Workshop on Making Cities ODF+ (FSSM)
Session 1: ODF+ (FSSM) Need of the hour
High dependence on Onsite systems in Urban India!!

Based on the PAS-SLB data by 6 states covering 907 cities, 2016-17

- **88%** of cities in India are fully dependent on **on-site sanitation systems**
- **12%** are dependent on **mixed sanitation systems**

- **Only 3 cities in Gujarat** are reported to have **100% sewerage system**
- **Nearly 800** cities have **fully onsite sanitation systems**
Status of waste water treatment in Maharashtra

- Majority of cities do not have under ground drainage systems
- 340 Cities are without any Sewage Treatment facility

Source: PAS-SLB 2016-17
Some Definitions

“**Faecal sludge** is the solid or settled contents of pit latrines and septic tanks.

Faecal sludge (FS) comes from onsite sanitation system such as pit latrines, non-sewered public ablution blocks, septic tanks, aqua privies, and dry toilets.”

“**Septage** is the liquid and solid material that is pumped from a septic tank, cesspool, or such onsite treatment facility after it has accumulated over a period of time.

Septage is the combination of scum, sludge, and liquid that accumulates in septic tanks”.

Need for Faecal Sludge and Septage Management (FSSM)

- 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

- Pollution of groundwater and surface water sources caused by effluents from household or community toilet septic tanks that are not desludged regularly

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

Source: Advisory note on septage management in urban India, MoUD January 2013
Why is Faecal Sludge and Septage Management (FSSM) important!!!

1 truck of Faecal Sludge and Septage carelessly dumped = 5,000 people shitting in the open!

1 Gram of Faeces may contain:
- 100 parasites eggs
- 1000 Protozoa
- 1,000,000 Bacteria
- 10,000,000 Virus

Are we really ODF !!!!
# FSSM as compared to conventional sewerage systems

<table>
<thead>
<tr>
<th></th>
<th>CONVENTIONAL SEWERAGE</th>
<th>FSSM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water Requirement</td>
<td>High (&gt;135lpcd)</td>
<td>Low</td>
</tr>
<tr>
<td>Capital Costs</td>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td>O &amp; M Costs</td>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td>Technical Expertise</td>
<td>High - Conveyance</td>
<td>Low - Conveyance</td>
</tr>
<tr>
<td></td>
<td>High - Treatment</td>
<td>Low - Treatment</td>
</tr>
<tr>
<td>Maintenance requirement</td>
<td>High – on Service Provider</td>
<td>Low – on Service Provider</td>
</tr>
<tr>
<td>Required capacity to operate</td>
<td>Low – on Households</td>
<td>Medium – on Households</td>
</tr>
<tr>
<td>Implementation challenges</td>
<td>High</td>
<td>Low</td>
</tr>
</tbody>
</table>
Recognition of FSSM in India

- **SBM focus** on having sanitary toilets and eradicating Manual scavenging

- **Post SBM context** - Toilets are being constructed but need to think beyond that . . .

- **National Policy** on FSSM by MoHUA, GoI

- **States** beginning to roll out **similar policies**

- **National declaration** on Septage Management by MoHUA, GoI

- One of the major **thrust areas** of **AMRUT** – Financial allocations

- **Primer** on septage Management and **Rapid Assessment tool** for estimating **budget requirements** for FSSM

- National **ODF+ and ODF++ protocol**
Journey of Urban Maharashtra to become ODF

**Swachh Maharashtra Mission, Urban**

Launch of SMMU
15th May 2015

A near impossible task achieved in a short time...
In Maharashtra...

- “Move beyond toilets” – concept of ODF, ODF+, ODF++ cities - GoM GR dated 17th March. 2017
- Emphasis on quality – discouraging prefab toilets & contractor constructed toilets - GoM GR dated 20th November 2015 – Septic tanks with toilets

**ODF**

![Diagram of ODF]

**ODF+**

![Diagram of ODF+]

**ODF++**

![Diagram of ODF++]

Citywide FSSM Plan

80% HHs have access to individual toilets and rest dependent on CTs

80% HHs have access to individual toilets

100% HHs have access to individual toilets
Sustainability Charter Launched by the Chief Minister

Sustainability Charter

We are committed towards the vision of Swachh Bharat. We shall ensure ODF sustainability in Maharashtra by:

#1. Achieving universal access to Individual Household Level Latrines (IHHL), which is a leading development priority.

#2. Ensuring adequate, clean and reliable access to public/community toilets across urban Maharashtra, wherever IHHL are not possible.

#3. Ensuring ODF sustainability through effective participation of government, elected representatives, schools, donors, implementers, NGOs, SHGs, CBOs and the communities.

#4. Continuing and institutionalizing rigorous ODF validation and monitoring process through ‘OD Watch’ and ‘ODF sustainability tracker’

#5. Auditing the performance of community/public toilet and encouraging development of OD spots into usable public spaces.

#6. Recognizing and awarding sustained performance

#7. Moving towards ODF+++ by ensuring effective collection and adequate treatment of human fecal waste

Mr. Devendra Fadnavis
Chief Minister, Maharashtra
Focus on FSSM by Government of Maharashtra

- Increased focus on moving ODF cities towards ODF+ after declaring Urban Maharashtra ODF

- Maharashtra Government has passed two resolutions, directing to move towards ODF+ and to utilize Incentive grant and 14th FC funds for ODF+ activities

GR on ODF, ODF+ and ODF++ framework

GR on use of Incentive Funds

Chief Minister Speech on occasion of declaring Urban Maharashtra ODF on 2nd October 2017
Documentation, policy and guidelines for FSSM
Monitoring by State for ODF + activities ...

- **State** is going to provide training to ULBs for preparing ODF+ plans

- State to follow up with ULBs regarding:
  - Whether cities have done an assessment for preparing FSSM plan
  - Whether cities have developed an FSSM plan
    - Emptying plan
    - Treatment plan
  - Have cities allocated land for construction of FSTP
  - Have cities allocated funds for financing capital and O&M of FSSM services
  - By when does the city plan to implement the FSSM plan
  - Timeline of all these activities
Challenges we are trying to resolve through FSSM . . .
Understanding the Sanitation Service Chain...

- **User interface**: Describes the type of toilet facilities the user accesses.
- **Containment**: Describes ways of collecting and sometimes treating the faecal waste generated by the users.
- **Conveyance and Transport**: Describes the transport of waste from collection to the treatment/disposal site.
- **Treatment**: Describes the way in which waste is treated.
- **Reuse/Disposal**: Describes the way in which waste reused/disposed off.

