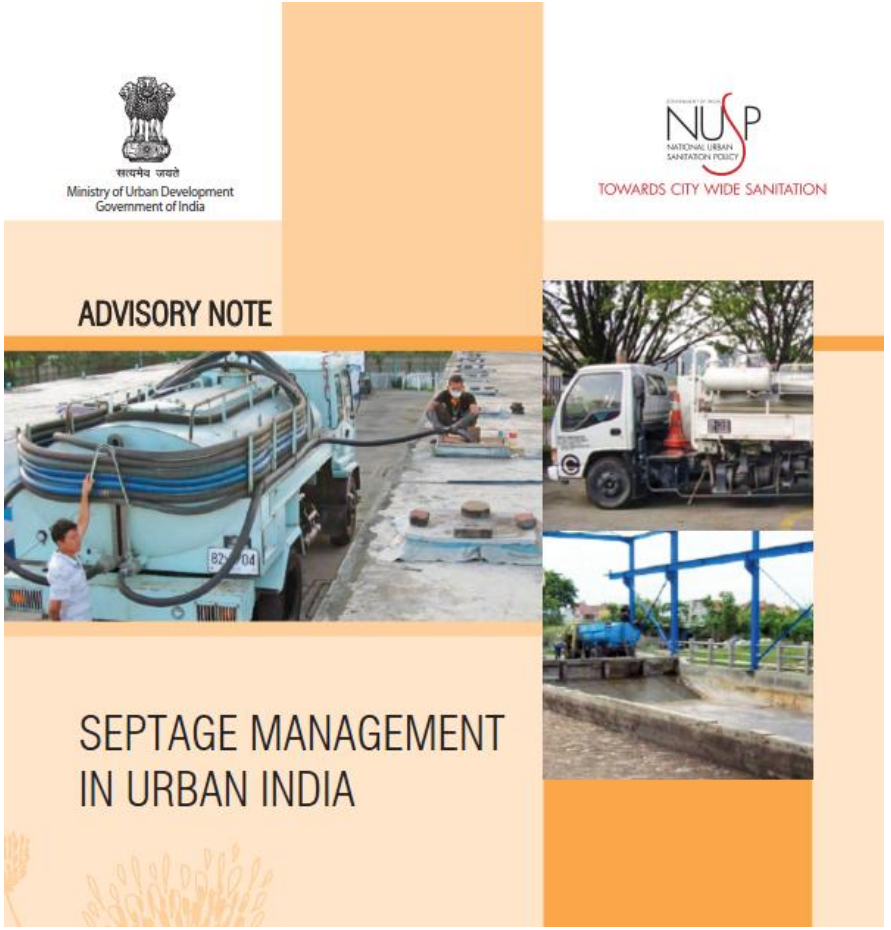
Where does the effluent flow ?

What happens to the SLUDGE?

What is septage . . .

As per MoUD Advisory on Septage Management

"The settled solid matter in semi-solid condition usually a mixture of solids and water settled at the bottom of septic tank. It has an offensive odour, appearance and is high in organics and pathogenic microorganisms."



Characteristics of septage

Physical and chemical characteristics of septage

Constituent (all units but for pH are in mg/l)	Average	Range
Biochemical Oxygen Demand	6,480	440 - 78,600
Chemical Oxygen Demand	31,900	1,500 - 703,000
Total Solids	34,106	1,132 - 130,745
Total Volatile Solids	23,100	353 - 71,402
Total Suspended Solids	12,862	310 - 93,378
Volatile Suspended Solids	9,027	95 - 51,500
Total Kjeldahal Nitrogen	588	66 - 1,060
Ammonia-Nitrogen	97	3 - 116
Total Phosphorus	210	20 - 760
Alkalinity	970	522 - 4,190
Grease	5,600	208 - 23,368
pH		1.5 - 12.6

Parameter	Type "A" high strength	Type "B" low strength
Example	Public toilet or bucket latrine sludge	Septage
Characterization	Highly concentrated, mostly fresh FS; stored for days or weeks only	FS of low concentration; usually stored for several years; more stabilized than Type "A"
COD (mg/L)	20-50,000	<15,000
COD/BOD	5:1 to 10:1	5:1 to 10:1
NH_4-N (mg/L)	2-5,000	<1,000
TS (%)	≥ 3.5 %	< 3 %
SS (mg/L)	≥30,000	7,000 (approx)
Helminth Eggs (unit/ml)	20-60,000	4,000 (approx)

* Detailed septage characterization (BOD, SS & other microbial characteristics) as well as its dewatering characteristics (Specific resistance etc.) should be mandatory prior to the design of any septage management facility.

Source: Strauss, 1996

Characteristics of septage in tropical countries

Source : Advisory note on Septage management in Urban India, MoUD Jan 2013

Need of Septage Management ?

- Facilities like **septic tanks**, dry latrines, community toilets, or other types **accumulate fecal sludge**

- **Septage needs to be removed periodically**. If this septage is **not properly managed**, **negative impacts** on the **urban environment** and on **public health** may result

- **Environmental pollution** is caused by **effluents of not regularly de-sludged septic tanks** or community toilets;

- **Improper handling of septage** regenerates the risks of faecal matter **re-entering the domestic environment**

Table 3: Pollutants in the effluent of on-site treatment Systems

Pollutant	Reason for concern
Total suspended solids	In surface waters, suspended solids can settle and form sludge deposits that smother benthic invertebrates, fish eggs and can contribute to benthic enrichment, toxicity and sediment oxygen demand. Colloidal solids can block sunlight, affect aquatic life and lower the ability of aquatic plants to increase the dissolved oxygen in the water.
Biodegradable organics (BOD)	Biological degradation of organics can deplete the dissolved oxygen in surface waters resulting in anoxic conditions, harmful to aquatic life.
Nitrogen	Nitrogen could lead to eutrophication and dissolved oxygen loss in surface waters. High levels of nitrate nitrogen in drinking water can cause methemoglobinemia in infants and pregnancy complications for women. Livestock can also suffer from drinking water high in nitrogen.
Phosphorus	Phosphorus would also lead to eutrophication and reduction of dissolved oxygen in surface waters.
Pathogens	Parasites, bacteria and viruses can cause communicable diseases through body contact, ingestion of contaminated water or shellfish. Transport distances of some pathogens (bacteria and viruses) can be quite significant.

Effluent and septage from septic tanks systems impacts ground and surface water resources

Source : Advisory note on septage management in urban India, MoUD January 2013

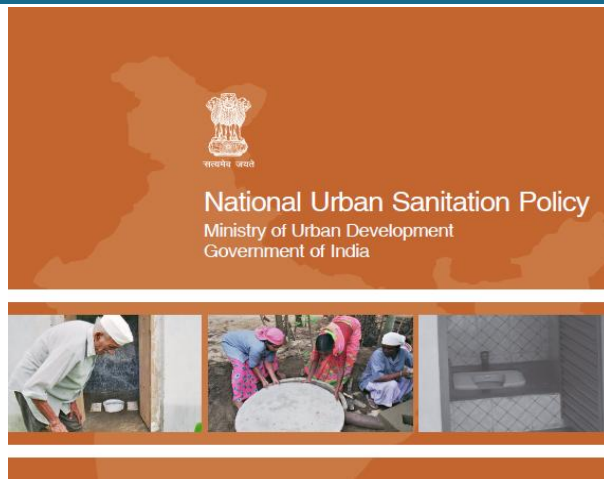
Emerging recognition of septage management

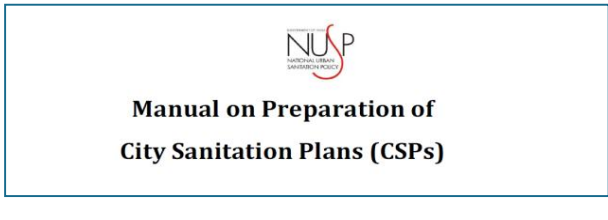
- **NUSP** has accorded **high importance** to **plan and implement** actions for the organized and **safe management** of **fecal matter** from **on-site installations**.

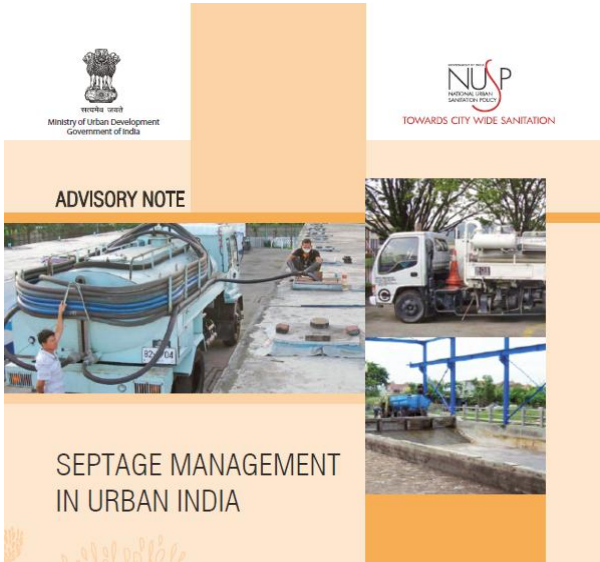
- It highlights the **importance of safe and hygienic facilities with proper disposal**. It emphasizes proper disposal and treatment of sludge from on-site installations (septic tanks, pit latrines, etc.); and proper operations & maintenance (O&M) of all sanitary facilities.

- **Recommends** developing a **Septage Management Plan** (SMP) as a **part** of city sanitation plans (**CSP**)

- **Septage Management Advisory** of Government of India provides references to CPHEEO guidelines, BIS standards, and other resources for preparing SMP / FSM plan.

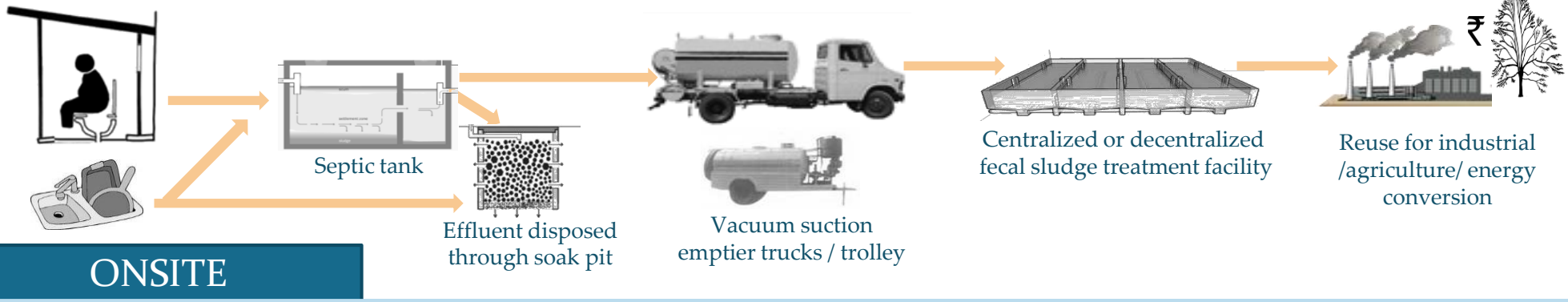


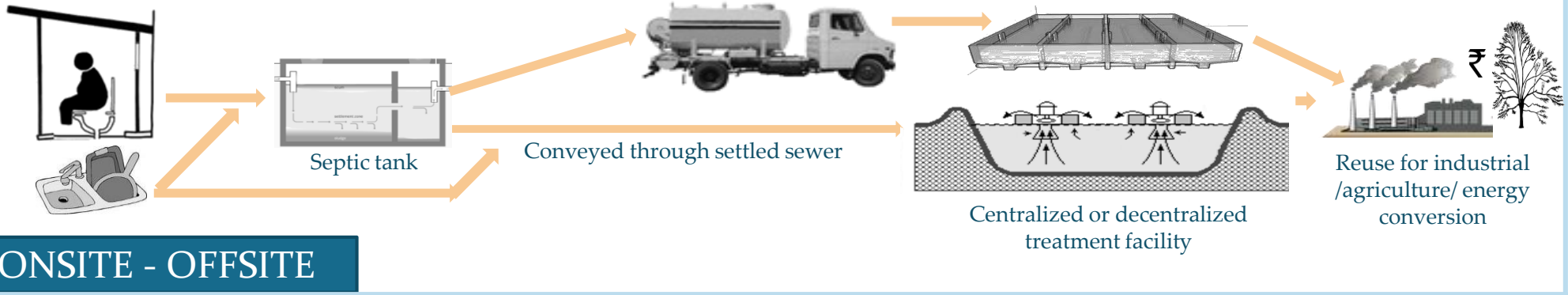


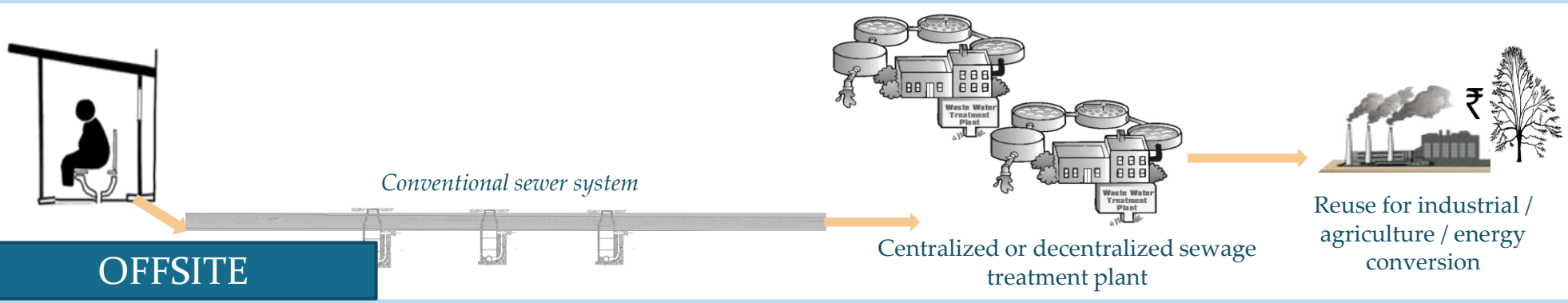


Various type of Sanitation systems in which septage is generated. . .

User interface	Collection	Conveyance	Treatment	Reuse/disposal







Various type of Sanitation system

SANITATION SYSTEM FOR AN IDENTIFIED AREA

ON-SITE SANITATION SYSTEM

Twin pit system

OR

Septic tanks for excreta / greywater + Soak pits for effluent / greywater

Only possible if:
- sufficient space is available in the plot.

SMALL-PIPED SEWERAGE SANITATION SYSTEM

On-site for excreta + settled sewerage system for grey water
OR
settled sewerage system for all wastewater after settling (**Hybrid**)

Only possible if:
- Sufficient space is available in the plot.
- Average to high water consumption
- High public or neighborhood investment capacity

Simplified sewerage system

Only possible if:
- High water consumption
- High public or neighborhood investment capacity

CONVENTIONAL SEWERAGE SANITATION SYSTEM

Conventional sewerage system

Only possible if:
- High water consumption by households in the area
- High public or household investment capacity.
- Planned settlement.
- Sufficient natural gradient
- High local technical and financial management skills.

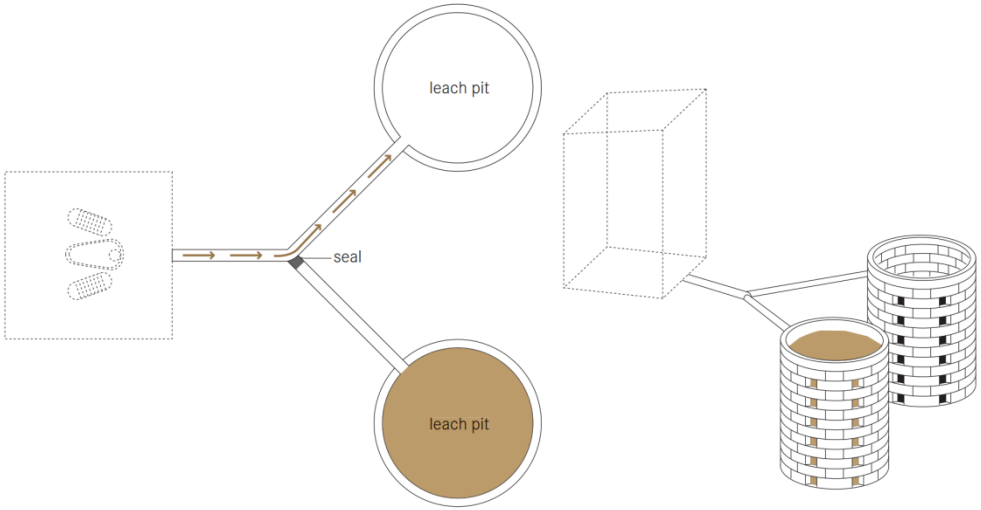
Non-Conventional

Components of Non-conventional Sanitation (1/2)

Twin Pit

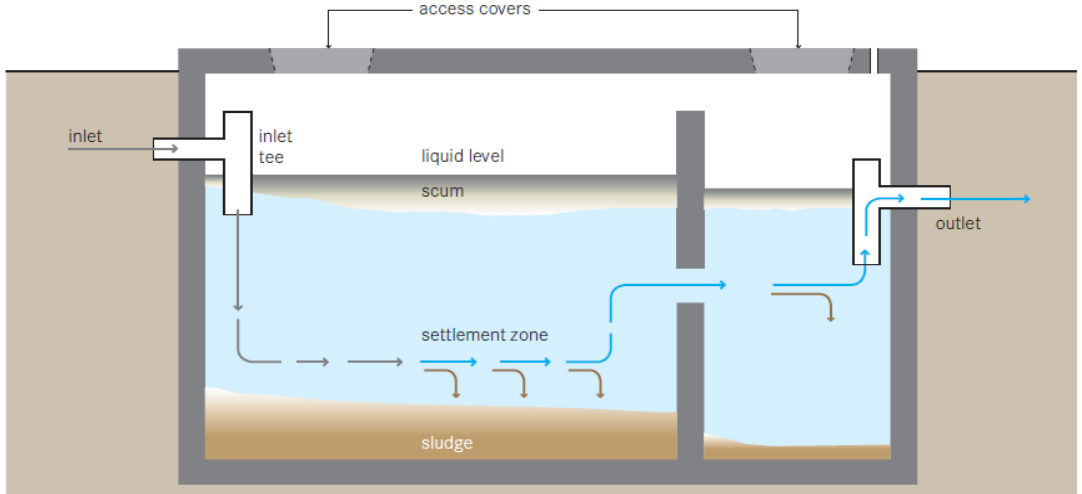
Application Level:	Management Level:	Inputs: Blackwater (Greywater)
★★ Household ★ Neighbourhood City	★★ Household ★★ Shared ★ Public	Outputs: Pit Humus

This technology consists of **two alternating pits** connected to a Pour Flush Toilet. The blackwater is collected in the pits and **allowed to slowly infiltrate** into the surrounding soil.



