Workshop for Academic Institutes

On

Faecal Sludge and Septage Management

AHMEDABAD

6TH & 7TH MARCH, 2018

SCBP

National Institute of Urban Affairs

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C-WAS

Session 1

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FSSM: An Overview

Sustainable Development Goals

Credit: United Nations

Goal 6: Ensure availability and sustainable management of water and sanitation for all

Means of Implementation

6.A International cooperation and capacity development

6.B Local participation

Credit: United Nations

Target 6.2: Sanitation and Hygiene

By 2030, achieve access to adequate and equitable sanitation and hygiene for all, and end open defecation, paying special attention to the needs of women and girls and those in vulnerable situations

6.2.1: Population using safely managed sanitation services

Definition: Population using an improved sanitation facility which is:

- not shared with other households and where
- excreta are safely disposed in situ or
- transported and treated off-site

Swachh Bharat Mission (SBM) Urban

Mission Objectives by October 2019

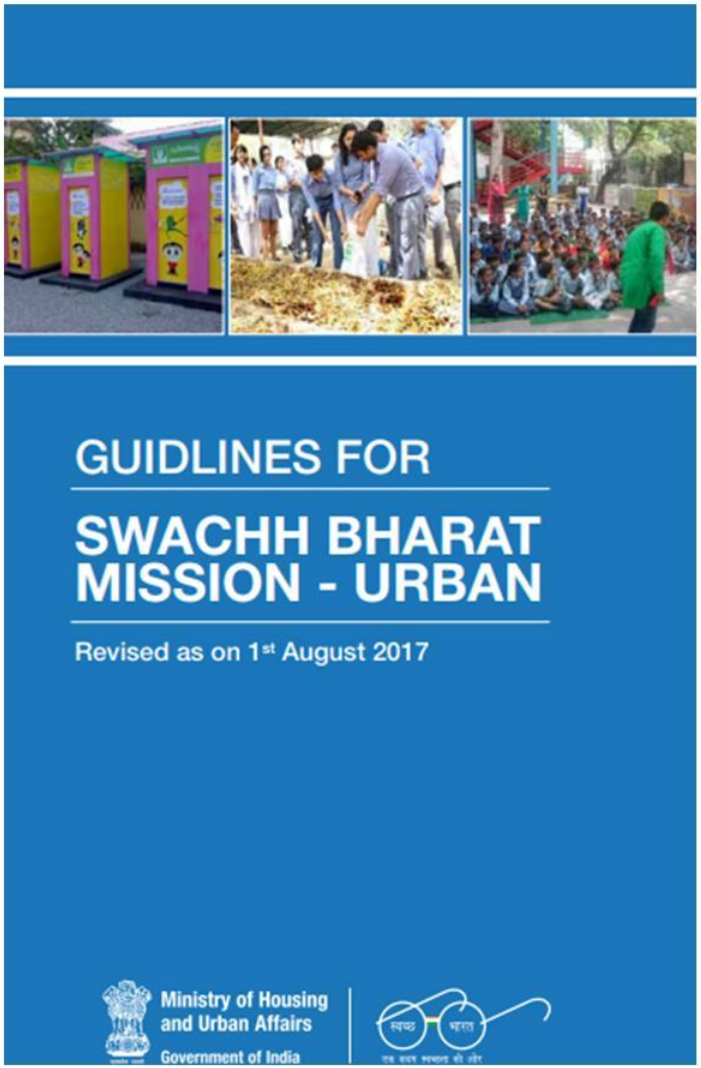
Elimination of open defecation

SBM (Urban) aims to ensure that

- No households engage in the practice of open defecation
- No new insanitary toilets are constructed during the mission period
- Pit latrines are converted to sanitary latrines
- Manual scavenging is eradicated

Mission Components

- Household toilets, including conversion of insanitary latrines into pour-flush latrines
- Community toilets
- Public toilets and urinals



Source: http://www.swachhbharaturban.in:8080/sbm/content/writereaddata/SBM_Guideline.pdf

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

19 CITIES ODF

2ND OCTOBER 2015

52 CITIES ODF

31st JANUARY 2016

100 CITIES ODF

31st OCTOBER 2016

Urban Maharashtra ODF

On 2nd Oct 2017

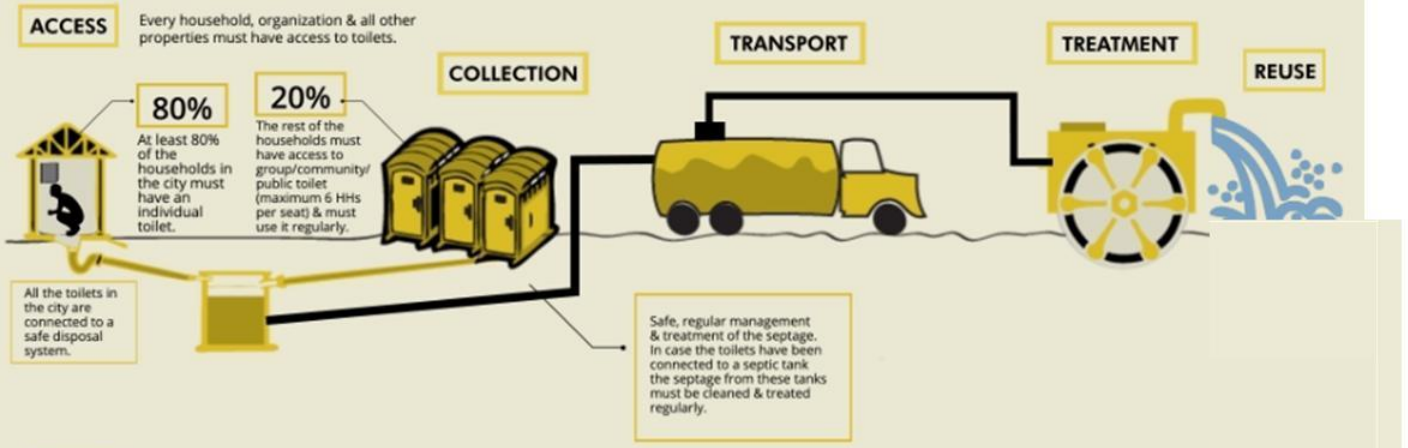
302 CITIES ODF

AUGUST 2017

Beyond toilets and ODF ... to ODF+ and ODF++

ODF

ODF +



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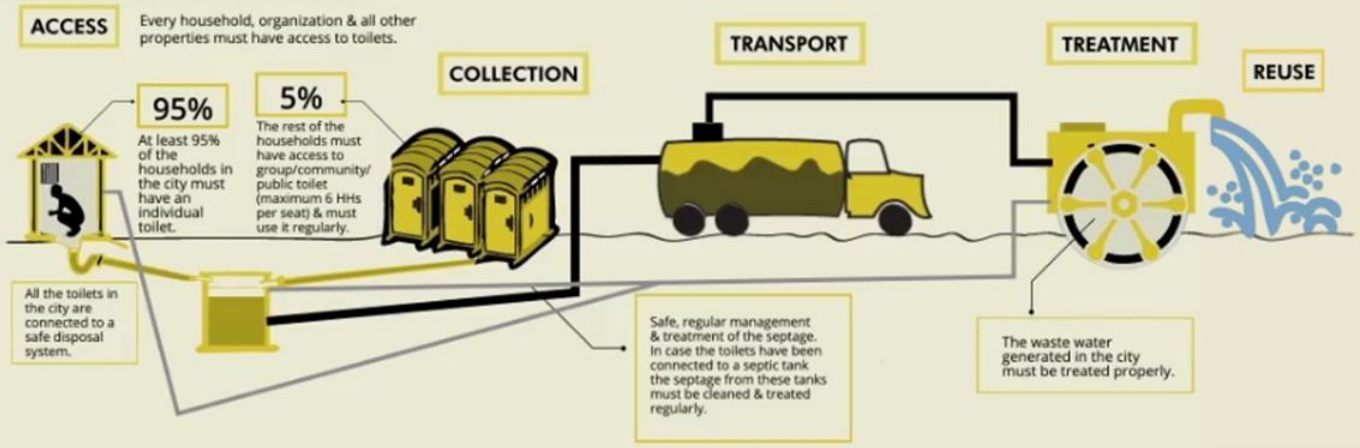

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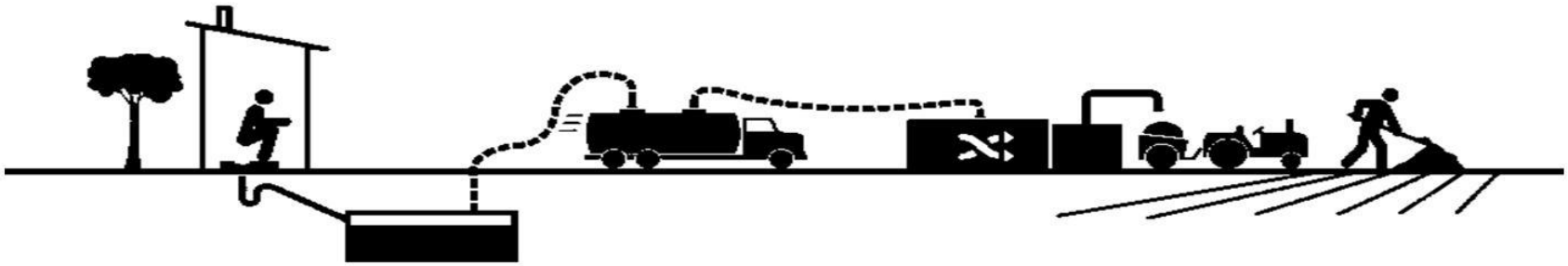
Understanding the Sanitation Service Chain . . .

On-site sanitation technology

Faecal Sludge Management

User interface | Containment | Collection and Transport | Treatment | Use or Disposal



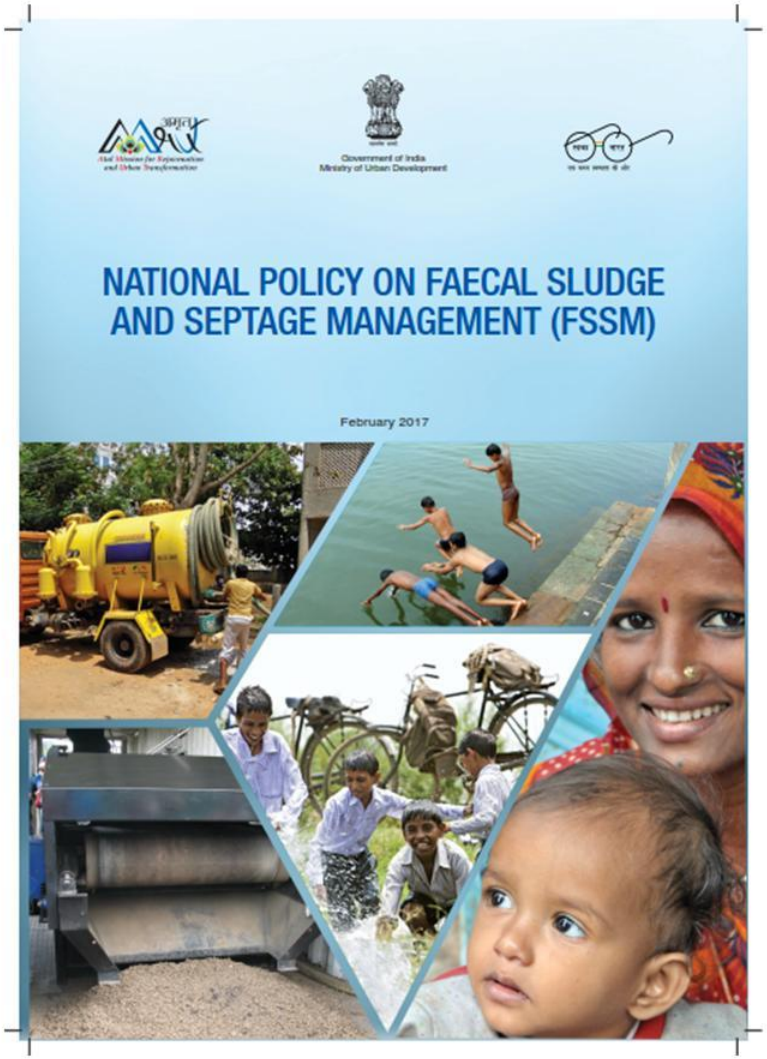
Access | Containment | Conveyance | Treatment | Reuse/Disposal

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

What is Faecal Sludge . . .

"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."

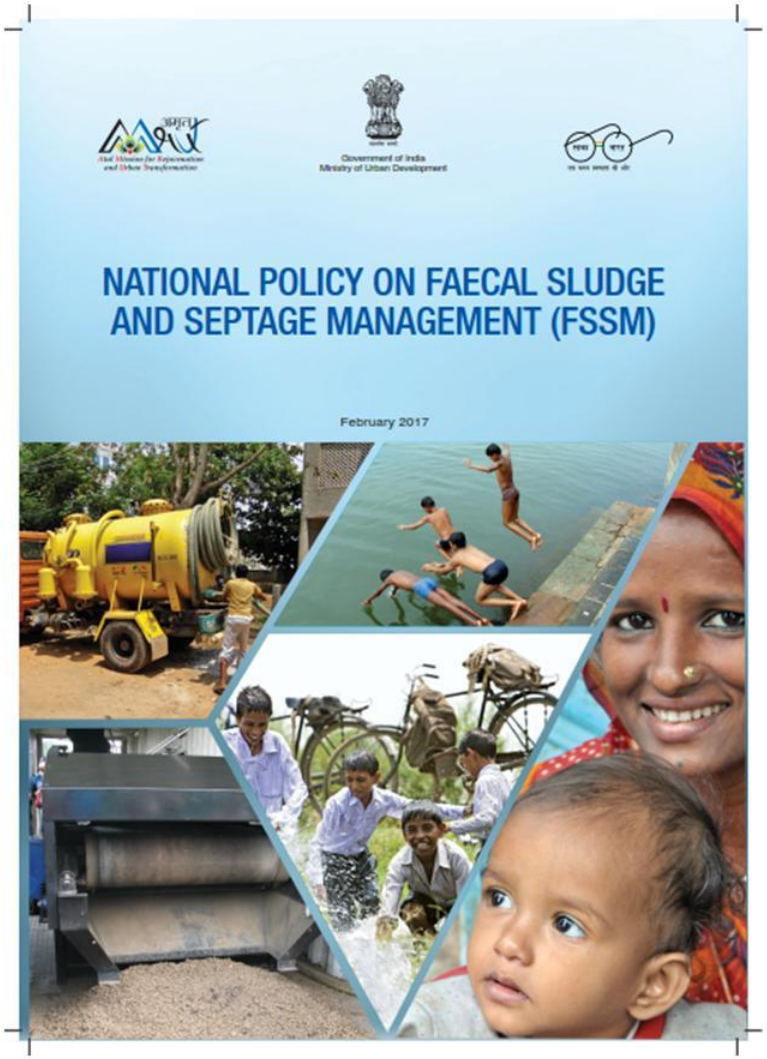


Source : http://amrut.gov.in/writereaddata/FSSM_Policy_Report_23Feb.pdf

What is Septage . . .

"It 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".



Source : http://amrut.gov.in/writereaddata/FSSM_Policy_Report_23Feb.pdf

Sanitation in India

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Sanitation situation assessment – Urban India

Access

~7.8 Million Households practice open defecation

~67 million

Source:
1. Census 2011 – Tables on Households Amenities
2. CEPT Analysis using information (ii) Inventorization of sewage treatment plants, Central Pollution Control Board -2015 (http://www.cpcb.nic.in/upload/NewItems/NewItem_210_Inventorization_of_Sewage-Treatment_Plant.pdf)

Sanitation situation assessment – Urban India

Sanitation situation assessment – Urban India

Source:

1. Census 2011 – Tables on Households Amenities
2. CEPT Analysis using information (ii) Inventorization of sewage treatment plants, Central Pollution Control Board -2015 (http://www.cpcb.nic.in/upload/NewItems/NewItem_218_Inventorization_of_Sewage-Treatment_Plant.pdf)

Sanitation situation assessment – Urban India

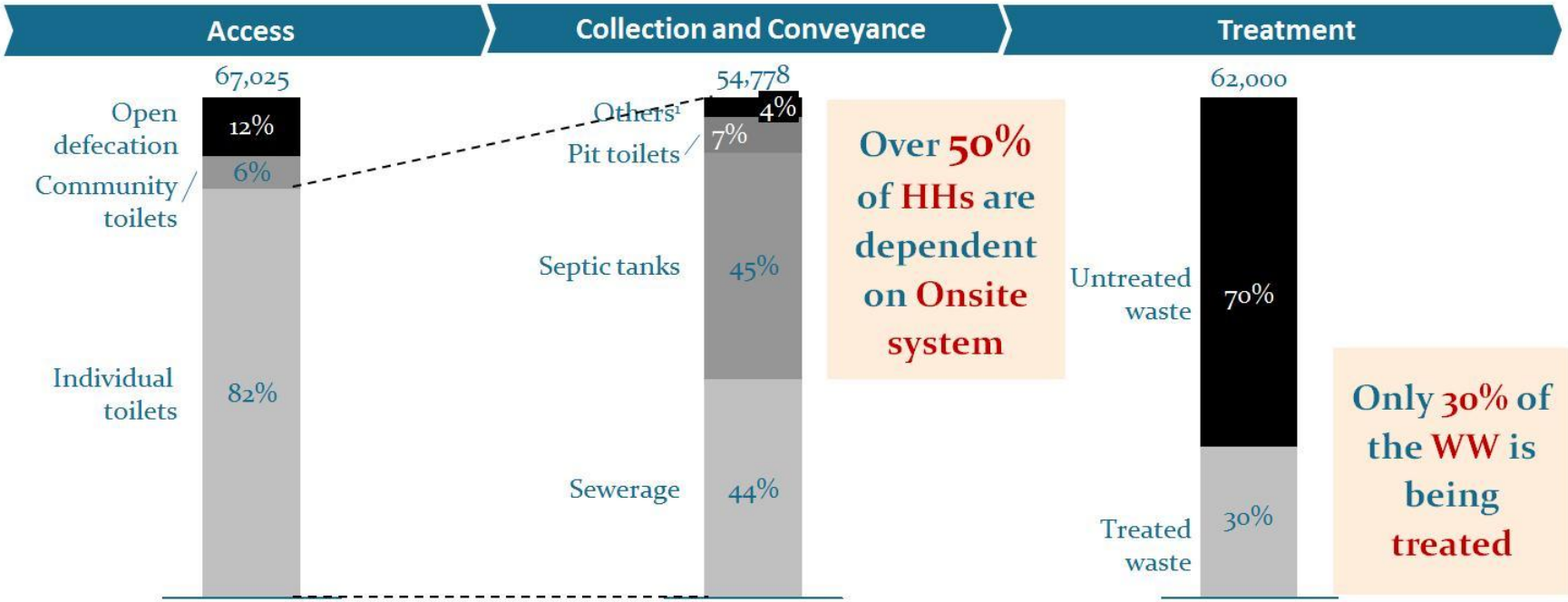
Source:

1. Census 2011 – Tables on Households Amenities
2. CEPT Analysis using information (ii) Inventorization of sewage treatment plants, Central Pollution Control Board -2015 (http://www.cpcb.nic.in/upload/NewItems/NewItem_210_Inventorization_of_Sewage_Treatment_Plant.pdf)

Sanitation situation in INDIA





Access to type of sanitation for HH in urban India *(in '000 HH)*

37 million people practice open defecation in urban India

Methods of disposal of waste by HH with personal toilets in urban India *(in '000 HH)*

28 million people with individual toilets use unsanitary methods of disposal of waste

Status of wastewater treatment in urban India[2] (MLD)

43,117 MLD untreated wastewater is discharged in water bodies or on land

Note: (1) Others includes primitive methods of C&C such as pour flush toilets-other systems, night soil disposed intro open drain and latrines serviced by humans and animals, (2) "Inventorization of sewage treatment plants " report by Central Pollution Control Board of India (CPCB), 2015

Source: Based on Census of India 2011

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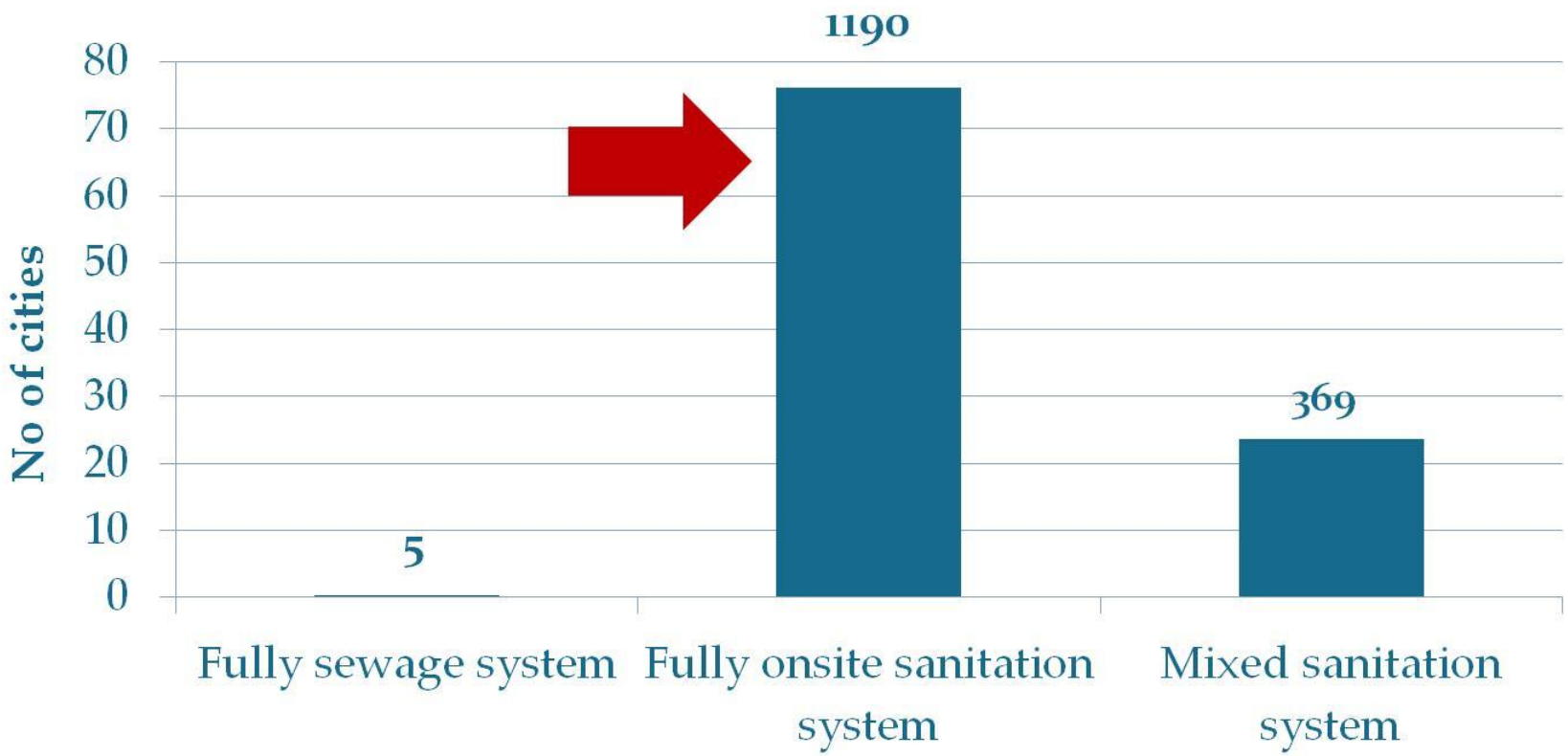
Almost all cities in Urban India dependent on onsite systems!!



76% of cities in **India** are fully dependent on **on-site sanitation systems**

24% are dependent on **mixed sanitation systems**

Source: Based on the SLB data submitted to GOI by 16 states covering 1564 cities in 2011

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Onsite sanitation and FSSM – emerging questions

38% 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?

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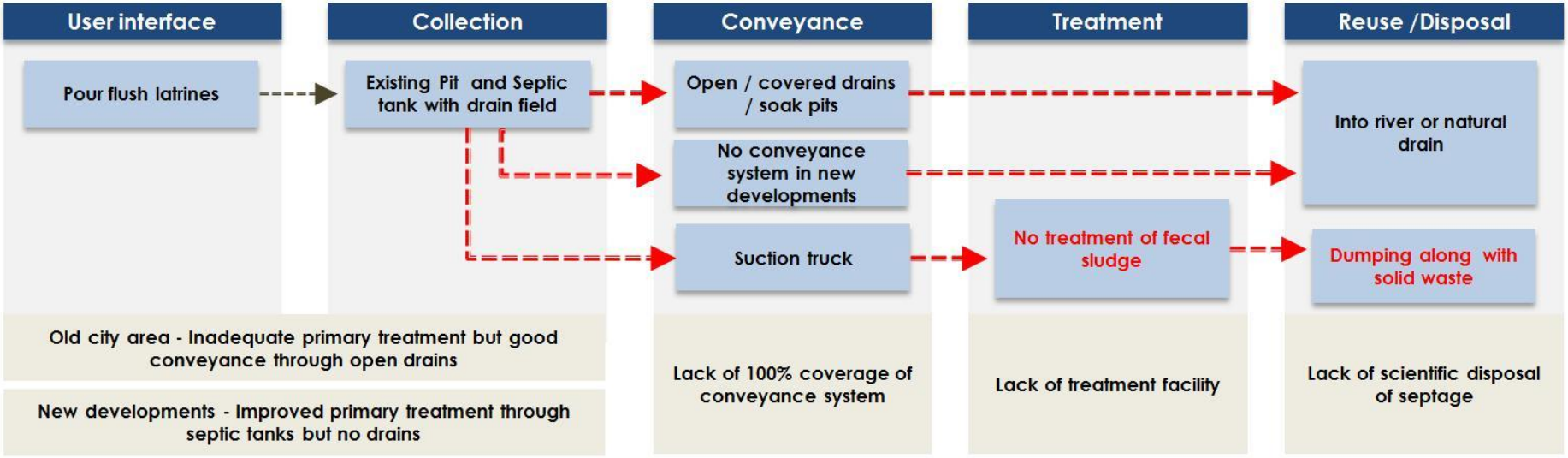
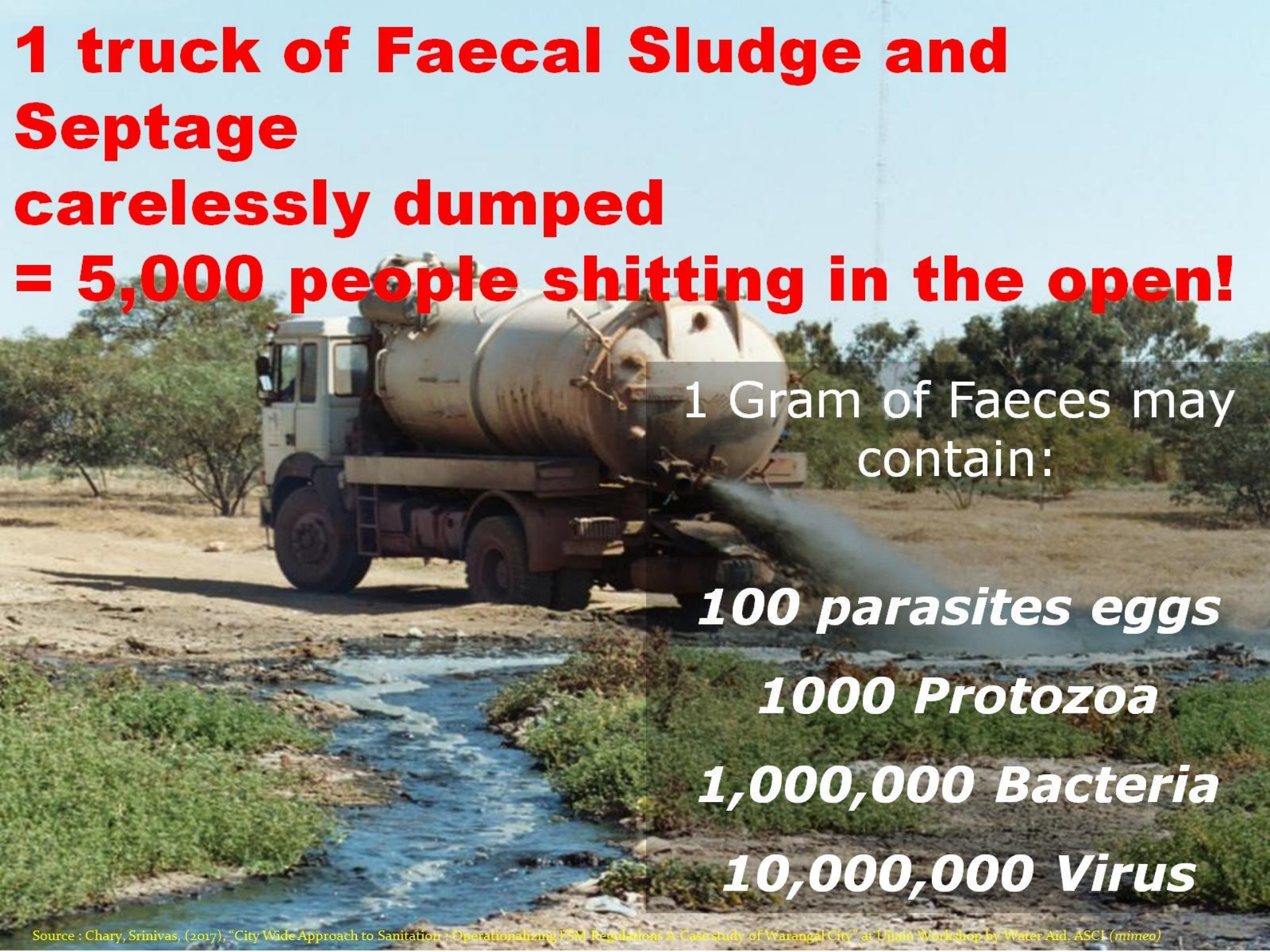
Poor septage management in Indian cities!!



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

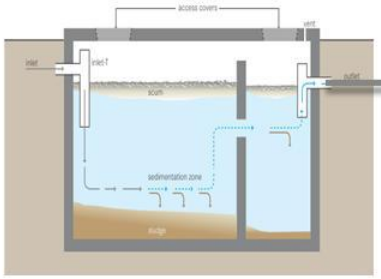


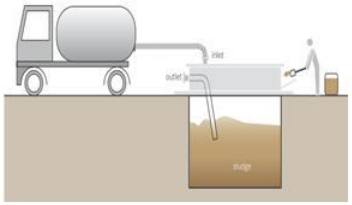
Source : Chary, Srinivas, (2017), "City Wide Approach to Sanitation : Operationalizing FSM Regulations A Case study of Warangal City" at Ujjain Workshop by Water Aid, ASCI *(mimeo)*

SAN Benchmarks: Indicators for Onsite sanitation systems (1/2)

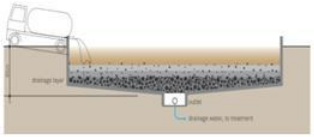
Onsite system – Septic tank with Settled Sewer/lined drain

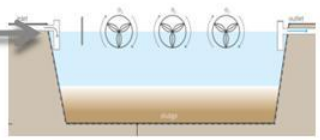
User interface	Collection	Conveyance	Treatment	Recycle & Reuse

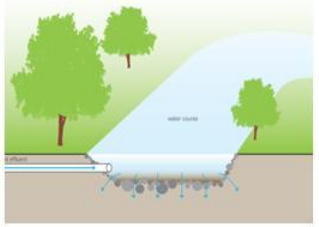




Settled sewers/drains







1. Coverage of toilets	2. Coverage of onsite sanitation system	3a. Collection efficiency of septage	4a. Adequacy of septage treatment plant	6a. Extent of reuse and recycling of treated Septage
			4b. Adequacy of effluent and grey water treatment plant	
		3b. Collection efficiency of effluents from septic tank and grey water	5a. Quality of septage treatment plant	6b. Extent of reuse and recycling of treated effluent and grey water
			5b. Quality of effluent and grey water treatment plant	

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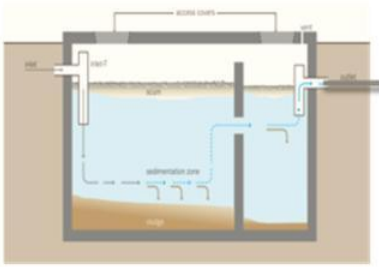
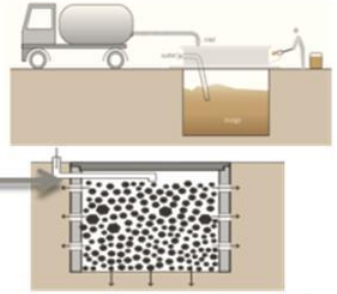
SAN Benchmarks: Indicators for Onsite sanitation systems (2/2)

Onsite system – Septic tank with Soak pit

Toilets

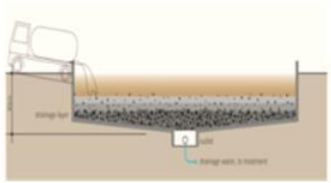


Toilets connected to septic tank

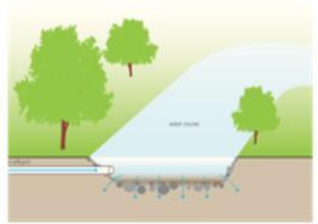


Septage collection through septic tank emptying service

Effluents from septic tank and grey water are collected and treated in soak pit



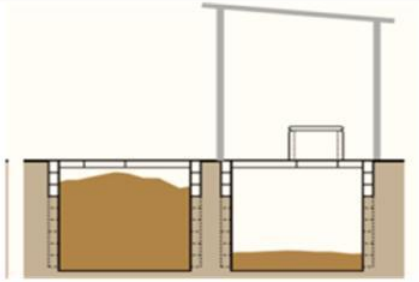
Treatment of septage



Reuse and recycling of treated septage

Onsite system –Double Pit toilet

Toilets



Toilet connected to double pit

Reuse as manure in Agriculture

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Need for Faecal Sludge and Septage Management (FSSM)