- **Access**: On-site sanitation technology
- **Containment**: Faecal Sludge Management
Sanitation service chain of medium-small cities of Maharashtra

User interface
- Pour flush latrines

Collection
- Existing Pit and Septic tank with drain field

Conveyance
- Open / covered drains / soak pits
- No conveyance system in new developments
- Suction truck

Treatment
- No treatment of fecal sludge

Reuse /Disposal
- Into river or natural drain
- Dumping along with solid waste

Old city area - Inadequate primary treatment but good conveyance through open drains
New developments - Improved primary treatment through septic tanks but no drains

Lack of 100% coverage of conveyance system
Lack of treatment facility
Lack of scientific disposal of septage

Missing links in Sanitation value chain in a city

EXISTING SANITATION VALUE CHAIN
- Pour flush latrines
- Septic tanks/ Pits
- Open/ Closed drains
- No treatment
- Natural Drain/ Water body
Challenges in Collection system

- Septic tanks are below the toilets and don’t have access covers
- Inaccessible septic tanks with sealed tops
- Septic tanks located near drains and sealed from the top
- Single pit toilets
- Oversized septic tanks
- Toilets directly connected to drains
Challenges in Conveyance system

- No monitoring mechanism for informal sector
- Cleaning cycle greater than 8-10 years against recommended cycle of 2-3 years
- Due to infrequent cleaning, septage begins to solidify in tanks and septic tank fills up, fecal matter along with effluents is released into the drains

Services mainly provided by city governments
Unsafe handling of septage
Informal Private sector
Emptying when the tank is full
Challenges in Treatment and Disposal

Disposal of septage at dump site

NO TREATMENT OF FECAL SLUDGE & SEPTAGE

Disposal of septage in open land

Disposal of septage in water bodies

FSSM as a solution for Moving from RED to GREEN

**Current Situation**
- Lack of universal access to improved toilets
- Lack of adequate data base on toilets for properties

**Proposed Approach**
- Converting unimproved toilets to improved toilets
- Ensuring 100% access to improved toilets
- Data base on toilets for all properties

**Access**
- Pour flush toilets
- Septic tanks

**Collection**
- Septic tanks lack manhole covers
- Septic tanks are not of standard size
- No database on septic tanks for properties

**Conveyance**
- Suction emptier truck
- Only 2%-4 % of septic tanks cleaned annually

**Treatment**
- No treatment facility
- No facility for fecal sludge treatment

**Disposal / Reuse**
- Disposed off on dumping site
- Septage disposed off on dumping site without treatment

- Providing access manhole covers to allow regular cleaning
- Ensuring regular emptying of septic tanks
- Licensing, registrations and monitoring of private emptier
- Payment using local taxes using escrow mechanisms

- Installing treatment facility for the treatment of septage
- Safe dumping of treated fecal matter and/or the sale of septage at a fixed rate to nearby farms or agro-businesses

Data base on toilets for all properties

Payment using local taxes using escrow mechanisms
Journey of Wai and Sinnar in moving towards ODF+

Both councils have signed resolution to implement FSM plans

- Councils signed to implement FSM plans
- 1st cities in India to execute scheduled desludging
- Built FSTP for treating septage
- Private sector participation for emptying services
- Escrow account to minimize payment risks for private operator
- Funding through Sanitation tax levied on all properties

Wai and Sinnar - The FSTP are setup in both the towns

- Wai has allocated land for treatment facility
- 70cum/day FSTP by Tide technocrats in Wai funded by BMGF
- Plant is operational from June, 2018.

- Sinnar had floated DBOT tender for 70cum/day plant and Lowest technically qualified tender has been identified.
- The Project is 100% funded by ULB own funds
- The project to commission in next 4 months

Wai and Sinnar have been declared as an ODF City by GoM & GoI

- 2600+ applications have been received
- ~1900 applications have been approved for construction
- ~1100 toilets constructed

1st Cities in INDIA to execute the idea of scheduled emptying...

3 trucks to desludge ~ 4000 septic tanks annually

2 trucks to desludge ~ 2000 septic tanks annually

CEPT UNIVERSITY C-WAS
Sinnar Movie
Session 2: Planning for emptying services
Understanding the Sanitation Service Chain...

- **User interface**
- **Containment**
- **Conveyance and Transport**
- **Treatment**
- **Use or Disposal**

**Access**: Describes the type of toilet facilities the user accesses.

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**On-site sanitation technology**

**Faecal Sludge Management**
Type of collection Systems

- Single pit toilet
- Twin pit toilet
- 2-3 chambered Septic tank
- Biogas
- Composting toilet
- Bio-digestor
Existing types of emptying & conveyance systems

- No monitoring mechanism for informal sector
- Cleaning cycle greater than 8-10 years against recommended cycle of 2-3 years by GoI advisory on Septage Management
- Due to infrequent cleaning, septage begins to solidify in tanks and septic tank fills up, faecal matter along with effluents is released into the drains

Services mainly provided by city governments

Unsafe handling of septage

Informal Private sector

Emptying when the tank is full
Manual Scavenging Act


Came into force on Dec 6, 2013

“Prohibition of Insanitary Latrines and Employment and Engagement for cleaning of Sewers or Septic Tanks as Manual Scavenger

Prohibition of Activity

Local authorities to survey Insanitary latrines and provide Sanitary community latrines.  

Survey of manual scavengers in urban areas by Municipalities.  

Duty of local authorities and other agencies to use modern mechanical technology for cleaning of sewers and onsite systems, etc.

Rehabilitation

Rehabilitation of persons identified as Manual Scavengers by a Municipality. Housing and Financial Assistance to be given.
"When the pit is Full".

Often a tank is emptied when it is full. There is a tendency to use/build oversized septic tanks to avoid frequent emptying. It is important to assess how often a septic tank is emptied. Such information will need to be gathered through a household surveys.

Planning Decision

| Demand desludging | V/S | Scheduled desludging |

Example

In India: the Central Public Health Engineering and Environmental Organization (CPHEEO) suggests:

"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
### Demand v/s Scheduled Emptying

<table>
<thead>
<tr>
<th>On-Demand Basis</th>
<th>Scheduled Practice</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cleaning is done <strong>on-call</strong> by the household, who do not see the need for regular cleaning.</td>
<td>Septic tanks will be cleaned on a <strong>pre-determined schedule</strong>.</td>
</tr>
<tr>
<td>The <strong>cleaning services</strong> of the ULB are currently treated as a <strong>complaint redressal</strong> system for overflowing septic tanks rather than a regular cleaning and maintenance service.</td>
<td><strong>Regulations</strong> and <strong>penalties</strong> will be set in place to ensure periodic cleaning.</td>
</tr>
<tr>
<td>The ULBs operates the trucks (either owned or borrowed) when the demand arises.</td>
<td><strong>Awareness generation</strong> activities will educate households about the need for regular cleaning.</td>
</tr>
<tr>
<td>Households generally pay a certain amount once in &gt;8-10 years to get tanks cleaned during the time of overflow.</td>
<td>Each town will require an additional <strong>number of trucks to meet service standards</strong> (which can be <strong>operated by a private player</strong>).</td>
</tr>
<tr>
<td></td>
<td><strong>Local taxes levied</strong> by the ULB will be used to recover the <strong>operating expenses</strong> for regular cleaning.</td>
</tr>
</tbody>
</table>
Demand Based emptying services