Septic tank

Application Level	Management Level	Inputs: Blackwater Greywater
★★ Household ★★ Neighbourhood City	★★ Household ★★ Shared ★★ Public	Outputs: Faecal Sludge Effluent

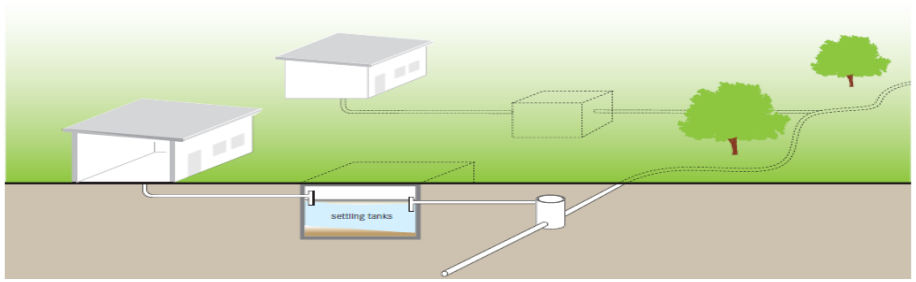


A Septic Tank is a **watertight 2-3 chamber** made of concrete, brickwork, PVC or plastic, for the storage and treatment of blackwater and greywater. **Settling and anaerobic processes** reduce solids and organics.

Components of Non-conventional Sanitation (2/2)

Settled Sewer

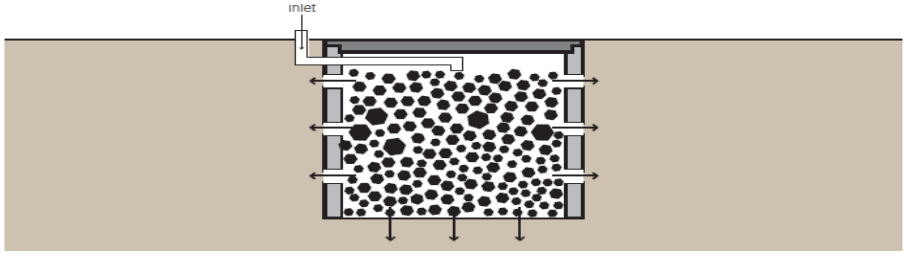
Application Level	Management Level	Inputs/Outputs:
Household	Household	Effluent
Neighbourhood	Shared	
City	Public	



A Settled Sewer is a network of **small diameter pipes** that transports **solids-free wastewater**

Soak Pit

Application Level	Management Level	Inputs:
Household	Household	Effluent, Greywater
Neighbourhood	Shared	Urine, Anal Cleansing Water
City	Public	



A Soak Pit, also known as a soakaway or leach pit, is a covered, **porous-walled chamber** that allows **water to slowly soak into the ground**. Pre-settled effluent is discharged to the underground chamber from where it infiltrates into the surrounding soil

International Experience

Following its successful installation in Northern Zambia (1960), settled sewerage was then installed in:

- **Australia, in 1962;**
- **Nigeria, in 1965;**
- **United States, in 1975;**
- **Colombia in 1982;**
- **Brazil, in 1987; and**
- **South Africa, in 1989.**

It is now **most common** in **Australia** and the **United States**, with over 300 schemes installed.

National Experience

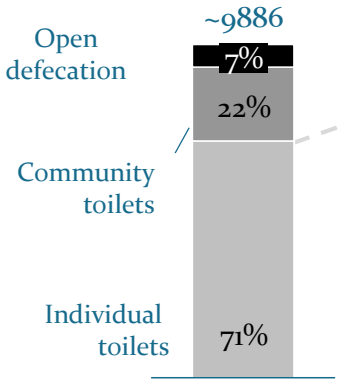
Under **Punjab Rural Water supply scheme**

- **100 Villages are going to be provided with settled sewer network**

Overview of sanitation situation in Maharashtra

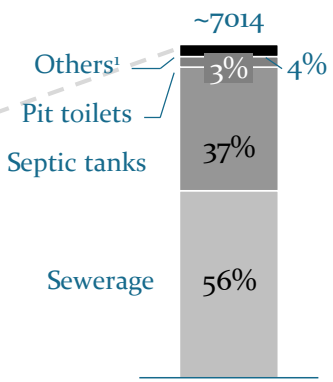
Access	Collection	Conveyance	Treatment	Disposal/Reuse

Access to type of sanitation *('000s of HH)*



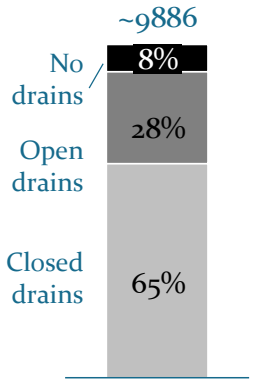
~690,000 HH practice open defecation and ~1/5th of HH depend on community toilets, even in non-slum areas

Method of collection of waste *('000s of HH)*



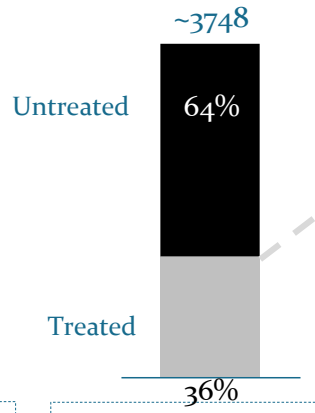
~250,000 HH with personal toilets use other method of waste collection

Methods of conveyance of waste *('000s of HH)*



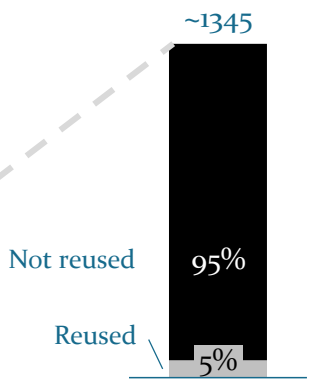
~730,000 HH have no drains for conveyance of wastewater

Treatment of wastewater *(in MLD)*



~2,400 MLD of wastewater is left untreated every day

Disposal of waste *(in MLD)*



~1,280 MLD of treated wastewater is disposed off without being reused

Septage Management

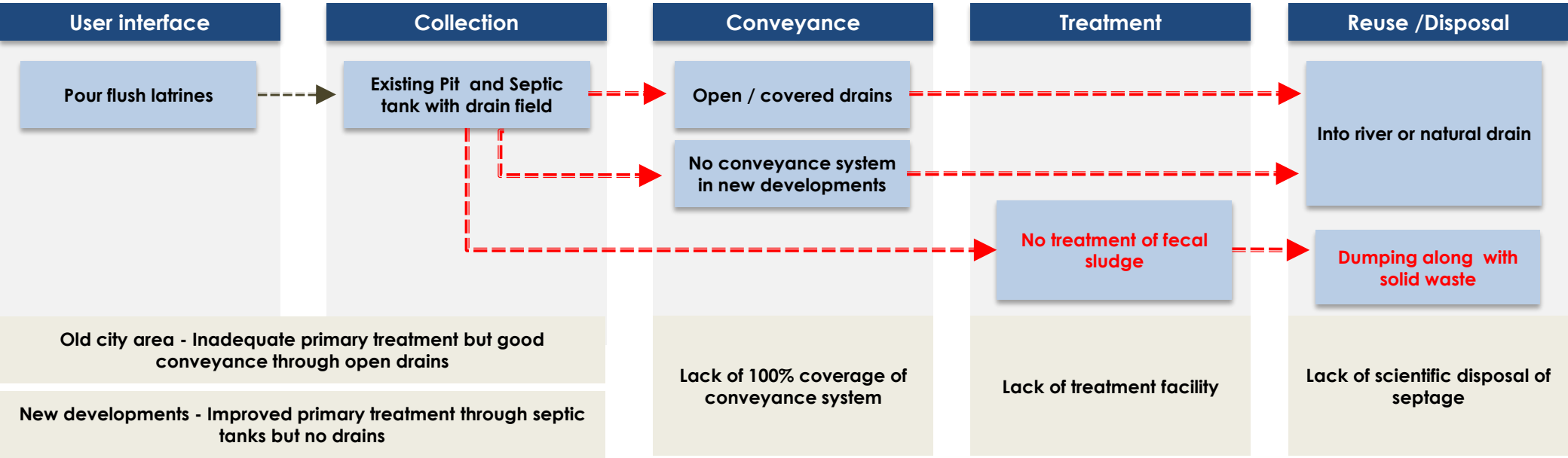
- ***STs are oversized*** *and are* ***cleaned*** *at an* ***interval of 8-10 years***
- ***Effluent from STs goes into drains or soak pits***

- ***197 cities*** *provide septic tank* ***emptying services***
- ***23 cities*** *have* ***licensed private sector*** *for providing septic tank emptying services*

- ***None of the cities*** *have* ***independent septage treatment facilities***
- *Only* ***6 cities treat septage*** *along with sewage* ***at their STPs***
- ***Septage is dumped*** *at* ***dumpsite*** *or open land*

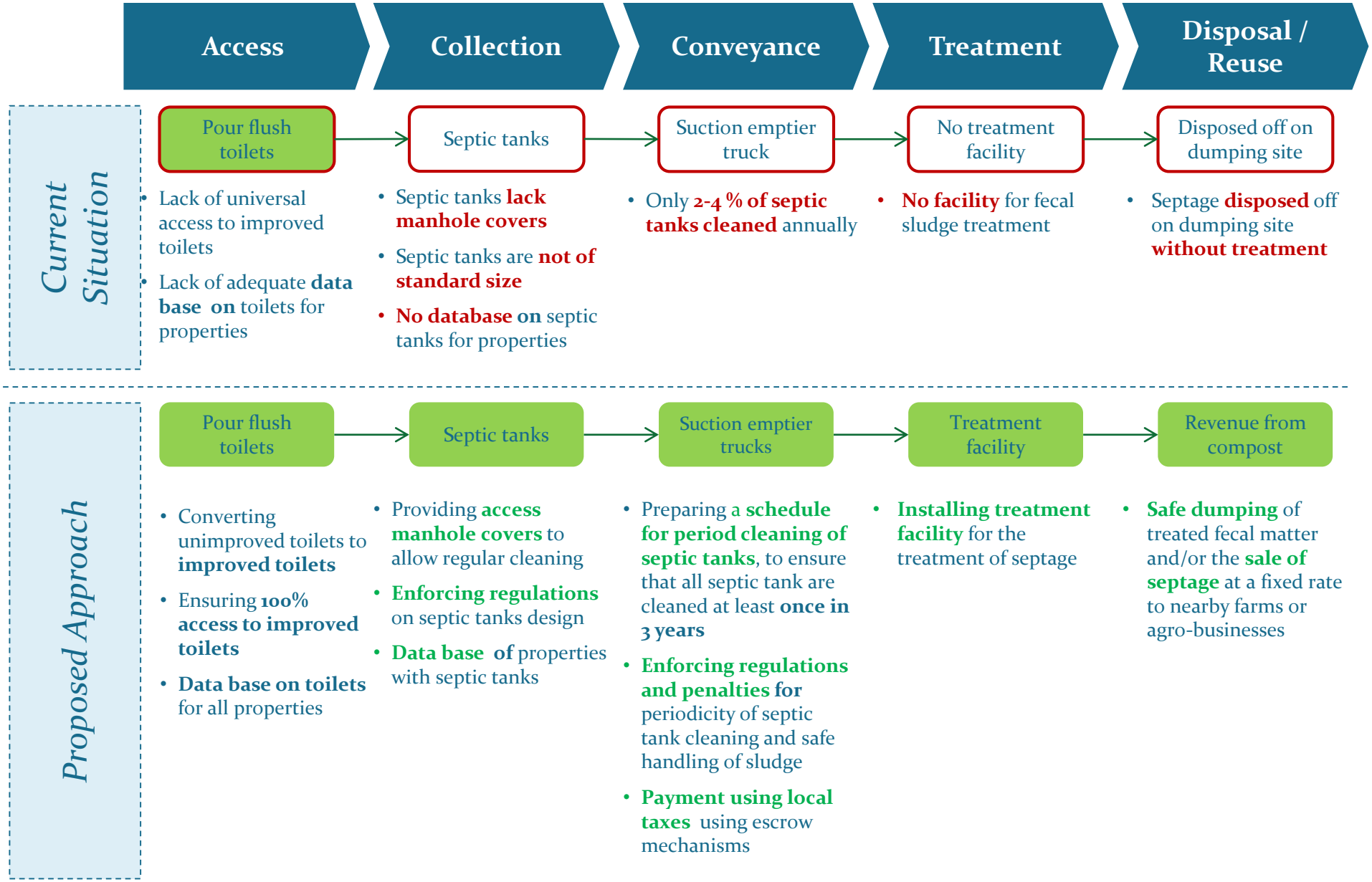
Source: CEPT PAS data 2011 & 2014 , Census of India 2011,

Current situation of septage management in Small – Medium towns of Maharashtra



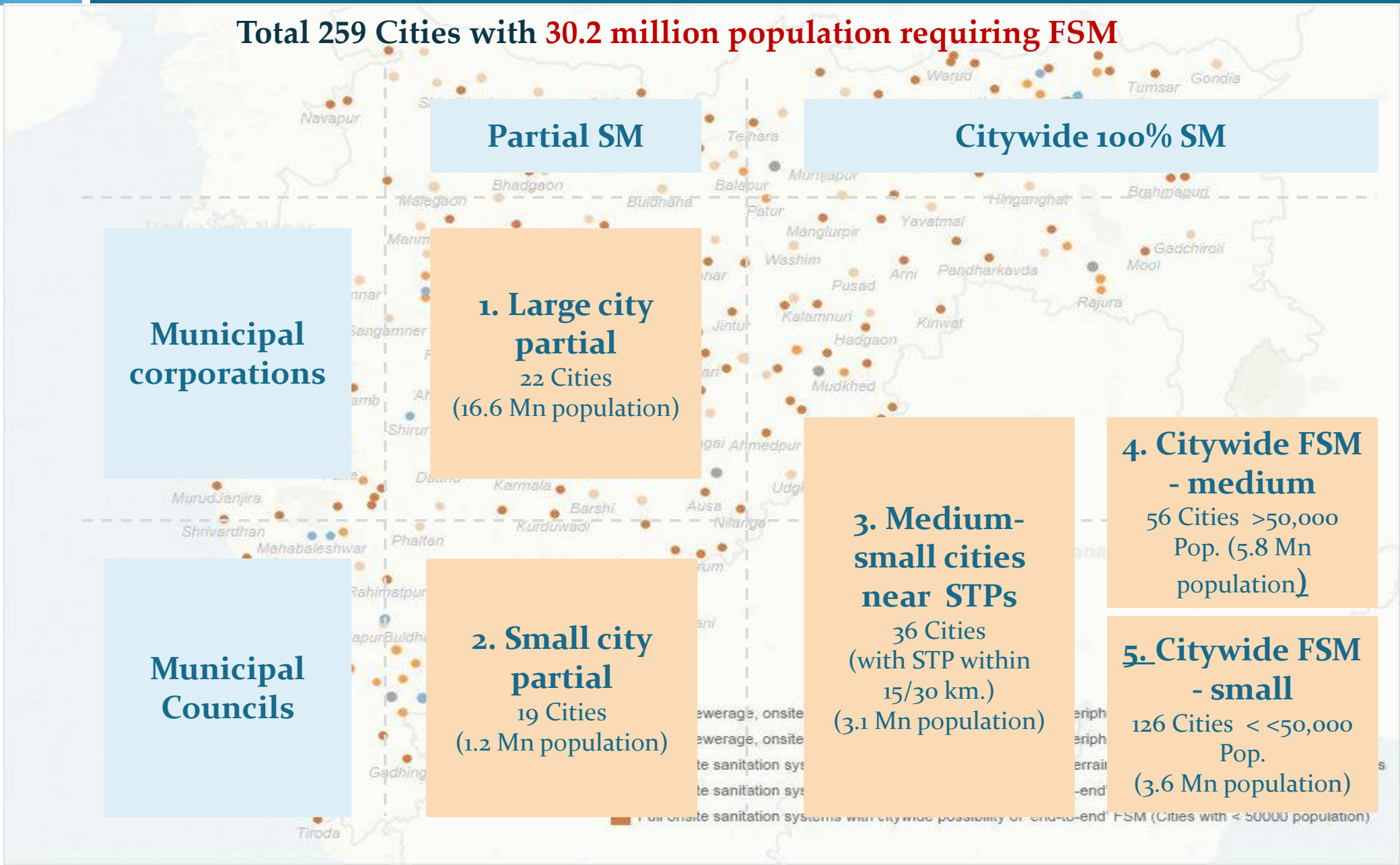
Missing links in Sanitation value chain in a city

End-to-end IFSM solution – From red to green

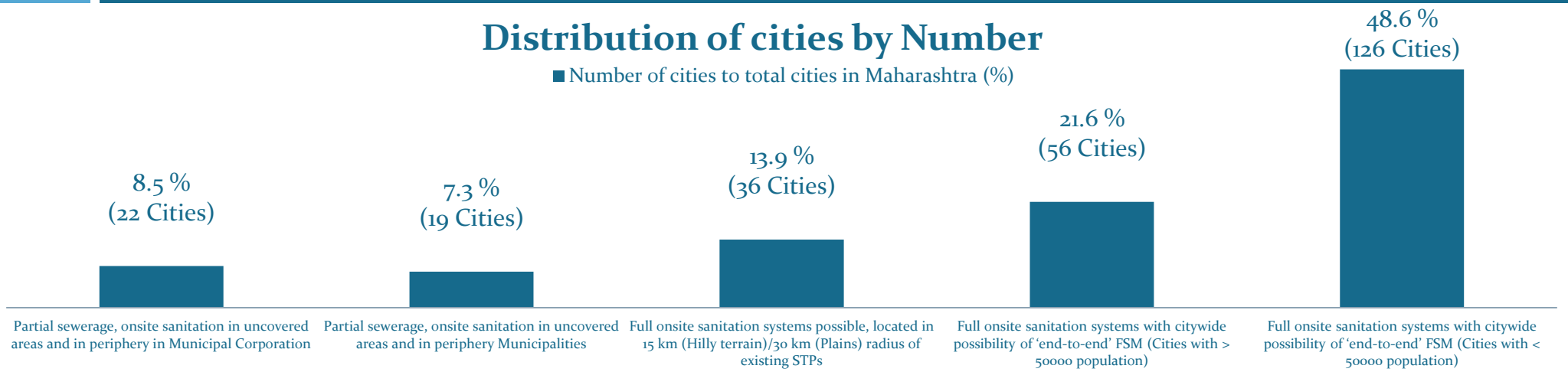


Extent of septage management (SM) required in Maharashtra (1/2)

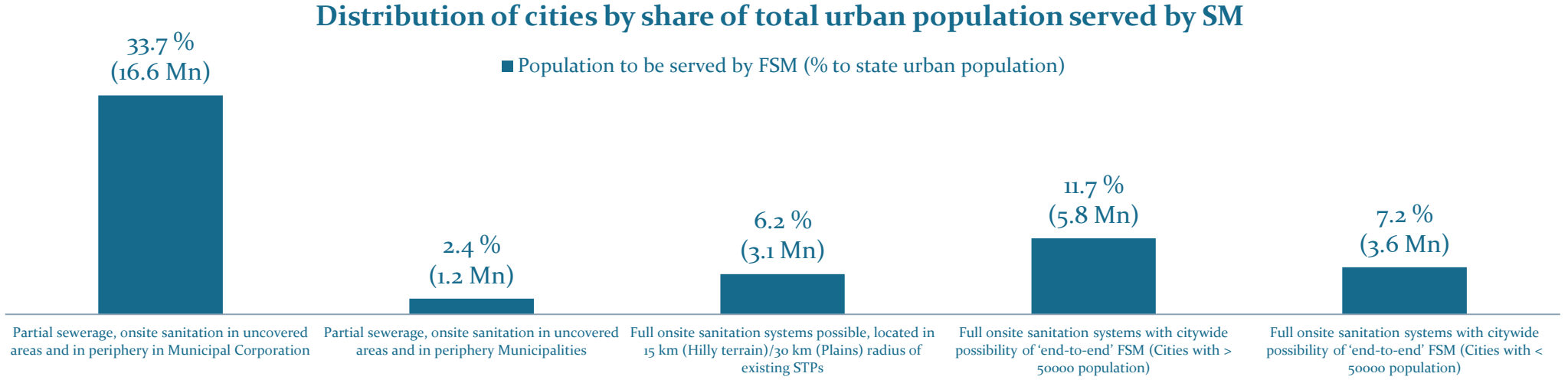
Total 259 Cities with 30.2 million population requiring FSM