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

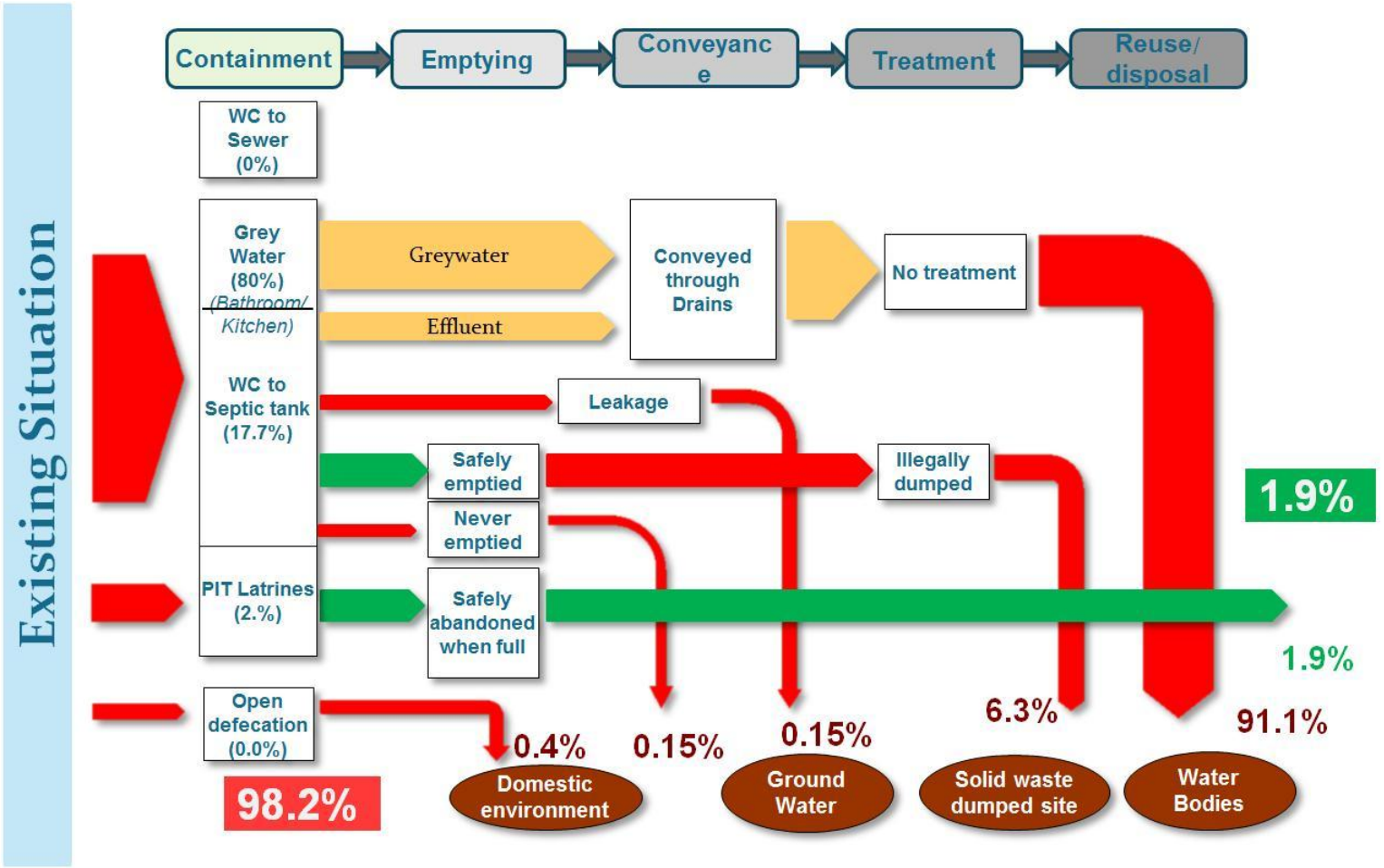
Table 3: Pollutants in the effluent of on-site treatment Systems

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

Key Challenges: Beyond toilets



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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

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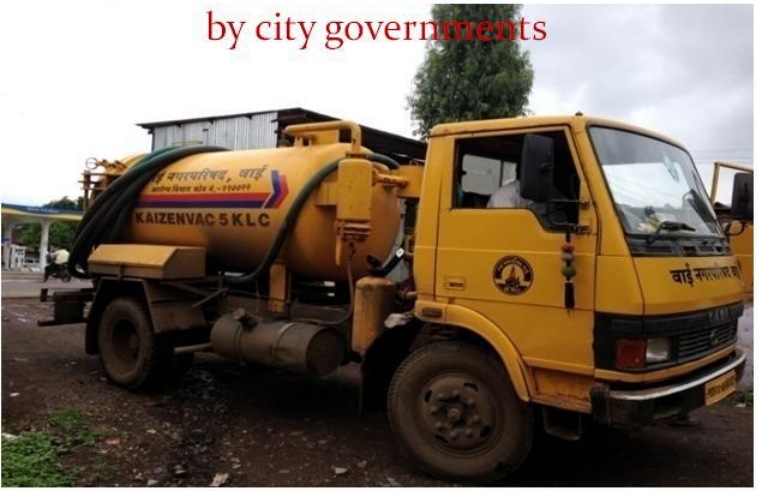
Challenges in Conveyance system

Complaint based service provision mainly by city governments



Unsafe handling of septage

Inaccessible septic tank from road for mechanised emptying

Emptying when the tank is full

Informal Private sector

Cleaning cycle greater than 8-10 years against recommended cycle of 2-3 years !!

Manual Scavenging Act

Prohibition of Employment as Manual Scavengers and their Rehabilitation Act, 2013

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.

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Challenges in Disposal system

Disposal of septage at dump site

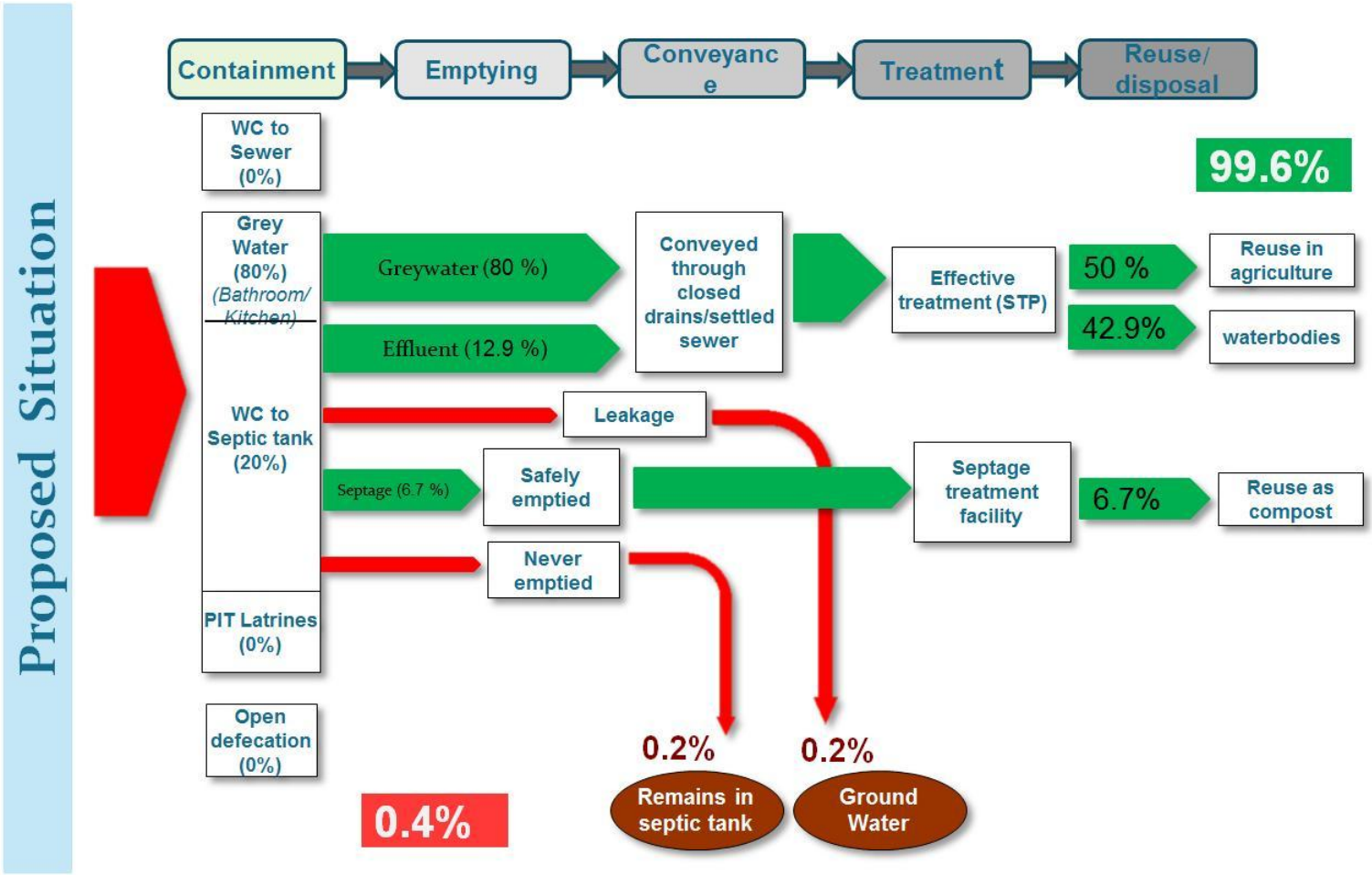
NO TREATMENT OF FAECAL SLUDGE & SEPTAGE

Disposal of septage in open land

Disposal of septage in water bodies

Source : Chary, Srinivas, (2017), "City Wide Approach to Sanitation : Operationalizing FSM Regulations A Case study of Warangal City" at Ujjain Workshop by Water Aid, ASCI (mimeo)

Moving from ODF+ to ODF++



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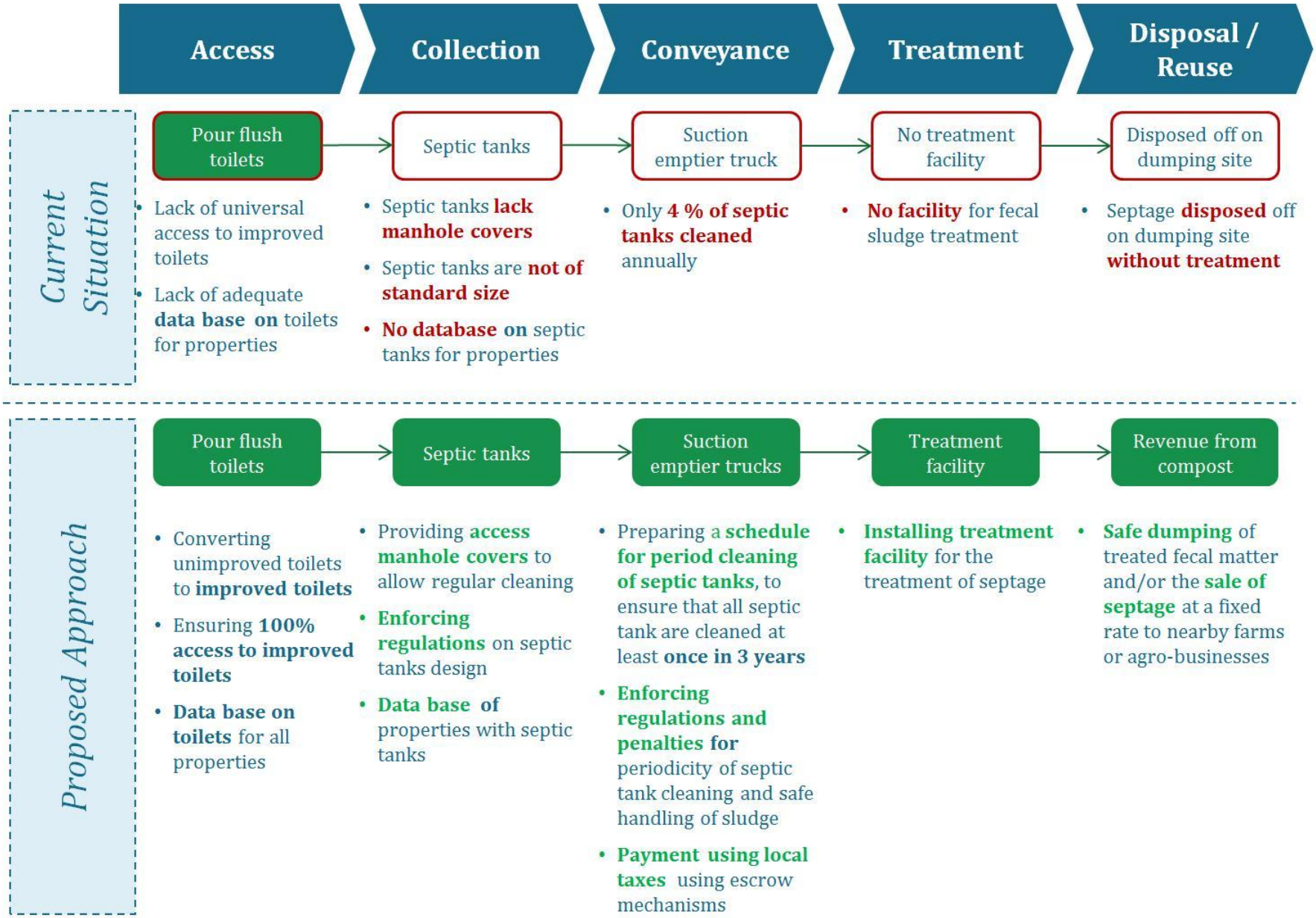
Issues tackled to achieve End-to-end FSSM solution
Moving from RED to GREEN



Online Module for performance assessment

Performance Measurement Framework for developing countries

Capacity Building of Govt. Officials

SLB cell formation at city/state level

City Ranking

National Roll-Out

Repository of 1800 city Benchmarks over 3 years

Information system improvement plan

Innovative Sanitation Financing

Integration with e-governance system

SAN Benchmarks citywide sanitation assessment framework

IFSM toolkit

SANI Tab App for Sanitation Survey

Annual Data for UWSS of 600+ cities

Performance Improvement Plans

pas performance assessment system

Support to Maharashtra State Government in implementing Swachh Maharashtra Mission

Demand Based Scheme for making cities ODF

Target Setting tool

Performance Improvement Planning (PIP) tool : SaniPlan

Tariff setting tool

Integrated faecal sludge management plan for cities

City Sanitation Plans for small and medium town

Project Directors : Prof. Meera Mehta and Prof. Dinesh Mehta | www.pas.org.in | pas@cept.ac.in

pas performance assessment system

C-WAS, CEPT University, Ahmedabad, India

Session 2

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FSSM in Indian Context

Government Programmes

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Swachh Bharat Mission (SBM) - Urban

Physical Progress under SBM

44,56,032	2,92,030	1,806
Constructions Achieved	Constructions Achieved	No. of Cities
Individual Toilets	Community & Public Toilets	Open Defecation free
100% Door to Door Waste Collection	Waste to Energy	Waste to Compost
Wards Achieved	Current Production (Mega Watt)	Production for year 2016 (Metric Ton)
51,734	88.4	1,64,891.6

ODF Status of Urban India

स्वच्छ भारत
एक कदम स्वच्छता की ओर

Toilets are being constructed but need to think beyond that . . .

Source: http://www.swachhbharaturban.in; Information retrieved as on 3.3.2018

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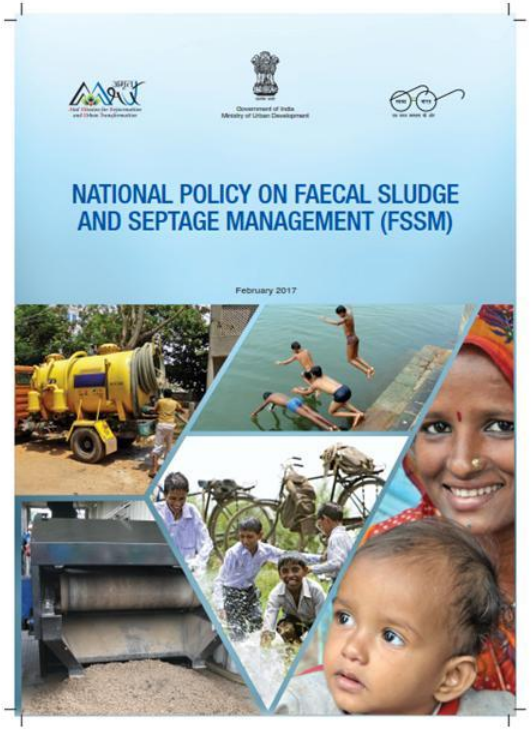
Emphasis on FSSM in National Policy

The **key objective** of the urban FSSM Policy is to **set the context, priorities, and direction** for, and to **facilitate, nationwide implementation of FSSM services** in all ULBs such that **safe and sustainable sanitation** becomes a reality for all in each and every household, street, town and city

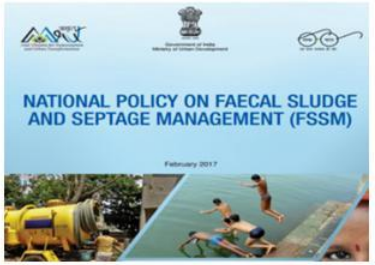
Key Milestones :

- ❑ **Leveraging FSSM to achieve 100% access to safe sanitation**
- ❑ **Achieving integrated citywide Sanitation: Mainstreaming Sanitation**
- ❑ **Sanitary and Safe disposal**
- ❑ **Awareness generation and behavior change**



Emerging recognition of FSSM in India

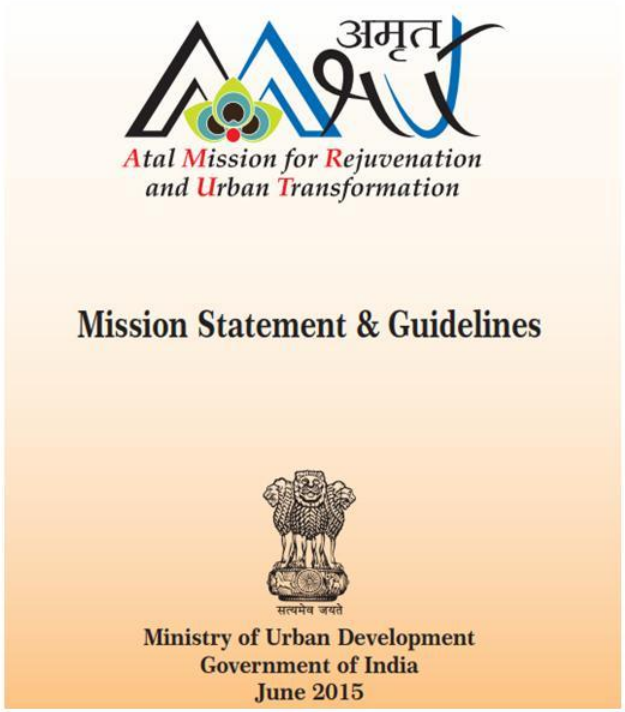
- **National Policy** and **Declaration** on **FSSM** by MoHUA, GoI
- One of the major **thrust areas** of **AMRUT**
- State governments under **Swachh Bharat Mission** moving from ODF goals to ODF+
- **Septage Management Advisory** of Government of India provides references to CPHEEO guidelines, BIS standards, and other resources for preparing SMP / FSSM plan.
- Recognition of availability of Feacal sludge Treatment Facilities in ULBs (42 Marks)



SWACHH SURVEKSHAN 2018

Emphasis on FSSM in AMRUT

- Service Delivery – Focus on infrastructure that leads to delivery of services to citizens.
- Incentives for achievement of Reforms – State to prepare FSSM policy
- Financial Allocation under AMRUT for FSSM related projects