HHs call emptying service when system is full

Provide service and charge the HHs

If non-regulated,
- No regular cleaning
- Overflowing system pose environmental and health risk
- Private emptier may charge higher
- No safety precautions
- No monitoring of septage disposal

Plan for Regulated Demand based emptying services

- Awareness and regulations to HHs for regular desludging
- Empanelment and training of desludging operators
- Monitoring of emptying services through GPS enabled trucks
- Mandatory safety measures during desludging
- Regulations for emptying charge/tax system

Dakar Model
Schedule of emptying services

Septic tank cleaning cycle of 3 years

- To maintain a cycle of 3 years, roughly 2800 septic tanks need to be cleaned annually
- Each vehicle needs to make 4 to 5 trips daily
- Roughly 300 Working Days are required
- To clean 2800 septic tanks, 2-3 nos of suction emptier trucks of 5000 capacity would be required

2-3 nos of trucks of 5000 litre capacity are required for cleaning HHs and non-residential septic tanks

Divide the city into zones and prepare a yearly plan

<table>
<thead>
<tr>
<th>Year</th>
<th>Zones</th>
<th>No. of septic tanks to be cleaned annually (no)</th>
<th>No. of Days required</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year 1</td>
<td>Zone 1</td>
<td>1889</td>
<td>201</td>
</tr>
<tr>
<td></td>
<td>Zone 2</td>
<td>947</td>
<td>101</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>2836</td>
<td>302</td>
</tr>
<tr>
<td>Year 2</td>
<td>Zone 2</td>
<td>1262</td>
<td>135</td>
</tr>
<tr>
<td></td>
<td>Zone 3</td>
<td>1582</td>
<td>169</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>2844</td>
<td>303</td>
</tr>
<tr>
<td>Year 3</td>
<td>Zone 3</td>
<td>2762</td>
<td>294</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>2762</td>
<td>294</td>
</tr>
</tbody>
</table>
Benefits of Scheduled Emptying

- **Equitable services** - all households / properties are covered by services

- **Pricing** – Services are offered at lower prices, due to efficiency gains

- **Behavior change** - Contribution to ODF sustainability as toilet usage can increase

- **Manual scavenging** - Removal of need for manual scavenging due to regular emptying

- **Infrastructure optimization** - More predictable loads for treatment facility and route optimization of trucks

- **Environmental benefits** - Likely reduction in BOD and coliform in septic tank effluent, as well as lower likelihood of septic tank overflows
Parameters while planning emptying and conveyance

i. Distance of treatment site

ii. Road Width

iii. Access to site

iv. Characteristics of septage

v. Size of septic tanks/pits

vi. Traffic congestion

vii. Fuel requirement and its implication in opex

viii. Financial budget of emptying services
Technology options for emptying and conveyance

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

Conventional Vacuum Tanker

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

Mini-Vacuum Tanker (Vacutug)

Smaller mechanized tricycle/motorcycle mounted collection tanks of 20–40 litres capacity with gulper or smaller vacuum pumps at the primary level backed by a secondary transport system may work in the informal slum settlements.

Gulper
Emptying service provision through licensing/contracting

**Licensing of septage transporters**

Emptying services by ULB or by private agencies: management contracts. 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.

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**Contracting the service to private sector**

The service for de-sludging and transport of septage can be contracted out to private sector for a predefined period of time and cost of the service. A detailed tender document should be made detailing out all the necessary terms and conditions.

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![Tender Document Example](image-url)
Occupational Safety

• Municipalities should provide workers with safety gear.
• Each worker should be made aware of the risks of the work through trainings.
• Workers should be held liable for not using available protective gear.

Safety Gears

- Helmet
- Safety goggles
- Mask
- Suit with apron
- Rubber gloves
- Torch
- Gum boots

Use of safety gears by a sanitation worker
Awareness Material and Activities for FSSM...

**Banners**

Awareness activities such as:
- Distribution of pamphlets
- Share video over whatsapp and local cable channel
- Auto rickshaw announcements
- Ward wise gatherings

A detailed schedule using different material...

**Flyers**

Awareness material should focus on importance of emptying, details of scheme, precautions to be taken etc.

**Video**

**Facebook page**
Monitoring and Regulating emptying services

Monitoring of emptying service is required to:

• Use of GPS enabled trucks to monitor emptying services
• Keep a check on operations of private service provider and regulate the payment
• Build a data base of toilets and septic tanks in the city
• Develop records on when septic tanks are emptied
• Monitor the quality of septage etc.

Different stakeholders such as Municipal Council, private service provider, citizens, treatment plant operator etc. can benefit from a robust monitoring process

Source: Operative guidelines for septage management for urban and rural local bodies in Tamil Nadu.(2014)
Formats for monitoring emptying services

Daily report formats to monitor emptying process.

<table>
<thead>
<tr>
<th>Municipal Council's copy</th>
<th>Property holder's copy</th>
<th>Emptying service provider's copy</th>
<th>Treatment plant's copy</th>
</tr>
</thead>
</table>

These records can be linked to the payment of private emptying service provider.

Use of mobile based applications for monitoring the emptying process

Template Manifest form for emptying

Manifest forms are an integral part of a comprehensive septicage management program. This completed document or documents with signatures of the household/property, suction truck operator and treatment plant operator should be submitted to the local government for their records. These records can be linked to the payment of the emptier operator in such a way that the emptier operator is only paid if there are signatures of all the stakeholders.

Collection and transport records form / manifest forms

Sample Form to be filled by Operator / Transporter of Septage

1. Identification of Waste:
   a) Volume: ______________________
   b) Type: ___ Septic Tank ___ Others
   c) Source: ___ Residential ___ Commercial ___ Restaurant ___ Portable Toilet ___ Others

2. Details of Waste Generator:
   a) Name: ______________________
   b) Phone Number: ______________________
   c) Address: ______________________
   d) City: ______________________
   e) Any kind of deficiencies, missing pipes or fittings, improper maintenance 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.

Note: ______________________ Signature: ______________________

3. Details of Transporter / Operator:
   a) Company Name: ______________________
   b) Form: ______________________
   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:

   a) Signature of authorized agent and title: ______________________

4. Acceptance by ______________________ Municipalities' 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 agency and title: ______________________

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

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1. Adapted from operative guidelines for septicage management for urban and rural local bodies in Tamil Nadu (2014)
Need for exploring PSP in FSM services

**Urban Local Body**
- Mandate to ensure service provision
- Challenges in FSSM
  - Improper onsite systems that do not conform to standards
  - No treatment facility and unsafe disposal
  - Limited funds, manpower, equipment
  - Low technical know-how

**Private sector**
- Already Active
- Better access to technology and knowhow
- Competitive prices

**Win-Win situation**
- ULB able to ensure adequate services and standards
- Citizens get timely services at competitive prices
- Entrepreneurs get business opportunities
- Current govt policies and schemes support and encourage PSP in urban infrastructure projects

Existing resources to guide PSP in large scale sanitation projects, but need for guidance on engaging contractors in small-scale sanitation projects based on the FSSM approach.
Private sector investment in trucks has significant benefits for the ULB

Benefits to public sector

✓ Ease of procurement: ULB procurement of the truck would require floating a tender, inviting, evaluating and negotiating bids. This is likely to be time consuming, and involve transaction costs that can be avoided if the private player purchases the truck.