Extent of septage management (SM) required in Maharashtra (2/2)



Septage Management is required for all the cities in the state to serve 61% urban state population



Key Elements of Septage Management Plan as per the MoUD Advisory

Desludging of Septic tanks

- **De-sludging** of septic tanks - using **mechanical devices**
- **De-sludging frequencies** of septic tanks once every **2 to 3 years**, or when the tank becomes one third full
- Periodical desludging also helps **reduce the pollution levels in the effluent**
- **1-2 inch of sludge** should be **left in tank** to **facilitate** future **decomposition**
- **Regular desludging** activities **require well-organized** community and **public/private service providers**
- **Tanks** should **not be scrub** cleaned or **washed with detergent**

Transportation

- **Vehicles** are available in different **capacities** from **2,000 to 12,000 litres**.
- Small scale vacuum trucks called **Vacutug** are recommended f**or areas inaccessible** to large vehicles
- The **no. of** cleaning **machines** - based on frequency of **cleaning**, **distance** of location **of treatment facility** and local conditions
- A **Transportation Plan** should be formulated which **should include**:
  - **Scheduling** and routing for **trucks**
  - **Customer** service **protocols**
  - **Locating** tanks and cleanouts with **proper pumping** equipment operation and worker safety
  - Transportation requirements, including rules of the road
  - **Disposal procedures** at the treatment facility
  - **Routine service** of equipment
  - **Recordkeeping** for all tanks pumped and wastes discharged at the disposal facility

Treatment / Reuse / Disposal

- Treatment at **existing sewage treatment plants**
  - Septage addition at the **nearest sewer** manhole
  - Septage addition **at the STP**
  - Septage addition to **sludge digesters/sludge drying beds**
- Treatment at **independent septage treatment plants**
  - **Space is not a constraint** : Lime treatment, Sludge drying beds, Anaerobic baffled reactor, stabilization pond, Constructed wetland, co-composting with solid waste
  - **Space is a constraint** : Mechanical Dewatering system
- Properly **treated sludge** can be **reused** to reclaim parched land by application **as soil conditioner**, and/or as a **fertilizer**

Regulation and Monitoring by the ULB and Awareness Generation

Key activities for Septage Management Plan

Key activities involved in Septage Management Plan

Module 2

- Assessment of existing toilets and septic tanks through surveys and creation of database
- Design and construction / refurbishment of septic tanks
- Desludging of septic tanks
- Scheduled septic tank emptying services
- Treatment of faecal sludge / septage

Institutional and governance aspects in Septage Management

Module 3

- Regulations for septage management systems
- Awareness generation and capacity building activities
- Record-keeping , reporting (MIS), monitoring and feedback systems
- Sources of revenues for septage management
- Exploring private sector participation for septage management

Module 2 : Key activities involved in Septage Management Plan

Key activities involved in Septage Management Plan

- **Assessment of existing toilets and septic tanks** through surveys and **creation of database**
- **Design** and **construction / refurbishment** of **septic tanks**
- **Desludging of septic tanks**
- **Scheduled** septic tank **emptying services**
- **Treatment** of faecal sludge / **septage**

Assessment of existing toilets and septic tanks through surveys and creation of database (1/2)

Present system

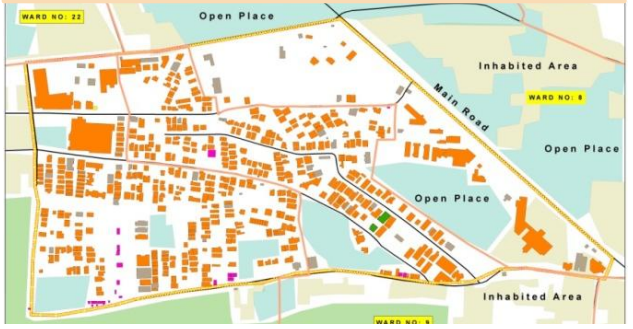
- **No database** of **toilets, septic tanks** for HHs
- **No ready database** to show **how often** a **septic tank** is being **cleaned** and at which location in the city

Creating database and improving monitoring :

- **Create GIS database** for each HHs / property depicting **details** on **Toilets, septic tanks**, soak pits details
- **Update of HHs / property** on server through mobile application or reporting systems **once** the **septic tank** is **cleaned**
  - Automatic reminder sent to the HHs after 3 years to clean the septic tank

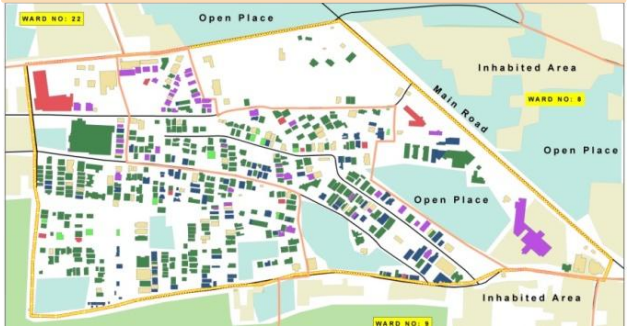
System required

Details of toilets



Details of where toilets are connected

Details of where bathroom and kitchen are connected



Assessment of existing toilets and septic tanks through surveys and creation of database (2/2)

Assessment should capture the following aspects

- Toilet availability
- Where is the toilet connected to
- Size and shape of septic tank
- Number of chambers in septic tank
- Access covers to septic tanks
- Accessibility of septic tanks
- When was the septic tank last cleaned.
- Cleaning frequency of septic tanks
- Problems encountered while cleaning of septic tanks
- Reasons for emptying septic tanks

Sample Questionnaire

	Toilet availability assessment
19	Where do you dispose greywater from kitchen and bathroom? (1. Sewer, 2. Septic tank, 3. Soak Pit, 4. Covered drains, 5. Open drains, 6. Others, specify, 7. Don't Know)
20	Do you have your own toilet on your premises? 1. Yes 2. No.
21	**If 20=1,** Does any member of the household still go for defecation in the open? (1. Men. 2. Women. 3. Children. 4. No one)
	Septic tank assessment
22	**What is the type of toilet facility is being used?** (1. Flush/pour flush toilet connected to piped sewer system, 2. Flush/pour flush toilet connected to septic tank, 3. Flush/pour flush toilet connected to other system, 4. Single Pit toilet with slab, 5. Single pit toilet with ventilated improved pit, 6. Single pit toilet without slab / open pit, 7. Twin/Double pit toilet , 8.Night soil disposed into open drain, 9.Service toilet with night soil removed by humans, 10. Service toilet with night soil services by animals
	If Q22 is 2 (toilet connected to Septic tank) answer 23 to 46
	If Q22 is not 2 (toilet connected to Septic tank) go to B
23	No. of septic tanks in the property (1.Number_____, 2. Don't know)
24	Distance of septic tank from the nearest well/bore (1. Distance _____ft. to on-site system, 2.Don't know)
25	Septic tank outfall is connected to (1. Soak pit, 2. Open drain, 3. Covered drain, 4. Others (Specify) 5. Don't Know)
26	What is the average frequency of cleaning of septic tank? (1. 1 year, 2. 2 years, 3. 3 Years, 4. 4 Years 5. More than 5 years, 6. Don't Know)
27	What is the shape of your septic tank (1. Rectangular, 2. Circular, 3. Don't Know)
28	Can you provide the dimensions of the septic tank? (1. Yes 2. No.)
29	**If Q. no 27= 1 and Q.no 28= 1,** provide L _____ft, B _____ft., H_____ft.
30	**If Q. no 27= 2 and Q.no 28=1,** provide Diameter _____ft., Depth_____ft.
31	How many chambers are there in the septic tank (1. one, 2. two , 3. three, 4. Don't Know)
32	The base of septic tank is (1. Sealed with concrete and /or plaster, 2.No base – only soil, 3.Other, please specify, 4. Don't know)
33	Are there ventilation pipes for septic tanks (1.Yes, 2. No)
34	What construction materials have been used for constructing septic tanks? (1. R.C.C, 2. Cement concrete and brick, 3. Prefabricated unit, 4. Don't Know, 5. Other, specify)
35	What is the age of septic tank? (1. No. of years_____, 2. Don't know)
	Where is septic tank located? (1.Front yard, 2.Back yard (easy access), 3.Back yard (no access/through house), 4. House

PAS has developed a Mobile App- **"SaniTab"** for conducting household level sanitation surveys, which can be used by the ULBs

Key activities involved in Septage Management Plan

- **Assessment of existing toilets and septic tanks** through surveys and **creation of database**
- **Design** and **construction / refurbishment** of **septic tanks**
- **Desludging of septic tanks**
- **Scheduled** septic tank **emptying services**
- **Treatment** of faecal sludge / **septage**

Design and construction / refurbishment of septic tanks

- The **septic tanks** need to **be designed and constructed** as per the **norms suggested** in:
  - ***Swachh Bharat Mission Guidelines, 2014***
  - *Manual on Sewerage and sewage treatment systems ,* ***CPHEEO, 2013***
  - ***National Building Code of India, 2005***
  - ***IS: 2470 - Code of practice for installation of septic tanks*** *- Part 1: Design and Construction and Part 2: Secondary treatment and disposal of septic tank effluent 1985 (Reaffirmed 1996).*

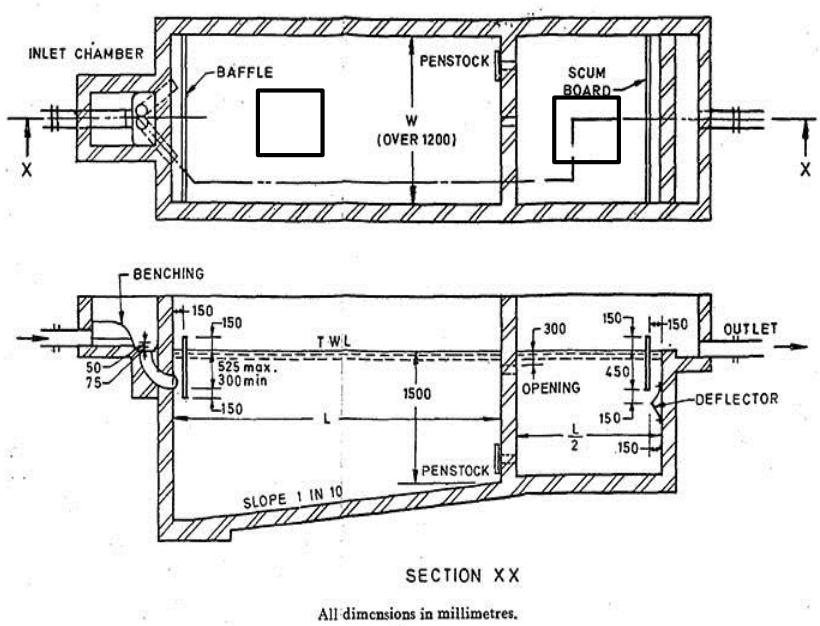
- **Notices** should be issued to all **property owners** whose **septic tanks do not meet** the **standard septic tank design**.

- All **insanitary toilets** need to be **converted to sanitary toilets** with twin pits or septic tanks

No. of Users	Length(M)	Breadth(M)	Liquid Depth (Cleaning interval of)	
			2 Years	3 Years
Recommended size of septic tank up to 20 users				
5	1.50	0.75	1.00	1.05
10	2.00	0.90	1.00	1.40
15	2.00	0.90	1.30	2.00
20	2.30	1.10	1.30	1.80
Recommended size of septic tank for housing colony upto 300 users				
50	5.00	2.00	1.00	1.2
100	7.50	2.65	1.00	1.2
150	10.00	3.00	1.00	1.2
200	12.00	3.30	1.00	1.24
300	15.00	4.00	1.00	1.24

Note : A provision of 300 mm should be made for free board.

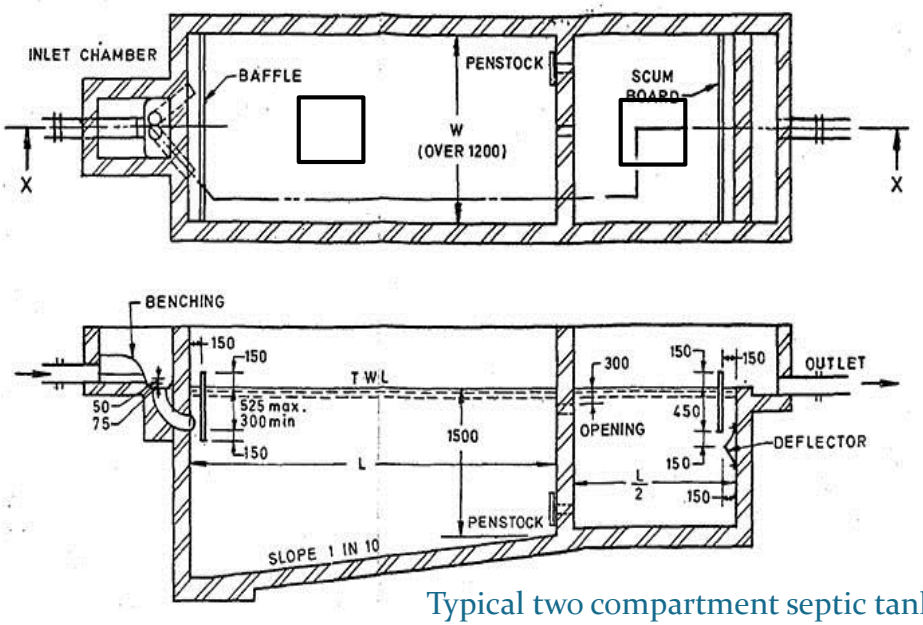
Typical sizes of septic tanks for various user sizes



Typical two compartment septic tank

Design considerations for septic tanks . . .

- **Septic tank** should be designed for **1 to 2 days of sewage retention**.
- Septic tank shall have **minimum width of 750 mm**, **minimum depth of one metre below water level** and a **minimum liquid capacity of 1000 litres**.
- The **septic tanks** are **normally rectangular** in shape and can either be a **single tank or a double tank**
- In **double tank, first compartment is usually twice the size of the second**
- The **liquid depth is 1-2 m** and the **length to breadth ratio is 2-3 to 1**
- For **circular tanks the minimum diameter** shall **not be less than 1.35 m** and **operating depth shall not be less than 1·0 m.**
- **Each compartment** of a septic tank shall be **provided with a rectangular access opening** measuring not less **455 × 610 mm** or a **circular opening 500 mm diameter**
- Ventilating Pipe—Every **septic tank** shall be provided **with ventilating pipe of at least 50 mm diameter**. The **top of the pipe** shall be provided with a **suitable cage of mosquito proof mesh.**

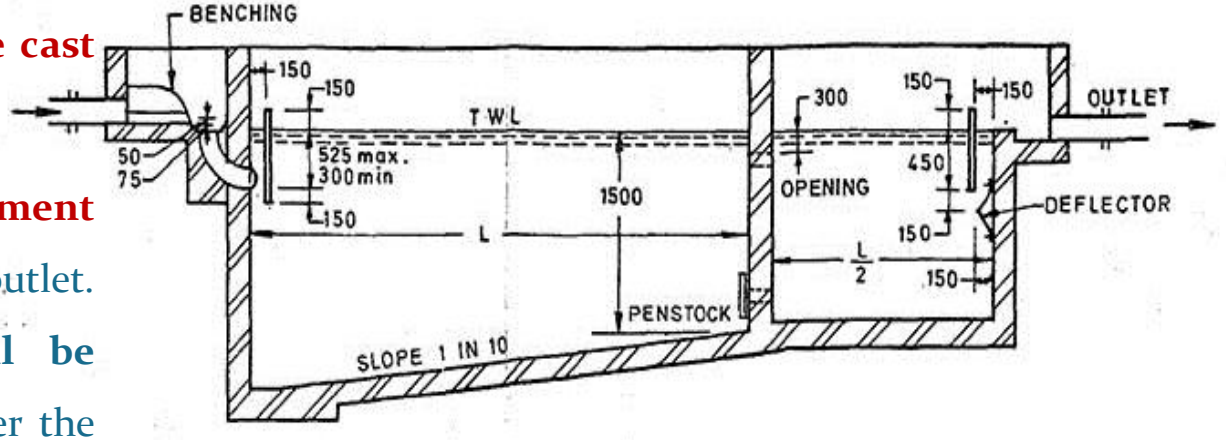


Typical two compartment septic tank

Construction considerations for septic tanks . . .

- **Baffles** are generally **provided at both inlet and outlet** which dip 25 cm to 30 cm into and project 15 cm above the liquid. The baffles should be placed at a distance of one-fifth of the tank length from the mouth of the straight inlet pipe
- The **invert of the outlet pipe** should be **placed at a level 5 to 7 cm below the invert level of inlet pipe**
- For **two compartment septic tanks**, the tanks should be **interconnected above the sludge storage level** by **means of pipes or square openings of diameter or side length respectively of not less than 75 mm**
- The height of the **ventilation pipe should extend at least 2 m above the top of the highest building within a radius of 20 m**
- Septic tanks may either be **constructed in brick work, stone masonry or concrete cast in situ or pre-cast materials**
- The **floor of the tank should be of cement concrete** and sloped towards the sludge outlet. Both the **floor and side wall shall be plastered with cement mortar** to render the surfaces smooth and to make them **water tight.**

Typical two compartment septic tank

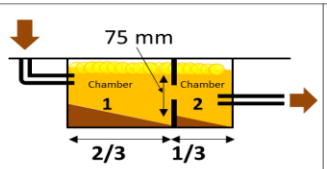
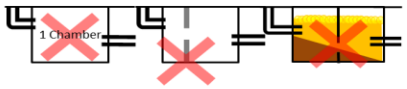
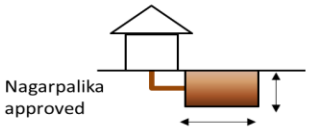
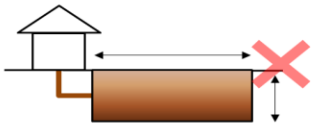
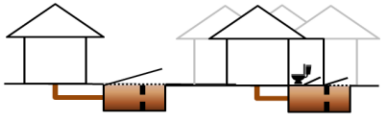
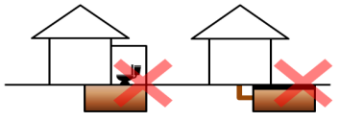
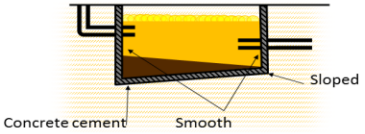
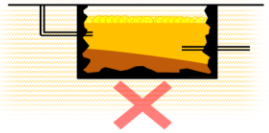
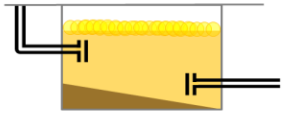
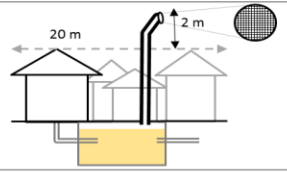
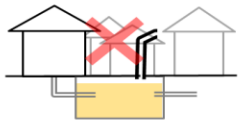


SECTION XX

All dimensions in millimetres.

