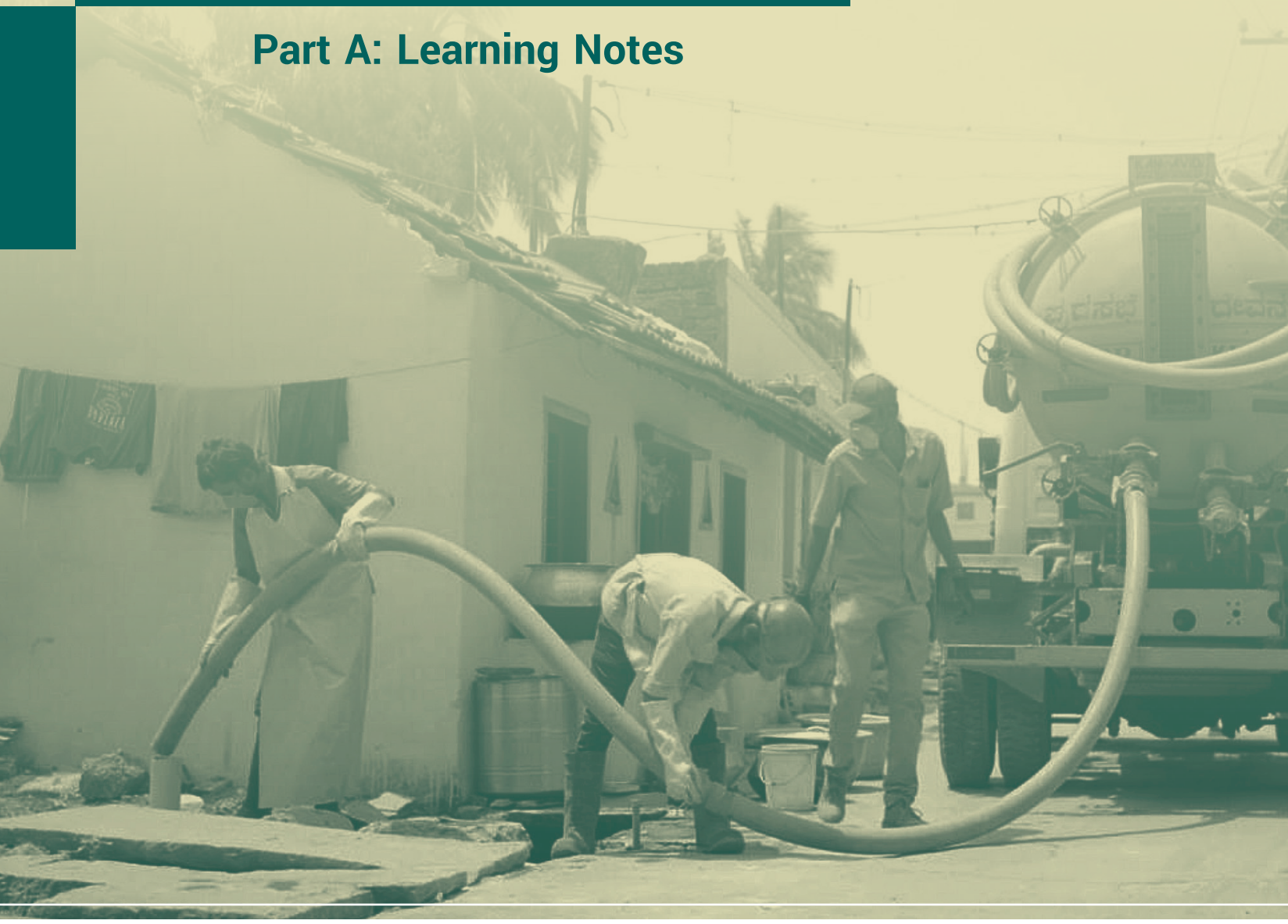
FAECAL SLUDGE AND SEPTAGE MANAGEMENT

An Orientation Module

Part A: Learning Notes

SCBP

Sanitation Capacity Building Platform



NIUA

National Institute of Urban Affairs

Sanitation Capacity Building Platform

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TITLE
FAECAL SLUDGE AND SEPTAGE MANAGEMENT — AN ORIENTATION MODULE (PART A: LEARNING NOTES)

PUBLISHER
NATIONAL INSTITUTE OF URBAN AFFAIRS, DELHI

RESEARCH PROJECT
SANITATION CAPACITY BUILDING PLATFORM

GRAPHIC DESIGN
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Year Of Publishing: 2017

CONTENT
This module draws extensively from work of following partners:

CDD & UMC for Session 3 (Septage Treatment and Reuse / Disposal)

C-WAS, CEPT University for Session 2 (Planning for Fssm at Town Level – Containment and Conveyance) & Session 4 (Planning for FSSM And its Financing)

UMC for Session 5 (IEC and BCC for FSSM)

DISCLAIMER

The full module should be referenced as follows:
NIUA (2018) “Faecal Sludge and Septage Management: An Orientation Module”.
Text from this module can be quoted provided the source is acknowledged.

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Preface

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LIST OF ABBREVIATIONS

ABR	Anaerobic Baffled Reactors
AIILSG	All India Institute of Local Self-Government
AMRUT	Atal Mission for Rejuvenation and Urban Transformation
BCC	Behaviour Change Communication
BIS	Bureau of Indian Standards
BMGF	Bill & Melinda Gates Foundation
BOD	Biochemical Oxygen Demand
BORDA	Bremen Overseas Research & Development Association
CAPEX	Capital Expenditure
CDD	The Consortium for DEWATS Dissemination Society
CDP	City Development Plan
CEPT	Centre for Environmental Planning and Technology
COD	Chemical Oxygen Demand
CPCB	Central Pollution Control Board
CPHEEO	Central Public Health and Environmental Engineering Organization
CPR	Centre for Policy Research
CSE	Centre for Science and Environment
CSR	Corporate Social Responsibility
CSTEP	Center for Study of Science, Technology & Policy
CT	Community Toilet
Cu.m.	Cubic Metre
C-WAS	Centre for Water and Sanitation
DEWATS	Decentralized Wastewater Treatment System
DRDO	Defence Research and Development Organization
ECOSAN	Ecological Sanitation
ECOSOC	The United Nations Economic and Social Council
FGD	Focused Group Discussion
FC	Finance Commission
FSSM	Faecal Sludge and Septage Management
FSTP	Faecal Sludge Treatment Plant
FTI	Faeco-orally Transmitted Infections
FY	Financial Year
HH	Household
IAEG	Inter-Agency and Expert Group
IEC	Information Education and Communication
IHHL	Individual Household Latrine
IWK	Indah Water Konsortium
JNNURM	Jawaharlal Nehru National Urban Renewal Mission
LaDePa	Latrine Dehydration and Pasteurization
LPCD	Litres Per Capita per Day
MLD	Million Litre per Day
MoHUA	Ministry of Housing and Urban Affairs
MoUD	Ministry of Urban Development
NGO	Non-governmental Organization
NIUA	National Institute of Urban Affairs
NUSP	National Urban Sanitation Policy
O&M	Operation and Maintenance
OD	Open Defecation
ODF	Open Defecation Free
OG	Out Growths
OPEX	Operational Expenditure
OSS	On-site Sanitation
PMU	Project Management Unit
PPP	Public Private Partnership
PT	Public Toilet
RWA	Resident Welfare Association
SBM	Swachh Bharat Mission
SCBP	Sanitation Capacity Building Platform
SDG	Sustainable Development Goals
SLB	Service Level Benchmark
SLIP	Service Level Improvement Plan
SOPPECOM	Society for Promoting Participative Ecosystem Management
Sq. m.	Square Metre
STP	Sewage Treatment Plant
TSS	Total Suspended Solids
UASB	Upflow Anaerobic Sludge Blanket
ULB	Urban Local Bodies
UMC	Urban Management Centre
UNESCO	United Nations Educational Scientific and Cultural Organization
USA	United States of America
USEPA	United States Environmental Protection Agency
WASH	Water, Sanitation and Hygiene
WSP	Water and Sanitation Program

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About Sanitation Capacity Building Platform

National Institute of Urban Affairs (NIUA) is a national nodal institute that works closely with the Ministry of Housing and Urban Affairs (MoHUA), Government of India. The Sanitation Capacity Building Platform (SCBP) anchored by NIUA aims to build local capacity for planning, designing and implementing non-sewer decentralized sanitation solutions, with specific focus on Faecal sludge and septage management (FSSM) and waste water.

SCBP is a partnership of various research organizations and non-profit institutions (CPR, BORDA/ CDD, CEPT, CSTEP, UMC, CSE, CPR, WASHi, iDECK, Dasara, Ecosan Services Foundation, AIILSG). The platform works in in partnership with national nodal training institutes working for Atal Mission for Rejuvenation and Urban Transformation (AMRUT) and Swachh Bharat Mission (SBM), with universities and research organizations and all stakeholders in the urban sanitation space. SCBP is supported by a grant from the Bill and Melinda Gates Foundation (BMGF).

About this Handbook

The Handbook is an initiative of SCBP to build capacities in FSSM for officials of urban local bodies (ULB), para state technical agencies, administrators and professionals from the private sector and Non-governmental Organizations. It is meant to be freely used by any can organisation(public or private), national and state level training institutes, AMRUT and SBM Training institutes: for conducting a one to one and a half day basic Orientation Training on Feacal Sludge and Septage Management(FSSM).

The Handbook presents the key learning elements for the basic training module in a narrative format covering the aslpect of: urbanization trend, urban sanitation concepts, Open Defecation Free (ODF) priorities, terminologies, technologies, financing and behaviour change, in the urban sanitation policy and program framework of India.

The Handbook has been developed based on the experience of delivering FSSM trainings to ULB officials by NIUA and SCBP partners in 2016-17. Achieving ODF towns and cities, and sustaining them, will remain a challenge for many states. This Module attempts to bridge the ODF and ODF+ (FSSM and grey water treatment) challenges that India faces.

The Handbook identifies key information and facts that need to be conveyed in all FSSM trainings, learnings and should be read together with Part B of the Presentations based training material. The Handbook is Part A of the Basic FSSM Orientation Module. The other two Parts (B & C) are available on request.

A	**Learning notes**	Identifies the learning objectives and key learning outcomes that can guide trainers and trainees. Key learning outcomes are defined as specific points for each session, which need to be imbibed.
B	**Module presentation slides**	Contains the MS PowerPoint presentations and practical exercises that trainees can refer to during the training sessions and exercise work.
C	**Reading and reference materials**	Includes session-wise references and additional reading material. It offers additional information and resources to participants in the form of reading material and audio-visual material. This also includes posters and other materials prepared by SCBP. A more detailed learning resource is available in a pen drive.

About the Training Module

Title	**FSSM Orientation Training Module** An Orientation on Faecal Sludge and Septage Management
Purpose	There are centralized and decentralized/on-site systems for treatment of waste water and septage. While conventional sewerage may be a comprehensive system for sewage collection and transport, it also is a highly resource-intensive technology for both capital expenditure (capex) and operational expenditure (opex). Consequently, high capital cost and significant O&M cost of this system inhibits its widespread adoption in all sizes of urban areas. Decentralized faecal septage treatment plants (FSTP) are emerging as solutions to the challenge of addressing safe treatment and disposal of septage. However it does not imply that all small towns and cities need FSTPs infrastructure. The Handbook attempts to instill a rational perspective for tackling the urban sanitation challenge, without being prescriptive or offering single technology solutions. This is not a Technology Handbook. Part C provides links to a few technical training modules and handbooks for further reading.
Module is for	Municipal Commissioners and Executive Officers of Class II and Class III towns and cities, officials of the state parastatal departments and the ULBs including engineers, sanitary inspectors, public health officials and staff from the Finance and Accounts departments dealing with sanitation.
Learning Objectives	The module aims to convey the following learning: • Urbanization trend in India and the urban sanitation challenge • Understanding ODF and ODF+ concepts and experiences • Decentralized septage, sludge and waste water treatment solutions are technically sound options for Indian towns and cities, and are not sub optimal solution as compared to centralized sewerage systems • Assessment & planning both technical and financial for FSSM at the city level • Overview of policy, regulation and behaviour change communication • Gender, caste and class dimensions of sanitation By the end of the training, participants would be able to understand the urban sanitation challenge, concepts and definitions of centralized and decentralized treatment options, how to calculate and assess the generation of septage in volumetric terms and the cost of treatment using decentralized treatment options. In the long run it will help towns and cities to improve their sanitation, public health status and rankings on Service Level Benchmarks (SLB); by investing in sustainable and cheaper septage and waste water treatment options instead of waiting endlessly for funding for sewerage systems.
Duration	The workshop is proposed to be conducted in one day. It could be extended by another day depending on the size of a batch of trainees and their interest and time given for all the sessions.