✓ Aligns private sector incentives: Private sector investment in trucks incentivizes the player to use and maintain the truck well.

✓ Allows investment in quality: ULBs are often bound to minimize cost, while the private sector can invest in quality trucks with longer lifecycles and additional features like water jets.

Benefits to private sector

✓ Facilitates access to finance: Having a contract from the ULB can make it easier for the private player to raise capital for the truck and negotiate better financing terms.

✓ Provides a platform for business expansion: A contract with the ULB serves as a low-risk platform for private sector players to scale by providing access to guaranteed demand to recoup investment in a truck.
### Typical opportunities for PSP across sanitation chain

<table>
<thead>
<tr>
<th>Access</th>
<th>Collection</th>
<th>Conveyance</th>
<th>Treatment</th>
<th>Disposal/ Reuse</th>
</tr>
</thead>
<tbody>
<tr>
<td>Improper onsite systems</td>
<td>Inadequate suction trucks, manpower</td>
<td>No treatment facility</td>
<td>Unsafe disposal</td>
<td></td>
</tr>
<tr>
<td>- Onsite systems lack access manhole covers and are not of standard size</td>
<td>- Very few onsite systems cleaned annually</td>
<td>- No facility for faecal sludge treatment</td>
<td>- Septage disposed in the open without treatment</td>
<td></td>
</tr>
<tr>
<td>1. <strong>Regular emptying</strong> of onsite systems to ensure that 1/3 of the onsite systems in the town/city are cleaned every year as per GOI guidelines</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>2. <strong>Regular refurbishment</strong> of the onsite systems which includes providing access manhole covers to allow regular emptying, and repair of onsite system (if needed)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Construction of Septage Treatment Facility (STFs) for the treatment of faecal sludge</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Regular reuse / disposal of treated sludge and cleaning of STF</td>
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</tr>
</tbody>
</table>

Note: (i) As per MoUD guidelines, a household onsite system/onsite system must be emptied every 3 years hence 33% of all onsite systems/onsite systems should be emptied annually
Private sector is available for FSSM services ...

ULB can invite Expression of interest (EoI) to scope possible players

- **Access**
  - Pour flush toilets
  - Septic tanks

- **Collection**
  - Refurbishment of septic tanks with access manhole covers
  - Periodic cleaning of septic tanks along a regulated schedule

- **Conveyance**
  - Suction emptier trucks

- **Treatment**
  - Construction treatment facility
  - Operation and maintenance of treatment facility

- **Disposal / Reuse**
  - Revenue from treated septage

Activities required:

1. Labor contractors for septic tank cleaning
2. Septic tank cleaning companies
3. Pure-play treatment players
4. Integrated faecal sludge management providers

Proposed value chain:

- Sale of septage at a fixed rate to nearby farms or agro-businesses

Buyers of septage:
- Organic Farming Association
- Agro-based industries
- Local farmers and growers associations

Small scale players (<10 employees)
Medium scale enterprises (>10-50 employees)
Developed tender for emptying services covering these aspects

1. Operational role of the private contractor
2. Source of revenue
3. Investment/ownership of capital asset
4. Payment structure
5. Contract length and value
6. Risk mitigation and allocation

Bundled or Unbundled contract?
Revenue stream enough to meet private players’ return expectations?
Who should invest in capital assets?
What is the appropriate contract duration for private and ULB?
What is the appropriate payment structure for the private player?
How to address the major risks for the private player and the ULB?

SELECTING AN APPROPRIATE PSP OPTION

MODEL TENDER covering these aspects is AVAILABLE for FSSM
Following this process bid documents have been rolled out in few cities of Maharashtra.

**Sinnar Municipal Council, Sinnar**

**TENDER DOCUMENT**

**Name of Work**

"Scheduled cleaning of septic tanks, Sinnar"

**Estimated Cost:** To be given by the bidder

**E.M.D.** ₹40,000/-

Office of the

Chief Officer,
Sinnar Municipal Council, Sinnar

Sunil S. Patil
Vyanikesh R. Durve
Sanjay Rave
Ashwini Deshmukh
Municipal Engineer
Chief Officer
Vice President
President

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I. Short Tender Notice

II. Detailed Tender Schedule

Notes

III. List of documents to be submitted along with tender

IV. Detailed Tender Notice – General Conditions

V. Detailed Tender Notice – Special Conditions

VI. Form Formats

- Details of suction emptier trucks available with the tenderer for the use of this work
- Details of work of similar type and magnitude carried out by the tenderer
- Details of technical personnel with the tenderer
- Year wise statement showing cost of completed works

VII. Opening of Tender

VIII. Acceptance of Tender

IX. Declaration of the Contractor

X. Financial Bid Form

---

**Item Rate BoQ**

Tender Inviting Authority: Sinnar Municipal Council, Sinnar

Name of Work: Scheduled cleaning of septic tanks, Sinnar

Contract No:

**Bidder Name:**

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Item Description</th>
<th>Quantity</th>
<th>Units</th>
<th>Estimated Rate</th>
<th>DA/MC Rate</th>
<th>Total Amount In Rs.</th>
<th>TOTAL AMOUNT in Lacs</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td>4</td>
<td>6</td>
<td>4</td>
<td>6</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>4</td>
<td>6</td>
<td>4</td>
<td>6</td>
<td>6</td>
<td></td>
</tr>
</tbody>
</table>

---

### Schedule II

- Cleaning of 1000 septic tanks per year for three years of household properties as per schedule and emergency cleaning with appropriate safety plans for septic tanks, emptying cleaners and operators, transportation of septage to OMs and removal of waste and other hazards caused by contaminated waste.

The bidder shall undertake a regular cleaning of septic tanks in areas where scheduled cleaning needs to be undertaken.

Total in Figures

---

**Septic tank emptying Tender document**

**Model Tender document is available**
How to finance emptying services?

Identify revenue sources....