Do's and Don'ts for septic tank construction . . .

Septic Tank and Dos and DON'Ts

Dos		DON'Ts
✓ Construct at least a two chambered septic tank ✓ Partition wall should be constructed at a distance of 2/3 the length from the inlet ✓ The 2 chambers should be interconnected above the sludge storage level by means of a pipe or square opening of diameter or side length not less than 75 mm		 X Do not construct a one chambered septic tank X Do not construct a partition wall at an inappropriate distance X Do not provide the interconnection at a level where the sludge or scum is formed
✓ The size of the tank should be as per Nagarpalika norms		 X Do not construct an oversized septic tank
✓ Always construct septic tank away from structure ✓ If space not available, construct toilet over septic tank such that all chambers are accessible ✓ Provide openable access covers to all chambers for inspection and desludging		 X Do not construct toilet above septic tank X Do not completely seal the septic tank from top
✓ Septic tanks should be constructed in materials such as brick, stone, concrete (cast in-situ) or be of pre-cast materials		 X Do not use a dug trench as septic tank X Tank should not leak
✓ The base or floor should be cement concrete and sloped upwards to the outlet ✓ The floor and sides should be plastered with cement mortar to render the surfaces smooth		 X Do not keep the base level or slope downwards to the outlet X The inside surfaces of the septic tank should not be rough
✓ The inlet and outlet should be located at different levels ✓ The inlet and outlets should be below scum level and above sludge level ✓ Baffles or T junctions should be provided at inlet and outlet		 X The inlet and outlet should not be located at such levels where the sludge of scum collects X Inlet and outlet should not be at same level to prevent backflow or exit of solids
✓ Septic tank should be provided with ventilation pipes, the top being covered with mosquito proof wire mesh ✓ The height of the pipe should extend at least 2 m above the top of the highest building within a radius of 20 m		 X Do not leave ventilation pipe unprotected from mosquitoes X Do not keep the ventilation pipe too short

Key activities involved in Septage Management Plan

- **Assessment of existing toilets and septic tanks** through surveys and **creation of database**
- **Design** and **construction / refurbishment** of **septic tanks**
- **Desludging of septic tanks**
- **Scheduled** septic tank **emptying services**
- **Treatment** of faecal sludge / **septage**

Desludging of septic tanks

As per **Prohibition of Employment as Manual Scavengers and their Rehabilitation Act, 2013** , **desludging** / emptying of septic tanks will be **undertaken by mechanical devices** like suction emptier trucks / vacuum tankers

For septic tanks which have proper access roads, a larger vehicle maybe used

For septic tanks located in narrow lanes or those that do not have proper access roads, smaller vehicles maybe used

As per ***CPHEEO Manual*** on Sewerage and Sewage Treatment , 2013

IS : 2470 (Part I & II), 1985 on Code of Practice for Installation of Septic tank

"***Yearly desludging of septic tank is desirable***, *but if it is not feasible or economical, then* ***septic tanks should be cleaned at least once in two - three years***, *provided the tank is not overloaded due to use by more than the number of persons for which it is designed*"

Pg 9-22, CPHEEO Manual

Recommendations for desludging as per MoUD Advisory

Desludging of Septic tanks

- **De-sludging** of septic tanks - using **mechanical devices**
- **De-sludging frequencies** of septic tanks once every **2 to 3 years**, or when the tank becomes one third full
- Periodical desludging will help **reduce the pollution levels in the effluent**
- **1-2 inch of sludge** should be **left in tank** to **facilitate** future **decomposition**
- **Regular desludging** activities will **require well-organized** community and **public/private service providers**
- **Tanks should not be scrub** cleaned or **washed with detergent**

Transportation

- **Vehicles** are available in different **capacities** from **2,000 to 12,000 litres**.
- Small scale vacuum trucks called **Vacutug** are recommended f**or areas inaccessible** to large vehicles
- The **no. of** cleaning **machines** - based on frequency of **cleaning**, **distance** of location **of treatment facility** and local conditions
- A **Transportation Plan** should be formulated which **should include**:
  - **Scheduling** and routing for **trucks**
  - **Customer** service **protocols**
  - **Locating** tanks and cleanouts with **proper pumping** equipment operation and worker safety
  - Transportation requirements, including rules of the road
  - **Disposal procedures** at the treatment facility
  - **Routine service** of equipment
  - **Recordkeeping** for all tanks pumped and wastes discharged at the disposal facility

From complaint Redressal → To regular service

Current septage management practice

~2-4% of tanks cleaned per year
(once in >8-10 years)

Recommended septage management practice

~33% of tanks cleaned per year
(once in 3 -5 years)

Current barriers

1. Cleaning is done **on-call** by the household, who do not see the need for regular cleaning

   The **cleaning services** of the ULB are currently treated as a **complaint redressal** system for overflowing septic tanks rather than a regular cleaning and maintenance service

2. Each town mainly has only **1 truck, owned and operated by the ULB**

3. Households generally pay ~**INR 400-1000** to get **tanks cleaned**, but only once in >8-10 years when the tanks overflow

Proposed solution

1. Septic tanks will be cleaned on a **pre-determined schedule**

   Regulations and **penalties** will be set in place to **ensure periodic cleaning**

   Awareness generation activities will educate households about the need for regular cleaning

2. Each town will now require an additional **1- 3 trucks to meet service standards**, which can be **operated by a private player**

3. **Local taxes levied** by the ULB as **per municipal act**[1] will be used to **recover** the **operating expenses** for regular cleaning

Note (1) Maharashtra Municipal Councils, Nagar Panchayats and Industrial Townships Act, 1965, Chapter IX : Municipal taxation, Section 108

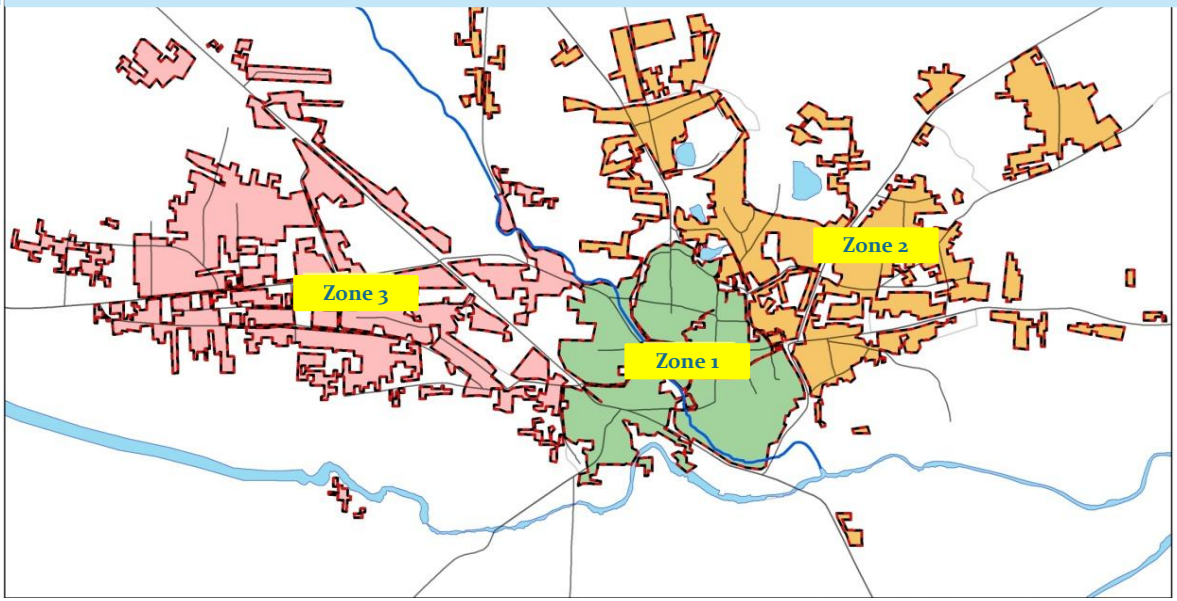
Planning for a scheduled septic tank emptying services – Answer following questions . . .

Septic tank cleaning cycle of _____ years

- To maintain a cycle of ___years, roughly _____ **nos of septic tanks** need to be **cleaned annually**
- To clean _____ septic tanks, _____ **nos of suction emptier trucks** of ____ **capacity** would be **required**
- **Each vehicle** needs to make ____ **trips daily**
- Roughly _____ **Working Days are required**

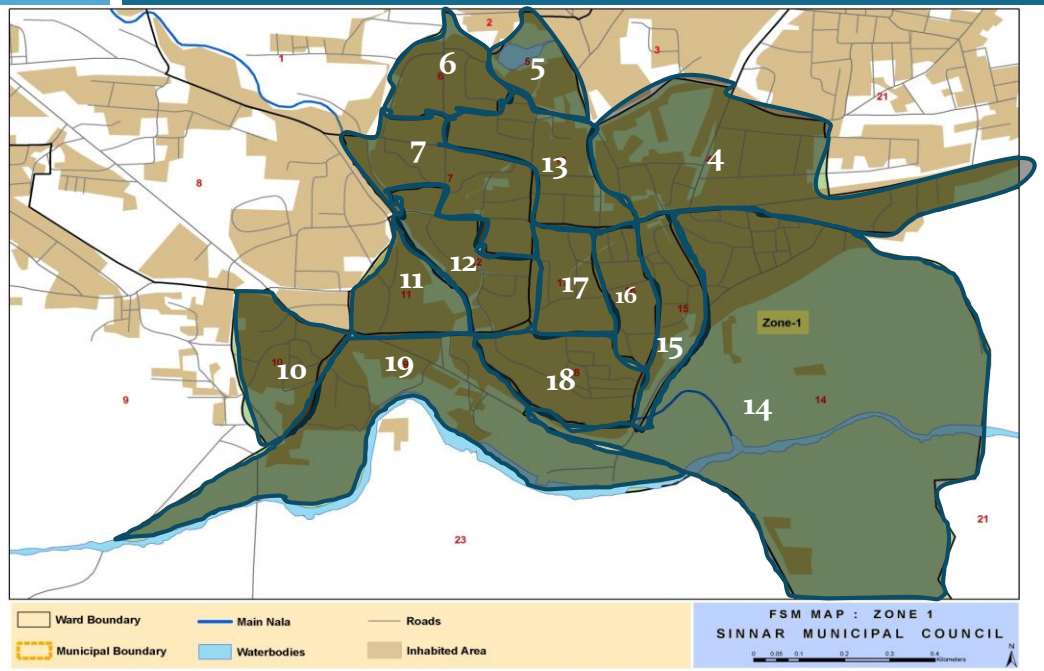
_____ nos of trucks of _____ litre capacity are required for cleaning HHs and non-residential septic tanks

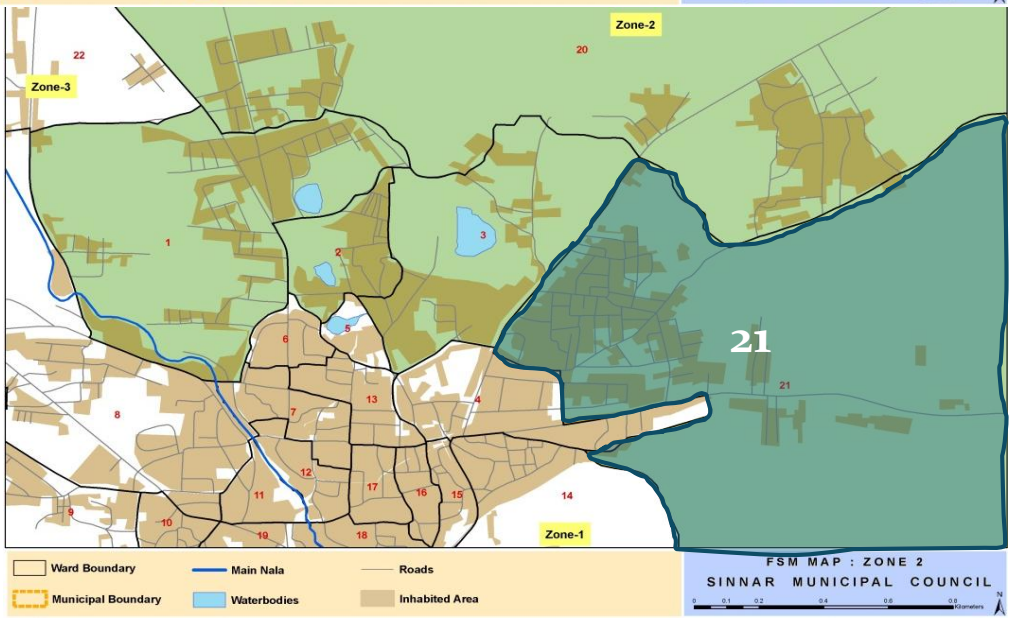
Divide the city into zones and prepare a yearly plan



Year	Zones	No. of septic tanks to be cleaned annually (no)	No. of Days required
Year 1	Zone 1	1889	201
	Zone 2	947	101
	Total	2836	302
Year 2	Zone 2	1262	135
	Zone 3	1582	169
	Total	2844	303
Year 3	Zone 3	2762	294
	Total	2762	294

Prepare a scheduled desludging service plan for each year. . .

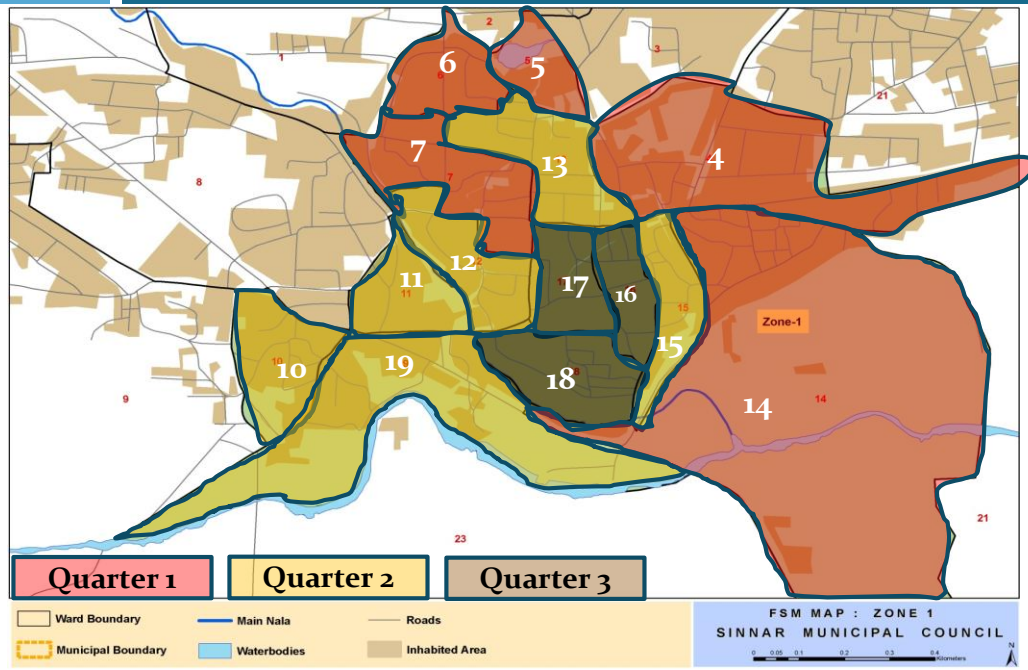


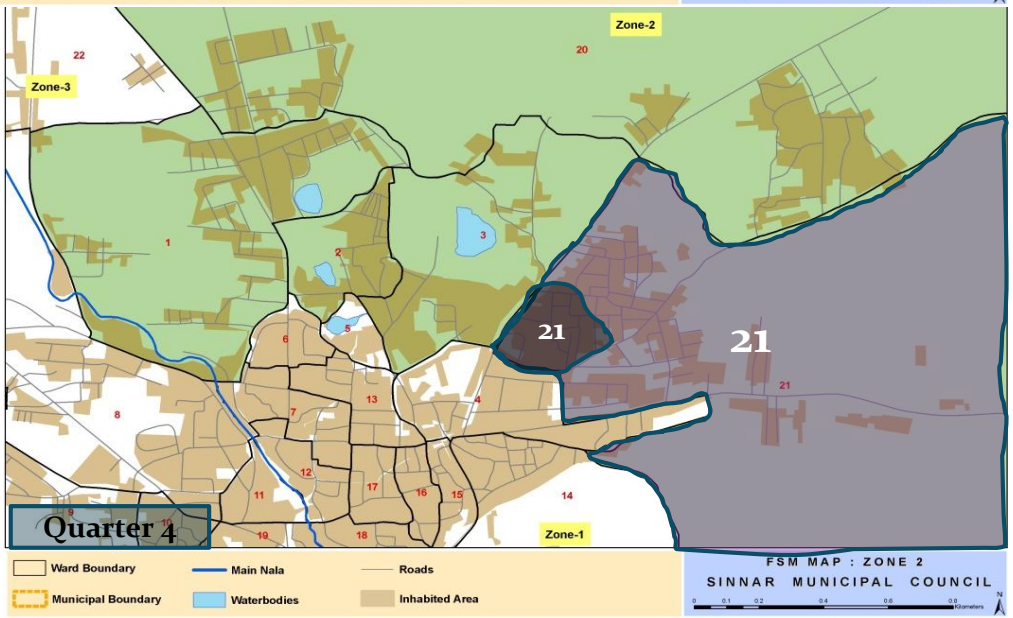


Year 1

Zone	Ward	No. of septic tanks to be emptied	No. of days required
Zone 1	4	62	7
	5	25	3
	6	183	20
	7	357	38
	10	71	8
	11	101	11
	12	195	21
	13	226	24
	14	53	6
	15	68	7
	16	127	14
	17	199	21
	18	146	16
	19	76	8
Zone 2	21	947	101
	Total	2836	302

Then develop a quarterly desludging service plan for a given year. . .