FSSM Update under AMRUT

- Of the 36 submitted SAAPs, 26 states/UTs have explicitly identified FSSM related projects
- Five marks allocated to State FSSM policy under AMRUT reforms evaluation;
- Coordinating and tracking states for issuance of policy guidelines at the state level

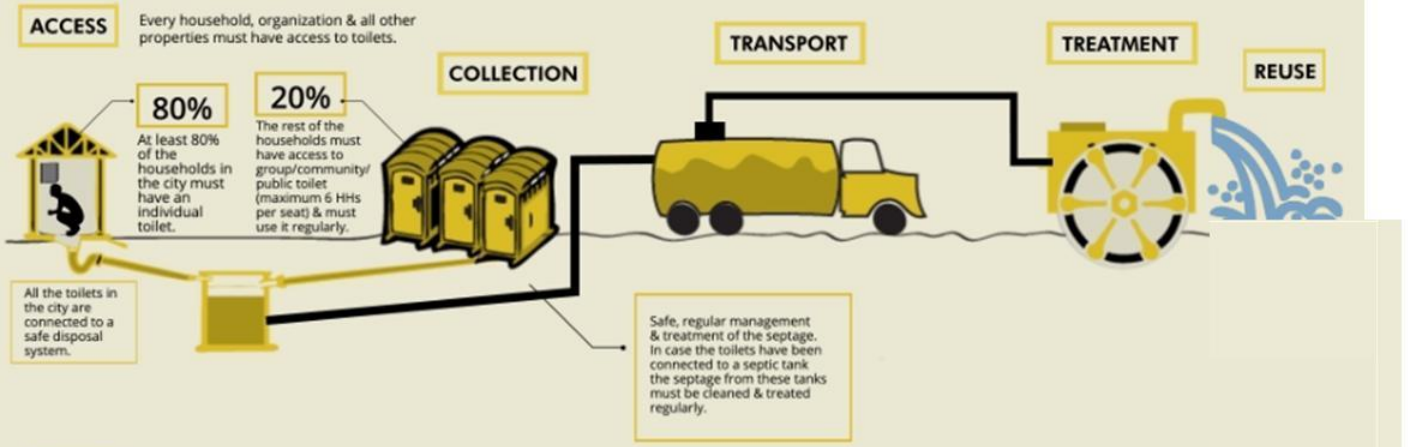
Maharashtra Experience:

Beyond toilets and ODF … to

ODF+ and ODF++

ODF

ODF +



ODF++

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FSSM options across service chain

Assess FSSM options across services

In designing a citywide FSSM service, it is important to

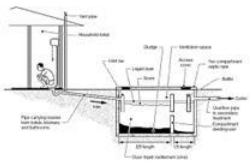
a) **assess technology options,**

b) **planning and management aspects**

c) **assess governance and finance aspects** across sanitation service chain.

Toilets and its connectivity

Septic tank



Bio-digestor toilet

Emptying services

Conventional Vacuum Tanker

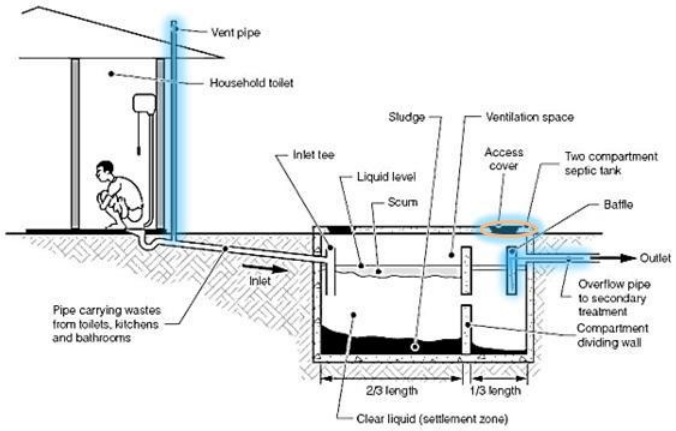
Mini-Vacuum Tanker (Vacutug)

Treatment technologies

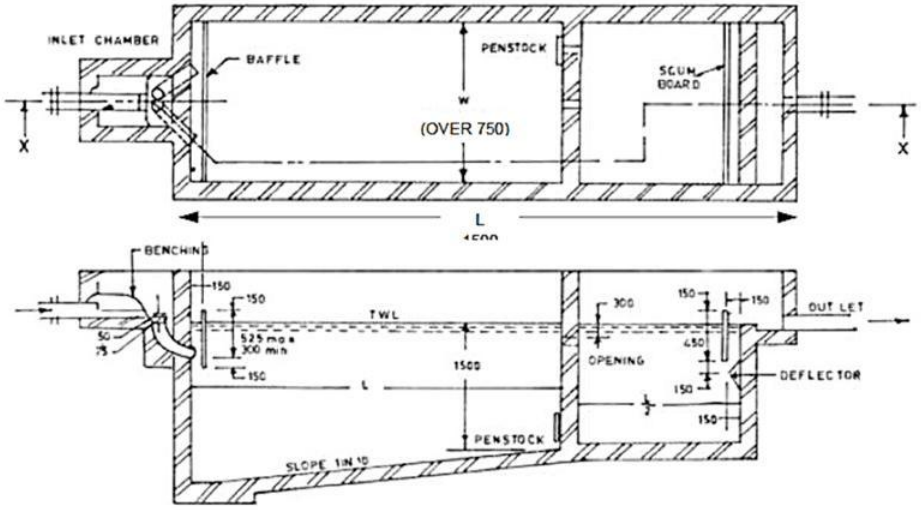
Sludge drying bed

Co-composting

Options for onsite systems: Containment (1/2)

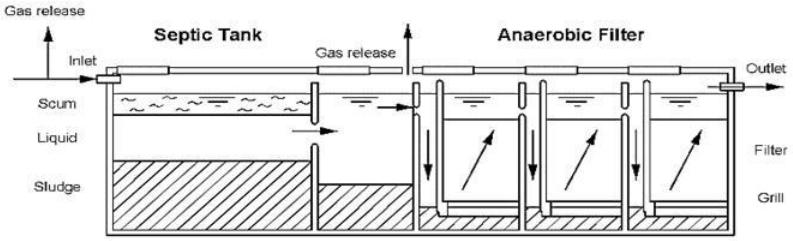


(Dimensions in mm)



Source: Manual on Sewerage and Sewage Treatment Systems, CPHEEO, 2013, Part A: Engineering: http://cpheeo.nic.in/WriteReadData/Cpheeo_Sewarage_Latest/PartA-HighResolution/Chapter%209.pdf

Toilet with Improved Septic tanks →



Applicability:
1. Where there is no sewerage network.
2. Appropriate in peri-urban settlements as they do not require any centralized infrastructure.

Soil characteristic:
1. Must be suitable for infiltration of effluent
2. Micro wetland can help through increased evapo-transpiration losses and moisture uptake

O&M Requirement:
Septage must be removed and transported off-site for treatment prior to disposal.

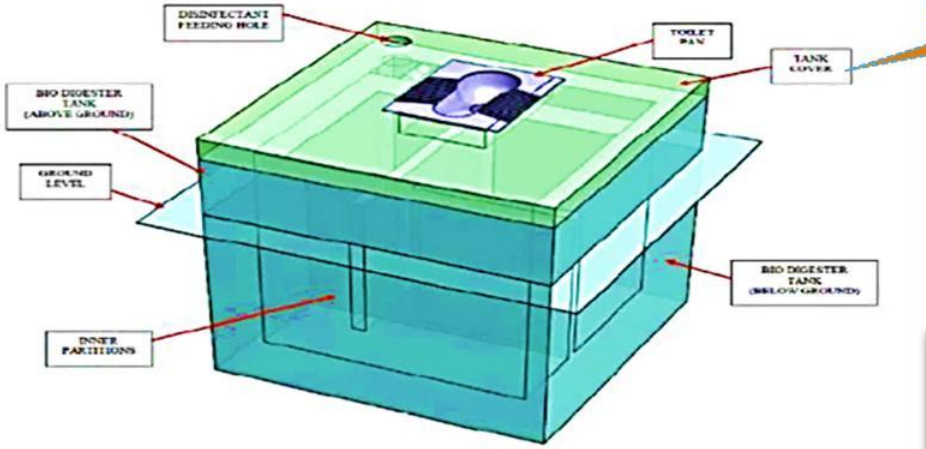
Limitation and risk:
1. High cost and space requirements for the soak away or drain field
2. Common practice is to discharge effluent directly into an open drain as leaching system is often not constructed
3. Retention time is insufficient if Septic tank receives too much wastewater
4. Commonly the householder bypasses the soak away and connects the overflow directly to a surface water drain
5. Performance monitoring of septic tanks is rarely undertaken
6. Regulation to control private desludging operators is problematic

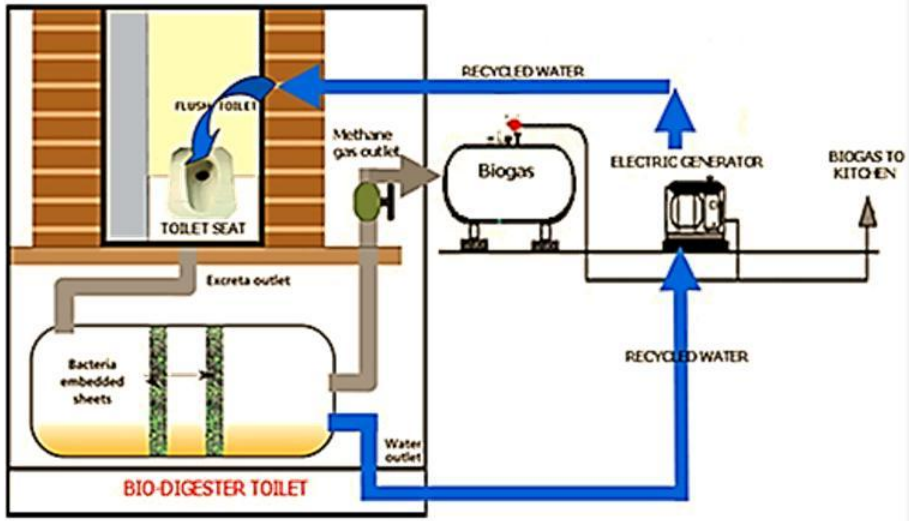
Linked technologies:
Periodic emptying

TOILET WITH SEPTIC TANKS

Options for onsite systems: Containment (2/2)

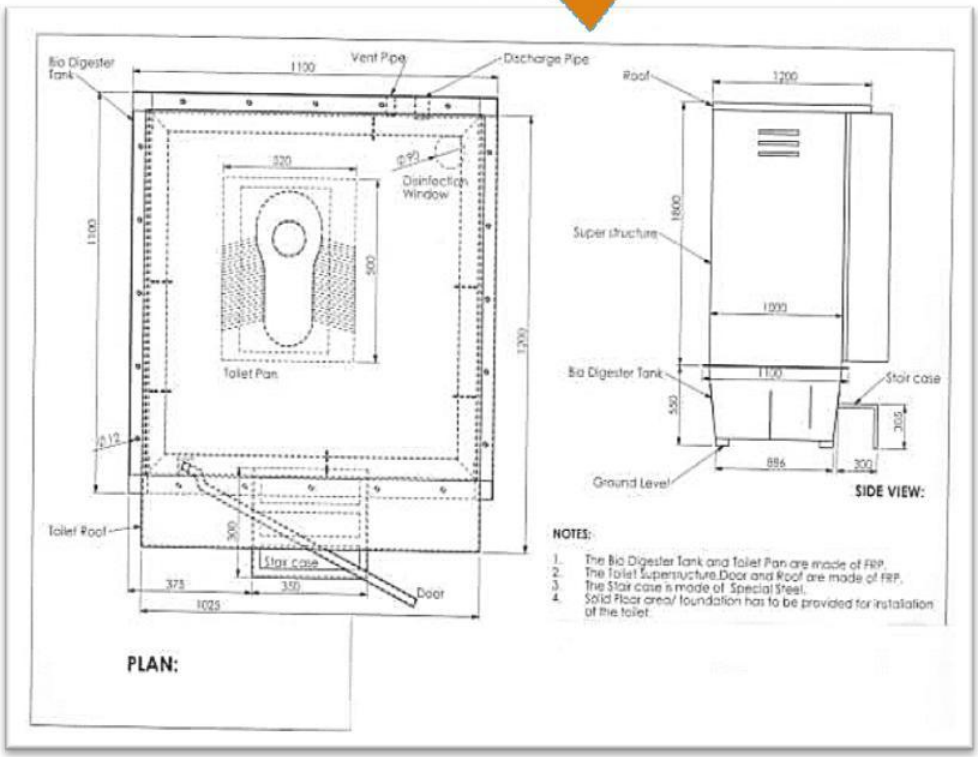
Bio-Digester toilets





Source : Guidelines for Swachh Bharat Mission – Urban (2017), Ministry of Housing and Urban Affairs (MoHUA), Government of India (GoI)

Bio-toilet

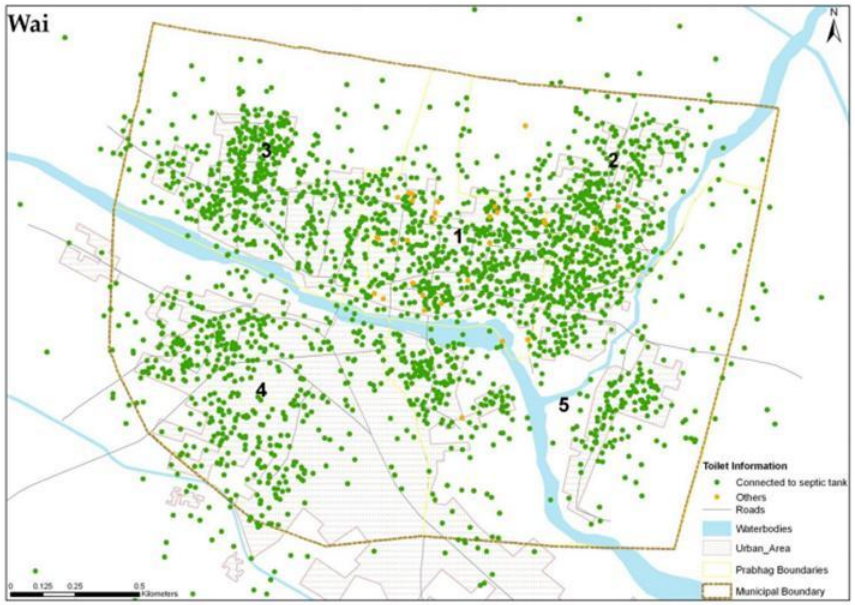


Assess containment systems at city level..

It is important to create robust database on on-site systems for effective implementation of citywide FSSM service. Assessment of containment system should capture the following aspects:

- Toilet availability and its disposal system
- Size of septic tank
- Location of septic tank in property
- Accessibility of septic tanks for emptying
- Access cover for septic tanks
- Cleaning frequency of septic tanks,
- Problems encountered while cleaning and Reasons for emptying septic tanks

Toilets connected to various systems



SANITAB is an android-based tool for household / property level survey and creating database for Onsite Sanitation Systems.

SaniTab

- CEPT has developed a generic Mobile Application - **"SaniTab"**

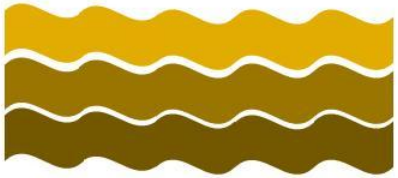
Parameters for assessing emptying and conveyance options

i. Distance of treatment site

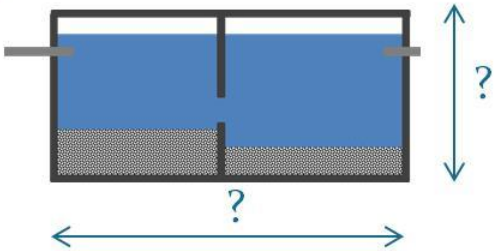
ii. Road Width

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

Options for emptying and conveyance

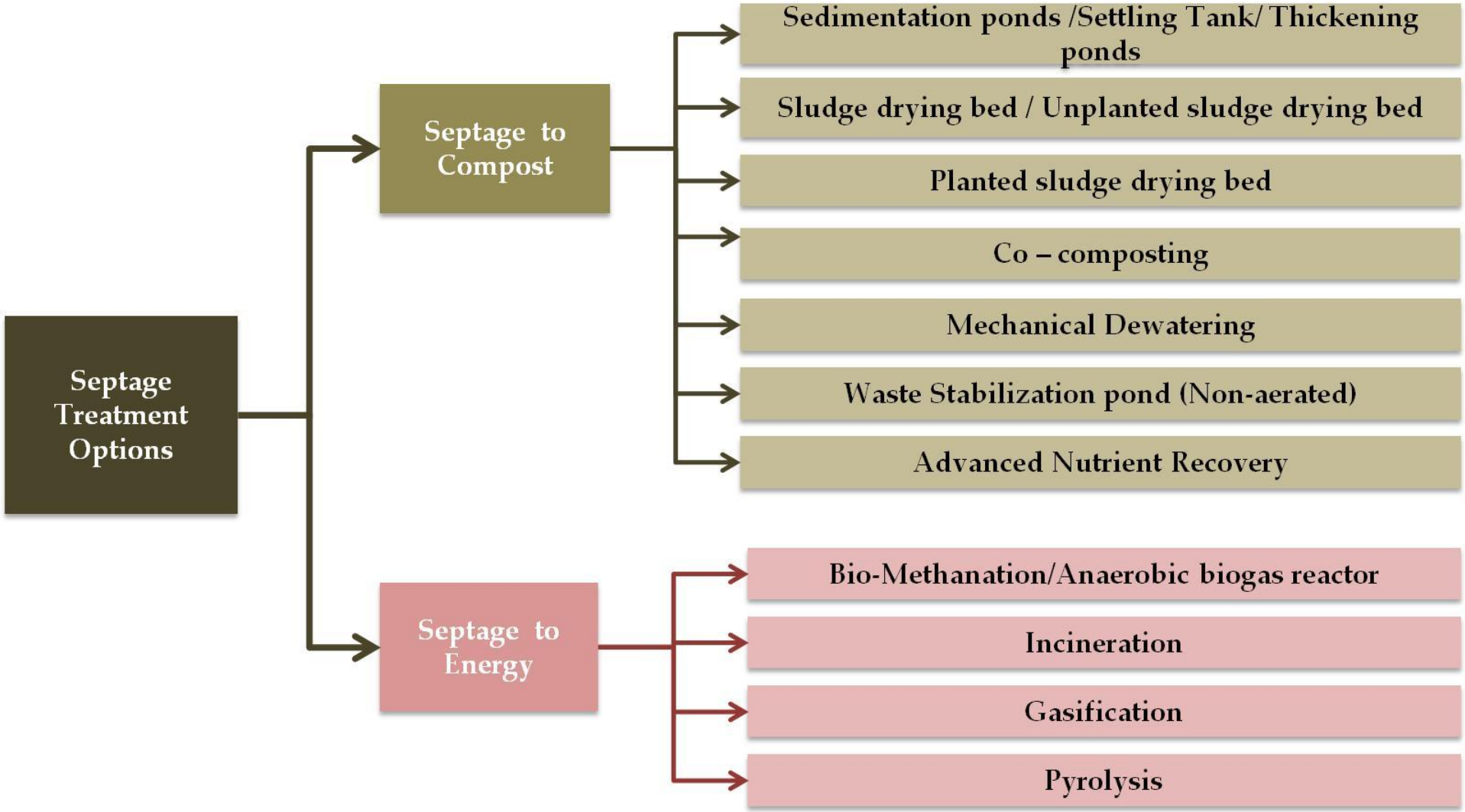
Conventional Vacuum Tanker	Mini-Vacuum Tanker (Vacutug)	Gulper
For septic tanks which have proper **access roads**, a **larger vehicle** maybe used	For septic tanks located in **narrow lanes** or those that do not have proper access roads, **smaller vehicles** maybe used	**Smaller mechanized tricycle/ 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.