A. Potential sources of finance for Capital Expenditure

<table>
<thead>
<tr>
<th>Financial Requirement</th>
<th>Suction Emptier Trucks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Central/state Grants</td>
</tr>
<tr>
<td></td>
<td>Private sector/PPP</td>
</tr>
<tr>
<td></td>
<td>Local government fund</td>
</tr>
</tbody>
</table>

B. Potential sources of finance for O&M Expenditure

<table>
<thead>
<tr>
<th>Financial Requirement</th>
<th>Operation of Emptier trucks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Sanitation Tax/ Other tax</td>
</tr>
<tr>
<td></td>
<td>User charge (Emptying fees)</td>
</tr>
</tbody>
</table>
Potential Revenue structure

Scheduled Desludging through Sanitation Tax

**Basis** - a) sanitation tax collected from owners of OSSs, and 
b) mandatory scheduled desludging of tanks/pits.

Sanitation tax is collected by the local authority either as a percentage of property tax or by the public utilities as a surcharge on water bills.
Levied differential tax on all properties for financing FSSM services

### Differential taxation rates

<table>
<thead>
<tr>
<th>Category</th>
<th>With toilets</th>
<th>Without toilets</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residential Properties</td>
<td>Rs. 300 / annum</td>
<td></td>
</tr>
<tr>
<td>Non Residential Properties</td>
<td>Rs. 300 / annum</td>
<td>Rs. 100 / annum</td>
</tr>
</tbody>
</table>

### City level resolution for taxation

<table>
<thead>
<tr>
<th>A.</th>
<th>करारे नाव</th>
<th>निधानी मालमता</th>
<th>बिगर निधानी मालमता</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.</td>
<td>मैत्र व्यवस्थापन कर</td>
<td>300/- (प्रति मिति)</td>
<td>300/-</td>
</tr>
<tr>
<td>6</td>
<td>प्रभावकार व्यवस्थापन कर</td>
<td>100/-</td>
<td>200/-</td>
</tr>
</tbody>
</table>

चर्चाग्रामयों के लिए कारकर्ता कर्मचारी समाज सबसे पहले मैत्र व्यवस्थापन करें. तथ्यानुसार प्रभावकृत व्यवस्थापन समेत लागू होता है।
 phủtal Revenue structure

**Demand Based Desludging through emptying charge**

*Basis* - Requires setting up a call center or a customer help center managed by the local authorities which acts as a network orchestrator linking users of OSSs with vacuum truck operators. The truck operators register with the call center for a fixed annual fee which can also double up as a license or permit. Users of OSSs call the help center when their septic tanks or pits are full.
Group Work
Part 1 - Prepare FSSM plan for a city

Participants will plan for Emptying infrastructure that is required for implementing a FSSM plan for a city.

<table>
<thead>
<tr>
<th>Sr.No</th>
<th>Description</th>
<th>No.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Input details</strong></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>Total number of Septic tanks in the city (no)</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>Average volume of septic tanks (cum)</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>Septic tank cleaning cycle (Years)</td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>No. of working days in an year</td>
<td></td>
</tr>
<tr>
<td>E</td>
<td>No. of trips possible per emptying vehicle per day (trip/day/vehicle)</td>
<td></td>
</tr>
</tbody>
</table>
Infrastructure required

- **Number of septic tanks to be emptied daily**
  - Number of septic tanks to be emptied daily
  - \[ \text{Total number of Septic tanks in the city} \]
  - (Septic tank cleaning cycle \* No. of working days in an year)
  - = \[ \text{daily} \]

- **Number of trucks required (Nos.)**
  - Number of trucks required
  - = \[ \text{Number of septic tanks to be emptied daily} \]
  - Number of trips possible per truck per day
  - = \[ \text{nos} \]

- **Volume of septage to be treated (cum/day)**
  - Average volume of septic tanks \times \text{number of septic tanks emptied per day}
  - = \[ \text{cum/day} \]
### O&M cost of emptying services

#### O&M cost for schedule septic tank emptying service

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
<th>Calculation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Fuel cost for schedule emptying service = (Number of septic tank to be emptied daily ( \times ) Number of working days in a year ( \times ) Average distance ( \times ) 2 ( \times ) (Fuel price / Fuel efficiency))</td>
<td>[ \text{Fuel cost} = (\text{Number of septic tank to be emptied daily} \times \text{Number of working days in a year} \times \text{Average distance} \times 2 \times \left(\frac{\text{Fuel price}}{\text{Fuel efficiency}}\right) ]</td>
</tr>
<tr>
<td></td>
<td>- Assume Fuel efficiency for truck = 5 km per liter</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Assume Fuel price = Rs 70 per liter</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Assume number of working days in a year = 300 days</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Repair and maintenance cost = (Number of suction emptier truck requirement ( \times ) months in a year ( \times ) avg repair and maintenance cost per month)</td>
<td>[ \text{Repair and maintenance cost} = (\text{Number of suction emptier truck requirement} \times \text{Months in a year} \times \text{Avg repair and maintenance cost per month}) ]</td>
</tr>
<tr>
<td></td>
<td>- Assume average repair &amp; maintenance cost = Rs 2,000 per month</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Establishment expenses = ((Number of suction emptier truck requirement ( \times ) 12 ( \times ) No of manpower ( \times ) Monthly Salary)</td>
<td>[ \text{Establishment expenses} = (\text{Number of suction emptier truck requirement} \times 12 \times \text{No of manpower} \times \text{Monthly Salary}) ]</td>
</tr>
<tr>
<td></td>
<td>- Assume, 2 manpower requirement per truck</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Assume, Salary = Rs 10,000 per month</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>O&amp;M cost per year Sub-total = (1+2+3)</td>
<td>[ \text{O&amp;M cost per year} = (1+2+3) ]</td>
</tr>
<tr>
<td>5</td>
<td>Overhead + Insurance + other Miscellaneous cost = Sub-total(4) ( \times ) 10%</td>
<td>[ \text{Overhead + Insurance + other Miscellaneous cost} = \text{Sub-total(4)} \times 0.10 ]</td>
</tr>
<tr>
<td></td>
<td>- Assume, other cost as 10% of sub-total (4)</td>
<td></td>
</tr>
<tr>
<td>6-A</td>
<td>Total O&amp;M cost for schedule septic emptying service = (4+5) (Per year)</td>
<td>[ \text{Total O&amp;M cost for schedule septic emptying service} = \text{(4+5)} ]</td>
</tr>
<tr>
<td>6-B</td>
<td>Sanitation Tax (per property per year)</td>
<td>[ \text{Sanitation Tax per property per year} = \frac{\text{Total O&amp;M cost (6-A)}}{\text{Total number of properties in city}} ]</td>
</tr>
</tbody>
</table>
Session 3: Planning for Treatment services
Understanding the Sanitation Service Chain...

- **User interface**: Describes the type of toilet facilities the user accesses.
- **Containment**: Describes ways of collecting and sometimes treating the faecal waste generated by the users.
- **Collection and Transport**: Describes the transport of waste from collection to the treatment/disposal site.
- **Treatment**: Describes the way in which waste is treated.
- **Use or Disposal**: Describes the way in which waste reused/disposed off.