Year 1

Zone	Quarter Plan	Ward	No. of septic tanks to be emptied	No. of days required
Zone 1	Q 1	4	62	7
		5	25	3
		6	183	20
		7	357	38
		14	53	6
		Sub Tot	680	74
	Q 2	10	71	8
		11	101	11
		12	195	21
		13	226	24
		15	68	7
		19	76	8
		Sub Tot	737	79
	Q 3	16	127	14
		17	199	21
		18	146	16
		21	235	25
		Sub Tot	707	75
Zone 2	Q 4	21	713	76
		Sub Tot	713	76
		Total	2836	302

Sample Calculation for arriving at number of suction trucks required and nos of septic tanks to be cleaned. . . (1/2)

SEPTAGE MANAGEMENT PLAN			
Sr.No	**Description**	**No.**	**Formula**
	Basic details		
A	Population	65251	Input
B	Total households (HHs)	13112	Input
C	HHs having toilets with septic tanks	6091	Input
D	Up-gradation of HHs pit to septic tank	2152	Input
E	No. of HHs to be provided with Individual toilet	1658	Input
F	No. of HHs dependent on community toilets	3211	Input
G	No. of community/ public toilets having septic tanks	21	Input
H	Total capacity of Community/public toilet septic tank (cum)	10	Input
I	No. of Septic tanks cleaned for CT/PT on daily basis (no)	3	= G / 7 days
J	Total Septage generated in in CT/PT on daily basis (cum/day) (in all CTs)	10.1	= (F * O) / 365 days
K	Septage collected in per CT/PT per day (cum/day)	0.48	= (J/G)
L	Septage cleaning cycle (7 days). Therefore total septage collected from each CT/PT	3.36	= (K * 7 days)
M	Total Septage collected from CT/PT per day (cum/day)	10.1	= (I * L)

Sample Calculation for arriving at number of suction trucks required and nos of septic tanks to be cleaned. . . (2/2)

SEPTAGE MANAGEMENT PLAN			
Sr.No	**Description**	**No.**	**Formula**
	Septic tank emptying Plan		
N	Septic tank cleaning cycle (Years)	3	Input
O	Total septage generated per HHs in a year (as per USEPA, 230 litre/year/person) (cum)	1.14	= (230 * (A/B)) / 1000
P	Total septage generated after 3 years in each HHs (if cleaning cycle is 3 years) (cum)	3.43	= N * O
Q	No. of working days	300	Input
R	Truck capacity (cum)	5	Input
S	**No. of HHs level septic tanks to be annually cleaned (no)**	**3300**	**= (C + D + E) / N**
T	No. of septic tanks to be cleared daily (assuming 300 working days) (no)	11	= (S / Q)
U	Total septage to be cleared (cum/day) (septage cleaned after 3 years)	37.77	= (T * P)
V	No. of trips possible per vehicle per day (trip/day)	4	Input
W	**No. of vehicles required (no)**	**3**	**= ((T+ I) / V)**
X	**Standby vehicles (10-25%)**	**10%**	**Input**
Y	**Total Vehicles required**	**3**	**= (W + (1+X%))**

Licensing of septage transporters for providing scheduled services

- **ULBs** should either **provide** the **emptying services themselves** or enter into appropriate **management contracts** with **private agencies.**

- In case of private sector contract, **ULBs should certify** and **license private septage transporters** to **de-sludge** and **transport waste** to the designated **treatment facility.**

Septage Transporter Permit for _____ Municipality

In accordance with all the terms and conditions of the current _____ Municipality's Rates, Rules and Regulations, the special permit conditions accompanying this permit, and all applicable rules, laws or regulations of Government of Maharashtra, permission is hereby granted to:

NAME OF PERMITTEE: _____

ADDRESS:_____

For the disposal of septage from domestic septic tank or commercial holding tank at the_____ treatment facility.

This Permit is based on information provided in the Septage Transporter Permit application which constitutes the Septage Management Hauled Permit.

This Permit is effective for the period set forth below, may be suspended or revoked for Permit Condition Non Compliance and is not transferable. The original permit shall be kept on file in the Permittee's office. A copy of this Permit shall be carried in every registered vehicle used by the permittee.

EFFECTIVE DATE:

EXPIRATION DATE:

____ CHECK IF RENEWED PERMIT

Permit is liable to be cancelled in case of violations of any Acts, Rules and Regulations relating to the operation of Septage System or in cases of safety protocols not being adhered to or in case of non-permitted disposals.

Sample licensing format[1]

1: Source: Operative guidelines for septage management for urban and rural local bodies in Tamil Nadu.(2014)

Key activities involved in Septage Management Plan

- **Assessment of existing toilets and septic tanks** through surveys and **creation of database**
- **Design** and **construction / refurbishment** of **septic tanks**
- **Desludging of septic tanks**
- **Scheduled** septic tank **emptying services**
- **Treatment** of faecal sludge / **septage**

Dumping site वर मैलाची साधारण विल्हेवाट

Treatment of faecal sludge / septage as per MoUD advisory

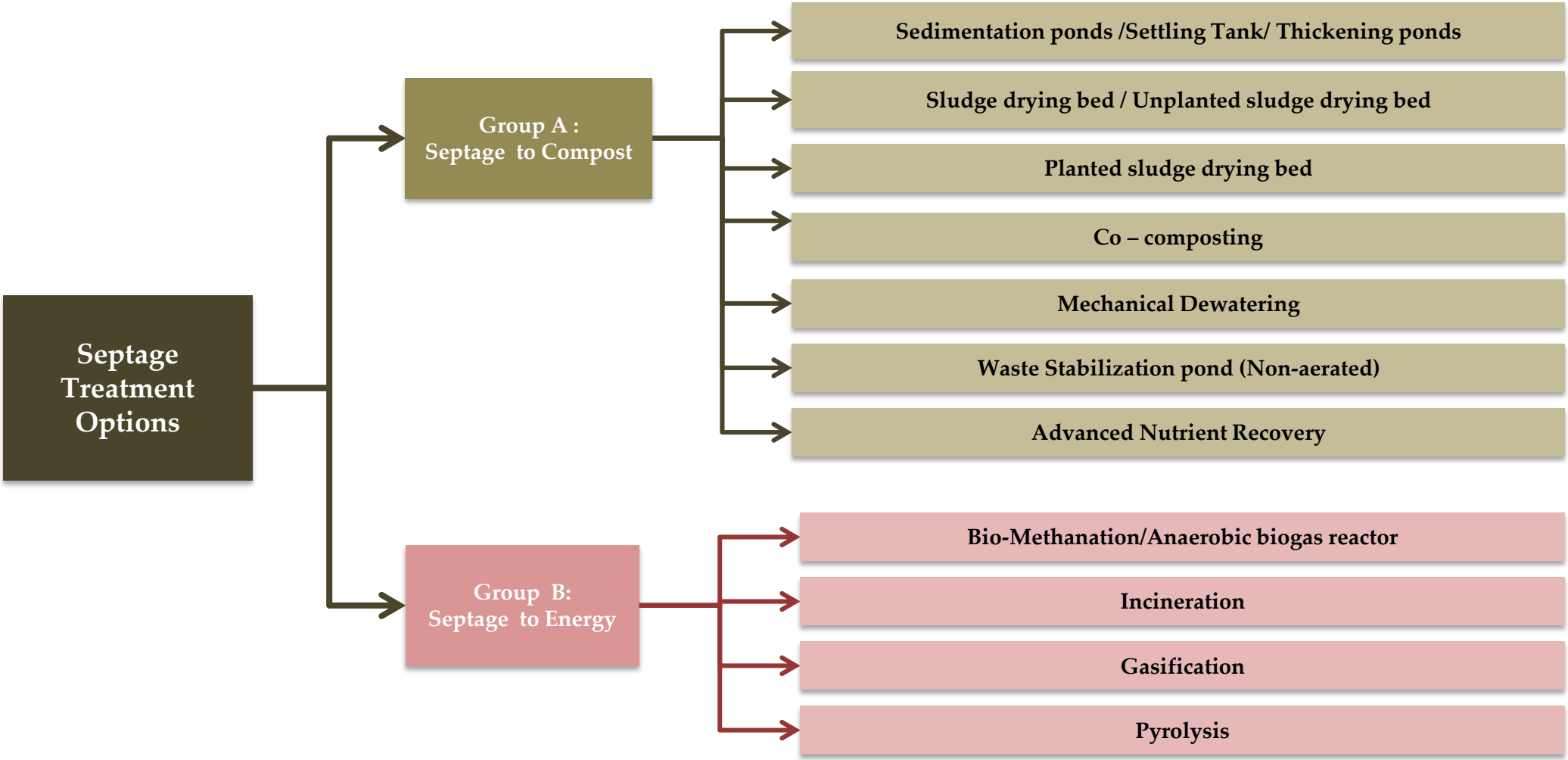
Treatment / Reuse / Disposal

- Treatment at **existing sewage treatment plants**
  - Septage addition at the **nearest sewer** manhole
  - Septage addition **at the STP**
  - Septage addition to **sludge digesters/sludge drying beds**
- Treatment at **independent septage treatment plants**
  - **Space is not a constraint** : Lime treatment, Sludge drying beds, Anaerobic baffled reactor, stabilization pond, Constructed wetland, co-composting with solid waste
  - **Space is a constraint** : Mechanical Dewatering system
- Properly **treated sludge** can be **reused** to reclaim parched land by application **as soil conditioner**, and/or as a **fertilizer**






Septage treatment options based on outputs. . .



Comparison across various aspects for treatment options that convert septage to energy

Sr No	Technologies / Parameters	Bio-Methanation/ Anaerobic biogas reactor	Incineration	Gasification	Pyrolysis
1	Operational Energy Demand	Limited (Except for advanced sludge pre-processing methods)	High	Very High	High
2	Energy Recovery Efficiency	50-70%	50-60%	70-80%	70-80%
3	Energy Product and its applications	Methane as a fuel for heat, electricity and transport Compost-Soil fertilizer	Electricity or heat from hot steam/air	Syngas - As fuel for heat and electricity	Pyrolytic oil as industrial fuel in boilers. Char as solid fuel for heat production in furnaces and medium for soil amendment
5	Capital cost	Medium-High	Medium-High	High	High
6	O&M Cost	Medium-High	Medium-High	High	High
7	Land Requirement	Low (Underground Construction)	Low	Low	Low

Comparison across various aspects for treatment options that convert septage to compost

Sr No	Technologies / Parameters	Sedimentation ponds /Settling Tank/ Thickening ponds	Sludge drying bed / Unplanted sludge drying bed	Planted sludge drying bed	Co - Composting	Deep row entrenchment	Mechanical Dewatering	Waste stabilization pond (Non - aerated)	Advanced nutrient recovery
1	Expertise for design	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes
2	Built with Local materials	Yes	Yes	Yes	Yes	Yes	No	Yes	No
3	Expertise for construction	No	No	No	No	No	Yes	Yes	Yes
4	Expertise for operations	No	No	Yes	No	No	Yes	Yes	Yes
5	Capital cost	Low	Moderate	Moderate	Low	Low	High	Variable	Very High
6	Land required	High	Moderate	High	High: cold climates, average : warmer climates	High	Low	High	Low
7	O & M cost	Low	Low to Medium	Low	Medium	Low	High	Low	Very High
8	Resting period (i.e No. of days / months / years)	SP : 8-12 Months; ST: 2-4 months	10-15 days	2-3 years / 5-6 Years	6-8 weeks	-	-	Anaerobic ponds - 1 to 7 days Facultative ponds - 5 to 30 days	-

Quality Standards for Reuse of treated Septage

- ***Dewatered septage/sludge use as a fertilizer in agriculture , should satisfy criteria of Class A Bio-solids of US EPA :***
  - Fecal coliform density < 1000 MPN/g total dry solids
  - Salmonella sp. Density < 3MPN/4g total dry solids
  - Helminth egg concentration < 1/g total dry solids (WHO, 2006)
  - E – Coli of 1000/g total solids (WHO, 2006)

- ***As per MSW Rules, 2000 compost quality should not exceed the prescribed limit as below:***

Parameter	Concentration not to exceed (mg/kg dry basis, except for pH and carbon to nitrogen ratio)
Arsenic	10
Cadmium	5
Chromium	50
Copper	300
Lead	100
Mercury	0.15
Nickel	50
Zinc	1000
C/N ratio	20 – 40
pH	5.5 – 8.5

Properly **treated sludge** can be **reused to reclaim parched land** by application as soil conditioner, and/or as a fertilizer.

Deteriorated land areas, which cannot support the plant vegetation due to lack of nutrients, soil organic matter, low pH and low water holding capacity, can be **reclaimed and improved by the application of treated septage**

Drip irrigation is the preferred irrigation method for **settled septage effluent** when irrigation is feasible. Crops which could be safely grown are corn, fodder, cotton, trees including fruit trees, eucalyptus and poplar.

Aquaculture can be practiced for **settled septage effluent** when **freshwater is available to achieve dilution to ensure dissolved oxygen is above 4 mg /l**. Fish species of tilapia and carp are preferred since they tolerate low dissolved oxygen

Source : Advisory note on Septage management in Urban India, MoUD Jan 2013 &
Guidelines for 'Open Defecation Free Towns' under the Mahatma Gandhi Swachhata Mission, 2015

Sample calculation for arriving at number of sludge drying beds required for treating collected septage

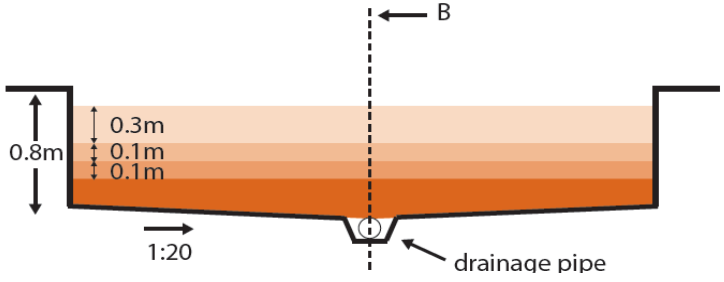
Should go for this option if land availability is not an issue

Unplanted Sludge Drying Bed

Dried sludge must be removed after 15 days

	Treatment Plant Option (Unplanted Sludge drying Beds)		Formula
A	Quantum of septage to be treated (cum/day) *(HHs + CTs)*	47	U + M
B	Single Drying Bed area (12m x 10 m)	120	Input
C	Max. septage depth (m)	0.3	Input
D	Capacity per bed (cum)	36	= C * B
E	Daily requirement of beds (no)	1.3	= A / D
F	**Sludge drying cycle (days)**	**15**	Input
G	**Total No. of sludge drying beds required (SDB)**	**20**	= F * E
H	**Total SDB area (Sqm)**	**2400**	= G * B
I	**Total site area (SD Bed area + 10% SD bed area + area of office and dried storage + area of ancillary units) (sqm)**	**3110**	= H + 10 % (H) + 20 % (H)

Unplanted Sludge Drying Bed



- Faecal sludge layer 30 cm
- Sand layer 10 cm; d=0.2-0.6 mm
- Gravel layer 10 cm; d=7-15 mm
- Gravel layer 20 cm; d=15-30 mm

Output :
Dried Sludge
(Treated Septage)

Capital Cost : 2-5 lakhs / SDB

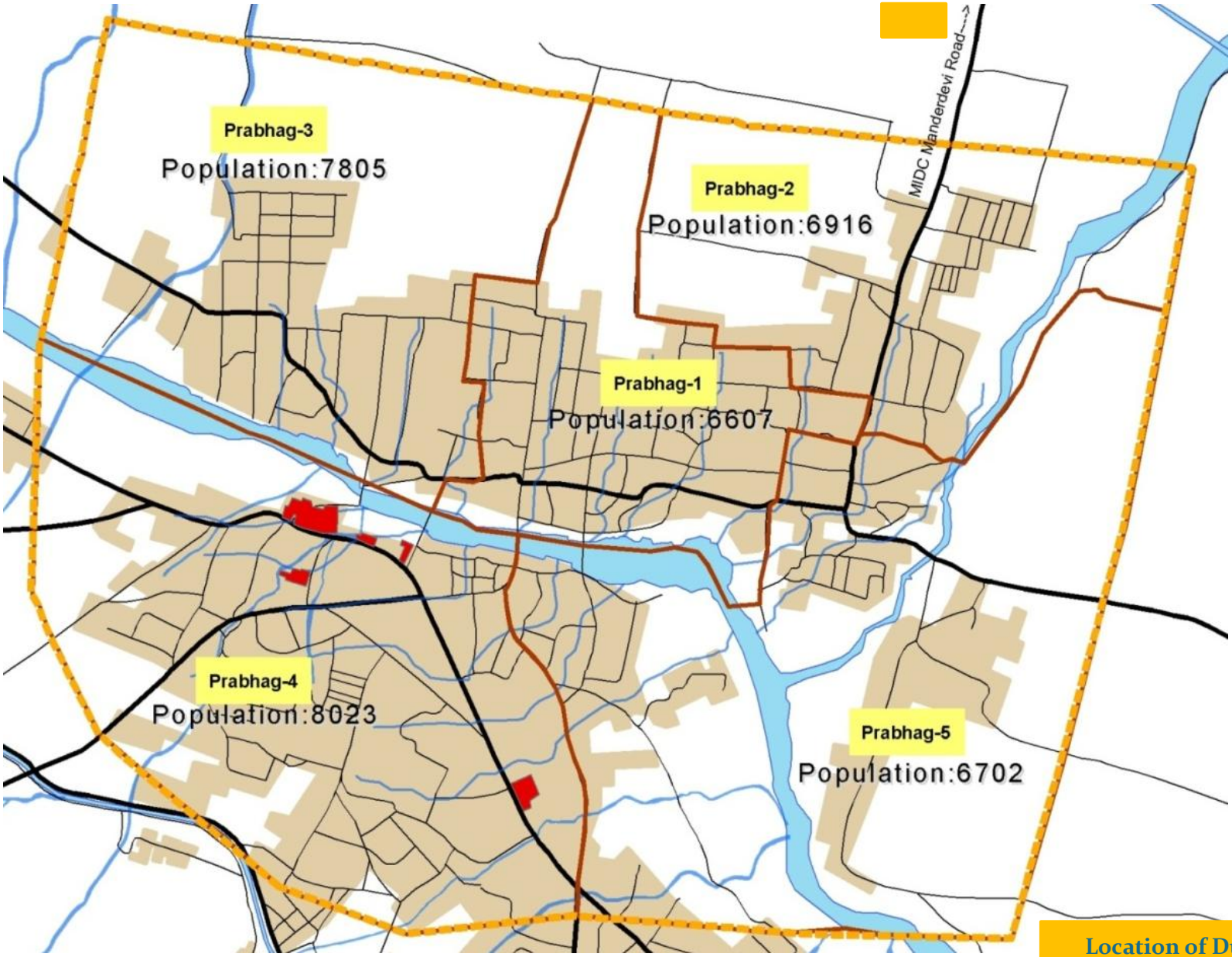
Group Work 1 : Preparing a septage management plan for city X (1/2)

Participants will plan for the infrastructure that is required for implementing the septage plan for the following city in terms of number of septic tanks to be emptied, number of trucks required and their capacity , treatment options with size and capacity.

Sr.No	Description	No.
	Basic details – City X	
A	Population	36053
B	Total households (HHs)	7580
C	HHs having toilets with septic tanks	4429
D	Up-gradation of HHs pit to septic tank	716
E	No. of HHs to be provided with Individual toilet	135
F	No. of HHs dependent on community toilets	2300
G	No. of community/ public toilets having septic tanks	48
H	Total capacity of Community/public toilet septic tank (cum)	5
I	No. of Septic tanks cleaned for CT/PT on daily basis (no)	7
J	Location of Dumpsite from City	4-6 km
K	Availability of suction emptier truck with City	1 no (5 cum cap.)