Faecal Sludge and Septage Management Orientation Training

AGENDA

Time duration	Session Title and Objective	Training method	Additional Material
	DAY - 1		
9.30-10.30	**Introduction to the training** a. Introduction of participants and trainers b. Ice Breaking activity such as: • reshuffling seating positions according to ranking or alphabetical order of cities or population of cities • Mixed group seating as per class of cities. c. Introduction to the day's agenda and understanding expectations. d. Filling of pre-evaluation form by the participants	1. Slide with the day's schedule. 2. Pre-Evaluation form. 3. Question cards for trainers for facilitating discussion.	• A brief overview of the workshop. • Reading material regarding workshop objectives and its goal.
	Session 1: Urbanization, Sanitation and Fundamentals of Faecal Sludge and Septage Management		
10.30-11.30	**OBJECTIVE:** • Understanding Urbanization trend of India • Understanding the ODF • Urban sanitation - caste, class and gender dimension • Why decentralized septage, sludge and waste water treatment solutions are technically sound option for Indian towns and cities, and not sub optimal solution as compared to centralized Sewerage systems.	1. Presentation 2. Interactive session of question and answers.	• Learning Note • PPT • Reading Material
11.30-12.00	TEA BREAK		
	Session 2: FSSM Conveyance and Treatment Overview		
12.00-13.30	OBJECTIVE: • Planning for FSSM at town level: how much septage needs to be treated • Importance of well-designed septic tanks as primary treatment facility • How to assess/calculate the desludging requirement of a town with septic tank systems	1. Presentation. 2. Devanahalli Audio-Video film 3. Exercise to calculate the septage produced and trucks needed to transport for treatment. 4. Discussion	• Learning Note • PPT • Reading Material • Exercise
13.30-14.30	Lunch Break		

Session 3: Sludge Treatment and Disposal/Reuse Options			
14.30-15.00	**OBJECTIVE:** • To understand the various technologies available for treatment of septage – both liquid and sludge • Recap by a participant on key learning Quiz/exercise to capture learning a. FSSM and its Value chain. • Treatment and • Re-use/ Disposal.	1. Quiz to capitulate learning.	• Leading practices from IWK-Malaysia, Devanahalli, Wai and Sinnar etc.
Session 4: Financing for FSSM			
15.00-15.45	**OBJECTIVE:** • Different tools for assessment of capex and opex of Decentralized Treatment Options • Understanding that scheduled desludging of septic tanks at a town level has a very low cost per household per year.	• Presentation • Exercise to calculate the desludging cost of FSSM	• Reading Material related to FSSM value chain. • Case studies of best practices of containment and conveyance aspects of FSSM
15.45-16.00	**Tea Break**		
Session 5: Information, Education and Communication (IEC) and Behaviour Change Communication (BCC)			
16.00-16.20	**OBJECTIVE:** • Understanding and Need for IEC and BCC for ODF and developing BCC material for FSSM. • Methods of IEC and BCC	1. Presentation. 2. Interactive session of question and answers.	• Reading Material related to FSSM value chain. • Flash cards and other tools used for such purposes.
16.20-17.00	Evaluation and cross discussion over the above exercise.		
	Informal discussion, Interaction and Q&A session.		
	Closing Session and certificate distribution.		

Pre-Evaluation Form

Q.1 An Open Defecation Free town is one where

- ☐ All households have access to toilets.
- ☐ All waste water is safely treated.
- ☐ All waste water is safely contained.
- ☐ None of the above

Q.2 Waste water treatment can be ensured by *(multiple answers possible)*

- ☐ Laying underground drainage and setting up sewage treatment plants (STP).
- ☐ Safely collecting wastewater using underground drainage and taking it out of the city or disposing in surface water body.
- ☐ Collecting of septic tank effluent and treating it.
- ☐ None of the above

Q.3 Sanitation systems in urban India are:

- ☐ Predominantly underground sewerage and STPs.
- ☐ Predominantly septic tanks and pit latrines.
- ☐ Predominantly open defecation.
- ☐ Predominantly small bore sewerage systems.

Q.4 Urban Local Bodies have a role in ensuring that septic tanks are built as per standards. Is this statement true?

- ☐ No, it is up to the household.
- ☐ Yes, as it is linked to building plan permission process.
- ☐ No, it's a responsibility of the Central Government.
- ☐ No, it's a responsibility of the State Government.

Q.5 What is the per capita cost of a centralized sewerage system for a city of 100,000 population?

- ☐ Less than 1000
- ☐ Less than 5,000
- ☐ Less than 10,000
- ☐ Above 10,000

Q.6 Do you think that the Manual Scavenging Act of 2013 applies to the manual emptying of septic tanks?

- ☐ No. It is only applicable to emptying of dry latrines.
- ☐ The Act is not relevant to waste treatment.
- ☐ No. It is only applicable to cleaning of sewers and drains.
- ☐ None of the above

Q.7 Waste water from a toilet is termed as:

- ☐ Grey water
- ☐ Blue water
- ☐ Black water
- ☐ None of above

Q.8 Is partial cleaning of waste water possible by disposing it in *kutcha* drains and *nallas*?

- ☐ No cleaning is possible as it further lowers the quality of waste water.
- ☐ Drains and *nallas* are like septic tanks. If their design is improved, they can partially clean waste water.
- ☐ All kutcha drains need to be converted to *pucca* drains for them to partially treat and clean waste water.
- ☐ If kutcha drains can be converted in to pucca drains, it is possible.

Q.9 Is a single pit considered as a sanitary latrine?

- ☐ Yes
- ☐ No
- ☐ May be
- ☐ Do not know

Q.10 A septic tank must be emptied

- ☐ Regularly (2-3 years)
- ☐ Only when it gets full and starts overflowing
- ☐ Every month
- ☐ Never

Q.11 The largest source of central government funding for septage and sewerage for a state government is from

- ☐ Swachh Bharat Mission Urban
- ☐ AMRUT
- ☐ Central Finance Commission
- ☐ Smart City Mission

Q.12 Following are characteristics of septage:

- ☐ Black in color
- ☐ High BOD, COD, TSS
- ☐ Well digested
- ☐ All of the above

Q.13 "Black Water" consists of...

- ☐ Urine
- ☐ Faeces
- ☐ Flushing water
- ☐ All of the above

Q.14 Which activities generate 'grey water'?

- ☐ Bathing
- ☐ Washing utensils
- ☐ Laundry
- ☐ All of the above

Q.15 The current discharge standards laid down by the Central Pollution Control Board (CPCB) mandates BOD to be less than

- ☐ 30 mg/L
- ☐ 30 gm/L
- ☐ 10 mg/L
- ☐ None of the above

Q.16 Having 'access to safe water supply' means

- ☐ Access with respect to distance.
- ☐ Adequate per capita availability of water.
- ☐ Good quality of water.
- ☐ All of the above

Q.17 Decentralized treatment system can be implemented at which level?

- ☐ Household level
- ☐ Community level
- ☐ Ward level
- ☐ All of the above

Q.18 What are the types of wastewater treatment processes?

- ☐ Physical treatment processes
- ☐ Biological treatment processes
- ☐ Chemical treatment processes
- ☐ All of the above

Q.19 Select the most important criteria for choosing a centralized system

- ☐ Population to be covered
- ☐ Area to be covered
- ☐ Population density of area
- ☐ All of the above

Q.20 What leads to eutrophication of water bodies?

- ☐ BOD
- ☐ COD
- ☐ Nitrates
- ☐ Phosphates

LEARNING NOTES

SESSION 1

Urban Sanitation and Fundamentals of FSSM

1.1 Learning Objectives

- Understand urban sanitation and the associated challenges
- Learn from strategies adopted by some states to achieve ODF cities
- Distinguish between black and grey water as well as sludge and septage
- Understand the sanitation value chain
- Understand gender and caste dimensions of urban sanitation

1.2 Duration

60 minutes

1.3 Key Facts

1.3.1 Urbanization in India

1. India is urbanizing but the pace and character of is different from countries in other parts of the world. In 2001, the numbers of Census towns and statutory towns were 1,362 and 3,799, respectively, while in 2011, these numbers grew to 3,894 and 4,041, respectively. The growth of population and urbanization has slowed down in the Million Plus cities in the last decade (2001-11), but continues to increase at a fast pace for smaller towns and cities. The number of urban agglomerations in the year 2001 was 384 and increased to 475[2] in 2011.

Table 1: Number of UAs/Towns and Out Growths (OGs)

S. No.	Types of Towns	Number of Towns	
		Census 2011	Census 2001
1	Statutory towns	4,041	3,799
2	Census towns	3,894	1,362
3	Urban agglomeration	475	384
4	Out growths	981	962

Source: Census of India 2011

The total population of India increased from 102.86 crore in 2001 to 121.02 crore in 2011. The urban population in the year 2011 also increased to 37.71 crore from 28.61 crore in 2001. The percentage of urban population in the year 2001 was 27.8% which increased to 31.2% in 2011. A decadal trend of urbanization from the year 1951 to 2011 is presented in below table.

Table 2: Urbanization in India

Year	Total Population (in crore)	Urban Population (In Crore)	Percentage of urban population	Decadal Growth of Urban Population (%)
1951	36.11	6.24	17.30	41.4
1961	43.92	7.89	17.97	26.4
1971	54.81	10.91	19.91	38.2
1981	68.33	15.95	23.31	46.1
1991	84.63	21.76	25.71	36.4
2001	102.86	28.61	27.82	31.3
2011	121.02	37.71	31.14	31.8

Source: Data from provisional tables released by Census of India 2011

[2] Number of census towns and statutory towns are taken from http://censusindia.gov.in/2011-prov-results/paper2/data_files/India2/1.%20Data%20Highlight.pdf

2. There is a financial crunch in urban infrastructure for basic services including sanitation. The situation of service delivery in slums within the city and peri-urban settlements outside the limits of municipalities is worse. Some of the key issues are:
   - States are not coming forward to declare 'Statutory Town' status to emerging small towns which continue to grow rapidly.
   - Administrative, legislative and judicial institutions to serve the growing urban population are not forthcoming.
   - Devolution of tax revenues from the state governments to the ULBs is inadequate in most cases. ULBs are becoming more dependent on the Finance Commission's devolution of funds.
   - Financing for the provision of basic services is affected in urban areas with a municipal status as well as in the census towns that are bereft of a municipal status. Census towns cannot raise taxes and are completely dependent on state financing.
   - Services including sanitation, water, education and health are still provided as a state service and not municipal services. The service levels are severely low in the ever growing urban centres and the fringes of cities and towns that are under the rural department's ambit and are not served by ULBs.