Faecal Sludge Management

On-site sanitation technology
## Physical and chemical characteristics of Fecal Sludge

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Fecal Sludge characteristics</th>
<th>Wastewater characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Range</td>
<td>Average</td>
</tr>
<tr>
<td>BOD</td>
<td>440-78,600</td>
<td>6,480</td>
</tr>
<tr>
<td>COD</td>
<td>1500-703,000</td>
<td>31,900</td>
</tr>
<tr>
<td>Total Solids</td>
<td>1,132-130,745</td>
<td>34,106</td>
</tr>
<tr>
<td>Total volatile solids</td>
<td>353-71,400</td>
<td>23,100</td>
</tr>
<tr>
<td>Total suspended solids</td>
<td>310-93,378</td>
<td>12,862</td>
</tr>
<tr>
<td>Total Nitrogen</td>
<td>66-1,060</td>
<td>588</td>
</tr>
<tr>
<td>Ammonia Nitrogen</td>
<td>3-116</td>
<td>97</td>
</tr>
<tr>
<td>Total phosphorus</td>
<td>20-760</td>
<td>210</td>
</tr>
</tbody>
</table>

Septage samples must be collected from:

- Community toilets/
  Public Toilets
- Bungalows
- Apartment

Period of desludging must be considered. Samples with long desludging frequency (7-8 years) and samples with shorter desludging frequency (2-3 years) must be considered for selecting the samples.
Septage Quantity calculation...

Volume of Septic tank

- Requires detailed survey of each property (residential, community, commercial, institutional)
- Total volume of all types of collection system

Per capita generation Standard

- Based on Std norm of 230 litres/capita/year (GOI septage guidelines)
- Septage quantity (litres/year) = population * 230
**Treatment Options**

**Typologies of Cities**

**Sewered Cities**

- **Typology 1 (24 cities)**
  - Municipal Corporation
  - Existing or planned sewer network with STP under AMRUT or any other scheme

- **Typology 2 (20 cities)**
  - Municipal Council
  - Existing or planned sewer network with STP under AMRUT or any other scheme

- **Typology 3 (45 cities)**
  - Possibility of co-treatment
  - No existing or planned sewer network, however, proximity to city with STP

**Cities reliant on FSSM / Co-treatment**

- **Typology 4 (63 cities)**
  - Population: Above 50,000
  - No current or planned sewer system
  - 100% reliance on FSSM

- **Typology 5 (232 cities)**
  - Population: Below 50,000
  - No current or planned sewer system
  - 100% reliance on FSSM

**No FSTP required**

- **Co-treatment with nearby STP**

- **Require independent FSTP**
Septage Treatment options

Co-treatment with own STP or nearby City STP

Co-treatment with SWM

Independent FSTP
Cities within 20 km vicinity of nearby city with STP can explore this option.
Co-treatment at nearby STP

• **Septage addition to nearest sewer manhole**: Septage could be added to a sewer upstream of the sewage treatment plant, and substantial dilution of septage occurs prior to it reaching the sewage treatment plant, depending on the volume of sewage flowing in the sewer.

• **Septage addition to STP**: Septage could be added to sewage immediately upstream of the screening and grit removal processes. It is economical because of the very simple receiving station design (As shown in figure) and also allows the wastewater treatment plant staff to have control of the septage discharge.

• **Septage addition to sludge digesters/sludge drying beds**:
  
  Dewater septage or sludge can be added to sludge drying bed of STP. The liquid fraction from sludge or septage can be directed to the STPs.
Puri FSTP (Co-treatment with STP)

- Puri is co-treating faecal sludge at their existing sewerage treatment plant
- Capacity of FSTP (Settling tank and SDB) : 50 KLD
- Wastewater treated at STP of 15MLD capacity
- Capex: INR 1.74 crores
- O&M : INR 17.58 lakhs/annum
- Land Area : 1000 Sq m.
- Year of Commissioning: December-2017
- Operated by: Private Operator

Effluent → Screen Channels: 2 No. → Effluent

Sludge

Settling thickening tank : 50 KLD → Effluent

Sludge Drying Bed : 8 beds

Sewerage Treatment Plant: 15 MLD
Septage Treatment options

- Co-treatment with own STP or nearby City STP
- Co-treatment with SWM
- Independent FSTP
Co-treatment with SWM

Septage

Organic Waste

Dewatering unit

Facultative pond

Chlorination tank

Reuse / Disposal

Solid in ratio 1:3

Windrow/Drum Composting

Dryer

Reuse / Disposal

Septage

Organic Waste

Bio-Methanation

Planted Gravel filter for effluent treatment

Chlorination tank

Reuse / Disposal

Drying

Reuse / Disposal
Co-treatment with Solid Waste

Waste to Energy through Co-fermentation of Organic Waste and Septage in Nashik

The Waste to Energy Project in Nashik, is a project of Nashik Municipal Corporation in cooperation with GIZ as implementation partner. The plant is treating biodegradable waste and septage generated in the city and generates energy through biogas for feeding it into the Maharashtra power grid. It is one solution which, through co-processing of septage (faecal sludge) with organic solid waste will generate energy from urban waste. This project is an attempt to showcase a viable business model for implementation of waste to energy projects through a Public Private Partnership (PPP) and is built on a comprehensive financial and operational model.

Daily 10 to 15 tons of food and vegetable waste from approximately 500 restaurants and 10 to 20 tons of septage from 400 community toilets are collected by trucks and delivered to the plant. The organic waste from hotels is segregated at the collection points. In a first step, organic waste and septage will be treated separately. The organic waste will once more be cleared from any foreign matter, fed to a crusher and then mixed with septage to form a slurry. The slurry is continuously agitated and forwarded to the digester. Option of pasteurization of septage using excess heat is kept open for further use of excess digest-ate to produce organic fertiliser. The co-fermentation process takes place in the bio-digester producing approx. 2,500m3 biogas per day.

Co-treatment with SWM

Bansberia, West Bengal

Capacity: 50 cum/day
Land: 27000 sq.mt
Commissioned: 2009

Capital cost: NA
O&M: Rs 13.5 lakh/year

Sand Drying bed and co-composting with SWM
Septage Treatment options

- Co-treatment with own STP or nearby City STP
- Co-treatment with SWM
- Independent FSTP
**Treatment technology selection criteria for independent FSTP**

- Identification of septage treatment technology is crucial for effective implementation of septage management plan.

- The Technology assessment is based on site specific criteria.