Type of treatment systems . . .

Co-treatment at an Existing Sewage Treatment plant

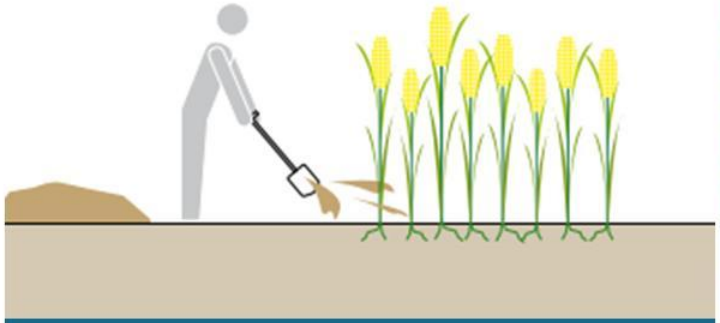
Treating at an Independent Faecal Sludge and Septage treatment plant (FSSTP)

Various Septage treatment options are available. . .



Based on literature reviews and international case studies . . .

Types of reuses / disposal systems. . .



Soil Conditioning

Surface disposal

Biogas

Backfilling Material

Parameters for selection of Treatment Technology

- **Technical performance of treatment option:**
  - Technology providing required quality output,
  - Popularity in local context, advantages and disadvantages,
  - requirement of pre-treatment or post treatment,
  - level of difficulty in handling or discharging endproduct generated, etc.
- **Site condition:** Permeability, groundwater table, soil type etc
- **Capital and operating cost**
- **Simplicity in Construction & Operation**
- **Level of mechanization** required for its operation
- Residue/End product

Governance and Finance for FSSM

It is important to understand and assess the prevailing governance and finance related provisions/regulations/ aspects to mange the citywide FSSM services.

- Prevailing policies, regulations and guidelines on FSSM
- Provisions in prevailing municipal acts related to FSSM
- Regulatory framework for treatment, disposal, and reuse of faecal matter
- Assess existing institutional arrangement and capacity to manage FSSM services at local level
- Review of existing programme, scheme for financing FSSM
- Provision of levying sanitation tax, user charges for FSSM services

Online Module for performance assessment

Performance Measurement Framework for developing countries

Capacity Building of Govt. Officials

SLB cell formation at city/state level

City Ranking

National Roll-Out

Repository of 1800 city Benchmarks over 3 years

Information system improvement plan

Innovative Sanitation Financing

Integration with e-governance system

SAN Benchmarks citywide sanitation assessment framework

IFSM toolkit

SANI Tab App for Sanitation Survey

Annual Data for UWSS of 600+ cities

Performance Improvement Plans

pas performance assessment system

Support to Maharashtra State Government in implementing Swachh Maharashtra Mission

Demand Based Scheme for making cities ODF

Target Setting tool

Performance Improvement Planning (PIP) tool : SaniPlan

Tariff setting tool

Integrated faecal sludge management plan for cities

City Sanitation Plans for small and medium town

Project Directors : Prof. Meera Mehta and Prof. Dinesh Mehta | www.pas.org.in | pas@cept.ac.in

pas performance assessment system

C-WAS, CEPT University, Ahmedabad, India

Session 3

CEPT UNIVERSITY


FSSM COURSE IN OTHER UNIVERSITIES

Need for capacity building of young professionals !

FSSM at least a 100 years behind conventional wastewater management in terms of research and knowledge

City governments lack professionals with technical capacity in FSM

Source: CAWST website

FSM courses in Universities/Institutions

Proposed University courses

MSc. Course on Faecal Sludge Management (one-year)	M. Plan course on Non-Network Sanitation (2-year)	M.Sc course in Sanitation Science and Engineering (2 year)	M. Tech course on Non-Network Sanitation (2-year)

Online course

Online course: Introduction to Faecal Sludge management, Dr. Linda Strande (Eawag) (Five week)	Online course: Faecal Sludge Management, e-Learning Alliance – BMGF, UNESCO-IHE, and partners (18 weeks)	Online course: Planning & Design of Sanitation Systems and Technologies (5 weeks)

Degree Programmes

MSc. Course on Faecal Sludge Management (one-year)

Target Group

- Sanitation professionals,
- Municipal assemblies
- Government Ministries
- Consulting Firms

Participants should have **Bachelors degree** in Civil, sanitary, environment engineering or degree in relevant fields (public health, medicine, urban planning, finances, administration, economics)

Course syllabus

- Introduction to sanitation
- Sanitation systems and services
- Governance
- Finances
- Project management
- Public health
- Introduction to sanitation
- WASH in emergencies
- Basic /advanced lab training
- Project Management
- Technology
- Behaviour change
- Social science methods
- Group Work

 Source: https://www.un-ihe.org/sites/default/files/ihe_delft_etg_2018_vs271117.pdf ; pg -17

Initial Outline for FSSM course at IHE-DELFT

Module	Title
1	Sanitation Systems / Service Delivery Chain
2	Public Health and Hygiene
3	Technology of Sanitation Systems
4	Sanitation Governance
5	Financing and Public/Private Sector Models for Sanitation
6	Strategic Communications and Behaviour Change
7	Project Planning, Implementation, Monitoring and Evaluation
8	Emergency and Slum Sanitation
9	Groupwork
x	

Outlines of these modules were developed by over 40 professionals who met at IHE-DELFT in January 2017 for four days

Final course structure at IHE-DELFT for April 2018

Minimum Education: BSc degree in Relevant field: sanitary, civil, chemical, agricultural, environmental engineering, chemistry, ecology, biology, natural science, environmental science, agriculture, environmental economics;

Grades: Grade Point Average (GPA) of at least B/B+ (US System) or a classification of at least 2nd upper (UK system).

Working experience in an environment related to the specialization is an asset.

Courses:
Preparatory Courses on Chemistry and Microbiology

The following topics are part of the programme:

Introduction to sanitation (1 week)
Sanitation systems and services (2)
Public health (2)
Technology (6)
Governance (3)
Finances (1)
Behaviour change (2)
Leadership (1)
Project management (1)
WASH in emergencies (2)
Group work (1)
Basic laboratory training (1)
Advanced laboratory training (2), or
Social science methods (2)

CEPT UNIVERSITY

MURP – Infrastructure with specialization in Non-Network Sanitation (Two-year)

1 MURP Programme: An overview

- 1. Local Area Planning
- 2. Comprehensive urban development
- 3. Specialization projects
- 4. Dissertation

2 Summer Winter Schools

3 Placements

Learning through

- Research
- Lectures
- Field visits
- Studios
- SWS

CEPT UNIVERSITY

MURP – Infrastructure with specialization in Non-Network Sanitation (Two-year)

Semester 1
Local Area Planning

- Introduction to Sanitation
- Elements of Urban and Regional Planning
- Analytical tools and Techniques
- **Studio:** Area planning

1. Analytical tools and Techniques

Basic statistical analysis tools and techniques.
Data collection methods, presentation of data, use of software, statistical analyses, and drawing meaningful conclusions.

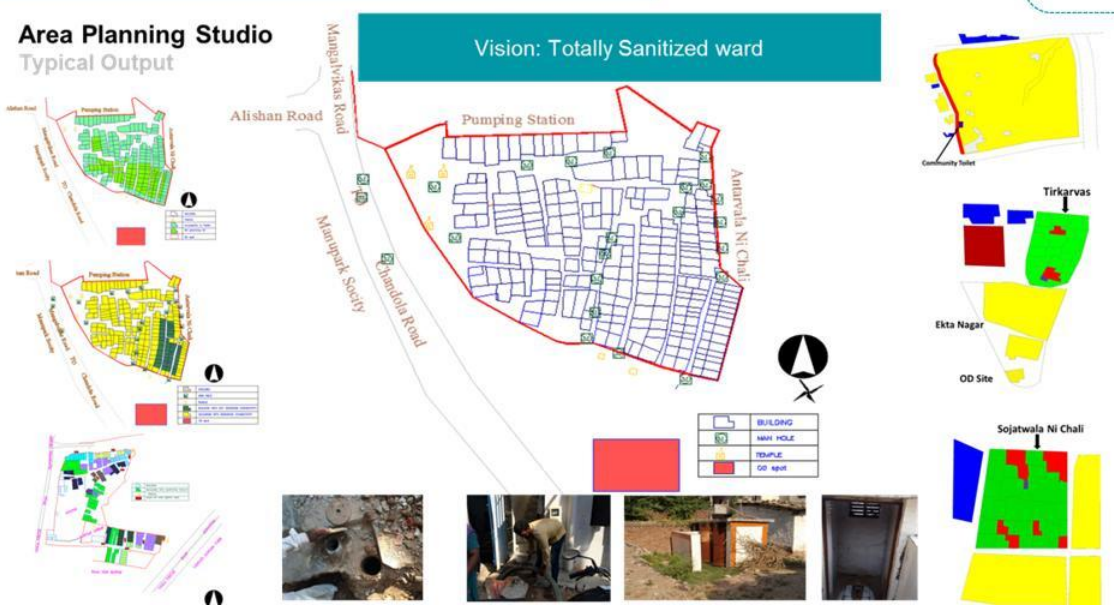
Comprehensive understanding of GIS – techniques and applications

Basic social research methods

2. Elements of Urban and Regional Planning

Urban Planning theories
Central place theory, multiple nuclei model, concentric zone theory
Acts, Policies and Programs
Town Planning scheme, 74th Amendment ACT, Municipal ACTS and bye-laws, JNNURM., SBM, AMRUT etc.

Area Planning Studio
Typical Output



Faculty of Planning

CEPT UNIVERSITY

MURP – Infrastructure with specialization in Non-Network Sanitation (Two-year)

Semester 2
Comprehensive Urban Development

- Urban and Regional Economics
- Urban sanitation systems and services
- Elective: Public health
- **Studio**: City Sanitation Plan

Urban Sanitation systems and services

Sanitation infrastructure sub systems

Urban sanitation, concepts of service chains, ACTs and policies, service levels, different types of sanitation systems, components of onsite sanitation system

Elective: Public Health

Core and Visiting Faculty

Public health and sanitation interlinkages, Behaviour changes, community hygiene studies,

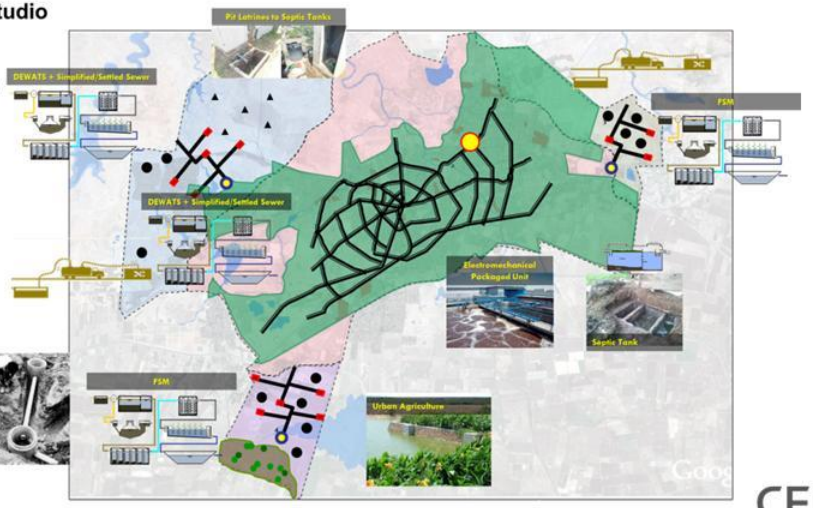
City Sanitation Plan

- Review of Existing Scenario
- Service level
- Demand projections, Demand gap analyses etc.
- Future status of low cost sanitation and sewerage, onsite sanitation ,
- Location of treatment plant, process of treatment, effluent disposal system, land requirement,
- Sanitation zones,
- Feasibility Analysis on financial, economical and social safeguards,
- Institutional review and arrangement of finances,
- Phasing of investment
- Recommendations: Long term, short term and immediate

Infrastructure Studio

Typical Output

City Sanitation Plan



CEPT UNIVERSITY

MURP – Infrastructure with specialization in Non-Network Sanitation (Two-year)

Semester 3
Specialization project studio

- Financing and Governance for Urban Development
- Urban Water and Sanitation planning and financing
- Sanitation Technology
- Studio: FSM Plan

Urban Water and Sanitation planning and financing

Urban water and sanitation

Assessment and planning, emerging guidelines and best practice case study, stakeholders assessment, Financial Assessment, Potential of Private Sector, Institutional, Regulatory and Policy Framework

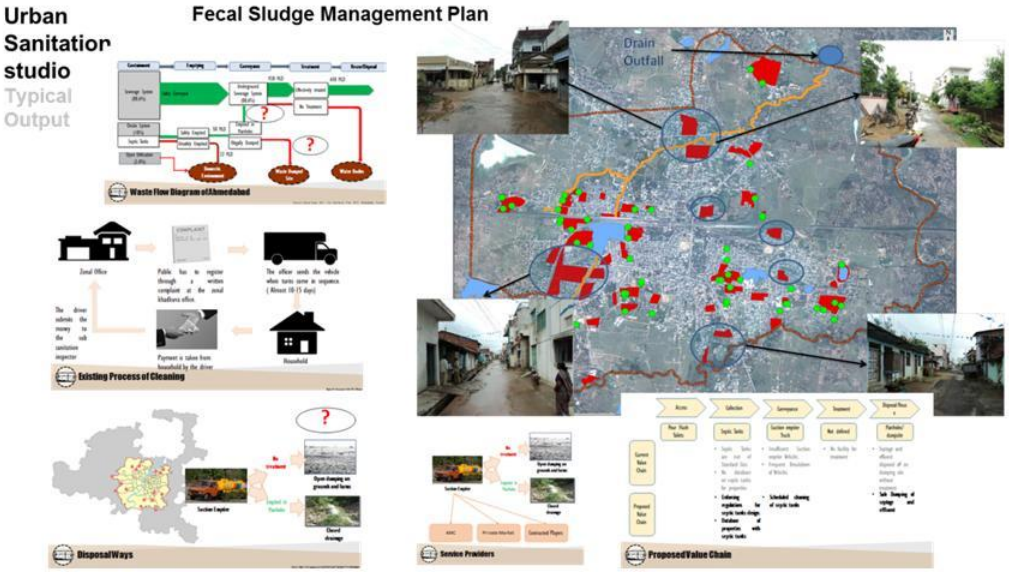
Project Appraisal and Finance

Project cycle, Financial, Technical, economic, social and environmental Appraisals Cash flow projections, NPV, internal rate of return, key financial ratios, risk and sensitivity analysis with applications