1.3.2 Urban Sanitation and associated challenges

Sanitation is defined[3] as safe management of human excreta, including its safe confinement treatment, disposal and associated hygiene-related practices. Sanitation pertains to management of human excreta and associated public health and environmental impacts, it is recognized that integral solutions need to take account of other elements of environmental sanitation, i.e. solid waste management; generation of industrial and other specialized / hazardous wastes; drainage; as also the management of drinking water supply. (National Urban Sanitation Policy, 2008)

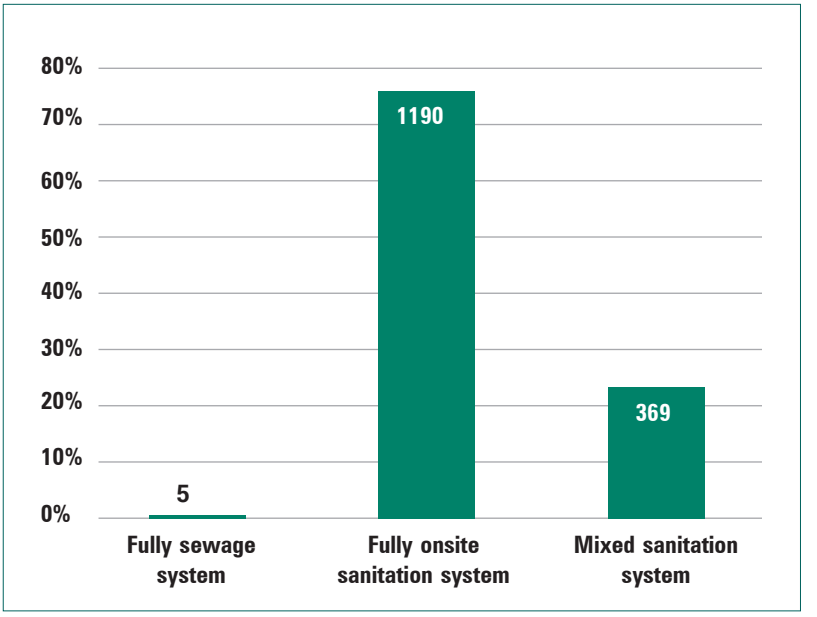
- Open defecation (OD) in urban India (12.6% in 2011) is lower, as compared to rural India (69%)[4]. The target for construction of toilets under the Swachh Bharat Mission – Gramin in rural areas was more than 10 crore in 2014, which was later reduced to around 7 crore. This target in the urban context was 1 crore toilets and later the target revised to around 66.4 lakh in 2016.[5]
- Some states are doing better than others in eliminating open defecation.
- Based on the SLB data submitted to the Government of India (GoI) by 16 states covering 1,564 cities, only 5 cities had 100% sewerage systems.

[3] National Urban Sanitation Policy

[4] Census of India, 2011

[5] http://sbm.gov.in/sbmreport/home.aspx; and http://swachhbharaturban.in:8080/sbm/content/writereaddata/Revised%20target%20of%20IHHT.XLSX

Figure 1: Number of cities with different types of sanitation systems in India



Source: CEPT, Based on the SLB data submitted to Government of India (2014)

1. What is the definition of ODF city?

a. Definition of ODF by MoHUA – A city / ward can be notified / declared as ODF city or ODF ward if, at any point of the day, not a single person is found defecating in the open[6]. (Ministry of Housing and Urban Affairs, Government of India)

b. What is slowing down the achievement of ODF cities: All 4,041 cities are competing with each other to become ODF, but the process of constructing toilets with safe disposal system, converting insanitary toilets into sanitary toilets and frequent applications/requests by households (HH) for new toilet construction is not happening diligently. Conducting campaigns for Information Education Communication (IEC) and Behavioural Change Communication (BCC) activities take more time to change the mindset of people practicing open defecation, which slows down the process of achieving status of ODF city.

c. Maharashtra ODF and ODF++ framework

Maharashtra Govt. ODF Framework

The Government of Maharashtra (GoM) has prepared its own ODF framework[7]. GoM has linked ODF for achieving safe sanitation including safe waste water disposal systems. The ODF component is divided into 3 stages – ODF, ODF+ and ODF++. The graphical representation of the ODF framework is shown in the figure below.

[6] Ready-reckoner for "Declaring your City/Ward open defecation free" is available on http://sac.ap.gov.in/sac/UserInterface/Downlaods/IECMaterials/ODF%20Declaration%20booklet.pdf

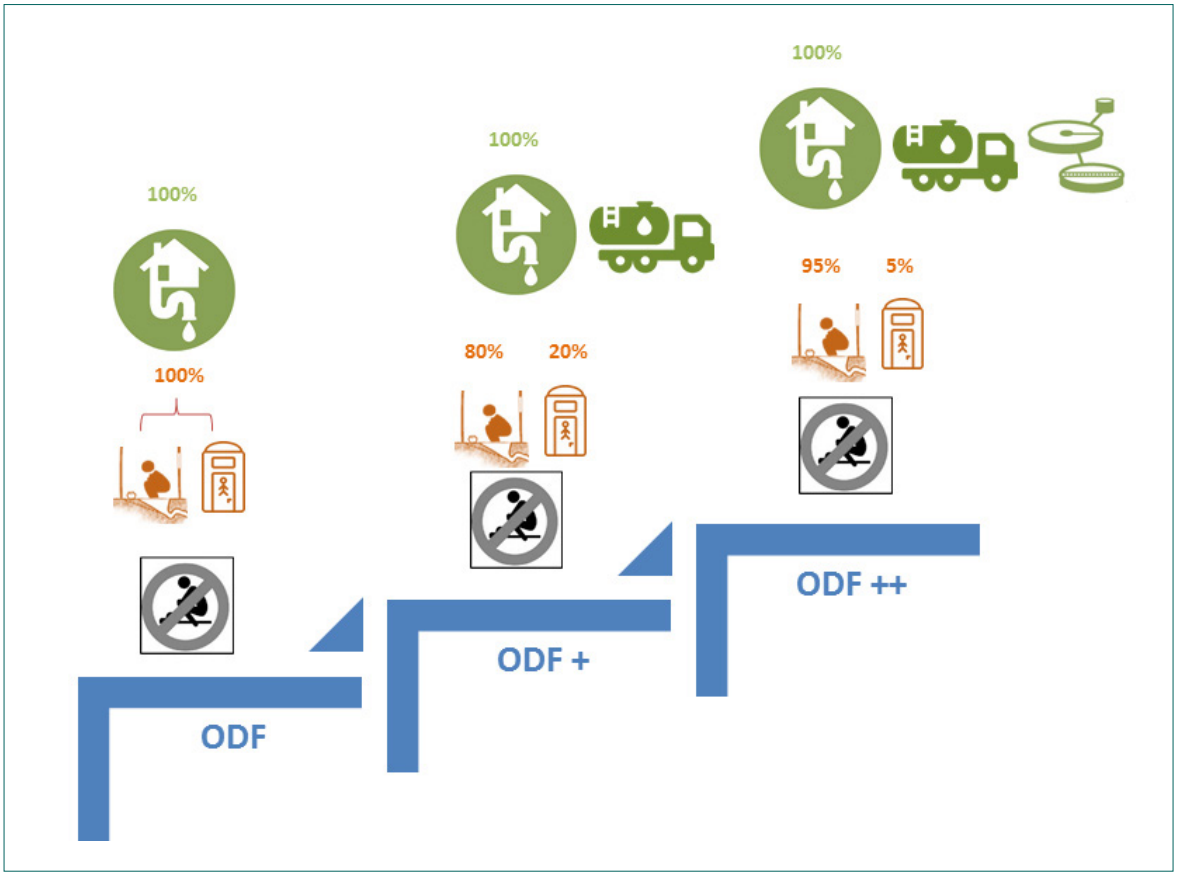
[7] ODF framework of Maharashtra is available on http://pas.org.in/Portal/document/UrbanSanitation/uploads/ODF%20framework%20of%20Govt%20of%20Maharashtra.pdf

Definition of "ODF, ODF + and ODF ++ Cities"

Table 3: ODF, ODF+ and ODF++ definition (Swachh Maharashtra Mission (Urban), Government of Maharashtra)

	Elimination of OD practices	Access to toilets	Conveyance and treatment of faecal waste
ODF City	• Not a single person found defecating in the open • No traces of faeces are visible in the city at any time of the day.	• All the properties in the city have access to either own toilet or functional community toilet (CT) / public toilet (PT) • Floating population in the city has an access to sufficient and functional PTs	• All toilets are connected to a disposal system
ODF+ City	• Not a single person found defecating in the open • No traces of faeces are visible in the city at any time of the day.	• At least 80% of residential properties in the city have access to own toilets • Remaining properties and floating population in the city have access to functional CTs/ PTs	• All toilets are connected to a disposal system • Regular and safe collection, conveyance and treatment of all the faecal matter
ODF++ City	• Not a single person found defecating in the open • No traces of faeces are visible in the city at any time of the day.	• At least 95% of residential properties in the city have access to own toilets • Remaining properties and floating population in the city have access to functional CTs/ PTs	• All toilets are connected to safe disposal system • Regular safe collection, conveyance and treatment of all faecal matter and waste water including septic tank effluent and grey water

Figure 2: ODF Framework, Maharashtra Government



2. Urban sanitation: How do we fare on safe treatment and disposal of faecal waste?

a. Existing inventory of Sewage Treatment Plants (STP):

During 2015, the estimated sewage generation in the country was 61,754 MLD as against the developed sewage treatment capacity of 22,963 MLD. Because of the hiatus in sewage treatment capacity, about 38,791 MLD of untreated sewage (62% of the total sewage) is discharged directly into nearby water bodies (Central Pollution Control Board, 2016). There are 920 STPs in different States/UTs out of which, 615 STPs are operational, 80 STPs are non-operational, 154 STPs are under construction and 71 STPs are under planning stage. (Central Pollution Control Board, 2016)

Table 4 List of States with STPs

Sr. No.	State/UT	Total No. of STPs
1	Punjab	86
2	Maharashtra	78
3	Tamil Nadu	73
4	Uttar Pradesh	73
5	Himachal Pradesh	68
6	Rajasthan	64
7	Karnataka	57
8	Gujarat	52
9	Odisha	47
10	Haryana	41
11	Chhattisgarh	36
12	Delhi	35
13	West Bengal	28
14	Jammu & Kashmir	25
15	Jharkhand	24
16	Uttarakhand	24
17	Telangana	18
18	Madhya Pradesh	17
19	Andhra Pradesh	12
20	Sikkim	11

Sr. No.	State/UT	Total No. of STPs
21	Kerala	10
22	Andaman & Nicobar Islands	8
23	Goa	7
24	Bihar	6
25	Puducherry	6
26	Assam	5
27	Chandigarh	5
28	Tripura	2
29	Meghalaya	1
30	Mizoram	1
31	Arunachal Pradesh	-
32	Daman Diu and Dadra & Nagar Haveli	-
33	Lakshadweep	-
34	Manipur	-
35	Nagaland	-

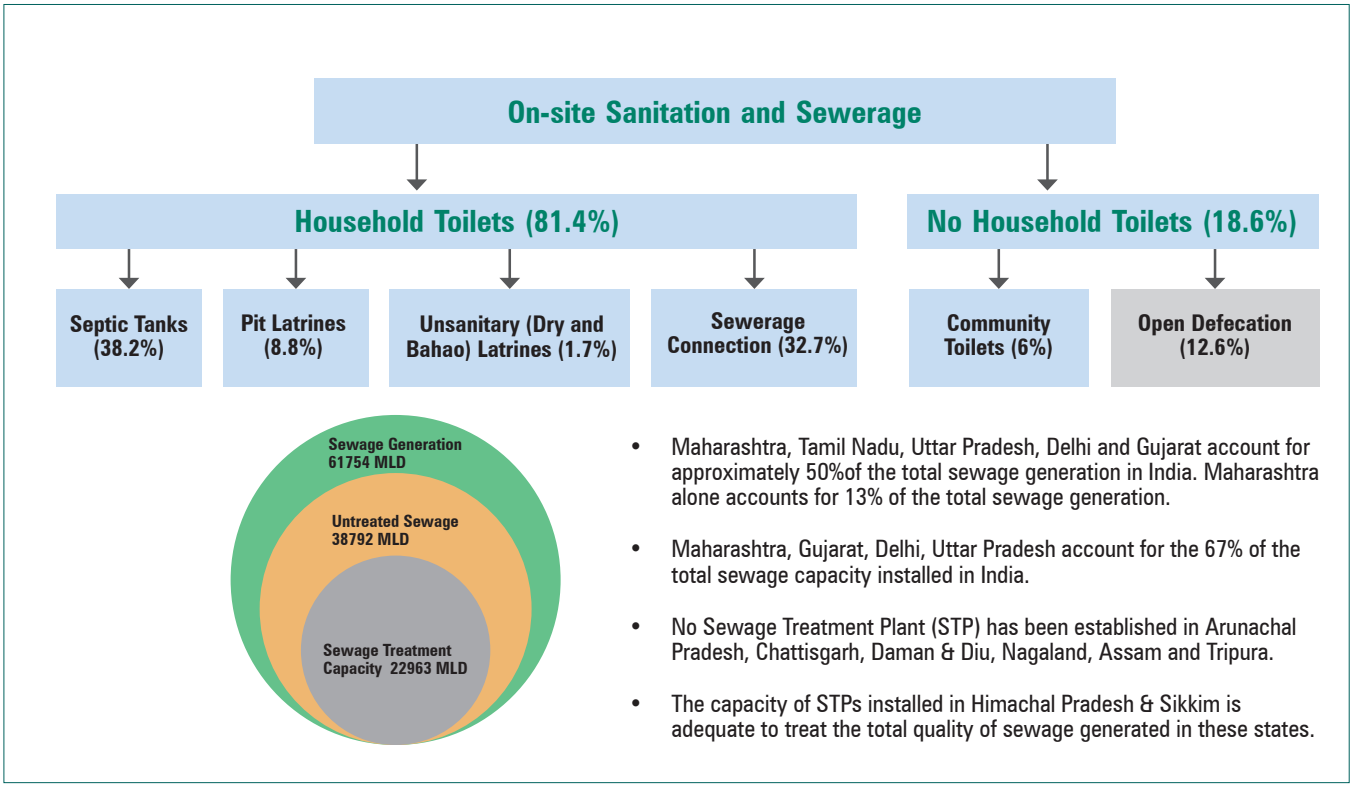
Source: CPCB 2016

b. STPs are not working because:

- Due to unmanaged solid waste management system, a lot of solid waste including plastic reaches to the STPs as influent which may cause the machinery to break down and reduce the efficiency of treatment, especially in the case of Upflow Anaerobic Sludge Blanket Reactor (UASB) process, where the feeding pipes and overflow weirs/V-notches in division boxes/effluent gutters are chocked or obstructed thus also resulting in reduced STP capacity.

- Mechanical screens installed in STPs become dysfunctional, mainly due to the reason that they are not regularly used and are also not properly maintained. The staff for the O&M of the STPs is not fully familiar and aware with topics of sewage treatment. They are not trained in the fields of O&M of the STPs.
- States like UP, Bihar and, even Delhi, which experience frequent power cuts do not have standby arrangements during power cuts to meet the power requirement for running the plant. Frequent and long power cuts and subsequent sudden discharges into the STP also cause shock loads to various units of the STP, thus greatly affecting the efficiency of the treatment.
- Majority of state governments or implementing agencies are not able to provide sufficient and regular funds for the O&M of STPs resulting in unsatisfactory performances. The revenue from STPs is negligible or far less than the expenditure required for the proper O&M of the STPs. (Central Pollution Control Board, 2007)

Figure 3: Status of on-site sanitation (OSS) systems and sewerage



Data Source: Census 2011 and CPCB Bulletin, Vol.1

3. Allocation of Funding for Urban Sanitation

The total fund allocation under the 13th Finance Commission[8] for the period of 2010-15, for all urban and rural local bodies was ₹87,519 crore. The number of urban and rural local bodies covered was 3,842 and 2,46,076 respectively. The allocation of share is based on the share of population in the respective state and hence, under the 13th FC, Uttar Pradesh was given ₹12,740.5 crore which was the highest amount of allocation while Goa was given ₹172 crore which was the lowest allocation. (Ministry of Finance, Government of India, 2009). Fund allocation under 14th FC for the period of 2015-20, for all urban and rural local bodies is ₹87,143 crore of which, ₹22,338 crore has already been released till September 2017 (Finance Commission India, September 2017).

Figure 4: Fund allocation under SBM, AMRUT and 13th Finance Commission (FC)

	Budgetary Allocation	Duration	Sectors covered
SBM Mission	Rs. 62,009 Crore	2014-19	Solid Waste Management, Sanitation, IEC and Capacity Building
AMRUT Mission	Rs. 50,000 Crore	2014-19	Sewerage and Septage Management, Water Supply, Storm Water Drainage, Urban Transport, Capacity Building, Reform Implementation, Development Of Green Space And Parks
13th FC	Rs. 87,519 Crore	2010-15	Untied grant, which can be used across various sectors (especially basic infrastructure services such as water supply, wastewater, solid waste and storm water) based on ULB's preference
14th FC	Rs. 87,143 Crore	2015-20	

Data source: SBM and AMRUT mission guidelines, 13th and 14th FC report

4. Gender, caste and class dimensions of urban sanitation

A gender specific effect and outcome of inadequate and unsafe sanitation is a weak spot in WASH. And even weaker when we address septage and waste water management. Here the gender focus is currently limited to women enterprises heading desludging operations and experiences from African context where dry sludge is managed by women at home.

More recent research literature on health impacts is restricted to a hypothesis that lack of safe sanitation causes stunting of the population at large and not on women in particular. This needs to be proven through long term medical studies and comparing other critical variables including hard physical work done by both men and women in the poorest districts of India(where stunting is higher),

[8] Retrieved from 13th Finance Commission report, Ministry of Finance http://fincomindia.nic.in/ShowContentOne.aspx?id=28&Section=1

impacts of successive malaria(all the three virulent types) and other most common diseases.

> *In Jharkhand and Gujarat villages, major illness was usually malaria and respiratory diseases and not serious stomach infections like Jaundice, Cholera, and Diarrhea. People do not attribute lack of sanitation to be the primary cause for major illness. Lack of proper nutrition, hard physical labour or general weakness of the human system over the years from early marriage and child birth, weakness from repeated bouts of malaria and viral fevers, etc., are seen as some of the most important factors for poor health condition than sanitation and hygiene borne factors. Health sector experts identify delayed breast feeding and related personal hygiene as important factors of high infant mortality in India. Page 13 of the Report.*[9]

a. Gender and urban sanitation

WASH sector literature on gender and sanitation is unfortunately dominated by a limited discourse on menstrual hygiene, the life cycle cost of sanitation and women's' access to toilets.

> *Gender equity becomes an issue when women and girls lack access to toilet facilities and appropriate hygiene education. Opportunities for learning are lost when children have to spend time collecting water or finding a safe place to defecate or urinate in the open. Many girls may permanently drop out of school with the onset of puberty if the toilet facilities are not clean or do not provide privacy to girls while they are menstruating. Menstruation is a taboo subject in many cultures and can create stigma, shame, and silence among young girls, which often continues into adulthood and perpetuates the cycle of gender inequality.*

> *Women are often vulnerable to harassment or violence when they have to travel long distances to fetch water, use shared toilets, or practice open defecation. Women and girls often wait until nightfall to defecate, which increases the risk of assault. Many choose to 'hold it' or limit their consumption of food and drink to delay the need to relieve them, which can increase the chance of urinary tract infections. The shame and indignity of defecating in the open also affects women's self-esteem, as does a lack of water for washing clothes and personal hygiene*[10]*. (WaterAid, 2015)*

Women are assumed to represent a homogenous category, devoid of caste and class differentiation. The urban sanitation study undertaken by SOPPECOM highlights the issues of how women discriminate among each other(higher caste women objecting to lower caste women using common public toilets) on the basis of caste.

[9] http://indiawashforum.com/wp-content/uploads/2016/05/Sanitation-Behaviour-Change-Formative-Research-2016.pdf

[10]WaterAid. Post-2015 Toolkit: WASH and Gender Equality. Retrieved from https://sustainabledevelopment.un.org/getWSDoc.php?id=2428

Gender perspective in WASH is possible when womens access to water and sanitation is looked both from the patriarchy at the family, culture, religion and social group level, as well as from the larger perspective of urbanization, dispossession and illegality of slum settlements that impacts women. The Jagori study of water and sanitation in urban slums of Delhi does this well.

> *The working-classes in Delhi have been subject to a systematic process of dispossession and impoverishment for the last three to four decades. Forcible eviction from slums in Delhi and relocation to the periphery of the city forms the core of this process as most of the evicted work in the informal sector. Such relocation to colonies such as Bawana on the periphery of the city make it impossible for them to continue to attempt to earn sustainable livelihoods. In order to understand the impact of eviction on people's livelihoods, action research, since 2004, has been undertaken in Bawana. The abysmal conditions of water supply in the area and the fact that the burden of filling water falls on women and young girls have been noted by Menon Sen & Bhan in " Swept off the Map: Surviving Eviction and Resettlement in Delhi" (2008: Jagori & Yoda Press).*[11]

Within a slum or a poor urban settlement, women whose caste and class are among the lowest in the social hierarchy, usually the rag pickers or those employed in manual scavenging work, suffer the most in terms of denial of sanitation services and payment for work done.

The most studied aspect of women and sanitation(not gender and sanitation), is the womens access to pubic toilets and how women suffer from poorly maintained public toilets.

> *The Urban Management Centre (UMC), based in Ahmedabad, conducted a technical audit of all public conveniences such as PT and CT in the jurisdiction of Ahmedabad Municipal Corporation in 2013. Survey results shows, majority of the community toilets (63%) did not have separate sections for men and women. Nearly 90% of public urinals did not have separate sections for men and women. Most of the urinals were for men only. Based on discussions with user groups, 15% women expressed that they felt unsafe using PTs while 20% women felt unsafe using a toilet that did not have separate sections for females. Considering the toilet accessibility for the physically disabled, 97% PTs were not designed to be accessible for the disabled. There was no provision of ramps, handrails for easy access. (Urban Management Centre, 2013). For better designing of public conveniences in terms of gender friendly, child friendly and disabled friendly, an e-learning course is available on the Swachh Bharat e-course portal. One can register for course number "413 – Designing of Community and Public Toilets" under course series 400.*

[11] http://jagoriwp.jagori.org/our-activities/fellow-research/rights-and-access-to-watsan/

Water, sanitation, and hygiene do play a large role in the lives of adolescent girls and women, both biologically and culturally. However a limited understanding of gender as a biological differentiator and not a power construct, is usually applied in most WASH programmes and in Behaviour change communication.

Gender as a power construct should not be blindly applied in WASH to show that womens preference for toilets is always negated by men or that men are never concerned about womens safety while going for open defecation(SOPPECOM study).

b. Caste and urban sanitation

It is not unknown; however there is extensive research that shows that caste has a major influence on achieving rural sanitation goals[12]. The Hindu notions of purity and pollution, inextricably linked with the caste system and the practice of untouchability, underlie the unsanitary practices in Indian society. These beliefs perpetuate the oppression of the "polluted castes," which are forced to undertake manual scavenging, unclog manholes and clean other people's filth. The availability of cheap Dalit labour to do these dehumanizing jobs can be cited as one of the reasons why development of toilet facilities and a modern garbage and sewage management system have been neglected so far[13]. (Subhash Gatade, Economic & Political Weekly, 2015)

The World Health Organization (WHO) estimates that when a normal latrine (meaning a latrine with a 50 cubic metre, honeycomb-style pit) is used daily by a family of six members, it will fill up after about five years. When the pit fills up, the owners must either empty it or build a new pit. In rural India, as in other parts of the developing world, when honeycomb-style latrine pits are emptied, it is done by hand. Biological germs turn out not to be the barrier to pit emptying. People in rural India equate manually emptying a latrine pit with the most degrading forms of Dalit (lower caste who generally engaged in cleaning pits and sewer lines) labour. Therefore, the idea of manually emptying a latrine pit is at least as reviled for its social implications as it is for the physically disgusting nature of the work. (Diane Coffey and Dean Spears, 2017)

Urban sanitation challenges are multi-dimensional when it comes to the understanding of caste, class and gender. However not much research has been done to address urban sanitation challenges from the gender, caste and class perspective in India.

A recent research[14] on urban sanitation by Society for Promoting Participative Ecosystem Management (SOPPECOM) highlighted the following:

[12]http://riceinstitute.org/research/culture-and-the-health-transition-understanding-sanitation-behavior-in-rural-north-india/

[13]Retrieved from "Silencing Caste, Sanitizing Oppression, Understanding Swachh Bharat Abhiyan" – A perspective paper by Subhash Gatade in Economic and Political Weekly, October 31, 2015.