- Following parameters to be taken into consideration before finalization of treatment technology:

<table>
<thead>
<tr>
<th>i. Land availability</th>
<th>ii. Reliability of electricity</th>
<th>iii. Climatic conditions</th>
<th>iv. Funds</th>
</tr>
</thead>
<tbody>
<tr>
<td>Projects are often delayed because of non-availability or high price of land.</td>
<td>Treatment technology depends on parcel on land available. If huge land is available then non-mechanized technology can be adopted; while in shortage of land, city has to go for mechanized treatment technology.</td>
<td>Assessment of existing climatic conditions on site like rainfall pattern, average temperature, prone to flooding, is always recommended as it may directly affect selection of technology option.</td>
<td>Assessment of capital cost and O&amp;M cost is always recommended as it may affect selection of technology option that are financially viable.</td>
</tr>
</tbody>
</table>
Planted Sludge Drying Bed

Septage from septic tank → Screen/Grit removal → Planted Sludge Drying Bed → Liquid → Anaerobic Baffle Reactor (ABR) → Horizontal Planted Gravel filter → Reuse/Disposal

Septage from septic tank → Screen/Grit removal → Planted Sludge Drying Bed → Solid → Platform for Drying → Reuse/Disposal

Screen/Grit removal → Planting → Plant dieback & growth

Collection tank + chlorination → Reuse/Disposal
Planted Sludge Drying Bed

**Advantages:**
- Simple operation
- No energy is required

**Disadvantages:**
- Large land requirement
- Not favorable in regions of high rainfall or required sheds during rainy season which increase capital cost

**Examples:**
**Leh FSTP**
- **Capacity:** 12 cum/day
- **Land:** 720 sq.mt
- **Capital cost:** Rs 52 lakhs
- **O&M:** Rs 10 lakh/year
- **Commissioned:** 2017
UnPlanted Sludge Drying Bed

1. Septage from septic tank
2. Settling tank with screen
3. Unplanted Sludge Drying Bed
4. Anaerobic Baffle Reactor (ABR)
5. Platform for Drying
6. Horizontal Planted Gravel filter
7. Polishing pond
8. Reuse / Disposal

---

Septage from septic tank
1. Screen/Grit removal
2. Settling tank
3. Unplanted Sludge Drying Bed
4. ABR
5. Horizontal Planted Gravel filter
6. Polishing Pond
7. Reuse/Disposal

---

CEPT UNIVERSITY C-WAS
Bhubaneshwar, Odisha

- Capacity: 75 KLD
- Capex: INR 2.85 crores
- O&M: INR 19.25 lakhs/annum
- Land Area: 10117 Sq m.
- Year of commissioning: June-2018
- Operated by: Private Operator
Anaerobic Digester

**Advantages:**
- Simple operation
- No energy is required

**Disadvantages:**
- Large land requirement
- Requires expert design and skilled construction

**Examples:**

**Devanahalli FSTP**

- **Capacity:** 6 cum/day
- **Land:** 520 sq.mt
- **Capital cost:** Rs 67 lakhs
- **O&M:** Rs 6 lakh/year
- **Commissioned:** 2015
Pyrolysis

Septage from septic tank

Waste Water Treatment – Soil Bio Filter: treats the waste water and sewage at site. Passive treatment system using Chrysopogon zizanioides

Receipt, Screening and Grit removal → Pasteurization → Dewatering → Sludge → Drying of sludge → Pyrolysis → End product usage

Pasteurization: removes pathogens and helminth eggs from the septage, making it biosafe

Mechanical Dryer: further dries the sludge received from dewatering

Pyrolyser: converts the dried sludge into Biochar & generates reusable energy

Thermal Energy Generation and Reuse
Pyrolysis

Warangal, Telangana

Capacity: 15 cum/day
Land: 1000 sq mt
Capital cost: Rs 1.2 cr
O&M: Rs 10-15 lakh/year
Commissioned: 2017

Planned with sanitation resource park

Wai, Maharashtra

Capacity: 70 cum/day
Land: 1200 sq mt
Capital cost: Rs 1.8 cr
O&M: Rs 24 lakh/year
Under construction
UASB– Conventional STP

BAR SCREEN CHAMBER → COLLECTION TANK

SCREENED SEWAGE GET COLLECTED IN COLLECTION TANK → CLARIFIER

SLUDGE GET SETTLE DOWN BY GRAVITY AND SEPARATED OUT → SUMP FOR SLUDGE

U.A.S.B

CLEAR WATER

CLEAR WATER

SLUDGE DRYING BEDS

TO BAR SCREEN

C.E.S

Ozonation

TREATED EFFLUENT TANK

EFFLUENT
MBBR- Co-composing with SWM
<table>
<thead>
<tr>
<th>Location</th>
<th>Capacity (cum/day)</th>
<th>Capital Cost (Rs cr)</th>
<th>O&amp;M Cost (Lakh/year)</th>
<th>Land (sq mt)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sinnar, Maharashtra</td>
<td>70</td>
<td>1.63</td>
<td>8.3</td>
<td>1547</td>
</tr>
<tr>
<td>Cochin, Kerala</td>
<td>100</td>
<td>2.75</td>
<td>24-30</td>
<td>1200</td>
</tr>
</tbody>
</table>

Commissioned: 2015
<table>
<thead>
<tr>
<th>Sr. No</th>
<th>Treatment Technology</th>
<th>Land Requirement</th>
<th>Energy Requirement</th>
<th>Climatic condition</th>
<th>Examples</th>
<th>Estimated Capex Cost (Rs. In lakhs/cum)</th>
<th>O&amp;M Cost (Rs. in lakhs/Year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Sludge drying bed (SDB) + Oxidation pond</td>
<td>High</td>
<td>Nil-low</td>
<td>Low - Medium rainfall</td>
<td>Leh, Punjab, West Bengal</td>
<td>0.75 - 1</td>
<td>10-12</td>
</tr>
<tr>
<td>2</td>
<td>Anaerobic Digester + ABR+PGF</td>
<td>High</td>
<td>Nil-low</td>
<td>Low - Medium rainfall</td>
<td>Devanahalli, Trichy</td>
<td>1.5-2</td>
<td>10-12</td>
</tr>
<tr>
<td>3</td>
<td>Dewatering unit+ co-treatment with SWM (windrow composting/ bio-methanation)+ Oxidation pond/PGF for liquid treatment</td>
<td>High-Medium</td>
<td>Medium</td>
<td>Nil</td>
<td>Nashik, Ganga basin cities <em>(Mughalsarai and Gangaghat)</em>, Ghana</td>
<td>1.5-2</td>
<td>12.3-12.8</td>
</tr>
<tr>
<td>4</td>
<td>Geobag+ Oxidation pond for liquid treatment</td>
<td>Medium</td>
<td>Medium</td>
<td>Nil</td>
<td>Malaysia</td>
<td>2-2.5</td>
<td>10-12</td>
</tr>
<tr>
<td>5</td>
<td>Pyrolysis</td>
<td>Low</td>
<td>High</td>
<td>Nil</td>
<td>Wai, Warangal, Narsapur</td>
<td>2.5-3</td>
<td>10-20</td>
</tr>
<tr>
<td>6</td>
<td>UASB/MBBR/SBR</td>
<td>Low</td>
<td>High</td>
<td>Nil</td>
<td>Sinnar, Kohima, Cochin, Periyanaiicken-palayam</td>
<td>2.5-5</td>
<td>8-15</td>
</tr>
</tbody>
</table>
Fecal sludge treatment service through DBOT Tender

• Bidder responsible for planning and designing, constructing as well as operation and maintenance for the first few years before the responsibility of the facility is transferred to the ULB

• Technology neutral tender; Performance based contracts

• Sinnar and Umred have rolled out for a DBOT tender for their septage treatment facility

• Can be rolled out easily and quickly with sample tender document

• Many bidders have shown interest; competitive prices, innovative technologies

This has been done for
- 76 FSTPs in AP
- 71 FSTPs in Telengana
- 2 FSTPs in Maharashtra
Fecal sludge treatment service through DPR based Tender

• A Detailed Project Report (DPR) that entails initial assessment, planning and finalized design and details of financing the project for FSSM in the city prepared by an organization.