Group Work 1 : Preparing a septage management plan for city X (2/2)

Plan of the City



Module 3 : Institutional and governance aspects in Septage Management

Institutional and governance aspects in Septage Management

- **Regulations** for Septage management systems
- **Awareness generation** and **capacity building activities**
- **Record-keeping , reporting (MIS)**, monitoring and **feedback systems**
- **Sources of revenues** for septage management
- **Exploring private sector participation** for septage management

Various aspects that need to be covered under the regulations for septage management

- **Design of septic tanks**, pits etc.(adapted to local conditions) and methods of approval of building plans, or retro-fitting existing installations to comply with rules
- **Periodicity of desludging**
- **Operating procedures** for **desludging and at treatment facilities** including safety procedures
- **Licensing and reporting**
- **Methods and locations** of **transport, treatment and disposal**
- **Tariffs or cess/tax** etc. **for septage management** in the city
- **Penalty clauses for untreated discharge** for households as well as desludging agents
- **Special provisions** for new real estate developments

Various provisions for these regulations (1/3)

Sr.No	Description of regulations required	Legal Provisions	Design Provision
1	Design of septic tanks, pits etc.(adapted to local conditions) and methods of approval of building plans, or retro-fitting existing installations to comply with rules	• Section 200, 202, 208, 209 of the Chapter XIII on Drainage of Municipal Act[1]	• Section 17.15 on septic tanks of DCPR for Class A,B, C municipal councils of Maharashtra • As per directives given by DMA, Letter No.NPP/2014/Swachh Bharat/Guidelines/Section-11, dated : 20th December, 2014 • Chapter 9- Onsite sanitation , PART A- CPHEEO, 2013 (GoI)
2	Periodicity of desludging	• Section 208(2) of the Chapter XIII on Drainage and section 232 of the Chapter XVI on Nuisances of the municipal act • The Prohibition of Employment as Manual Scavengers and their Rehabilitation Act, 2013	• As per directives given by DMA, Letter No.NPP/2014/Swachh Bharat/Guidelines/Section-11, dated : 20th December, 2014 • Chapter 9- Onsite sanitation , PART A - CPHEEO, 2013 (GoI)
3	Operating procedures for desludging and at treatment facilities including safety procedures	• The Prohibition of Employment as Manual Scavengers and their Rehabilitation Act, 2013	• Chapter 9- Onsite sanitation , PART A - CPHEEO, 2013 (GoI) • Chapter 5: Sludge treatment facilities of PART B- CPHEEO manual, 2013
4	Licensing and reporting	• The Prohibition of Employment as Manual Scavengers and their Rehabilitation Act, 2013	

Note (1) Maharashtra Municipal Councils, Nagar Panchayats and Industrial Townships Act, 1965

Various provisions for these regulations (2/3)

Sr.No	Description of regulations required	Legal Provisions	Design Provision
5	Methods and locations of transport, treatment and disposal	• Section 232(b) and section 233 of the Chapter XVI on Nuisances of the municipal act[1]	• Chapter 5: Sludge treatment facilities of PART B-CPHEEO manual, 2013 • Chapter 6 – Design and construction of sludge treatment facilities & Chapter 9- Onsite sanitation, PART A-CPHEEO, 2013 (GoI) • As per directives given by DMA, Letter No.NPP/2014/Swachh Bharat/Guidelines/Section-11, dated : 20th December, 2014
6	Tariffs or cess/tax etc. for septage management in the city	• Section 105, section108 and section 112 of Chapter IX on Municipal taxation of the municipal act	• As per directives given by DMA, Letter No.NPP/2014/Swachh Bharat/Guidelines/Section-11, dated : 20th December, 2014
7	Penalty clauses for untreated discharge for households as well as desludging agents	• Section 230, section 231, section 232 and section 233 of Chapter XVI on Nuisances of the municipal act • The prohibition of Employment as Manual Scavengers and their rehabilitation Act, 2013	

Note (1) Maharashtra Municipal Councils, Nagar Panchayats and Industrial Townships Act, 1965

Various provisions for these regulations (3/3)

Sr.No	Description of regulations required	Action to be taken
1	Design of septic tanks, pits etc.(adapted to local conditions) and methods of approval of building plans, or retro-fitting existing installations to comply with rules	• Council resolution • Additional monitoring for newly constructed septic tanks
2	Periodicity of desludging	• Council Resolution
3	Operating procedures for desludging and at treatment facilities including safety procedures	• Contract inclusive of monitoring
4	Licensing and reporting	• Contract inclusive of monitoring
5	Methods and locations of transport, treatment and disposal	• Contract
6	Tariffs or cess/tax etc. for septage management in the city	• Council resolution
7	Penalty clauses for untreated discharge for households as well as desludging agents	• Council Resolution

Institutional and governance aspects in Septage Management

- **Regulations** for Septage management systems
- **Awareness generation** and **capacity building activities**
- **Record-keeping , reporting (MIS)**, monitoring and **feedback systems**
- **Sources of revenues** for septage management
- **Exploring private sector participation** for septage management

Awareness generation and capacity building activities

Awareness generation for residents

Capacity building for municipal staff

Capacity building for septage transporters / private vendors

Awareness generation for residents

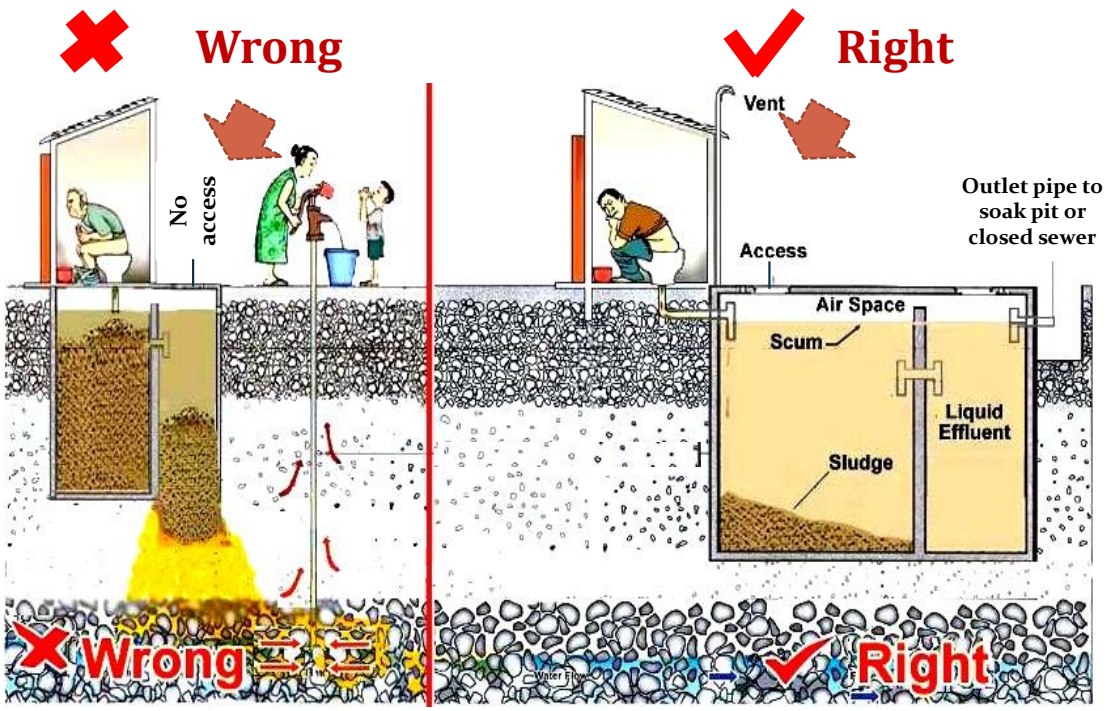
- Members of **Resident Welfare Associations, community organizers, self-help groups** and the **general public** should be **made sensitized periodically** regarding the **need for a septage management system** including a 3-year cycle.

- **Health hazards associated** with **improper collection** and **treatment of waste**, and the ill-effects of sewage discharge into fresh water/storm water drains **should be explained to the residents**

- **Awareness generation** activities should be carried out at the **beginning** of introducing a **scheduled service** in all wards and then **repeated periodically** over the three year cycle.

Awareness generation pamphlets

Proper Design and Cleaning of your Septic Tank!



Home

Nagar Palika

Pumping Truck

Services provided by _____ Nagar Parishad

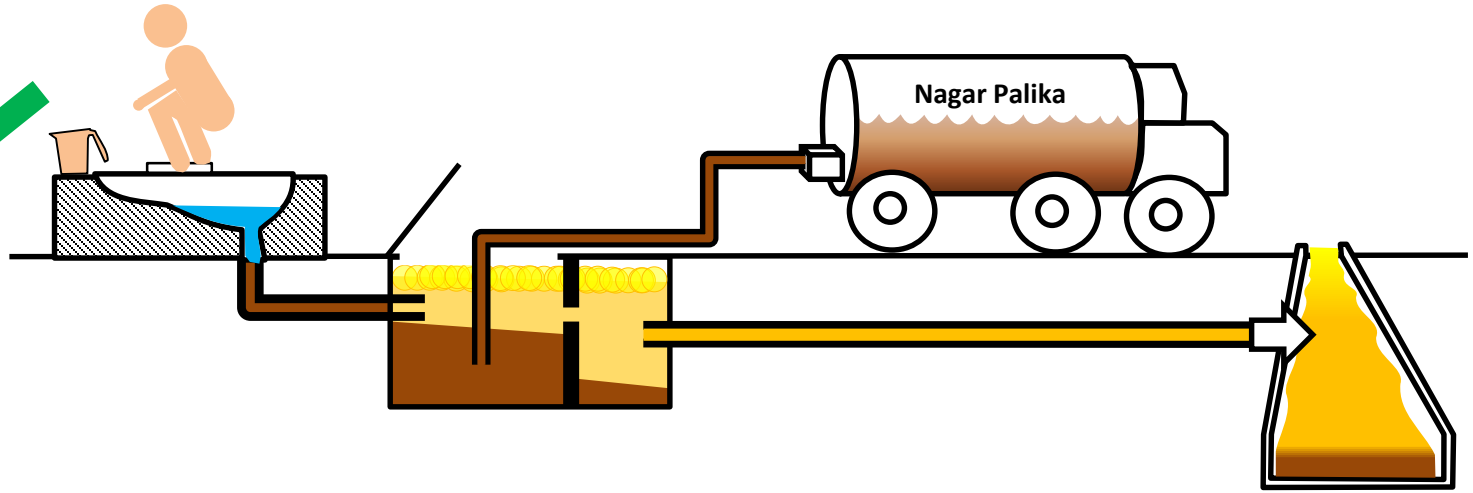
Proper Design

- Septic tank base should always be water tight and it should have proper vent pipes
- Proper access manhole should be provided for easy emptying

Cleaning your Septic Tank

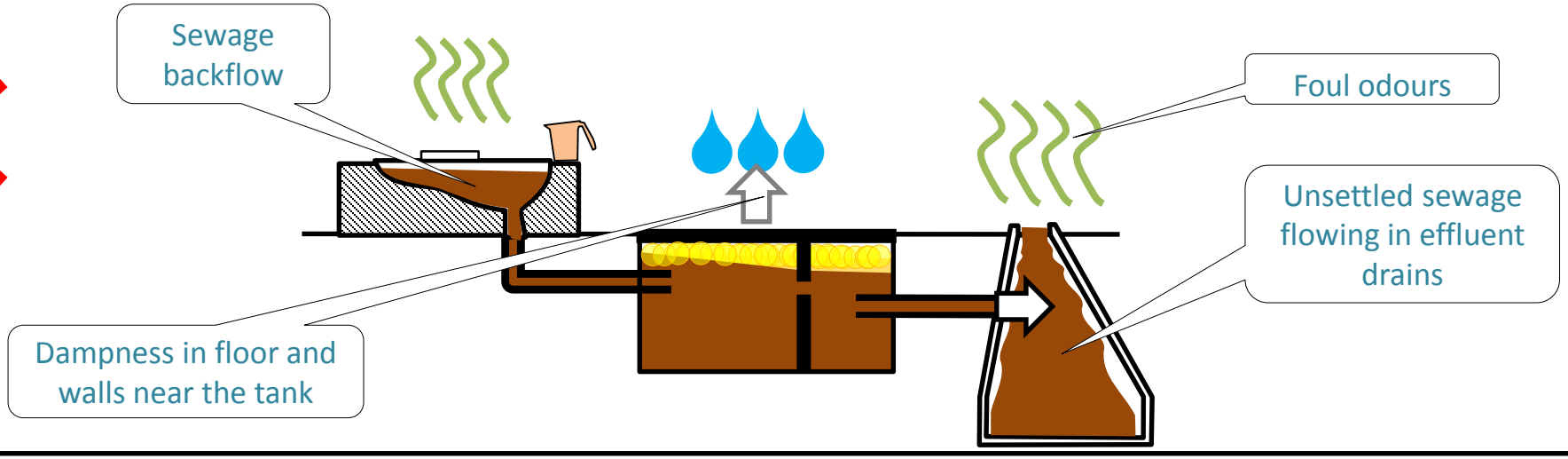
- Clean your septic tanks regularly once in 3 years
- Do not wait for it to overflow. This will adversely affect your health and your environment

Empty Septic tank regularly



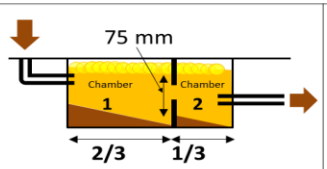
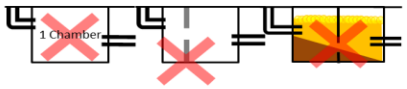
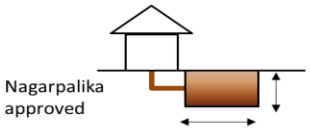
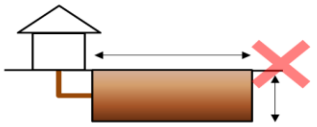
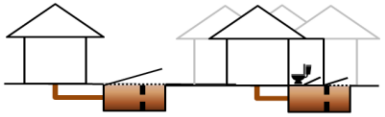
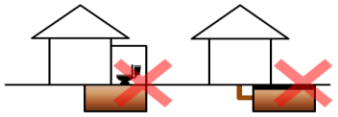
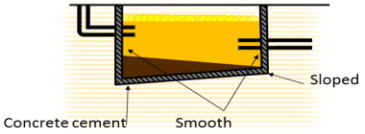
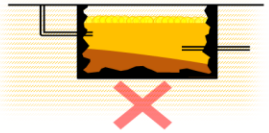
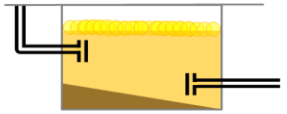
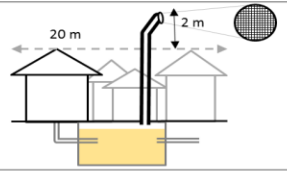
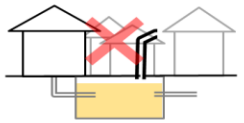
Septic tank should be emptied every 2-3years
Avail Nagarpalika services!

Not emptying it regularly will result in-



Do's and Don'ts for septic tank construction . . .

Septic Tank and Dos and DON'Ts

Dos		DON'Ts
✓ Construct at least a two chambered septic tank ✓ Partition wall should be constructed at a distance of 2/3 the length from the inlet ✓ The 2 chambers should be interconnected above the sludge storage level by means of a pipe or square opening of diameter or side length not less than 75 mm		 X Do not construct a one chambered septic tank X Do not construct a partition wall at an inappropriate distance X Do not provide the interconnection at a level where the sludge or scum is formed
✓ The size of the tank should be as per Nagarpalika norms		 X Do not construct an oversized septic tank
✓ Always construct septic tank away from structure ✓ If space not available, construct toilet over septic tank such that all chambers are accessible ✓ Provide openable access covers to all chambers for inspection and desludging		 X Do not construct toilet above septic tank X Do not completely seal the septic tank from top
✓ Septic tanks should be constructed in materials such as brick, stone, concrete (cast in-situ) or be of pre-cast materials		 X Do not use a dug trench as septic tank X Tank should not leak
✓ The base or floor should be cement concrete and sloped upwards to the outlet ✓ The floor and sides should be plastered with cement mortar to render the surfaces smooth		 X Do not keep the base level or slope downwards to the outlet X The inside surfaces of the septic tank should not be rough
✓ The inlet and outlet should be located at different levels ✓ The inlet and outlets should be below scum level and above sludge level ✓ Baffles or T junctions should be provided at inlet and outlet		 X The inlet and outlet should not be located at such levels where the sludge of scum collects X Inlet and outlet should not be at same level to prevent backflow or exit of solids
✓ Septic tank should be provided with ventilation pipes, the top being covered with mosquito proof wire mesh ✓ The height of the pipe should extend at least 2 m above the top of the highest building within a radius of 20 m		 X Do not leave ventilation pipe unprotected from mosquitoes X Do not keep the ventilation pipe too short

Capacity building for municipal staff

- **Municipal Commissioners/ Chief Officers, Engineers, Sanitary Inspectors, Health Officers, and Sanitary Workers** should be **well trained** in **safe septage management** and its **best practices**

- **Training sessions** on **safe collection, treatment and disposal** of **septage** should be undertaken

- **Information regarding** standard **septic tank design**, the **need for periodic inspection** and **desludging of septage**, design of a **treatment facility**, **tender details** for **engaging licensed transporters**, etc. should **be disseminated**

- **Training** should also be provided on **safety standards**

Capacity building for septage transporters / private vendors

- Local Bodies should ensure all **safety norms** are **clearly explained to the septage transporters**

- Private Operators and Transporters should be well **trained in safe collection and transportation** of septage including following aspects:
  - vehicle design and operation
  - process of desludging,
  - safety gears and
  - safe disposal at the nearest treatment facility.

Institutional and governance aspects in Septage Management

- **Regulations** for Septage management systems
- **Awareness generation** and **capacity building activities**
- **Record-keeping , reporting (MIS)**, monitoring and **feedback systems**
- **Sources of revenues** for septage management
- **Exploring private sector participation** for septage management

Record-keeping & monitoring systems

- **Recordkeeping and manifest forms** should be an **integral part** of a **comprehensive septage** management **program.**

- This **completed document** or documents **with signatures** of the h**ousehold/property**, **suction truck operator** and **treatment plant operator** should be **submitted** to the **local government** for their **records**

- **Payment** to the suction truck **operator** should **only be made if there are signatures of all the stakeholders**

Sample Form to be filled by Operator / Transporter of Septage

i. Identification of Waste:

a) Volume _____
b) b) Type: ____ Septic Tank ____ Others
c) c) Source: ____ Residential ____ Commercial ____ Restaurant ____ Portable Toilet ____Others

ii. Details of Waste Generator

a) Name:
b) Phone Number:
c) Address:
d) Pin:
e) Any kind of deficiencies, missing pipes or fittings, improper manholes or access covers, any other cracks or damage observed: _____

The undersigned being duly authorized does hereby certify to the accuracy of the source and type of wastewater collected and transported.

Date: _____ Signature: _____

iii. Details of Transporter / Operator

a) Company Name:
b) Permit:
c) Vehicle License:
d) Pump out date:

The above described wastewater was picked up and hauled by me to the disposal facility name below and was discharged. I certify that the foregoing is true and correct:

e) Signature of authorized agent and title: _____

iv. Acceptance by _____Municipality's authorized STP

The above transporter delivered the described wastewater to this disposal facility and it was accepted.