[14]https://www.soppecom.org/pdf/sanitation-vulnerability.pdf

- Poor slum-dwelling women have developed habits that fit their caste, stage in the life course, marital status, etc. Nonetheless, every day is a different day, and the fears and discomfort that women confront are not necessarily the same in content, intensity, or even present on any given day, depending on the circumstances that they leave at home, their physical condition that day, and the presence/absence of certain groups/ individuals at/near the defecation site.

- Discussion of the multiple inequalities that constrain women's choices surrounding sites of defecation begs the question, "What might the provision of adequate sanitation do to curtail gendered violence?" We find that individual women experience the risks of inadequate sanitation differently, but at broader scales, we reach the conclusions that provision of adequate sanitation is not sufficient to alter gendered social relations. Adequate sanitation without attention to gendered relations of power puts the burden of safety on women, and does not address the caste and gender-based patterns of violence against women.

- Provision of a toilet whether public or individual is not sufficient, its maintenance is a key issue. Maintenance of PTs has to be the ultimate responsibility of the ULBs. These toilets have to respond to needs of diverse women (for example old, pregnant, with children, disabled, belonging to different religious and caste communities) by being better lit, in safer locations and with regular provisioning of water. A need for a

Anecdote of Experiences of Women Harassment[15]:

- Sanitation in terms of open defecation and PT maintains the status quo of unequal gender relations. These relations intersect with relations of age, caste, and class. Seen as a struggle over resources, negotiations around the safe use of OD and PT sites were often to the disadvantage of women (e.g., inability to go at night).
- Widows faced more physical insecurity, but even married women avoided telling their husbands about harassment or being assaulted out of fear of conflict.
- Husbands set limits on wives' movement, time spent going for OD, and time of day of going out.
- However, gender relations were not necessarily antagonistic at the HH scale. A woman could ask her husband to accompany her for defecation. Husbands also responded to their wives' requests for Individual household latrines (IHLs) for themselves or daughters.
- Community played a significant role in shaping women's experiences around harassment. Belonging to a majority community had some advantages in both the cities. In Pune in Ambedkar basti Marathi women told us that the Marathi municipal Corporator (ward level political representative) belonging to a right wing regional party had "fixed" the non-Marathi men and there was thus overall less violence against women in the basti.
- Research shows that membership in the slum's dominant caste served as protection to married women, while women outside that caste might still be targets of harassment. In Jaipur women of dominant castes claimed they felt no fear, faced no trouble, and had little experience with harassment. In Pune

[15]Ibid

one of the few upper caste women we interviewed told us how insecure she was in the midst of Dalits and how she feared for her daughter's safety. We argue that such talk may be true, but it enables these women to put distance between themselves and other women's experiences and fears in the settlement.

- 'Women' are not a single entity, so we need not be surprised that caste and community relations present a division.
- Women showed little hesitation to point out caste groups that engaged in harassment, but responses about sexual assault usually blamed an outsider. This may be because women were reluctant in small bastis to name someone, but it also suggests that those outside community sanctions with access to women at OD places (e.g., along a busy road) seized opportunities to assault when they presented themselves. Notably, in both Pune and Jaipur, women's triumphant responses to attackers were against outsiders.
- Overall, the possibilities for women joining forces across caste groups seem minimal.
- Communities in Jaipur are rigidly caste divided, as evidenced by a riot in one of the slums during our interview period. Little community solidarity was evident against sanitation-related violence or for the provision of sanitation.

community mental health centre was evident given the various psycho-social stresses that women faced. (Society for Promoting Participative Eco-system Management, 2013-14)

5. FSSM enabling compliance for ending manual scavenging

a. Due to lack of awareness and technical understanding, HHs typically do not construct their OSS systems as per design guidelines. Also, it's a belief that keeping more depth of the pits will not allow frequent overflow of waste water from the OSS systems. These results workers to enter into pit and manually dig out dried faeces from deep unlined pits, which lead to the dehumanizing practice of manually cleaning human excreta from dry/ insanitary latrines which is known as manual scavenging. Many private and informal contractors are involved in providing emptying services. In many cases, informal workers are employed for cleaning the septic tanks by residential societies which may potentially lead to manual scavenging.

b. The practice of manual scavenging is linked with the caste system. A person from lower caste is expected to do this job. To eliminate manual scavenging, the "The Prohibition of Employment as Manual Scavengers and Their Rehabilitation Act, 2013" came into force. This act prohibits the construction or maintenance of insanitary toilets and engagement or employment of anyone as a manual scavenger. Violation of the Act could result imprisonment for a year or a fine of ₹50,000 or both. This act also offers rehabilitation of a person engaged in manual scavenging occupation. It is the responsibility of the ULBs to identify the manual scavengers in the city by conducting a primary survey and to rehabilitate them by providing alternate secured livelihood. The Act aims to help cities to identify and rehabilitate manual scavengers in the city.

c. Typically, many private agencies operate in the sector of emptying waste water from OSS systems and who take higher charges from the owners of OSS systems. There could be potential chances of manual scavenging where

private agencies provide emptying services as the ULBs have no control on private sector. To comply with the Act, cities have started empanelling the private agencies which will work on the terms and condition provided by the ULB, which ensures manual scavenging will not be occurred during emptying of OSS systems and cleaning of sewer lines and manholes. This will help cities to prevent and to end the practice of manual scavenging.

d. Based on an elaborate study undertaken by Urban Management Centre in the Ahmedabad Municipal Corporation to help conform with the Act, Manual scavenging may occur due to manual
   a. Cleaning of open defecation spots,
   b. Emptying OSS systems,
   c. Cleaning of sewer lines and manholes,
   d. Cleaning of PTs, and
   e. Cleaning of excreta from insanitary latrines.

   These are the areas where there is a possibility of manual scavenging in FSSM services but it can be avoided by considering following things:
   - Cities should have adequate suction based vacuum trucks to empty the waste water from OSS systems as Manual Scavenging Act clearly states waste water emptying should be done in a mechanical way. The ULB could either have these trucks themselves or the city should empanel private agencies for emptying OSS systems.
   - Safety gears should be given to the workers engaged in waste water emptying and disposal system, and
   - Capacity building of the workers and staff engaged in FSSM services. (Urban Management Centre, 2015)

6. Financing challenges for construction of individual household latrine (IHHL) under SBM

a. Non construction of toilets or incomplete toilets: after availing first installment subsidy.
b. Most construction of single pit latrines, no space for construction of twin pit toilets.
c. Small and inappropriate septic tanks with no soak pits.
d. Long process of toilet construction from identification of a HH without an IHHL to verification of application to ground survey to actual construction.

7. Sanitation and the Sustainable Development Goals 2015 : Goal 6

The global indicator framework was developed by the Inter-Agency and Expert Group on Sustainable Development Goal Indicators (IAEG-SDGs) and agreed to, as a practical starting point at the 47th session of the UN Statistical Commission held in March 2016. The report of the commission, which included the global indicator framework, was then taken note of by The United Nations Economic and Social Council (ECOSOC) at its 70th session in June 2016. Targets and indicators of the goal are mentioned in the below table.

Table 5: Targets and indicators of the Goal 6 under SDG

Goal 6. Ensure availability and sustainable management of water and sanitation for all	
Targets	**Indicators**
6.1 By 2030, achieve universal and equitable access to safe and affordable drinking water for all	6.1.1 Proportion of population using safely managed drinking water services
6.2 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 Proportion of population using safely managed sanitation services, including a hand-washing facility with soap and water
6.3 By 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally	6.3.1 Proportion of wastewater safely treated 6.3.2 Proportion of bodies of water with good ambient water quality
6.4 By 2030, substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity	6.4.1 Change in water-use efficiency over time 6.4.2 Level of water stress: freshwater withdrawal as a proportion of available freshwater resources
6.5 By 2030, implement integrated water resources management at all levels, including through transboundary cooperation as appropriate	6.5.1 Degree of integrated water resources management implementation (0–100) 6.5.2 Proportion of transboundary basin area with an operational arrangement for water cooperation
6.6 By 2020, protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes	6.6.1 Change in the extent of water-related ecosystems over time
6.A By 2030, expand international cooperation and capacity-building support to developing countries in water- and sanitation-related activities and programmes, including water harvesting, desalination, water efficiency, wastewater treatment, recycling and reuse technologies	6.A.1 Amount of water- and sanitation-related official development assistance that is part of a government-coordinated spending plan
6.B Support and strengthen the participation of local communities in improving water and sanitation management	6.B.1 Proportion of local administrative units with established and operational policies and procedures for participation of local communities in water and sanitation management

Source: (Department of Economic and Social Affairs, United Nations)

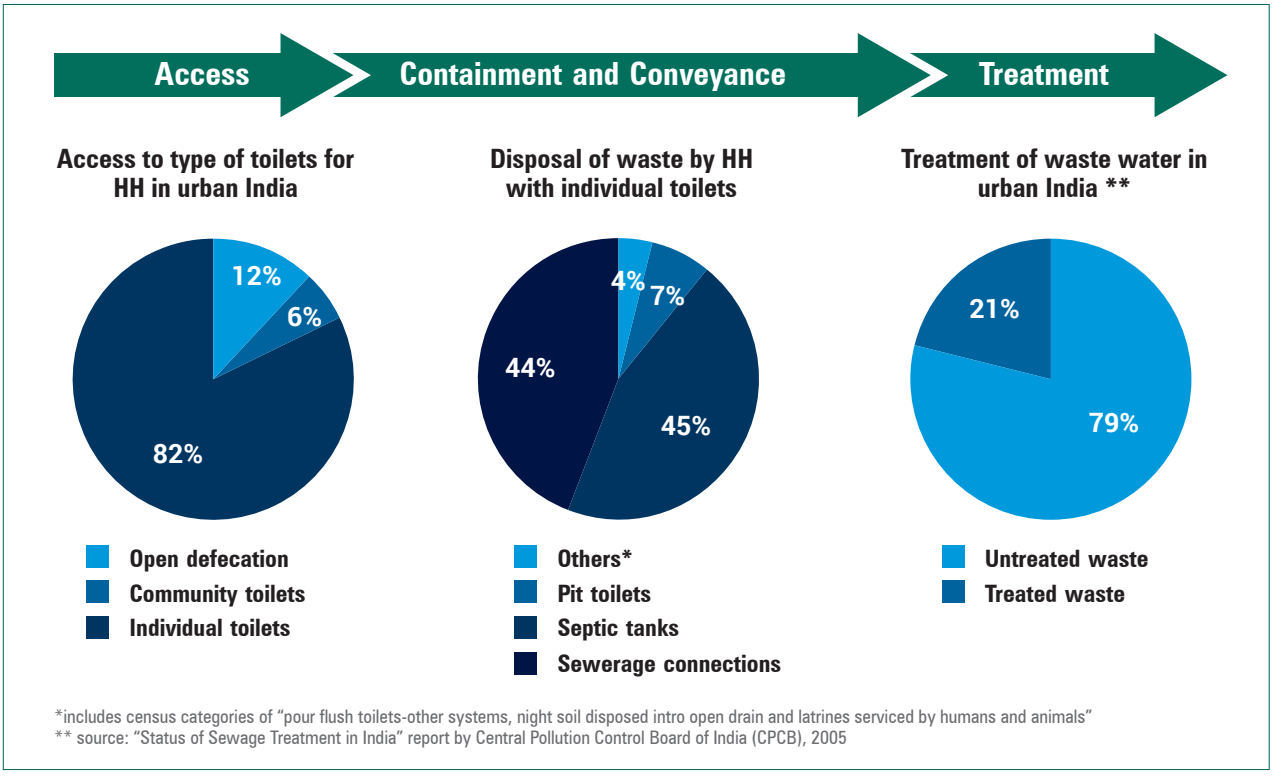
1.4 Learning Notes

1.4.1 Status of Urban Sanitation in India

According to Census 2011, nearly 12% or 95 Lakh urban HHs in India do not have access to toilets and defecate in the open exposing infants and young children to faeco-orally transmitted infections (FTIs). According to a study by the MoHUA, Government of India, 23 million children in urban India are at a risk of diseases due to poor sanitation[16]. A recent research study published by the Water and Sanitation Program (WSP) of the World has also attributed the practice of open defecation to excess stunting in Indian Children[17]. Similarly, improper treatment and disposal of waste water also poses tremendous health and environmental risks. As per the National Urban Sanitation Policy (NUSP), discharge of untreated domestic/municipal waste water has resulted in contamination of 75% of all surface water across India.