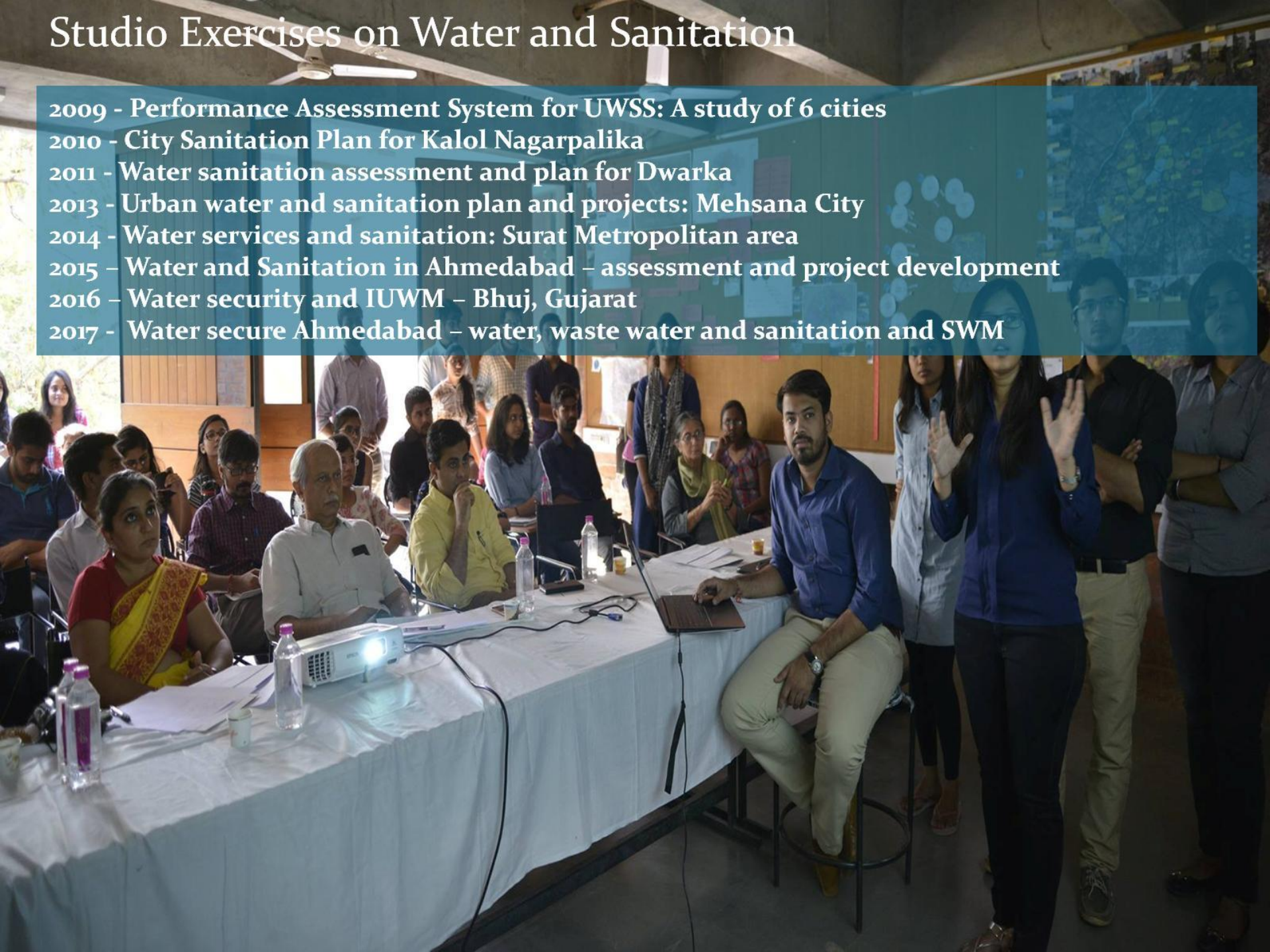
Sanitation Technology

- Technology options for toilets and septic tanks
- Technology options for Collection and conveyance of sanitation systems
- Treatment Technology option
- Co-treatment options
- New transformative technologies

Urban Sanitation studio
Typical Output



Studio Exercises on Water and Sanitation



2009 - Performance Assessment System for UWSS: A study of 6 cities
2010 - City Sanitation Plan for Kalol Nagarpalika
2011 - Water sanitation assessment and plan for Dwarka
2013 - Urban water and sanitation plan and projects: Mehsana City
2014 - Water services and sanitation: Surat Metropolitan area
2015 – Water and Sanitation in Ahmedabad – assessment and project development
2016 – Water security and IUWM – Bhuj, Gujarat
2017 - Water secure Ahmedabad – water, waste water and sanitation and SWM

MURP – Infrastructure with specialization in Non-Network Sanitation (Two-year)

Semester 4
Dissertation

Summer Winter School

Dissertation Topics

Decentralized waste systems
Water-Sanitation: Service Delivery & Performance
Waste management
Onsite sanitation,
Fecal Sludge Management
Open defecation, community toilets, Public Toilets, non-network sanitation,

Online Courses

Global Faecal Sludge Management, E-Learning Alliance BMGF, UNESCO-IHE, and partners (18 weeks/ 4 months)

GLOBAL FAECAL SLUDGE MANAGEMENT e-LEARNING ALLIANCE

UNESCO-IHE Institute for Water Education | Swiss Federal Instutute of Aquatic Science and Technology | Asian Institute of Technology | Centre for Science and Environment | International Institute for Water and Environmental Engineering | Bangladesh University of Engineering and Technology | University of KwaZulu-Natal | Bill & Melinda Gates Foundation

Participants

- Professionals working in FSM fields
- Engineers/Architects/ Planners, NGO
- Academicians
- Consultants
- Students

Delivery Methods

- Video Lectures/ PPT
- Case studies
- Reading materials
- Assignment
- Evaluation tests (for each module)
- Telephonic Viva Test

Commitment
8 hours per weeks

Course Fees
Rs. 10000

Course Website: http://www.cseindia.org/fsm/onlinecourse.html

Global Faecal Sludge Management, E-Learning Alliance BMGF, UNESCO-IHE, and partners (18 weeks/ 4 months)

Sub-course 1: Introduction to Faecal Sludge Management

- General Introduction to Faecal Sludge Management,
- Introduction to the Course
- The Global Situation
- JMP report on SDG baseline, 2017
- Sandec Training module on FSM

Sub-course 2: Technological Fundaments of Faecal Sludge Management

- Faecal Sludge Quantifi cation, Characterisation and Treatment Objectives
- Treatment Mechanisms
- Containment system (FSM case study in Delhi, SBM guideline, Septage management practitioners guide, On-Site Sanitation (Containment) System presentation
- Characterization of FS (case study eThewini Municipality video, Video lecture
- Treatment mechanisms (Nonthburi case study, LaDePa case study)

Sub-course 3: Collection and Transport of Faecal Sludge

- Case study video on collection and transportation by David Robbins, Engagement of traditional pit-emptiers in satkhira Municipality
- Investigation into Methods of Pit Latrine Emptying
- Septage Interative toolkit Dumaguete (calculation excel model for FS volume, number of trucks required, collection cost, operating expenses, revenue, projections)

Global Faecal Sludge Management, E-Learning Alliance BMGF, UNESCO-IHE, and partners (18 weeks/ 4 months)

Sub-course 4: Faecal Sludge Treatment Technologies

- Technologies for Faecal Sludge Treatment,
- Settling-Thickening,
- Drying Beds,
- Co-Treatment with Faecal Sludge,
- Enduse of Treatment Products

Sub-course 5: Management in Faecal Sludge Management

- Operation and Maintenance,
- Institutional Frameworks,
- Financial Transfers and Responsibility

Sub-course 6: Non-technical Aspects of Faecal Sludge Management

Assessment of the Initial Situation,

- Planning of Integrated FSM Systems

Assignment

- Case study on FSM : Questions and answer (Delhi Case study)
- Design of FSSM in City X (to design a sludge drying bed with subsequent co-composting of the dried sludge ; to design an experimental set-up for a novel drying system; to describe the institutional framework in your city, to design how you would set up the research to carry out a so-called shit flow diagram (SFD) in your city; to carry out an interview with an FSM stakeholder in your city)

- **Telephonic Viva**

Online course: Introduction to Faecal Sludge management, Dr. Linda Strande (Eawag) (Five week)

École Polytechnique Fédérale d...

Introduction to Faecal Sludge Management

Taught by: Dr. Linda Strande, Group leader

Management of Excreta, Wastewater and Sludge (MEWS), Eawag-Sandec

coursera education for everyone

eawag aquatic research

Participants

Background in environmental or civil engineering, urban planning or geography

Delivery Methods

- Video Lectures/ PPT
- Case studies
- Reading materials
- Evaluation tests (for each module)

Commitment
4-6 hours per weeks

Course Fees
Free

Course Website: https://www.coursera.org/learn/faecalsludge

Online course: Introduction to Faecal Sludge management, Dr. Linda Strande (Eawag) (Five week)

1. **An introduction to faecal sludge management**
   - Global Situation,
   - What is FSM,
   - What is FSM service chain

2. **Overview of fundamentals for design and selection of treatment technologies**
   - Treatment mechanisms,
   - Resource recovery,
   - Market-driven approach to select treatment products,
   - Characterization and Quantification of FSM,
   - Collection and transport technologies

3. **Treatment technologies for faecal sludge**
   - Settling-thickening tanks,
   - Drying beds,
   - Co-composting,
   - Co-treatment with wastewater,
   - Effluent treatment technologies,
   - Design of treatment plant

4. **Integrated approach to faecal sludge management**
   - Assessment of initial situation,
   - stakeholder analysis and engagement,
   - Institutional frameworks,
   - finances and business models,
   - O&M of treatment plant, Engineering Economics

5. **Innovations in faecal sludge management**
   - Case studies

FSM Eawag Book

Chapter 1 : The Global Situation
Chapter 2: Faecal Sludge Quantification, Characterisation and Treatment Objectives
Chapter 3: Treatment Mechanisms
Chapter 4: Methods and Means for Collection and Transport of Faecal Sludge
Chapter 5: Overview of Treatment Technologies
Chapter 6: Settling-Thickening Tanks
Chapter 7: Unplanted Drying Bed
Chapter 8: Planted Drying Bed
Chapter 9: Co-treatment of Faecal Sludge in Municipal Wastewater Treatment Plants
Chapter 10: Enduse of Treatment Products
Chapter 11: Operation, Maintenance and Monitoring of Faecal Sludge Treatment Plant
Chapter 12: Institutional Frameworks for Faecal Sludge Management
Chapter 13: Financial Transfers and Responsibility in Faecal Sludge Management Chains
Chapter 14: Assessment of the Initial Situation
Chapter 15: Stakeholder Analysis
Chapter 16: Stakeholder Engagement
Chapter 17: Planning Integrated Faecal Sludge Management Systems
Chapter 18: The Way Forward

Online course: Planning & Design of Sanitation Systems and Technologies (5 weeks)

École Polytechnique Fédérale d...

Planning & Design of Sanitation Systems and Technologies

Taught by: Christoph Lüthi, Dr.

Sanitation, Water and Solid Waste for Development / Eawag

coursera education for everyone

eawag aquatic research

Participants

Background in environmental or civil engineering, urban planning or geography

Delivery Methods

- Video Lectures/ PPT
- Case studies
- Reading materials
- Evaluation tests (for each module)

Commitment
4-6 hours per weeks

Course Fees
Free

Course Website: https://www.coursera.org/learn/sanitation

Planning & Design of Sanitation Systems and Technologies (5 weeks)

1. **Introduction to sanitation planning & systems approach**
   - City Sanitation Planning
   - City-wide sanitation diagnostic tools and planning framework
   - Local level sanitation planning
   - SDG baselines-Sanitation services
2. **Sanitation systems & technologies**
   - Sanitation systems and technologies
   - User interface, Collection and storage, conveyance options
   - Hands-on challenge: Draw your sanitation reality
3. **Sanitation systems & technologies**
   - Anaerobic/aerobic technologies, sludge treatment,
   - Reuse and disposal
   - Effluent and black water transport
4. **Urban sanitation solutions - Case studies**
   - Erdos, China- an eco-town pilot project
   - Indonesia - How Sanitation in Indonesia was transformed
   - Lusaka, Zambia - Sanitation service delivery through faecal sludge management
5. **Urban sanitation tools**
   - Shit Flow Diagrams
   - Decision-making Support for Urban Sanitation
   - Introduction to Sanitation Safety Planning
   - Tools for Institutional and Political Economy Analysis for Sanitation Solutions
   - Tools for Institutional and Political Economy Analysis for Sanitation Solutions
   - Behavior Change in Urban Sanitation
   - Institutional and financial options for sanitation service delivery
   - Results-based financing to deliver urban sanitation services
   - Working within the project cycle

Other Courses: FSM as a Subject

Coordinators

Dr. M.M. Ghangrekar
IIT Kharagpur

Civil Engineering: Wastewater management

NPTEL E-LEARNING COURSES FROM THE IITs & IISc

Onsite sanitation as One Subject in a Course

Participants

Post graduate students of Environmental Engineering or other equivalent degree programme.

Delivery Methods

- Lecture notes
- Reading materials

Commitment

42 hours

Onsite sanitation (1 hours)

Course Fees

Free

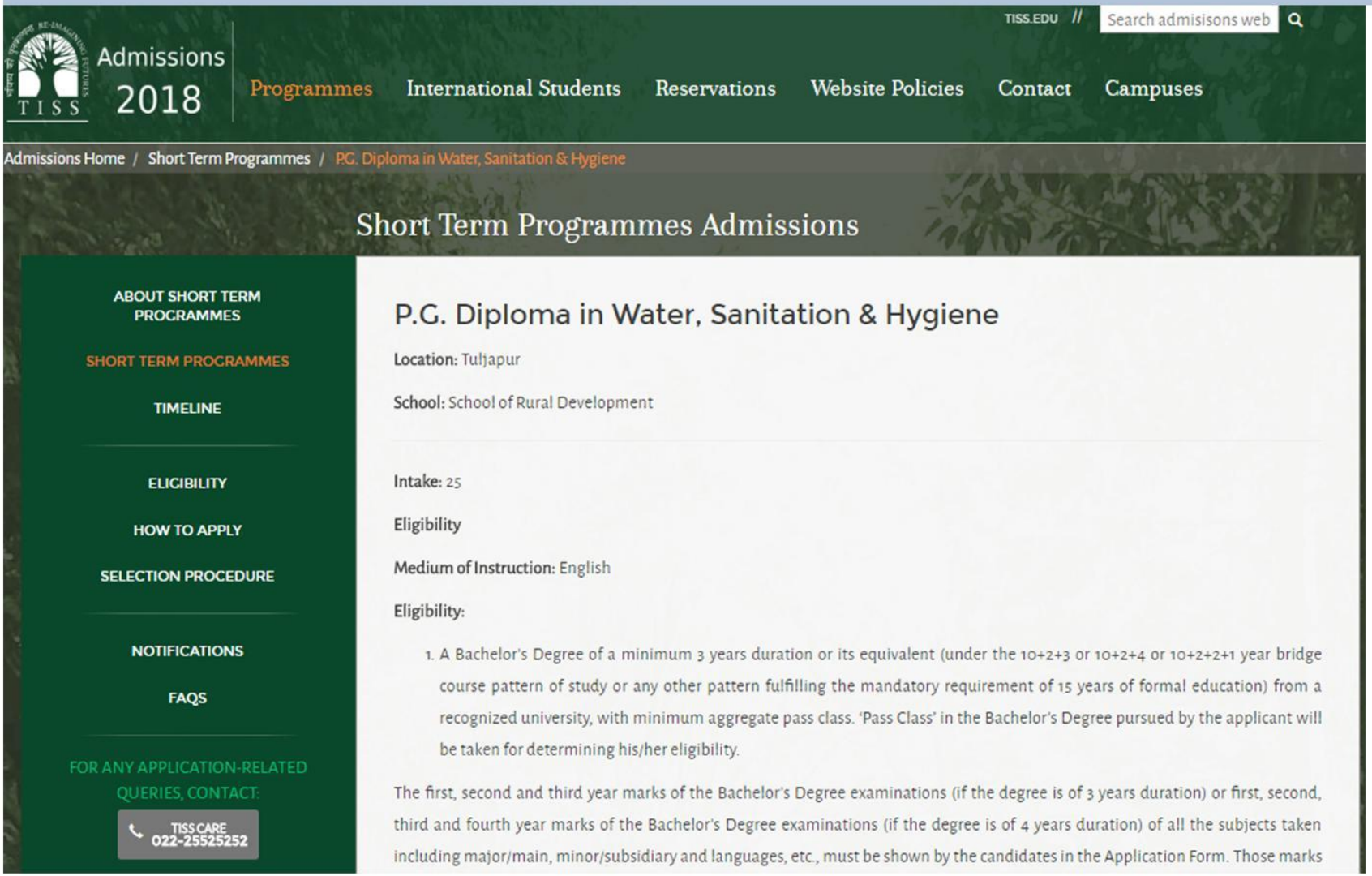
Subject Outline:

- Design of Septic tanks
- Design of Effluent units from Septic tanks
- Sludge management
- Design of Drying beds

Course Website: http://nptel.ac.in/syllabus/105105048/

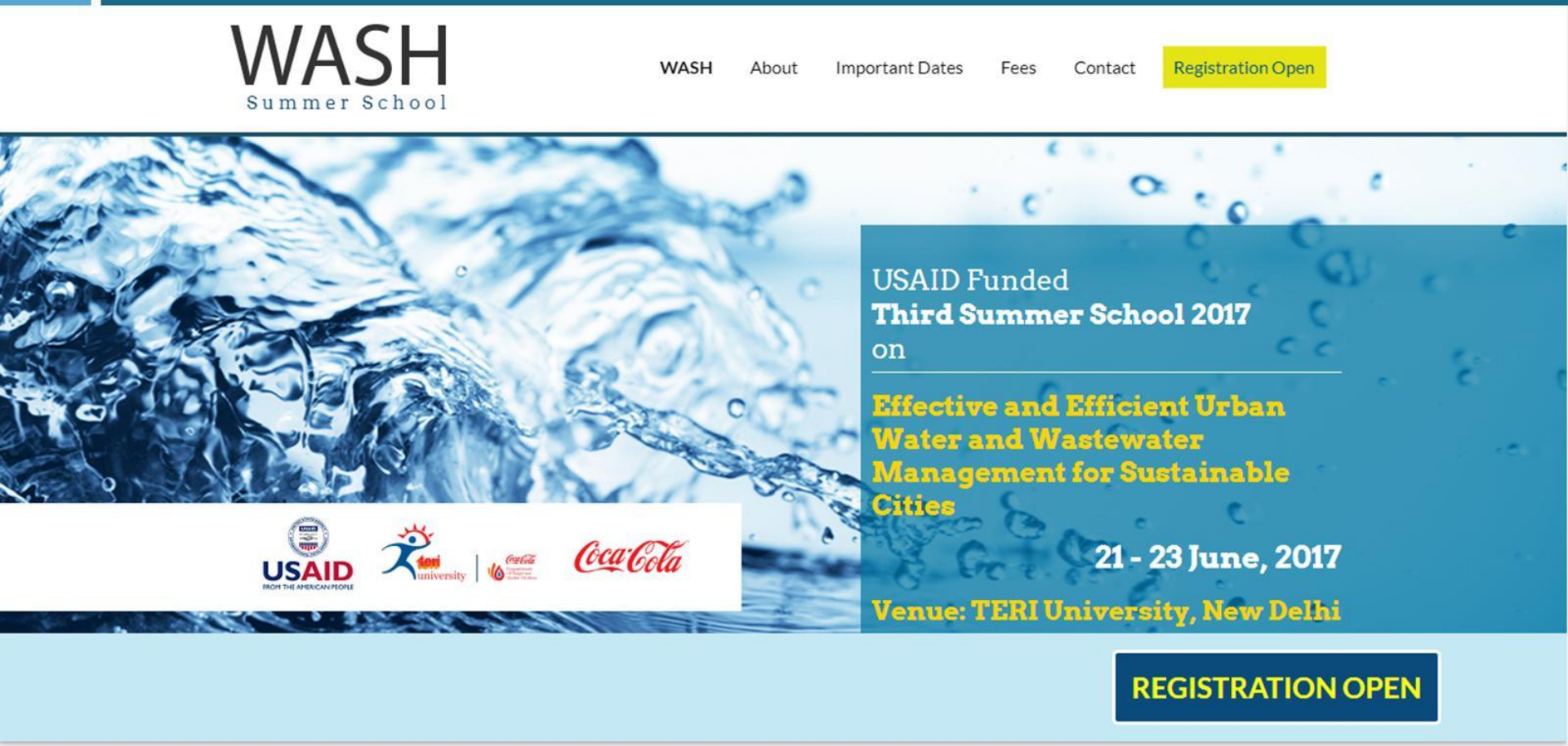
Tata Institute of Social Science (TISS)