• The DPR is sent for technical and financial approval to MJP / IIT Mumbai

• Once the DPR is approved, a tender for implementation of the project is then floated which includes construction and preferably operation and maintenance for fixed duration
## Identify potential sources of Financing

### CAPEX

<table>
<thead>
<tr>
<th>Source of Financing</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatment Facility</td>
<td>Land and construction cost</td>
</tr>
<tr>
<td>14th Finance Funds and ODF</td>
<td>Incentive funds</td>
</tr>
<tr>
<td>ULB own resources</td>
<td></td>
</tr>
<tr>
<td>Central and State schemes</td>
<td></td>
</tr>
<tr>
<td>CSR, Donor grants</td>
<td></td>
</tr>
<tr>
<td>Private Sector/PPP</td>
<td></td>
</tr>
</tbody>
</table>

### OPEX

<table>
<thead>
<tr>
<th>Source of Financing</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operation of Treatment Facility</td>
<td>Salary, electricity, pumps, replacement, etc</td>
</tr>
<tr>
<td>Sanitation Tax/Other Taxes</td>
<td></td>
</tr>
<tr>
<td>Sale of Compost</td>
<td></td>
</tr>
</tbody>
</table>
Dewatered septage/sludge use as a fertilizer in agriculture, should satisfy criteria of Class A Bio-solids of US EPA:

- Faecal coliform density < 1000 MPN/g total dry solids
- Salmonella sp. Density < 3 MPN/4g total dry solids
- Helminth egg concentration < 1/g total dry solids (WHO, 2006)
- E – Coli of 1000/g total solids (WHO, 2006)

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.

Source: Advisory note on Septage management in Urban India, MoUD Jan 2013
Assessment of Reuse market

- Landscape Assessment of Reuse Market
  - Possible market demand
    - Identify nearby industries or agriculture land
    - Assess how much they are willing to pay to buy treated Septage and water
  - Social Factors - Assess their willingness to reuse the treated Septage and water
Group Work
Discuss and plan treatment services

- What would be the prefer treatment option and Why? (co-treatment with STP, Co-treatment with SWM or independent treatment plant)
- Is land available for construction of treatment plant?
- What would be source of financing for construction and O&M of treatment plant?
- What would you prefer DBOT or DPR for tendering out treatment plant?
- What would be the major challenges in implementation of treatment services?
## Tariff requirement to recover O&M cost

### O&M cost for septage treatment facility

<table>
<thead>
<tr>
<th></th>
<th>Requirement</th>
<th>Calculation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Energy cost for Septage treatment facilities = (Energy cost per month * 12)</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Energy cost</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- &lt; 25 cum/day = Rs 5,000 per month</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- 25-50 cum/day = Rs 10,000 per month</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- 50-75 cum/day = Rs 15,000 per month</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- &gt; 75 cum/day = Rs 20,000 per month</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Repair and maintenance cost = (Avg. Repair &amp; maintenance cost * 12)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Assume average repair &amp; maintenance cost = Rs 10,000 per month</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Establishment expenses = (No. of manpower*Monthly Salary *12)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Assume, 4 manpower requirement (in 2 shifts)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Assume, Salary = Rs 10,000 per month</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td><strong>Sub-total = (1+2+3)</strong></td>
</tr>
<tr>
<td>5</td>
<td>Overhead + Insurance + other Miscellaneous cost = (4*X%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Assume, other cost as X% of sub-total (4)</td>
<td></td>
</tr>
<tr>
<td>6-B</td>
<td><strong>Total O&amp;M cost for managing Septage treatment facility = (4+5)</strong></td>
<td></td>
</tr>
</tbody>
</table>
Key Steps for implementation of ODF+ in your cities
Key Steps for implementation of ODF+ in your cities

1. Decide mode of **Emptying services** (scheduled or demand)
2. Decide the **treatment technology**
3. Decide **source of financing** the project (capex and opex of emptying and treatment)
4. Pass **council resolution** for implementation of **FSSM**
Key Steps for implementation of ODF+ in your cities

Float tender and appointment of Private Service Provider for emptying and treatment (if required)

Conduct Awareness Activities

Establish Monitoring Mechanism for emptying and treatment services
Action Plan for your city
Prepare Action plan for implementation of FSSM plan in your city
# FSSM Action Plan for your city

<table>
<thead>
<tr>
<th>S. no.</th>
<th>Description of action plan</th>
<th>Timeline</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td><strong>Assessment of onsite sanitation systems</strong> (Septic tanks, pit toilets) in your city?</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td><strong>FSSM plan for your city and its timeline for implementation</strong></td>
<td></td>
</tr>
<tr>
<td>2.a</td>
<td><strong>Decide mode of Emptying services</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- (Scheduled or demand)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- If scheduled based emptying what would be emptying cycle (2/3/5 years)?_______________</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Number of septic tanks to be emptied daily___________________________________________</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Number of trucks required___________________________________________________________</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- O&amp;M cost of emptying services (per year)_____________________________________________</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Sanitation tax (per property per year)_______________________________________________</td>
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<tr>
<td></td>
<td>- Will you explore private sector for providing emptying services (Yes/No)_______________</td>
<td></td>
</tr>
<tr>
<td>2.b</td>
<td><strong>Decide Fecal Sludge treatment option</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Co-treatment with own STP___________________________________________________________</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Co-treatment with nearby city STP (city name and distance)____________________________</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Co-treatment with SWM_______________________________________________________________</td>
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<tr>
<td></td>
<td>- Independent treatment plant________________________________________________________</td>
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</tr>
<tr>
<td></td>
<td>- Volume of septage to be treated (cum/day)____________________________________________</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Mode of implementation (DBOT/DPR)___________________________________________________</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td><strong>Council resolution</strong> for implementation of FSSM plan (timeline)</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td><strong>Source of financing</strong> for Emptying and Treatment?</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Emptying: Capex_________________ Opex_________________</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Treatment: Capex_________________ Opex_________________</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>City allocates land for treatment plant? (timeline)</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>City <strong>implements the FSSM plan</strong> (timeline)</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>What all <strong>Awareness</strong> activities city plans to undertake?</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>What type of <strong>Monitoring mechanism</strong> will city setup for emptying and treatment?</td>
<td></td>
</tr>
</tbody>
</table>
Thank You

Website: www.cwas.org.in | Email: pas@cept.ac.in

Contact Persons:
aasim.mansuri@cept.ac.in; upasana.yadav@cept.ac.in; dhanshree.zende@cept.ac.in