NUSP provides a vision for urban sanitation in India "that all Indian cities and towns become totally sanitized, healthy and liveable and ensure and sustain good public health and environmental outcomes for all their citizens with a special focus on hygienic and affordable sanitation facilities for the urban poor and women".

Figure 5: Analysis of access, containment and conveyance - Census of India 2011



Source: CPCB, 2005

[16]Quoted in Workshop on Urban Infrastructure and Service Delivery with Dr. Isher Judge Ahluwalia http://foundation.ifmr.co.in/wp-content/uploads/2012/11/IFF-CDF-workshop-background-note.pdf

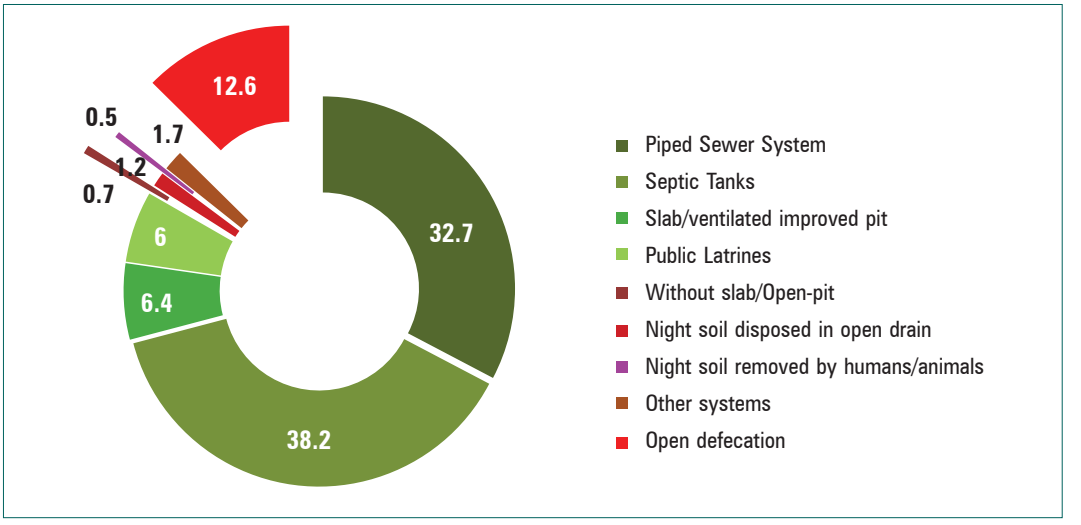
[17]Spears (2013). How Much International Variation in Child Height Can Sanitation Explain?

According to census 2011, 81.4% urban HHs, country-wide, had access to toilets, and 12.6% HHs, which roughly translates to 40 million individuals, were reported resorting to open defecation, in vacant fields, bushes, water-bodies, railway-tracks nearby. Effectively, the toilet coverage statistic reduces to 77.3% when you look for only 'improved latrines' (the ones with piped sewer connections, septic tanks, and improved pit latrines). This again reduces to 70.9% if one discounts the improved pit latrines[18], and even further when one considers the unaccounted/un-assessed dysfunctional and partially functional toilets that we all know exist due to hasty and uninformed construction choices. An oft cited reason for HHs not using their toilets is due to lack of water supply and shallow pits and hence a fear that these will get filled up soon.

As per the Census 2011, every one out of five HHs in urban areas does not have a HH toilet and have to depend on shared facilities. About 17.4% of the urban population dwells in slum areas with 36.1% being in notified slums, 27.6% in recognized slums and 36.3% in identified slums. The coverage of individual toilets in slums is 66% at the national level which is very low as compared to the coverage of 81.5% at a pan-city level. A majority of these HHs thus have to depend on using a community or a public toilet[19].

However, there are several challenges such as social and caste hierarchy, fragmented institutional roles and responsibilities, lack of an integrated city-wide approaches and reaching the un-served and the poor. Our next sessions will delve into these issues in detail.

Figure 6: Graphical representation of types of toilets in urban India (Census 2011)



[18]The purpose of doing so would be due to the fact that the census data does not clearly demarcate between improved twin-pit latrines (which are now benchmarked as the minimum criteria for having a toilet) and single-pit latrines. Census describes 'slab/ventilated improved pit latrines' that those that have provision for night soil fall directly into the pit underground, has a slab/platform to prevent water from entering the pit, is easy to clean, and has a ventilation pipe overhead.

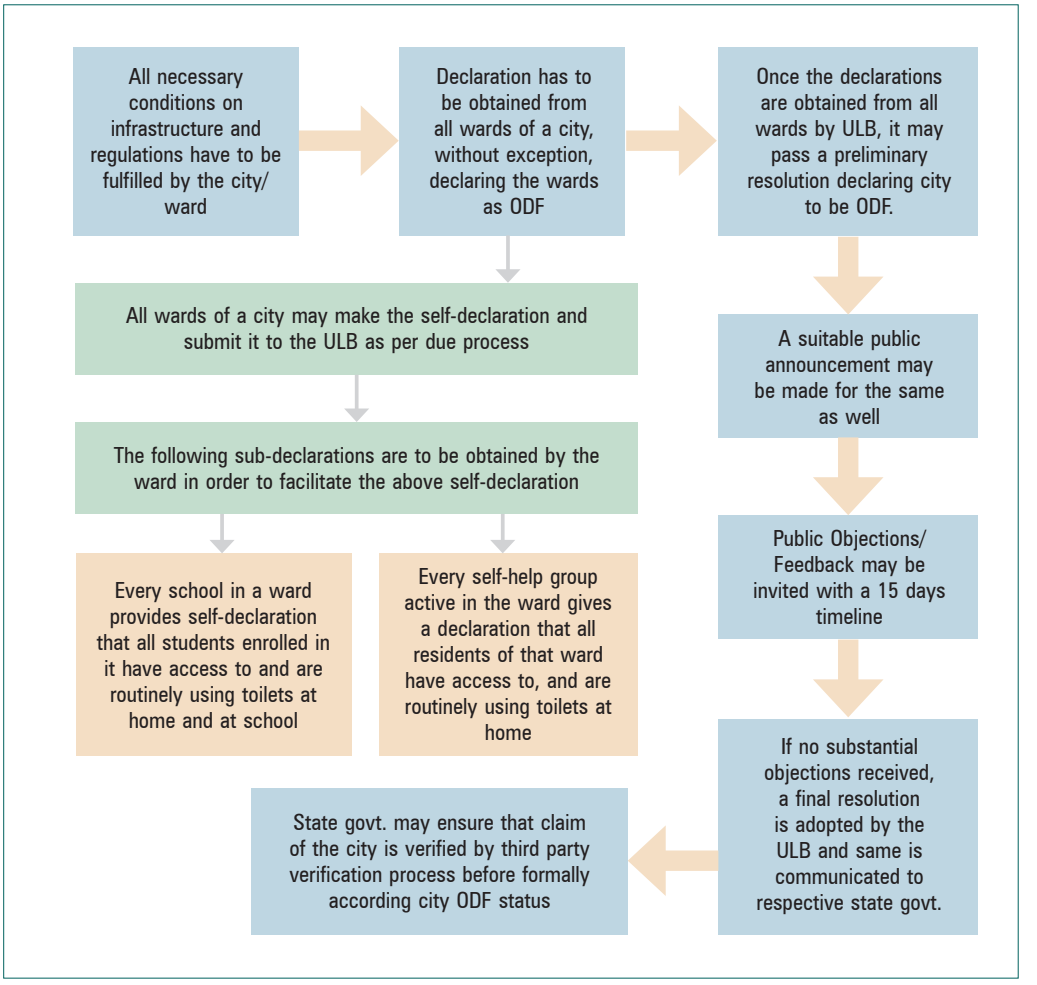
[19]http://censusindia.gov.in/2011census/hlo/Data_sheet/India/Latrine.pdf

1.4.2 Open Defecation Free city / ward Declaration Protocol

Necessary infrastructure and regulatory conditions to be achieved before declaring a city/ ward as ODF as per SBM (Urban) guidelines of the MoHUA:

1. All HHs that have space to construct toilet, have constructed one.
2. All occupants of those HHs that do not have space to construct toilet **have access to a functional community toilet within a distance of 500 meters.**
3. All commercial areas have functional **public toilets within a distance of 1 kilometer.**
4. Details of all IHHL constructed from 2011 onwards will have to mandatorily be uploaded on the SBM-Urban portal
5. Pictures of all functional community and public toilets in the city, irrespective of the date of construction, will have to mandatorily be uploaded on the SBM-Urban portal.

Figure 7: ODF Declaration Protocols



Source: Declaring your City/Town ODF, A ready-reckoner for ULBs, MoHUA

The MoHUA released a ready-reckoner for ULBs for declaring cities or wards free from open defecation. This ready reckoner contains the following:

- ODF declaration protocols
- Format for ODF declaration to be submitted by City / town
- Format for ODF declaration to be submitted by ward councilor
- Format for ODF declaration to be submitted by schools

1.4.3 Swachh Bharat Mission (Urban)

The Swachh Bharat Mission that was launched on the 2nd October 2014 is providing a huge impetus to improve sanitation and one of its key objectives is to make India free from open defecation. The major objectives of the mission are:

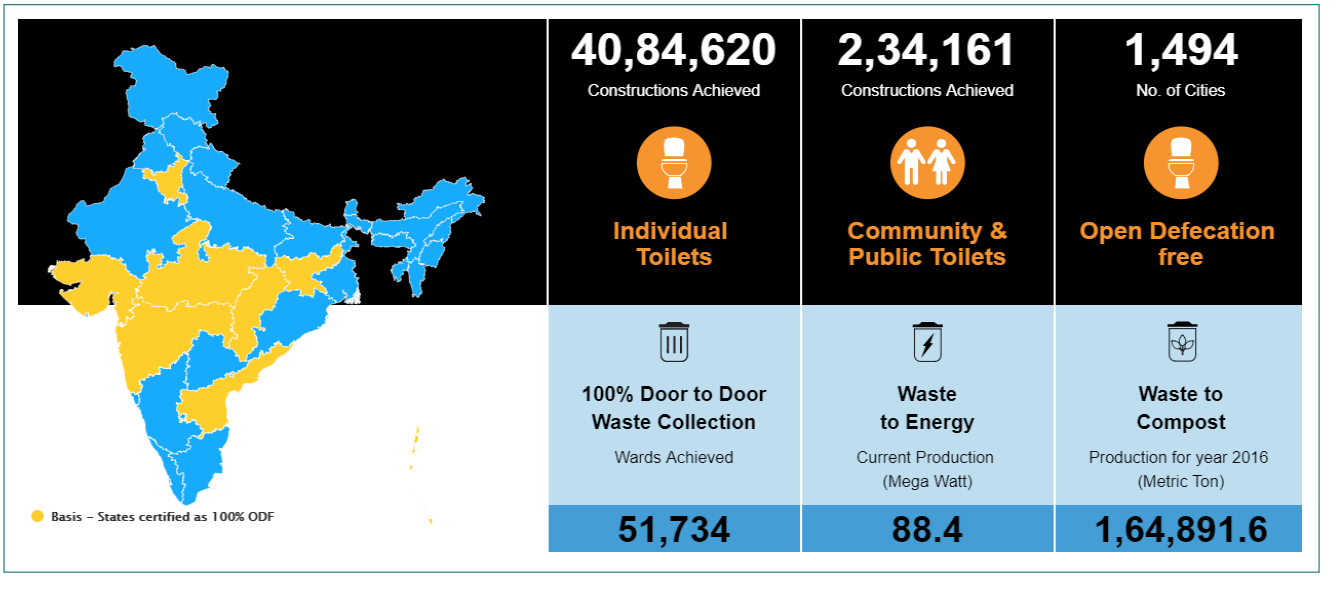
- Elimination of open defecation
- Eradication of manual scavenging
- Modern and scientific municipal solid waste management

To achieve these objectives, the following components are covered under SBM:

- Construction of individual household toilets,
- Conversion of insanitary latrines into sanitary latrines, and
- Construction of public and community toilets

SBM the progress can be tracked on the SBM portal[20].