Disposal date: _____ Amount Collected from Transporter (if any):_____

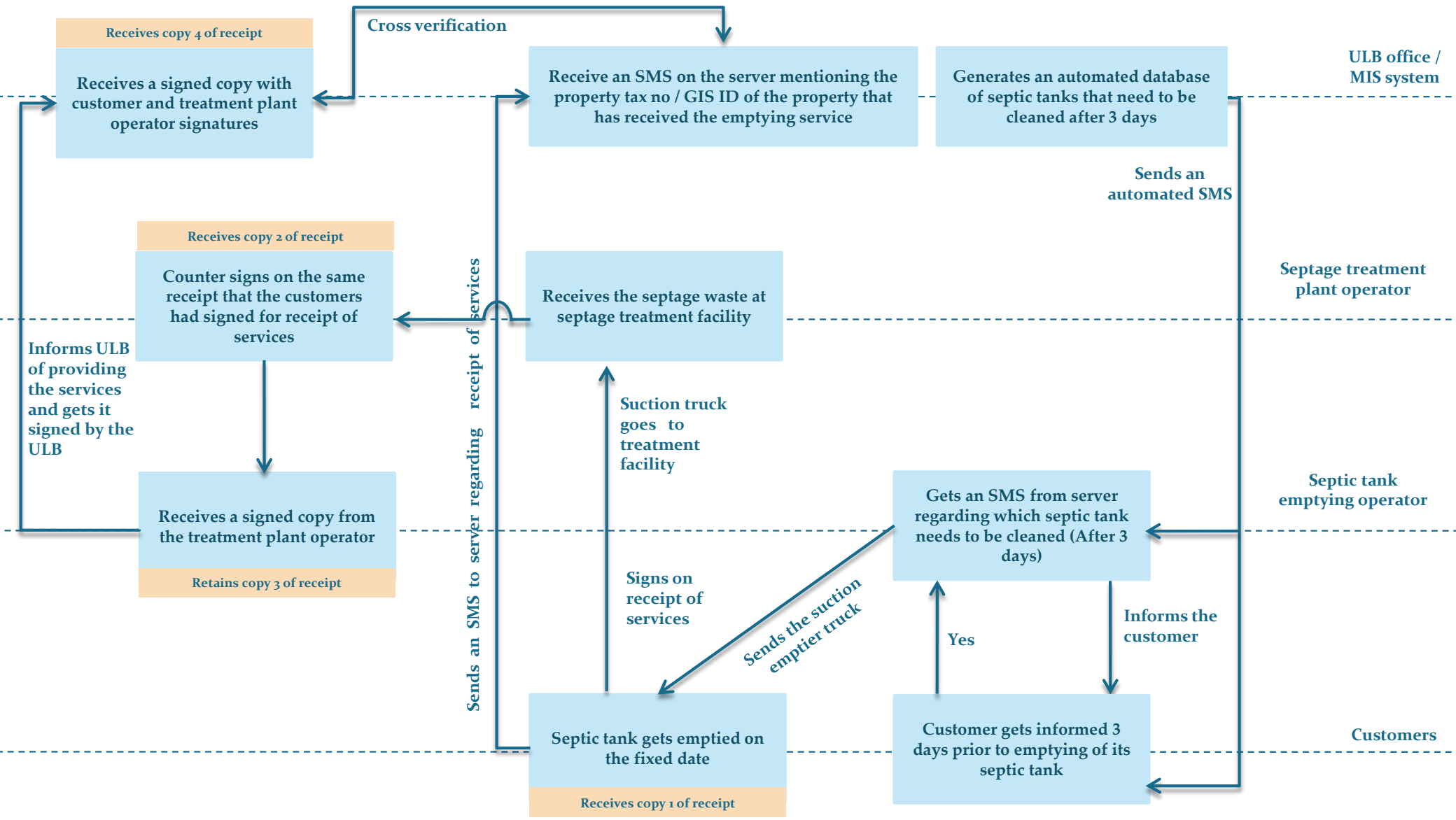
Signature of authorized signatory and title: _____

NOTE: SUBJECT TO THE TERMS AND CONDITIONS OF _____ MUNICIPALITY.

Sample Recording keeping format[1]

1 - Source : Adapted from operative guidelines for septage management for urban and rural local bodies in Tamil Nadu.(2014)

Monitoring framework for scheduled septic tank emptying service



Payment to the private sector is only made after verification of copy 4 by the ULB

Monitoring mechanism for septage management activities

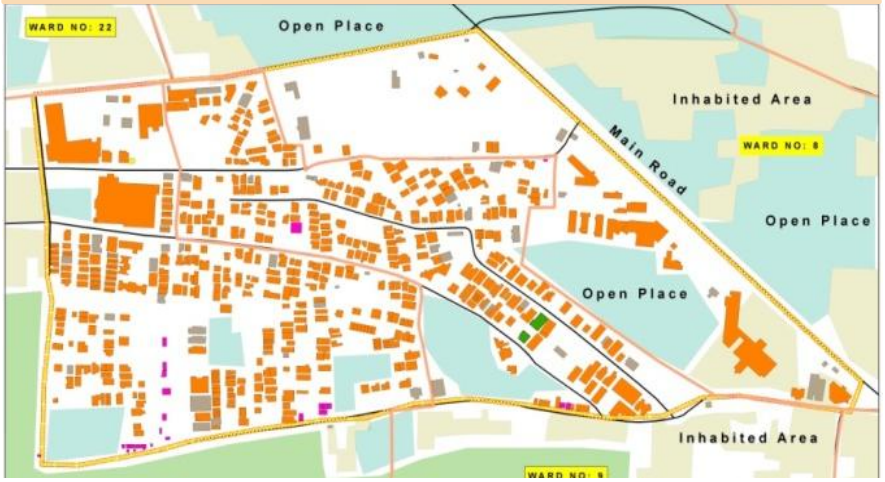
Activities to be Monitored	Performance Metrics	Type of monitoring mechanism				
		Households reporting	Self Reporting	ULB sample HH survey	ULB random treatment site inspection	Grievance Redressal
Cleaning of septic tanks	Percentage of households cleaned as per schedule	✓	✓	✓		✓
	Number of instances where safety regulations weren't adhered to or manual scavenging took place			✓		✓
	Number of instances of spillage during cleaning		✓	✓		✓
	Number of septic tanks damaged	✓	✓	✓		✓
	Percentage septic tanks cleaned inadequately	✓	✓	✓		✓
Transportation of fecal sludge	Number of instance of spillage during transportation		✓			✓
	Number of instances of fecal matter being dumped at non-designated sites					✓
Safe disposal of fecal sludge	Time taken to construct sludge drying beds		✓		✓	
	Standard of constructed sludge drying beds		✓		✓	
	Number of instances where safety regulations weren't adhered to at treatment site				✓	
	BOD and COD level of the treated septage				✓	

Performance metric can be **linked to payment** in terms of **performance incentive** or **penalty** in case of **non-performance**

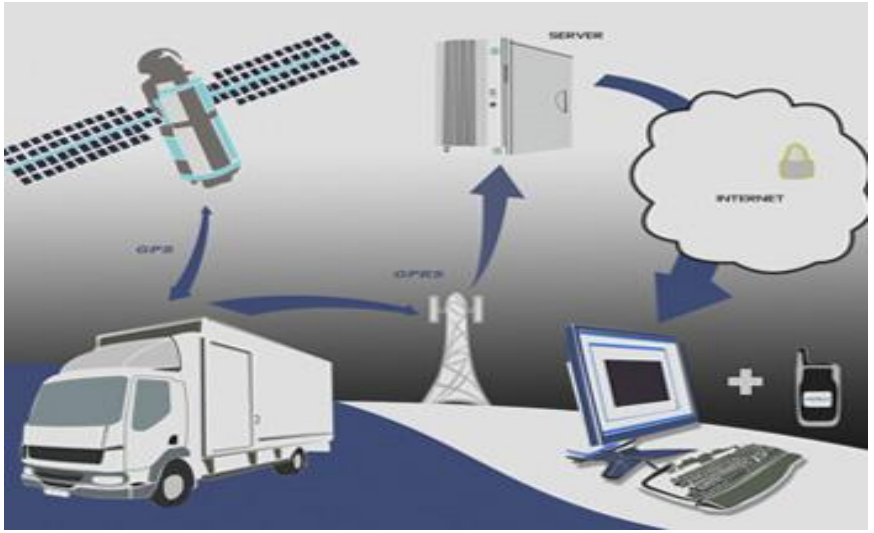
MIS and GIS database

- **MIS database:** Based on the **survey** that is undertaken **using the questionnaire create a database** of **toilets and septic** tanks
  - **Update** the database **every four years** along with **property tax assessment survey**

Details of toilets and septic tanks



- **GIS database : Link** the **database** to **GIS** help **to update property level details regarding availability** of **toilets and septic tanks** and help **monitor** whether the **septic tanks** have been **cleaned** as per the **planned schedule**



Feedback systems

- **Complaint redressal system** :

To be **set up in the ULB** to **track** the **performance of private sector** in terms of whether they are **emptying** the **septic tanks properly or not** and to track whether they are **dumping** the **septage at the designated site or not**

Institutional and governance aspects in Septage Management

- **Regulations** for Septage management systems
- **Awareness generation** and **capacity building activities**
- **Record-keeping , reporting (MIS)**, monitoring and **feedback systems**
- **Sources of revenues** for septage management
- **Exploring private sector participation** for septage management

Sources of revenues for septage management

- **Sanitation tax** should be **levied on all the properties** for **sustaining** the **septage management activities**. The **tax** can be **added either as surcharge** on **property tax** or a **new sanitation tax** can be **levied under** the Maharashtra Municipal Councils, Nagar Panchayats and Industrial **Townships Act, 1965**, **Chapter IX: Municipal taxation, Section 108.**

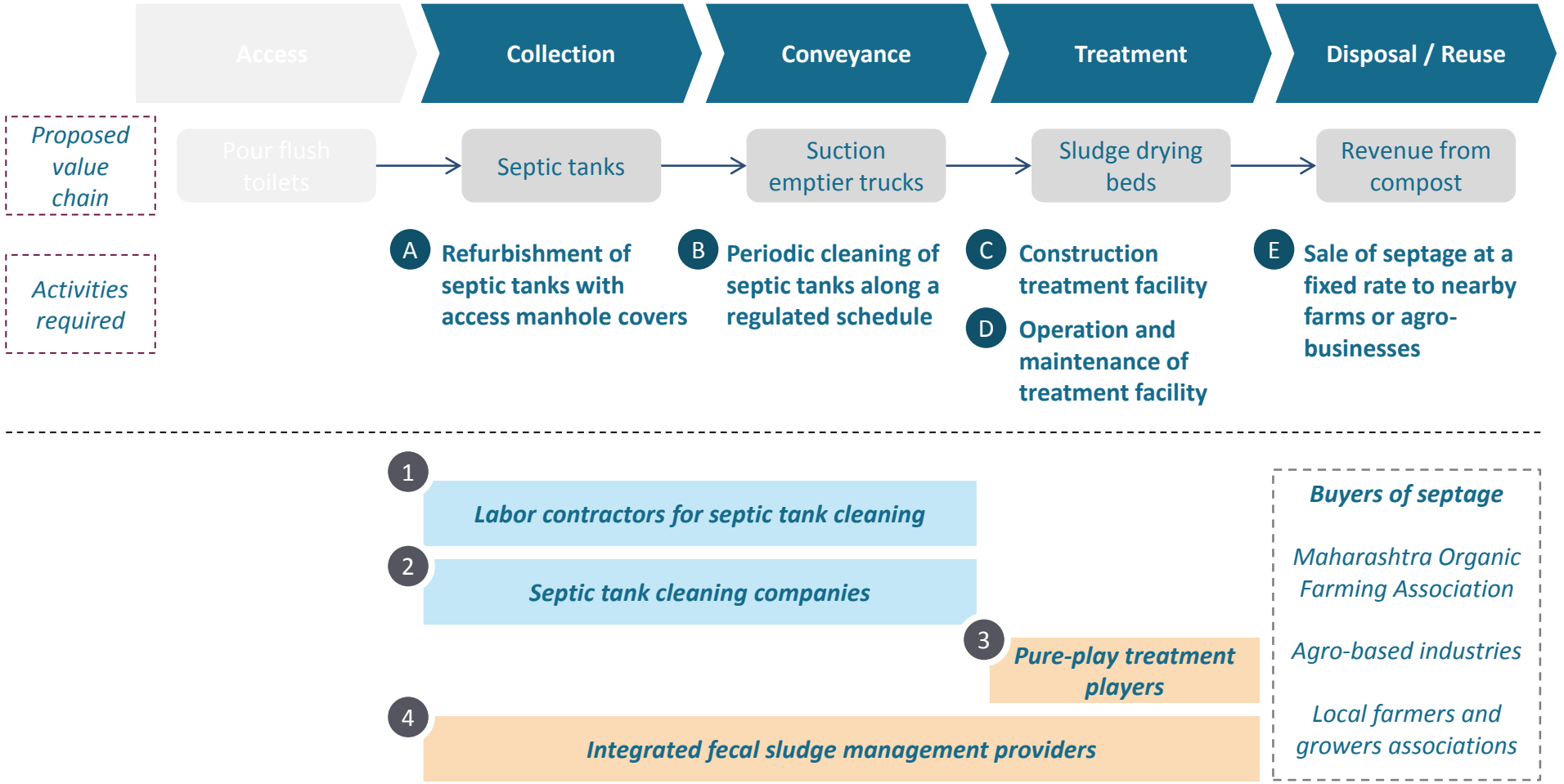
- **Periodic revisions for the taxes** to be effected based on revisions in costs involved

- To the extent possible**, revenues** should be generated from **sale of treated septage** for agriculture or other purposes.

- If **Private sector** is **involved** in septage management, then an **escrow account** can be set up where **revenues from the sanitation tax are transferred.** The **contractual amount** for **FSM services** to the private party can be **paid from this escrow account** to **avoid delays.**

Module 4: Private sector participation for septage management activities

Exploring private sector participation for septage management

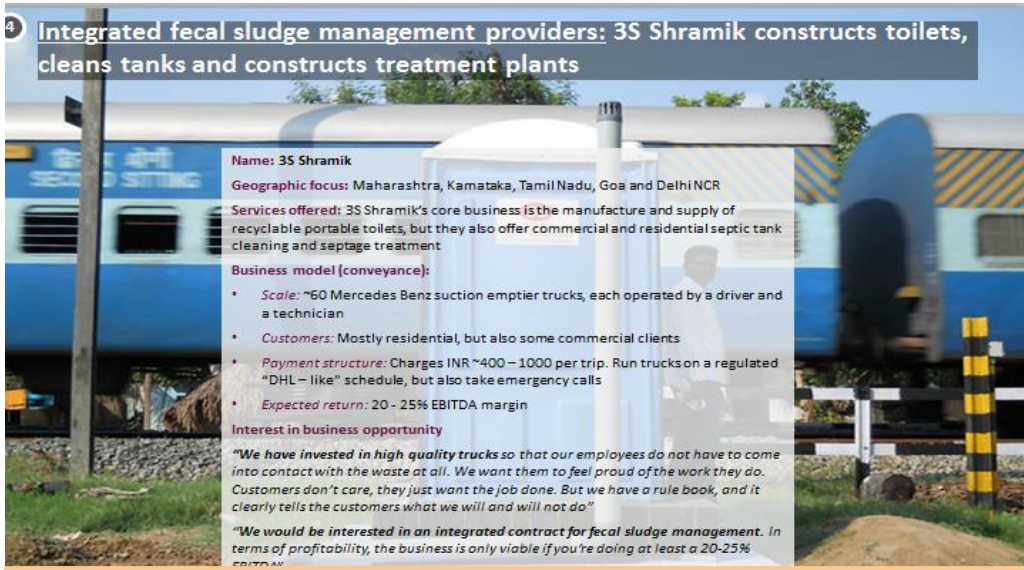


Need to assess work profile, interests and capacity of private sector doing septage management activities

Labour contractors

Septic tank cleaning companies

Pure play treatment players



Septage management service providers

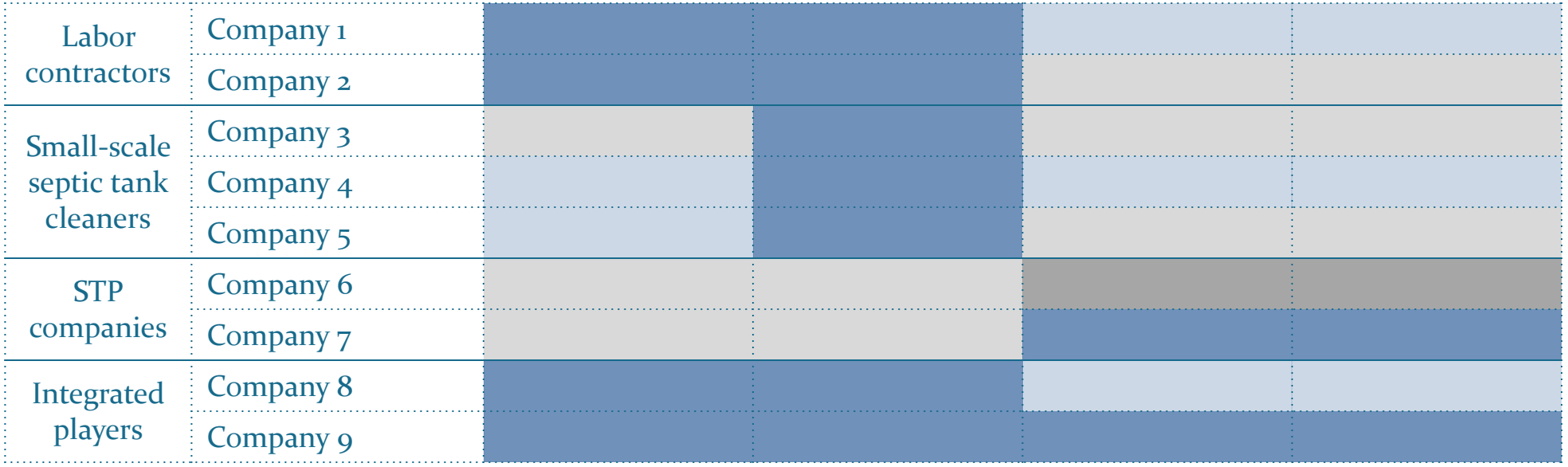
Exploring willingness of players to undertake various activities in the sanitation value chain as per their competencies and interests

Activities required

- A — Refurbishment of septic tanks with access manhole covers
- B — Periodic cleaning of septic tanks along a regulated schedule
- C — Construction of treatment facility
- D — Operation and maintenance of treatment facility

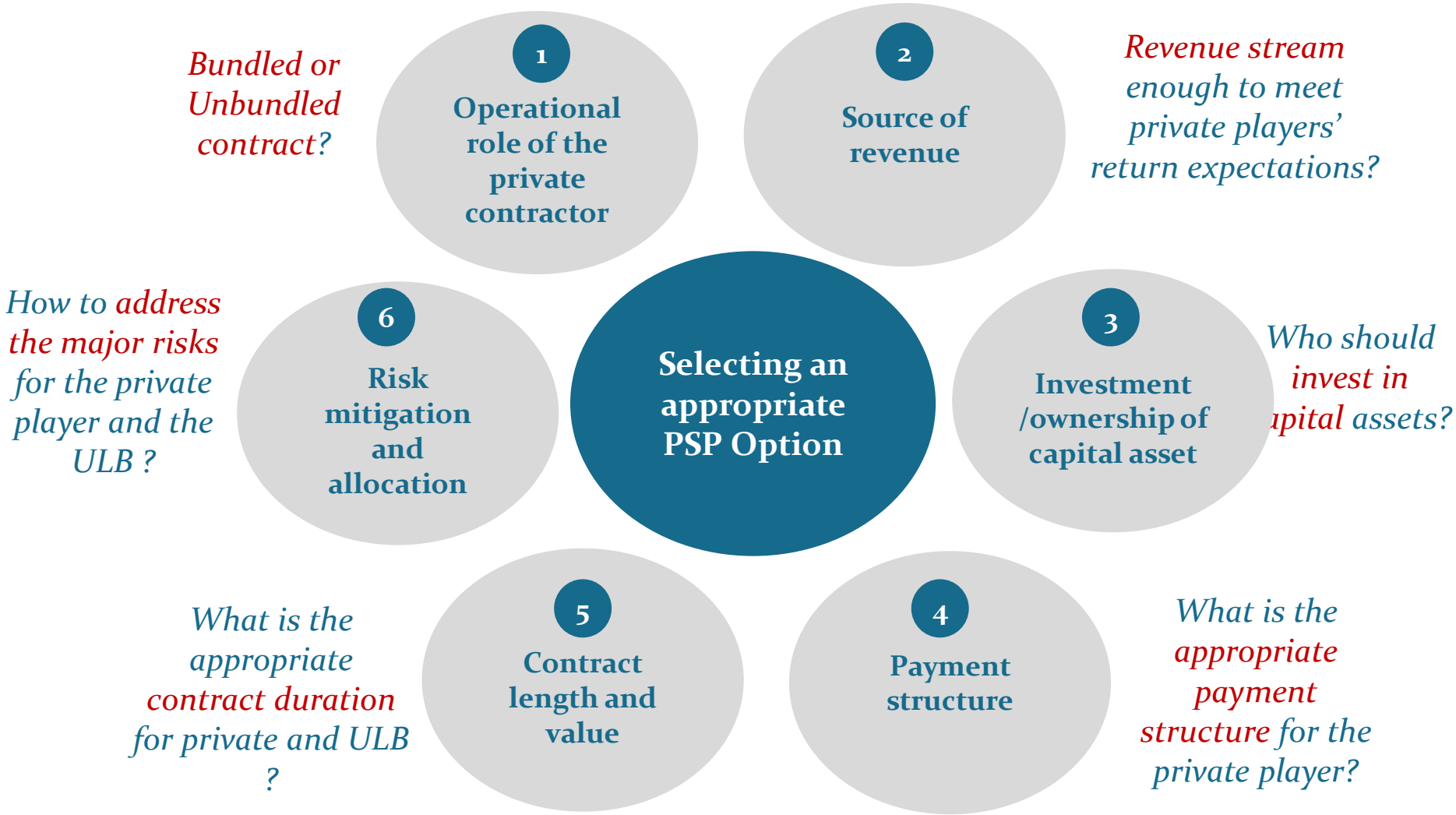
Key

- Interested, with previous experience
- Interested, no previous experience
- Experienced, not interested
- Not interested, not experienced