P.G. Diploma course in WASH (2-year)



CEPT UNIVERSITY

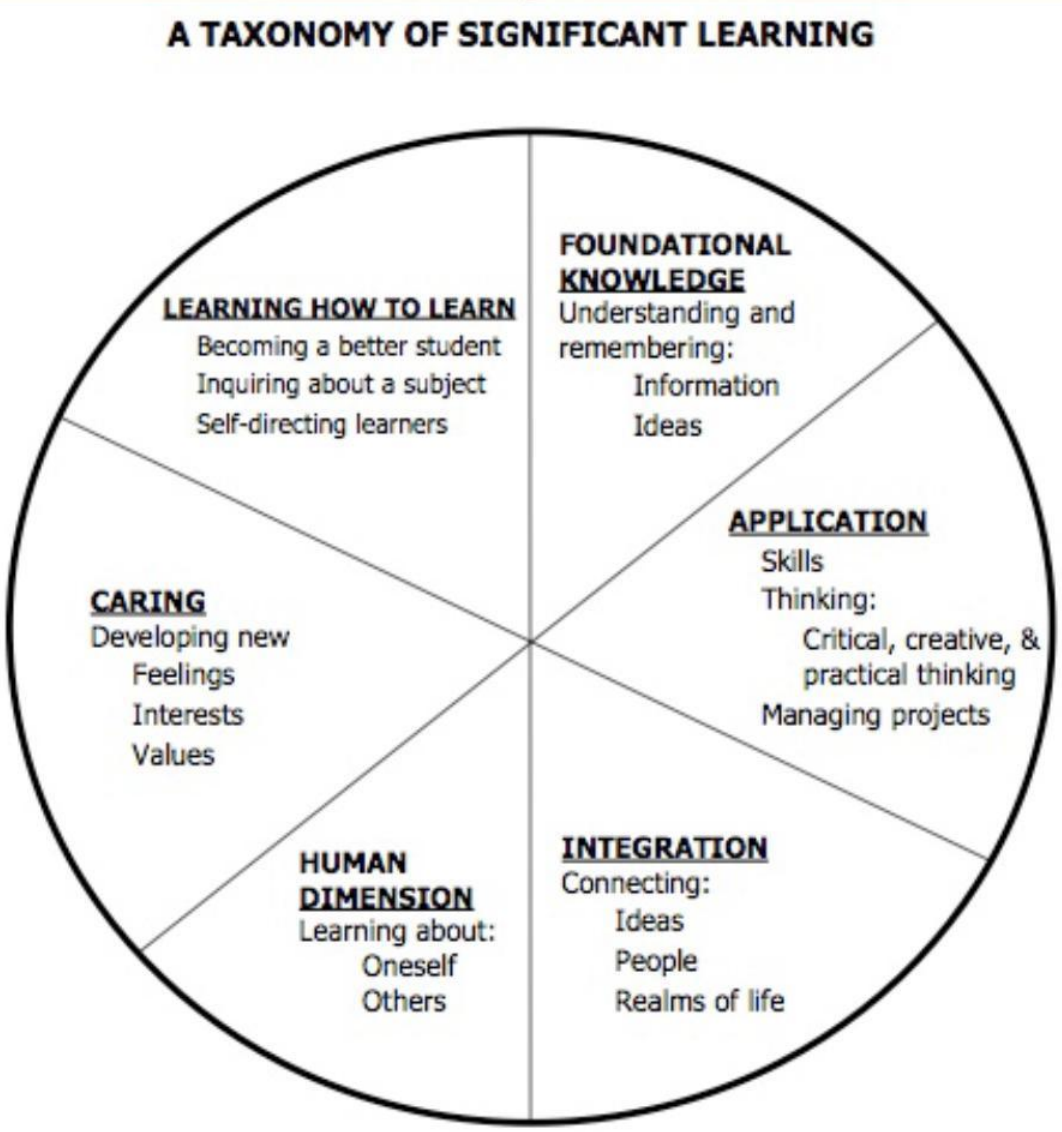
TERI University



Source: http://www.teriuniversity.ac.in/wash-summer-school/

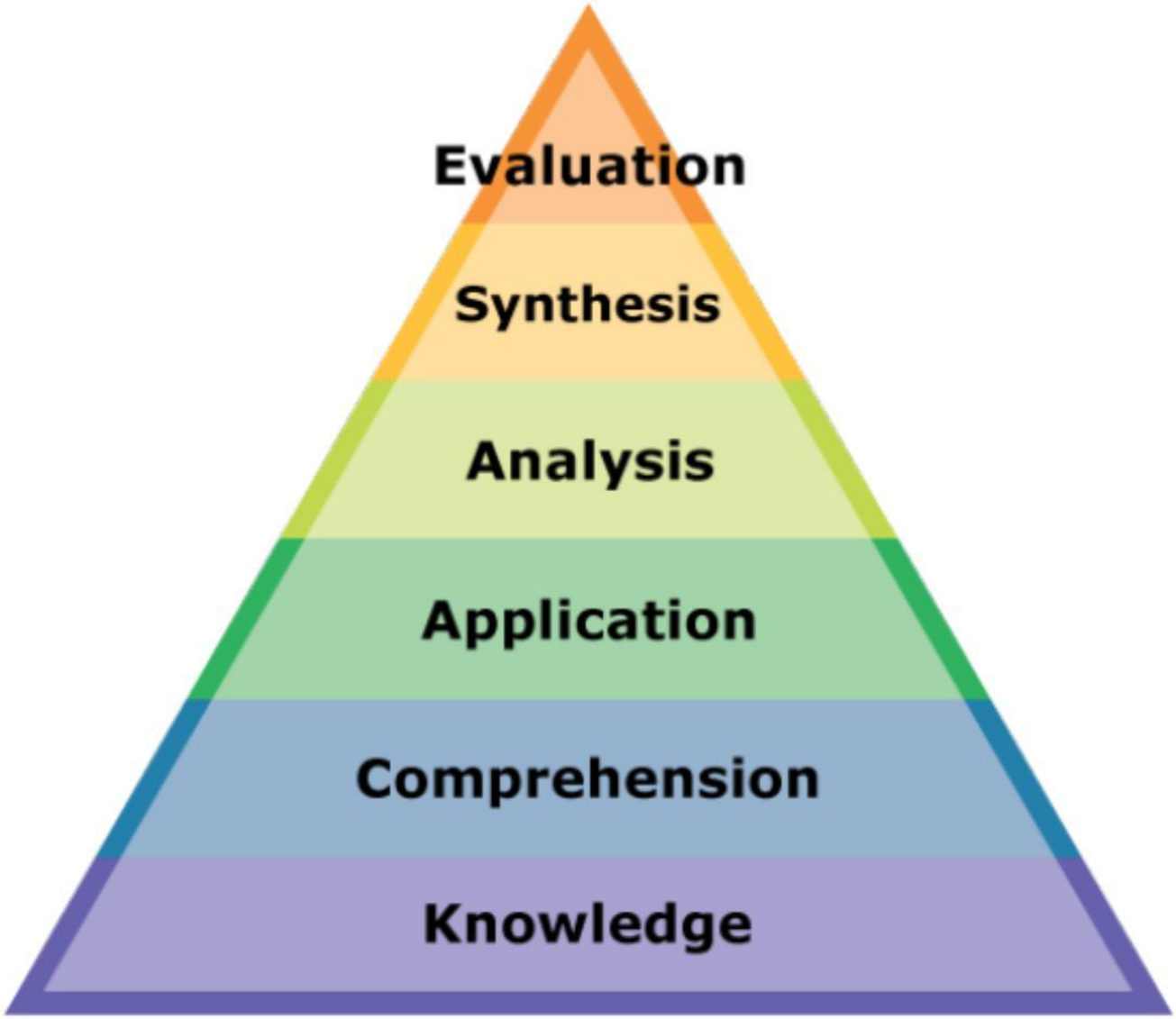
Designing a Course/Programme

Taxonomy of Significant Learning



Fink, L. Dee (2013), Creating significant learning experiences. An integrated approach to designing college courses. San Francisco: Jossey-Bass, p. 35.

Hierarchy of learning objectives



dr. Cornelia de Haan, DIDACTIC TOOLKIT for coordinators and lecturers of IHE DELFT's modules; Bureau Coaching Hoger Onderwijs, June 2017

CEPT UNIVERSITY

What do we want to impart?

A learning objective states what students should be able to do after the learning took place, which they are not able to do now. It makes clear what the intended outcome of the learning is.

Taxonomy of learning

- **Knowledge**: students have the ability to recall facts;
- **Comprehension**: students demonstrate they are able to explain facts and ideas;
- **Application**: students are able to use knowledge in a new situation and to solve problems applying the acquired knowledge;
- **Analysis:** students have the ability to break down a piece of information into its constituent parts by identifying motives or causes, they can draw inferences and find evidence to support conclusions;
- **Synthesis**: students are able to create something new, combining elements to form a whole and to propose alternative solutions;
- **Evaluation**: students are able to judge the value or the validity of information or ideas and thus present of defend their opinion.

Bloom B (2011) A Guide to teaching and learning practices (7th edition,) Center for teaching and learning, The Florida State University.

A possible learning objective

"Students are able to use knowledge of fecal sludge and septage management in a given situation and solve problems applying the acquired knowledge"

Learning Objectives

After successful learning, students will be able to:

- ✓ Understand and explain the role of Fecal sludge and septage management in the sanitation sector and its relation to public health and environment;
- ✓ Understand the basics of FSSM and its service chain;
- ✓ Comprehend and Evaluate suitable technical options available across the service chain and design of treatment technologies
- ✓ Analyze institutional, financial arrangement and private sector involvement in FSSM,
- ✓ Evaluate current practices and research through case studies and field visits

Fecal Sludge and Septage Management Course

For Whom?

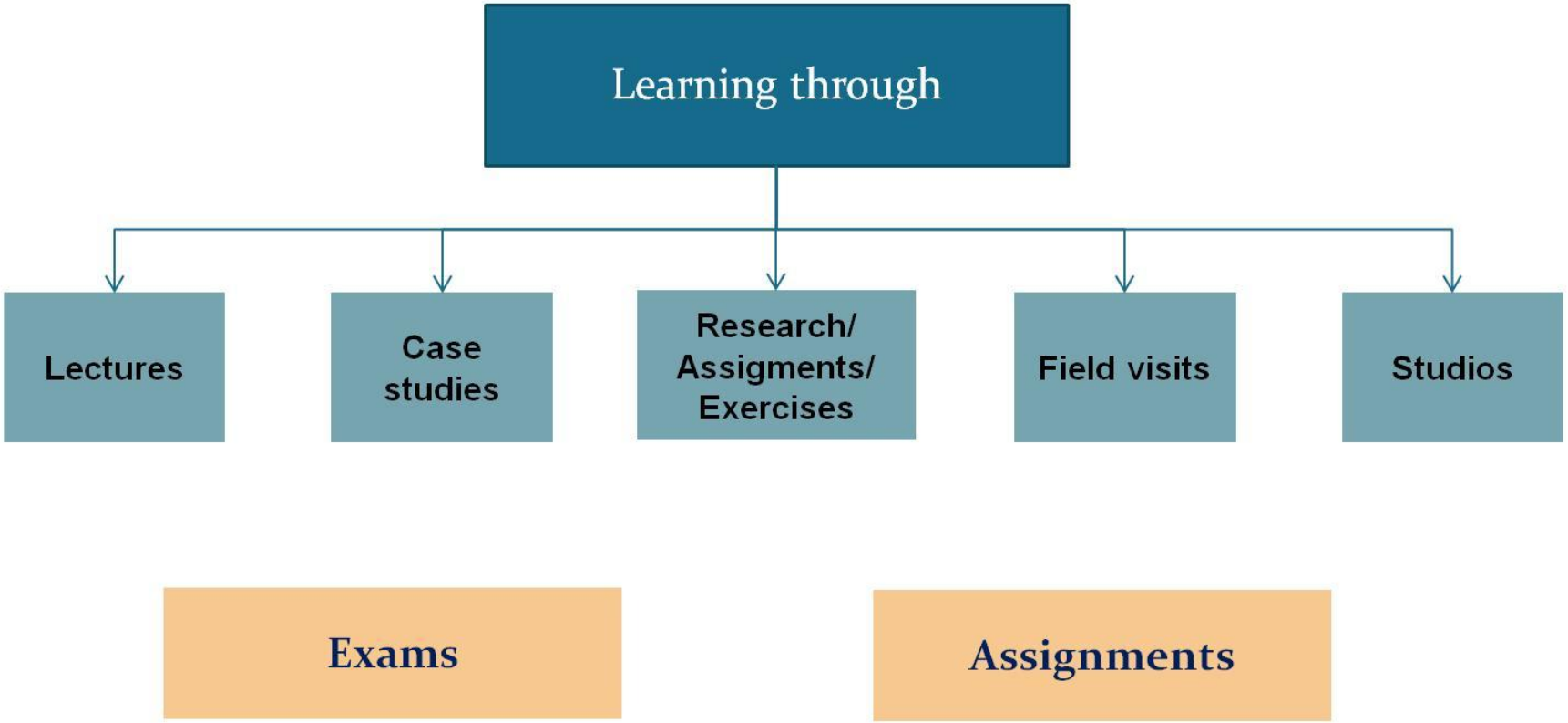
Courses can be designed to be included in any of the following disciplines

- Civil engineering
- Waste water engineering
- Environmental engineering
- Sanitary engineering
- Urban Planning
- Urban Management

There can be a variety of approached for FSSM coursese

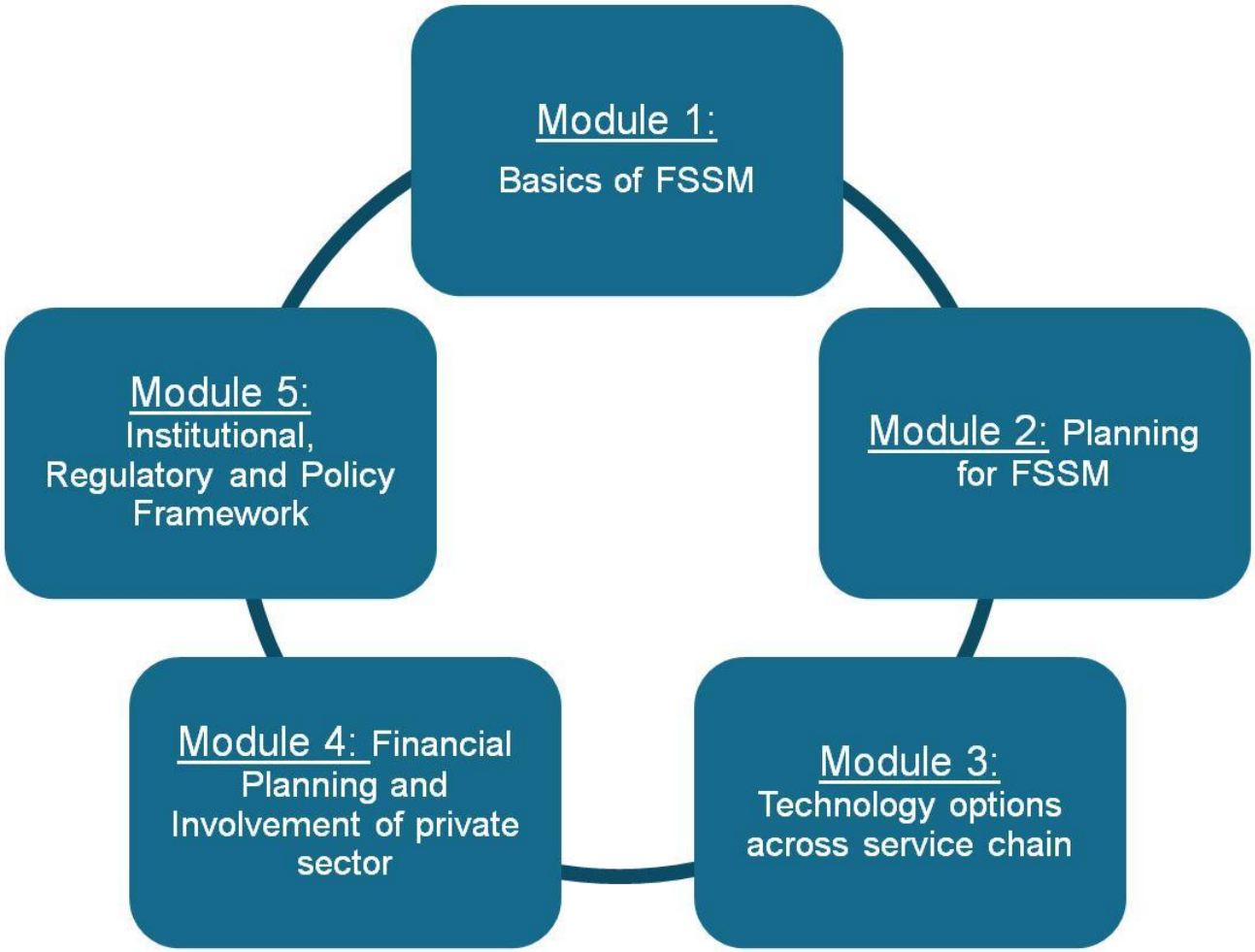
- Semester subject course
- Elective course
- Full 2-year Masters degree Programme
- Short Online course
- Professional Certificate course
- Workshop/ studio

Delivery Methods



IFSM toolkit of CEPT

Course Outline



Module-1 Basics of FSSM

- ✓ This module will give an overview of sanitation situation in India and highlight the need of FSSM.
- ✓ Recognition of FSSM under the current SBM programme and new national policy on FSSM will also be discussed in detail.
- ✓ The course will familiarize students with the basic terminology and concepts of the onsite sanitation system.
- ✓ Sanitation service chain for FSSM will be explained in detailed across Access> Collection> conveyance>treatment >reuse.