Figure 8: Status of toilet construction under SBM - Urban



Source: http://www.swachhbharaturban.in/sbm/home/#/SBM, Information retrieved on January 4, 2018

[20] Swachh Bharat Mission Portal: http://www.swachhbharaturban.in/sbm/home/#/SBM

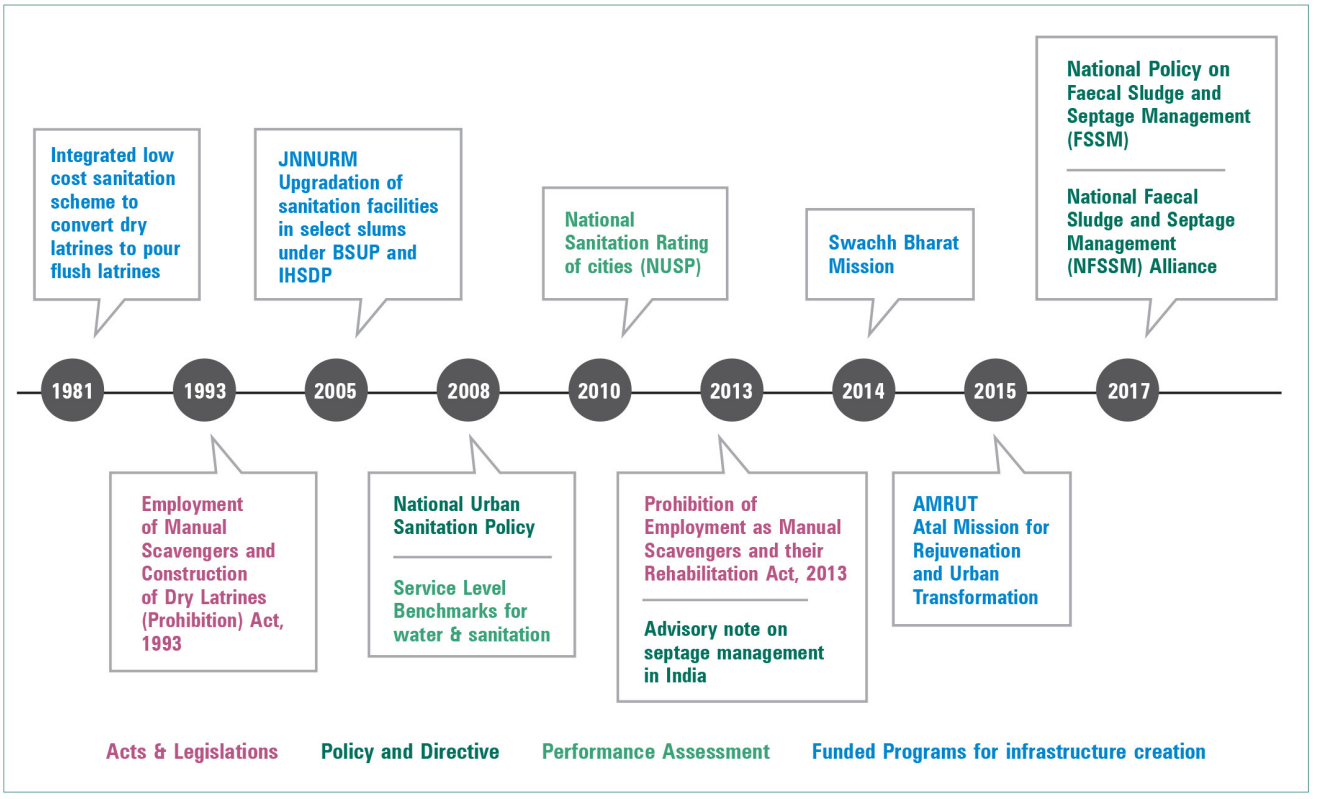
1.4.4 History of Sanitation Efforts and the Shifting Paradigm towards FSSM

Sanitation was included as an agenda item in Government of India's First Five Year Plan (1951-56), but the focus of the Central Government in the fifties was largely on housing and redevelopment of slums. The Slum (Clearance and Improvement) Act was formulated during this period.

In the sixties and seventies, urban policy in India began taking a more concrete shape. There was a huge focus on promoting planned development of cities through the implementation of master plans. By eighties, when the 1981 Census revealed that 23.3% of Indian population lived in cities, most cities were characterized by lack of infrastructure, planning and unimproved sanitation facilities.

Central government shifted from urban policy to infrastructure development. Sanitation became a prerogative of the local governments only with the passage of the landmark 74th Constitutional Amendment Act in 1992 that recognized cities and towns as the third tier of government through the constitution of ULBs. The

Figure 9: Initiatives in the sanitation sector in India: A timeline



Source: (Urban Management Centre, 2017)

Jawaharlal Nehru National Urban Renewal Mission (JNNURM), a massive urban renewal program targeting integrated development of urban infrastructure in 63 identified cities, mandated reforms and preparation of City Development Plans (CDP) that charted out plans by cities as to how they would develop land-use, transport and other basic infrastructure including sanitation. There was provision of funds and focus on creating sewage network and treatment facilities. However, all funds allocated to the sanitation sector were spent on construction of underground sewerage projects[21].

At the national level, the infrastructure driven approach started moving towards a holistic, integrated, people centered approach with the release of the NUSP in 2008. The policy moves away from prescribing piecemeal infrastructure solutions such as construction of toilets or STPs towards planning and implementing measures related to sanitation in various sectors as a cross-cutting issue.

1.4.5 FSSM Guidelines

Following are the names of states that have already prepared their FSSM guidelines:

1. Operative Guidelines for Septage Management in Urban and Rural Local Bodies, Tamil Nadu – released in September 2014
2. Guidelines for Septage Management, Maharashtra – released in February 2016
3. Urban Septage Management Guidelines, Odisha – released in 2016
4. Faecal Sludge and Septage Management Policy, Jharkhand – released in April 2017
5. Draft Policy on Faecal Sludge and Septage Management, Rajasthan – released in 2017

1.4.6 Roles and Responsibilities of various Stakeholders for FSSM

There is a DO letter released by SBM (Urban) for assigning responsibilities for FSSM, which is attached as Annexure 1. Below table is also showing responsibilities of various government departments.

[21] Ministry of Urban Development, GoI. (2014, April 29). Completed Projects. Retrieved November 21, 2014, from JNNURM: http://jnnurm.nic.in/wp-content/uploads/2014/04/Completed-Projects-29-04-20141.pdf

Table 6: Roles and responsibilities[22] of various government departments (Centre for Science and Environment, 2017)

Institutions	Lead role towards septage management	Supportive role
Ministry of Housing and Urban Affairs	Technical and planning support to states and ULBs	• Development of guidelines, schemes, national level policies, funding support, teaching assistance • Designing and implementing national level strategies on satiation, capacity building, financial assistance for City Sanitation Plan, monitoring and evaluating urban projects
Ministry of Environment, Forest and Climate Change	Enforce compliance of the relevant environmental laws and rules during the collection, transport, treatment, and disposal of faecal sludge and septage	• Support and build capacity of state pollution control boards towards enforcement of relevant laws and rules
Ministry of Social Justice and Empowerment	National-level awareness campaign through monitoring and evaluation	• Help states and ULBs eliminate manual scavenging and rehabilitate manual scavengers
Ministry of Women and Child Development	---------	• Gender mainstreaming in IEC material for FSSM across the country
State governments	Develop state level FSSM strategy and implementation plan	• Technical, financial and administrative support to ULBs • Encourage coordination and cooperation among ULBs • Regulate and help ULBs set up systems to ensure financial sustainability in provision of FSSM services • Implement municipal by-laws.
Local Bodies and development authorities	Design, develop, plan and implement ULB level FSSM strategy	• Create enabling environment for NGOs and private initiatives to achieve safe and sustainable FSSM • Planning, implementation, O&M of sanitation services
Households	Maintenance of septic tanks through scheduled desludging regular maintenance and monitoring of septic tanks	• Engage with decision-makers at state and ULB level to ensure that they receive good quality FSSM services

1.4.7 Frequently used terminologies

What is grey water?

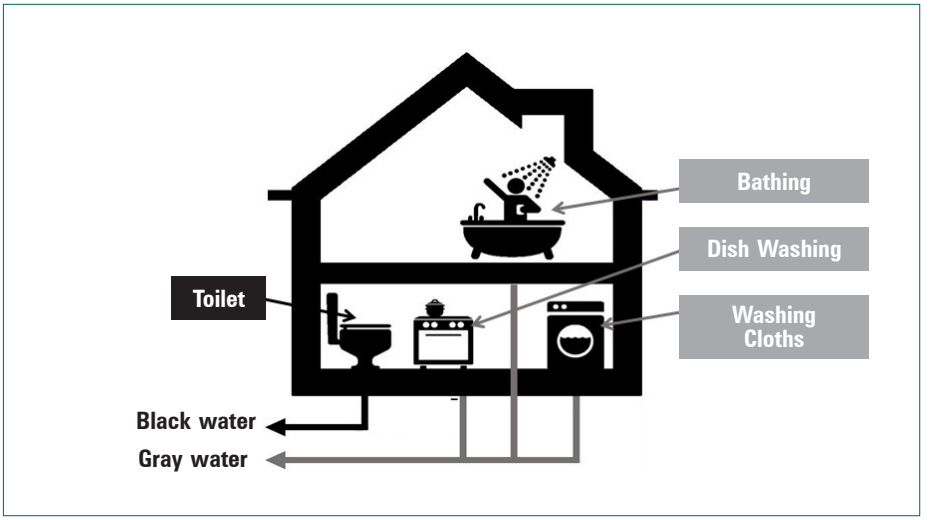
Grey water does not contain excreta, for example, waste water from kitchen and bathrooms.

What is black water?

According to Central Public Health and Environmental Engineering Organization (CPHEEO), waste water from a community, containing solid and liquid excreta, is known as black water.

[22] Retrieved from "Septage Management, A Practitioner's Guide" by CSE

Figure 10: Sources of generation of black and grey water



Source: From Liquid Waste Management presentation made by NIUA, CDD Society and BORDA

What are the potential sources of generation of black and grey water?

Black water is generated from the toilet, which contains human excreta whereas grey water can be generated from the other activities like cooking, washing cloths and dishes.

What is Faecal Sludge?

'Faecal Sludge' is raw or partially digested in slurry or semisolid form, the collection, storage or treatment of combinations of excreta and black water, with or without grey water. It is the solid or settled contents of pit latrines and septic tanks. The physical, chemical and biological qualities of faecal sludge are influenced by the duration of storage, temperature, soil condition, and intrusion of groundwater or surface water in septic tanks or pits, performance of septic tanks, and tank emptying technology and pattern. (Ministry of Housing and Urban Affairs, 2017)

It is estimated that 1 truck of faecal sludge and septage carelessly dumped equals to 5,000 people defecating in open. 1 gram of feces may contain one hundred parasites eggs, one thousand protozoa, 10 lakh bacteria and 1 crore virus (Chary and Srinivas, 2017).

What is Septage?

'Septage' is the liquid and solid material that is pumped from a septic tank, cesspool, or such on-site 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.

The effluent from the septic tank can be collected in a network of drains and/or sewers and treated in a treatment plant designed appropriately. The accumulating sludge at the bottom of the septic tank however, has to be also removed and treated once it has reached the designed depth or at the end of the designed desludging

frequency whichever occurs earlier. Such a removal is possible only by trucks. While sucking out the sludge, the liquid in the septic tank will also be sucked out. Such a mixture is referred to as septage. (National Policy on Faecal Sludge and Septage Management, 2017)

It is required to dispose septage safely otherwise it can impact on health. Due to wrong designs of the septic tanks and twin pits, waste water ends up mixing with ground water which can lead to water borne diseases and environmental issues.