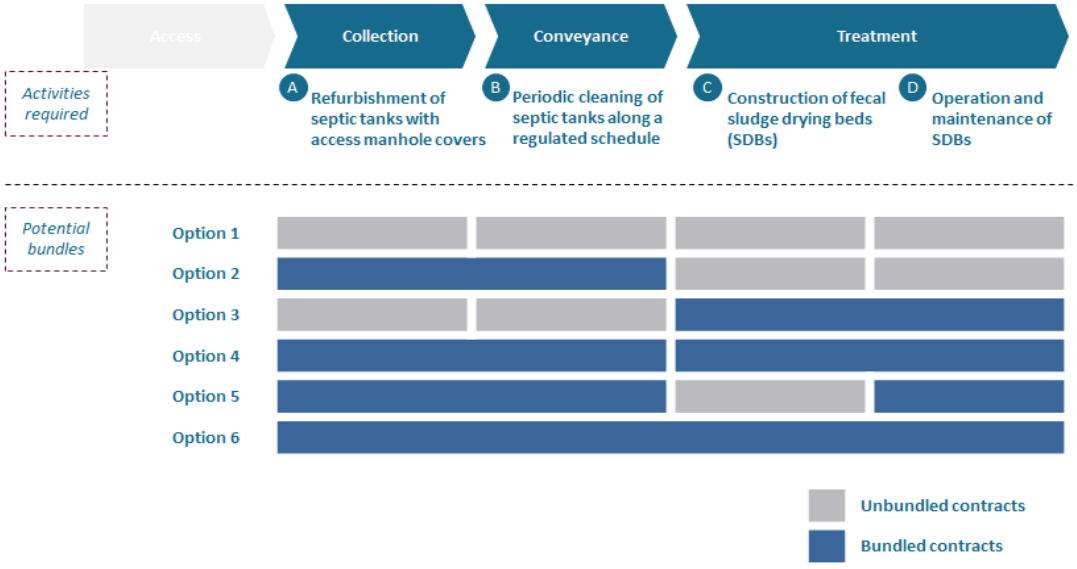
Assess interests of private sector for various activities

Six processes in structuring a PSP option for septage management



Need to assess contract options for septage management activities

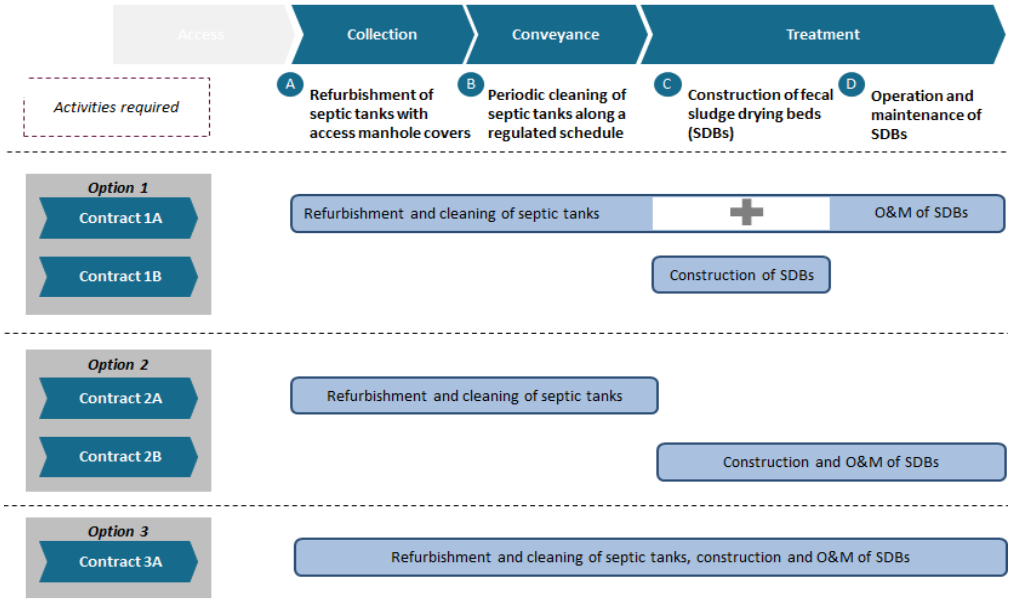
Operational role: There are various possible contract combinations depending on how IFSM activities are bundled together



Assessed possibilities of **bundling** and **unbundling** of **contracts**

Possible **contracts** based on **interests** and **capacities** of **private sector**

Given the interest and capabilities of identified players, there are three possible options for contract bundles



Formulate possible PPP structures for Integrated septage management activities

Contracts	Source of revenue	Ownership of asset	Payment method	Contract length and value
1A **Refurbishment and cleaning of septic tanks + O&M of treatment facility**	*ULB*	Private player	Recurring fixed fee with Fixed fee per unit for refurbishment	2-3 year, ~INR ____ lakhs in for city X
1B **Construction of treatment facility**	*ULB*	ULB	Overall fixed fee on a pre-decided schedule	~ INR _____ lakhs for city X lasting the time period of construction
2A **Refurbishment and cleaning of septic tanks**	*ULB*	Private player	Recurring fixed fee with Fixed fee per unit for refurbishment	2-3 year, ~INR ____ lakhs in for city X
2B **Construction and O&M of treatment facility**	*ULB*	ULB	Overall fixed fee on a pre-decided schedule + recurring fixed fee for O&M	12-18 months, Construction cost plus ~_____ lakhs annually for O&M in city X
3A **Integrated contract involving refurbishment, cleaning of septic tanks, construction and O&M of treatment facility**	*ULB*	Trucks – Private SDBs- ULB	Recurring fixed fee for cleaning and O&M with Fixed fee for Construction and Fixed fee per unit for refurbishment	Payment for refurbishment, cleaning and O&M as in 1A above; payment for construction as in 1B above

Need to assess contact values and taxes to be committed/ levied

Contract valuations for a city

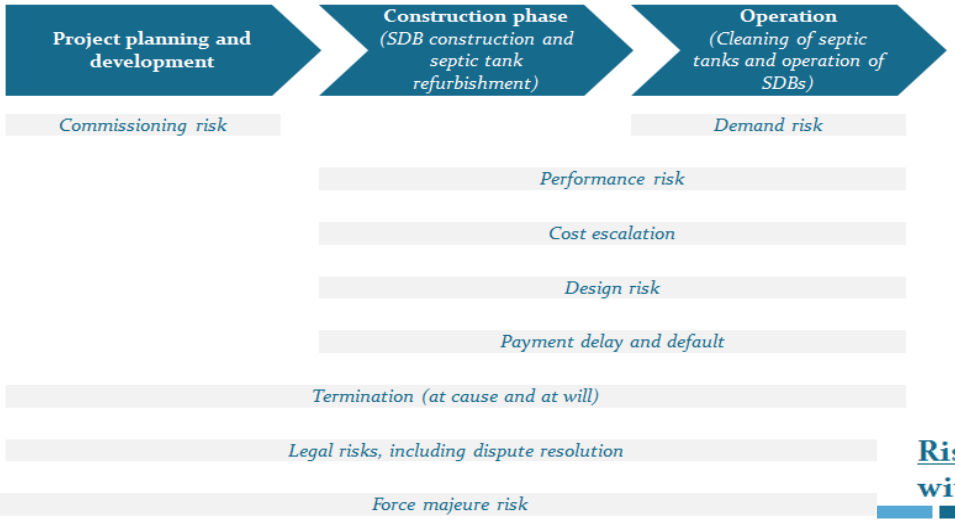
S. No.	Types of contract	Contract length	*City X*		
			Annual contract value *(INR, Lakhs)*	**Sanitation tax per residential property** *(INR)*	**Sanitation tax per non-residential property** *(INR)*
1A	Refurbishment and regular cleaning of septic tanks with O&M of treatment facility	2 - 3 years	15-17	~190	~230
1B	Construction of treatment facility	Duration of construction	24-28	N.A.	N.A.
2A	Refurbishment and regular cleaning of septic tanks	2 - 3 years	11-13	~140	~170
2B	Construction and O&M of treatment facility	1 year	28-33	N.A.	N.A.
3A	Refurbishment and regular cleaning of septic tanks with construction and O&M of treatment facility	2 - 3 years	39-45	~190	~230

Property owners currently have to **pay local taxes** of about **Rs _____/annum** in City X

To cover the costs of a cleaning cycle of ~3 years would require **an increase** in annual tax spend for a household of about **_____% in City X**

Good risk mitigation and allocation can attract good contractors and help reduce contract price

Risk mitigation: There are several types of risks that must be managed across the lifecycle of any public private partnership



Source: ADB, "Toolkit for Public Private Partnerships in Urban Water Supply for the State of Maharashtra, India; Ministry of Finance, Government of India, "PPP Toolkit for Improving PPP decision-making processes in water and sanitation, PPIAF, Vijay Sarma, 'Risks in PPP projects in Western India'"

Several **risks** involved during **lifecycle** of the **project**, where **PPP** is involved. These need to be **addressed**

Concerns about **addressing** the **risks** were **raised** by **private sector** during interactions

Risk mitigation: Private players highlighted a number of concerns with public private partnerships that need to be addressed

Termination

"The contract should have a clause defining a 3 month notification period in case of termination. It should also have a dispute resolution mechanism."
– Kadam Enterprises

Delayed payments

"Ideally, bills should be cleared in 30 days, and for late payments, interest should be paid at the rate of 8% per annum."
– Manisha Enterprises

Transparent procurement

"We would rather not deal with the ULB directly, there are always issues with internal politics. If there is a mediator in between then we would be interested."
- Envicare

Cost escalation

"For a fixed-fee contract for regulated schedule, we cannot offer 24 hour emergency service. We will only work 8 hours a day, otherwise it is likely that we will over-use our truck."
- Aditya Enterprises

"Another key issue is the escalation of fuel costs. The contract should clearly account for that."
– ZR Enterprises

Performance risks

"If we work on a regulated schedule, it will be difficult to get household signatures. That will become complicated, and I don't want my payment to suffer."
– Ugale Septic Tank Cleaning Services

"I have tried to do a regulated schedule on my route, but that has been difficult. People always say, "come back later", and it falls apart."
– Aditya Enterprises

Address the risks involved in PPP engagement for IFSM activities

Risk mitigation: Building a strong system for performance based monitoring and payment is critical to managing performance risk (1/2)

	Risk	Mitigation	Allocation of remaining risk
aning of septic tanks	Private player uses manual scavenging for cleaning septic tanks or sludge drying beds	• Require safety gear for all personnel • Include a clear description of activities that constitute manual scavenging	• Contract terminated if complaints of manual scavenging are received from households or ULB staff
	Private player does not clean household tanks as per the schedule	• Portion of the monthly payment should be tied to the number of household signatures collected from households whose septic tanks have been cleaned satisfactorily • ULB to undertake random inspections of households whose signatures have been submitted • A complaint redress mechanism to be opened where grievances can be lodged by the HH with the ULB	• Penalties to be imposed if the reported number of cleanings is lower than specified in the contract, or if discrepancies are found during random sampling, or if complaints are not dealt with in a timely manner • Large or persistent breaches can lead to termination
	Private player transportation	• As above	• Work on faulty septic tanks would have to
	Private player dumps septage at places other than the treatment site	• A portion of monthly payment is tied to signatures collected from the SDB operator	citizens with the ULB specified period, to avoid a fine • In case the number of complaints exceeds a specified number in a given time period, the contract can be terminated

Risk mitigation: Building a strong system for performance based monitoring and payment is critical to managing performance risk (2/2)

	Risk	Mitigation	Allocation of remaining risk
Refurbishment of septic tanks	Septic tanks are damaged during or as a result of refurbishment	• Specify the type of materials required • Payment tied to the number of signatures from households whose septic tanks have been repaired to their satisfaction • ULB to undertake random inspections of households whose signatures have been submitted • A complaint redress mechanism to be opened where grievances can be lodged by the HH with the ULB	• Damaged septic tanks must be repaired within a specified period days of complaint and the cost shall be borne by the private player • Penalties will be imposed if discrepancies are found during random sampling, or if complaints are not dealt with in a timely manner • Persistent breaches may lead to termination
Construction of SDBs	Sludge drying beds do not meet specified design	• The ULB will specify the design and materials to be used in consultation with town consultants • Payment made in installments on the completion of specific construction	• If the work is found to be faulty at any stage, the payment will be withheld until the corrections are made
O&M of SDBs	from SDBs is not sufficiently treated	sanitation department to measure sludge properties • X% of O&M payment to be conditional on the sludge meeting specified qualities	standards, a warning would be given, followed by fines. • Persistent breaches may lead to termination

Managing performance risk through performance based monitoring and payment

Risk mitigation: Contracts must also clearly manage at will and at cause termination by the private player and the ULB

	Risk	Mitigation	Allocation of remaining risk
Termination at cause	• ULB does not fulfill contract conditions	• Establishing a clear reporting and monitoring mechanism to ensure transparent contract execution • Ensuring that disputes are handled amicably through frequent communication and by appointing an agreed upon third party meditator	• Private player compensated for investments, the cost of winding down and foregone profits
	• Private player is unable to meet service standards	• As above	• ULB can compensate the private player for some portion of its capital investments but seize the performance bank guarantee[1]
	• ULB decides discontinue the	• Up-front discussions with key stakeholders to create buy-in for	• X month notice period required • Private player compensated for
Termination at will	• Private player wants to terminate the contract due to reasons unrelated to ULB compliance with contract terms	• Frequent communication between ULB and private player	• X month notice period required • Private player forfeits the performance bank guarantee

Managing termination risk

Risk mitigation: Provisions need to be made for payment delays and cost escalation to protect private player and public interests

	Risk	Mitigation	Allocation of remaining risk
Payment delays	• ULB is unable to make timely payments towards the project	• Ensuring budgetary allocation for contracts before procurement • Establishment of an escrow account for payment	• ULB to pay interest for the payment, delayed by X months or more, at a negotiated rate of interest
Cost escalation	• Cost of inputs increase over the course of contract	• Adjustment of contract value annually for inflation	• Private player would be responsible for bearing the cost escalations within

Managing payment and cost escalation risk

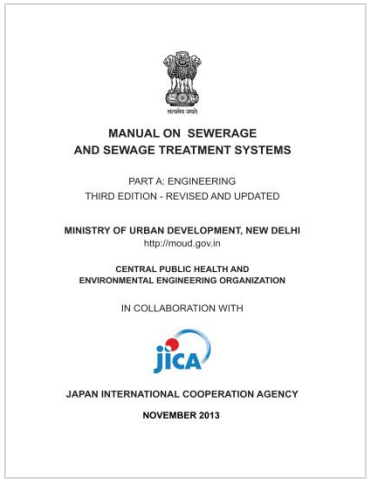
Group Work 2: Implementing septage management plan for the cities

Participants will discuss issues related to following aspects:

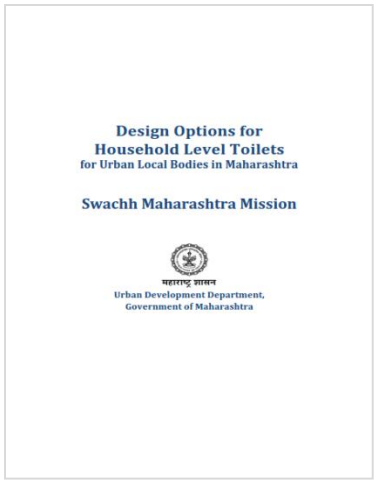
- Institutional and governance aspects of septage management plan
- Challenges
- The nature of support required from government and financial institutions
- Costing and Financing aspects
- Operational aspects etc

Wrap up and close

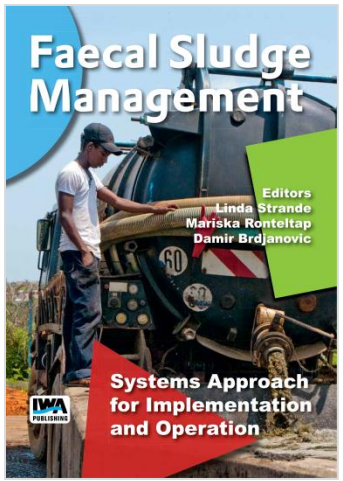
Reference documents. . .



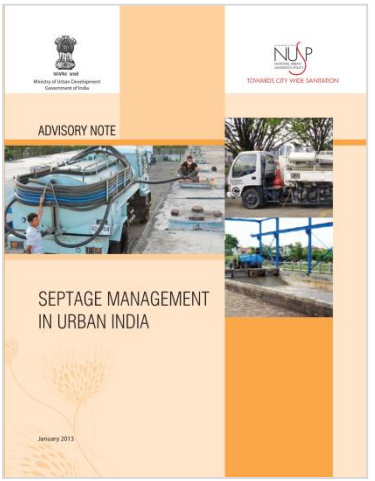
Manual on sewerage and sewage treatment systems – CPHEEO Manual, 2013



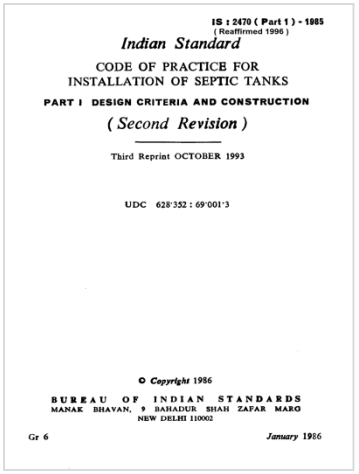
FSM Policy Guidelines - Maharashtra



Fecal Sludge Management – Systems Approach for implementation and operation, 2014



Advisory note – Septage Management in Urban India, MoUD,2013



IS 2470 – Code of practice for installation of septic tanks, Part I & II

Thank you

meeramehta@cept.ac.in dineshmehta@cept.ac.in
mansuriaasim@gmail.com

www.pas.org.in

@pas_project

https://twitter.com/pas_project

PAS project

http://fb.com/pas.cept