Topics:

1. Introduction

- Need for FSSM- referencing SDG, SBM, FSSM national policy
- Overview of Sanitation situation in India

2. Fundamentals of FSSM

- General Introduction of FSSM
- Introduction to Sanitation Service Chain
- Characterization of FSM: Physical. Chemical, biological

Module-2 Planning for FSSM

- ✓ This module will focus on citywide assessment and planning for FSSM.
- ✓ It will give a brief overview on how and what information needs to be collected to assess existing FSSM services in the city.
- ✓ The students will be explained different processes involved in planning FSSM and will be familiarized with different tools available for it.

Topics:

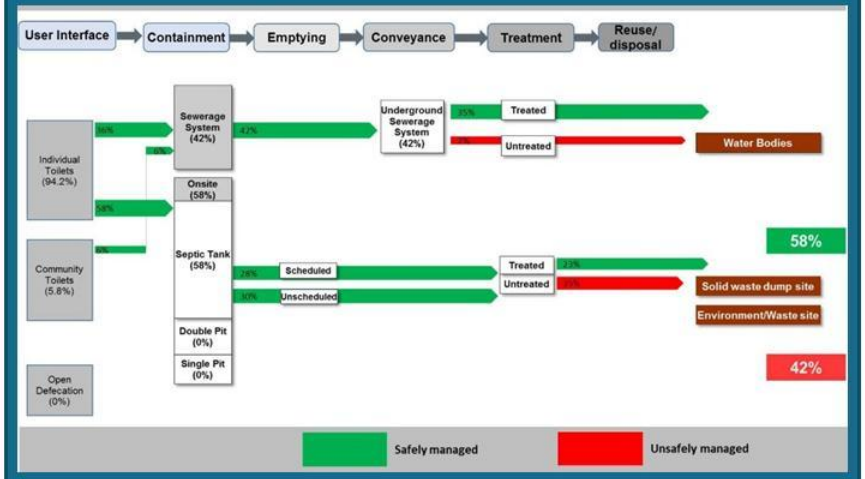
3. Assessment of FSSM across the sanitation service chain

4. Planning for FSSM

5. FSSM tools- SFD, SaniTab, SaniPlan, FSM toolkit

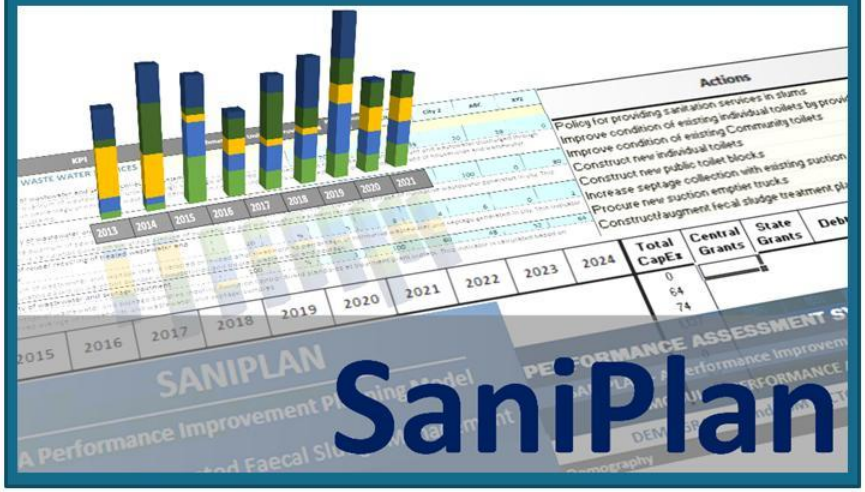
FSSM tools

Shit Flow diagrams for Sanitation assessment



SaniTab – app for conducting citywide sanitation survey

SaniPlan – Performance Improvement planning model



IFSM toolkit

Module-3 Technology options across service chain

- ✓ In designing an FSSM services, it is important to plan and assess technology options for each link in the service chain.
- ✓ This ranges from appropriate toilets and onsite systems such as septic tanks to conveyance as well as treatment and reuse.
- ✓ Demand versus scheduled desludging will be discussed in detail.
- ✓ The session will discuss different treatment technologies and its designing approach.

Topics:

6. Assessment of technical options for toilets and septic tanks

7. Collection and Transportation of Fecal Sludge

8. Treatment Technology option for FSM

Module-4 Financial Planning and Involvement of private sector

- ✓ This module will make students familiar with the practice of how sanitation projects are financed by the city government.
- ✓ It will also provide guidance on potential sources of finance for meeting FSSM expenditures through external grants, private sector investments, user contributions, external debt or through local government internal resources.
- ✓ The session on the private sector involvement will focus on understanding the current role of private sector providers in the emptying and treatment services of FSSM.

Topics:

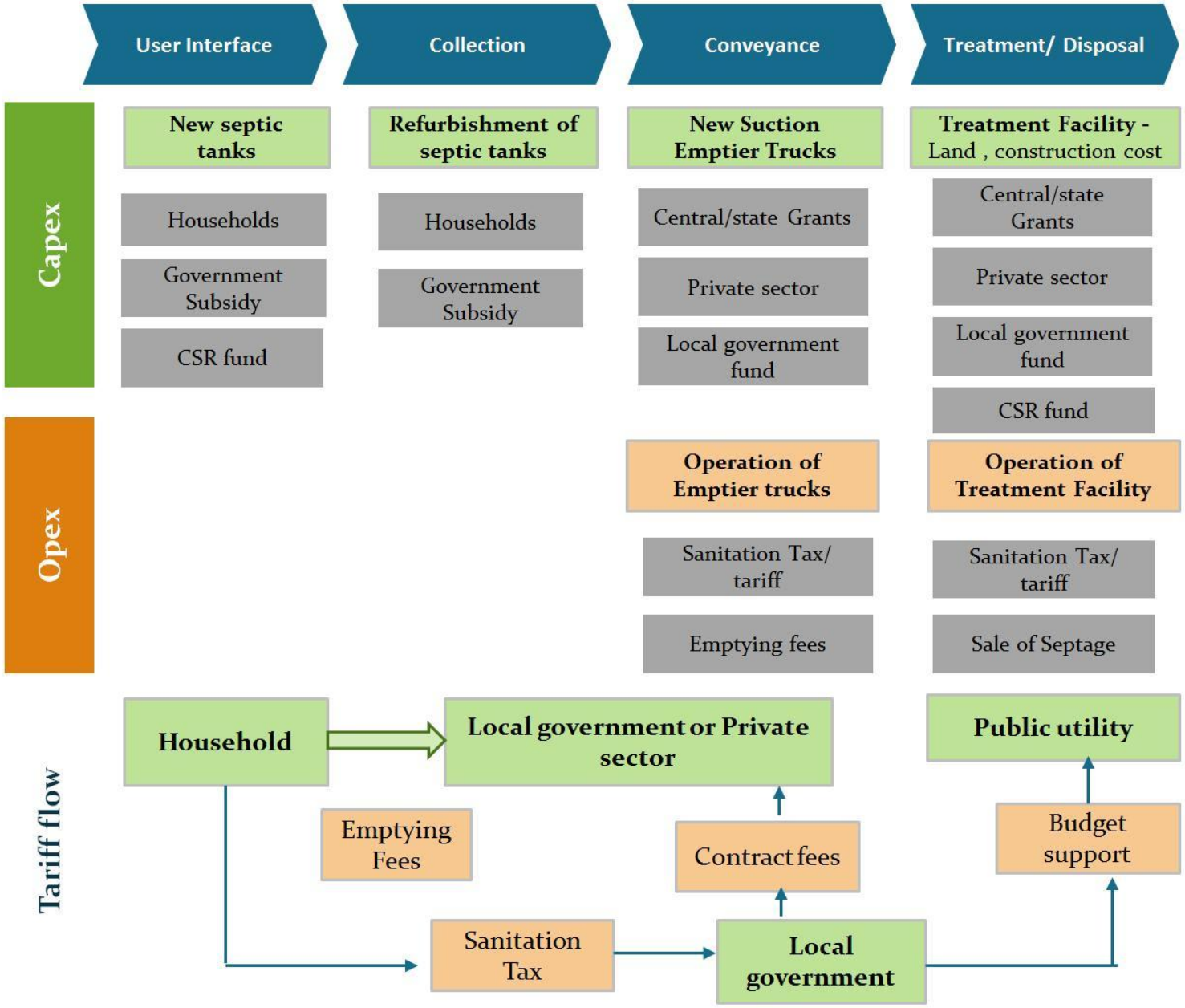
9. Financial Assessment

- Assessment of required finance for FSM project
- Finding potential sources for capital expenditure as well as O&M
- Assessment of user charges and taxes

10. Potential of Private Sector in IFSM

- Landscape Study of Private Sector- Interview guide for Private Sector Players
- Review of potential structure of PSP option

Financial assessments



Potential of Private Sector in IFSM

Options for involving the private sector

Collection	Conveyance	Treatment	Disposal / Reuse
Septic tanks →	Suction emptier trucks →	Treatment facility →	Revenue from treated septage

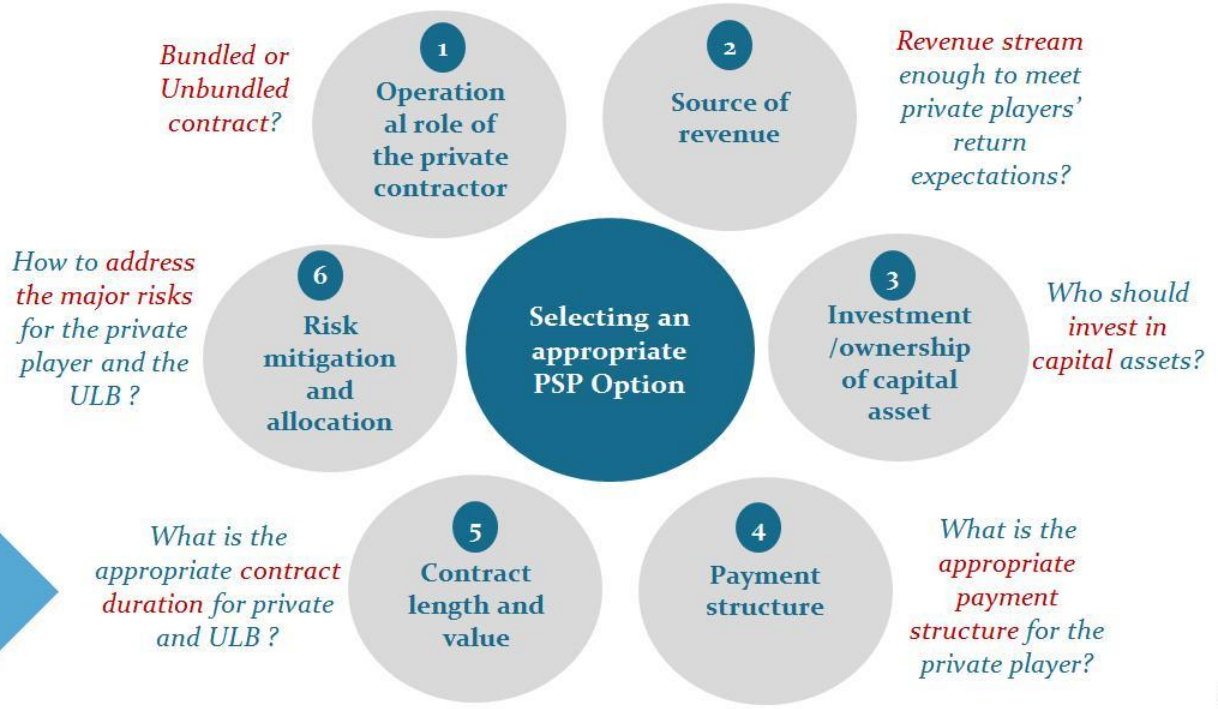
- **A** Refurbishment of septic tanks with access manhole covers
- **B** Periodic cleaning of septic tanks along a regulated schedule
- **C** Construction treatment facility
- **D** Operation and maintenance of treatment facility
- **E** Sale of septage at a fixed rate to nearby farms or agro-businesses

Landscape study of private sector

a. Are contractors available to provide the proposed services?

b. Do these players have expertise in delivering similar projects?

c. What are their key considerations or interests?



Structure of contracts

Module-5 Institutional, Regulatory and Policy Framework

- ✓ This session will provide an understanding of prevailing enabling and regulatory environment as well as the capacity of local government to manage the citywide FSM services.
- ✓ The institutional set-up and roles and responsibilities of various stakeholders involved in planning, regulating and monitoring of FSM will be discussed in some detail.

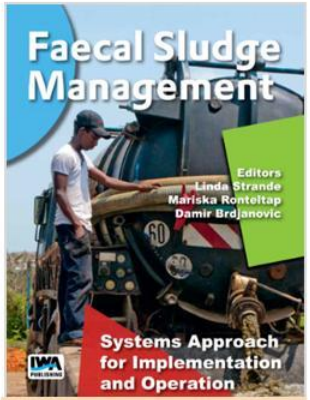
Topics:

11. Assessment of policies and regulations at local level

12. Institutional Assessment of local government

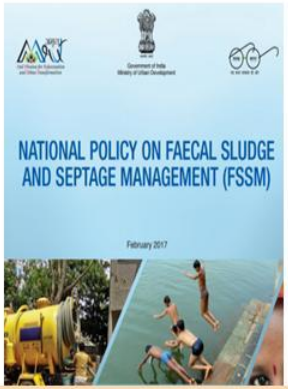
13. Stakeholders assessment and Involvement

Reading Materials

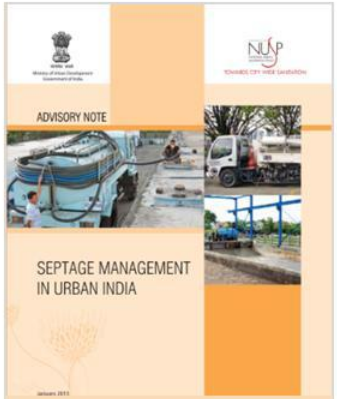


Fecal Sludge Management – Systems Approach for implementation and operation, 2014

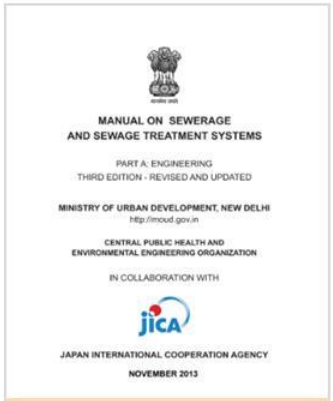
Compendium of sanitation systems and technologies



National Policy on Faecal and Septage Management (FSSM)



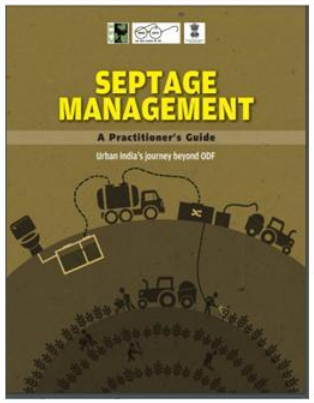
Advisory note – Septage Management in Urban India, MoUD,2013



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

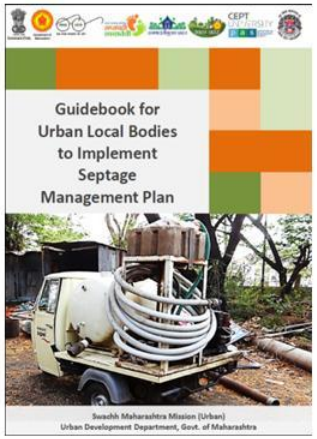
IS 2470 – Code of practice for installation of septic tanks, Part I & II

FSM Assessment and Planning toolkit



Practitioners guide on Septage management

FSM Innovations: Overview and Analysis Case studies



Guidebook for Urban Local Bodies to implement Septage management Plan

Online Module for performance assessment

Performance Measurement Framework for developing countries

Capacity Building of Govt. Officials

SLB cell formation at city/state level

City Ranking

National Roll-Out

Repository of 1800 city Benchmarks over 3 years

Information system improvement plan

Innovative Sanitation Financing

Integration with e-governance system

SAN Benchmarks citywide sanitation assessment framework

IFSM toolkit

SANI Tab App for Sanitation Survey

Annual Data for UWSS of 600+ cities

Performance Improvement Plans

pas performance assessment system

Support to Maharashtra State Government in implementing Swachh Maharashtra Mission

Demand Based Scheme for making cities ODF

Target Setting tool

Performance Improvement Planning (PIP) tool : SaniPlan

Tariff setting tool

Integrated faecal sludge management plan for cities

City Sanitation Plans for small and medium town

Project Directors : Prof. Meera Mehta and Prof. Dinesh Mehta | www.pas.org.in | pas@cept.ac.in

pas performance assessment system

C-WAS, CEPT University, Ahmedabad, India