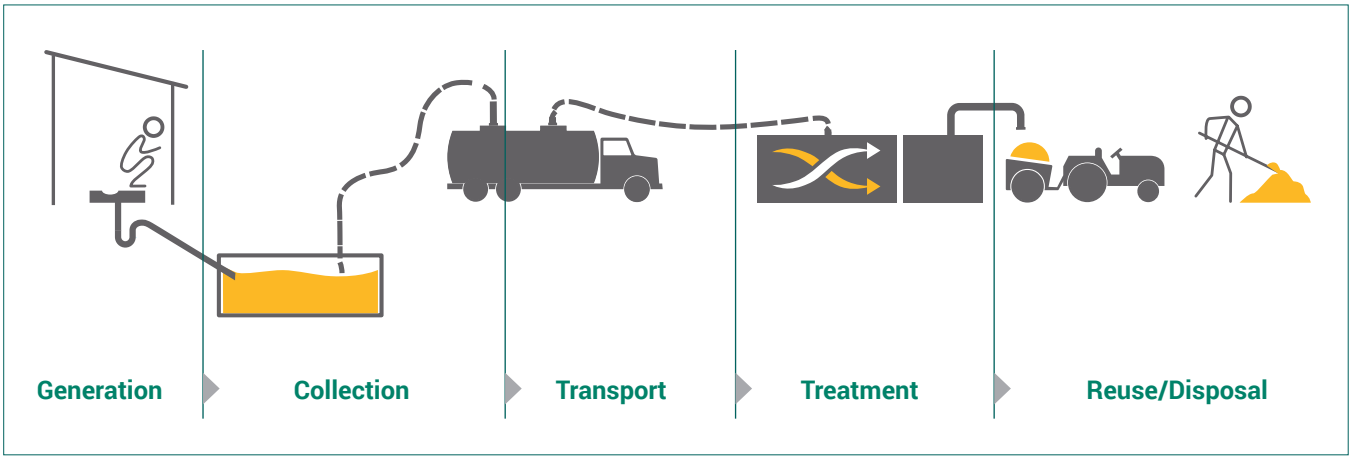
1.4.8 Sanitation Value Chain

A sanitation value chain is made of:

Generation – Collection – Transportation – Treatment – Disposal

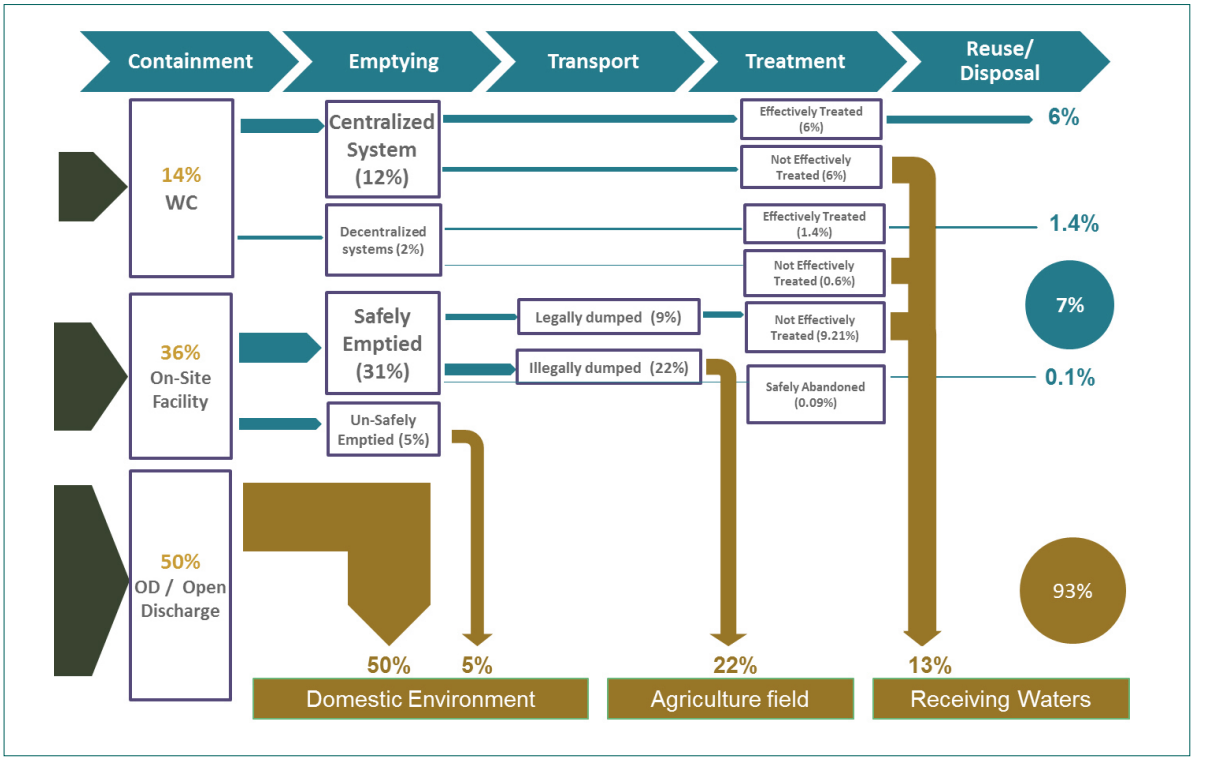
As per the Census of India 2011, 31.16% of the country was urbanized. Linkages in the sanitation value chain in urban India have been patchy. A shit flow diagram of urban India reveals that only 6.7% of all waste water generated in cities of India is safely disposed[23]. A staggering 93.3% of the waste water is either discharged in the open or agricultural fields or in water bodies. Only 50% of all the waste water is emptied through centralized systems and emptying of OSS systems. Out of this 50%, 34.8% of the waste water is then conveyed to a treatment or disposal site and only 6.6% is treated.

Figure 11: Sanitation value chain diagram



Source: Bill and Melinda Gates Foundation

Figure 12: Shit Flow Diagram



Source: Census 2011, Data Analysis: (Consortium for DEWATS Dissemination Society)

[23] CDD. (2016). *Faecal Sludge Management in India: Case of Devanahalli.* Retrieved May 2017, from https://smartnet.niua.org

SESSION 2

Planning for FSSM at Town Level – Containment and Conveyance

2.1 Learning Objectives

- To learn about containment technologies, current status and challenges
- To understand desludging and conveyance technologies, current status and challenges
- To learn to plan for FSSM by understanding the annual generation of septage, the processes of desludging and disposal and the roles played by various stakeholders

2.2 Duration

90 minutes

2.3 Key Facts

1. What do we mean by FSSM Planning and Assessment at town level

Different Assessments required:

- Septage Generation – type of containment system at household level
- Service performance - all sanitation services at ULB level
- Institutions(ULBs and state level), Regulatory environment and Norms. State and national level policy frameworks are aligned to proposed interventions.
- Conveyance and transportation options for feacal sludge and septage
- Technology Options for treatment and disposal, in order to design the most appropriate option for treatment
- Financing options : sources of financing for FSTPs, Tariffs, different models for CAPEX and OPEX

2. The Central Public Health and Environmental Engineering Organization (CPHEEO) has laid down design considerations for construction of sanitary toilets and septic tanks[24].

Design safety considerations for sanitary toilets

- To eliminate contact with human faeces, seal the air vent of septic tanks with mosquito fly traps.
- To eliminate the contamination of ground using a pit latrine system, toilets should be located at a safe distance from a drinking water source. The ground water table should not be high.
- A two pit latrine system is safer to adopt when compared to a single pit latrine system.

Design specifications for septic tanks

- A septic tank should have at least two lined chambers with a flow vent in between at the required height and size outlined by CPHEEO.
- The outflow is passed through a soak pit.
- An openable flap for regular cleaning
- A vent exhaust pipe equipped with a mesh capping

3. For safe conveyance of septage to the designated disposal site, there are a range of desludging vehicles available in the market.

The type of desludging vehicle or emptier truck that would need to be procured would depend on the volume of septic tanks to be emptied and the number of trips of an emptier truck. Suction-based vacuum trucks or emptier trucks with varying capacities of tanks are available in the market. The capacity of an emptier truck typically varies from 2,000 litres to 20,000 litres. The cost of the truck varies depending upon its capacity. The ULBs can avail information about the cost of emptier trucks from local vendors.

While making the decision regarding the procurement of emptier trucks, ULBs should consider the average road width of the areas from where the septic tanks need to be desludged. Emptier trucks of varying capacities can be procured. ULBs can also

[24]http://cpheeo.nic.in/Onsite%20Sanitation/suk/cha/Chap1-6.pdf, http://moud.gov.in/upload/uploadfiles/files/Chapter%209.pdf

consider outsourcing the desludging process to private agencies. However, ULBs would need to ensure that these agencies have adequate numbers and types of desludging vehicles.

4. Overview of Treatment Systems

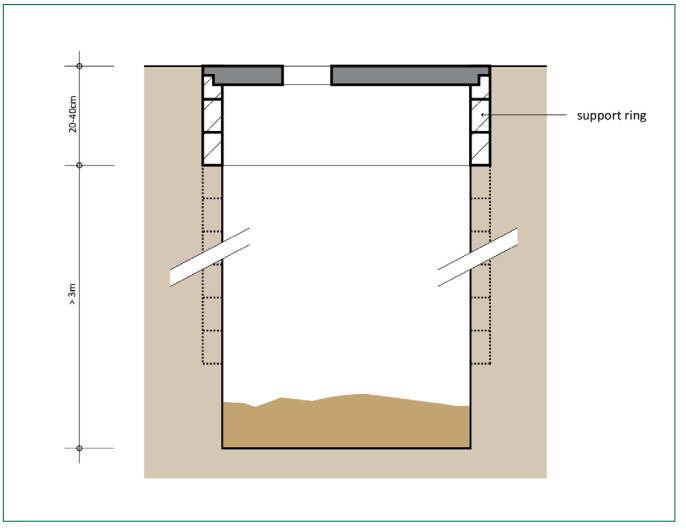
- Basic principle of facial sludge treatment is separation of solid matter from water and the treatment of both to make it safe for either reuse or disposal Faecal sludge collected from septic tanks has a higher solid content as well as Biochemical Oxygen Demand[25] (BOD) level, as compared to sewerage.
- Treatment options for the solid content of faecal matter are waste-to-energy and waste-to-compost.
- Treatment options range from gravity based biological treatment, mechanical centrifugal, chemical flocculants treatment, membrane-based and filtration systems, electrical heat and drying to the extent of incinerators.
- Treatment for waste water and liquid content of faecal waste matter can also be biological plant based systems, membrane and filtration, chlorination, ultra violet, among others.

2.4 Learning notes

2.4.1 Containment/On-site Sanitation Systems

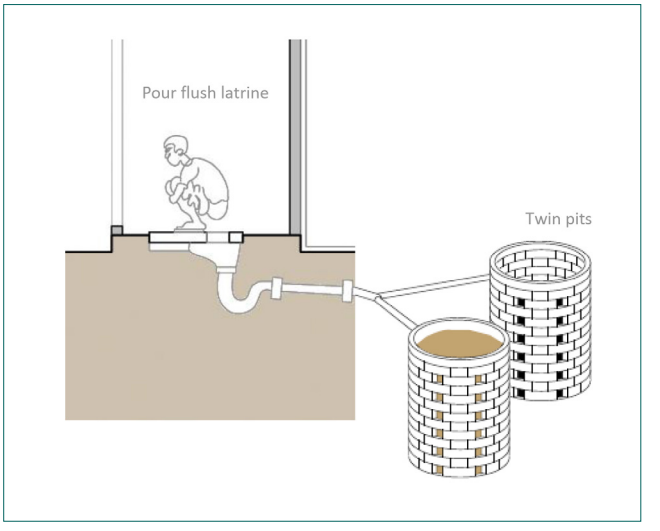
Containment systems for the management of faeces can be broadly categorized into two, offsite sanitation systems and OSS. Offsite sanitation systems carry the wastewater collected from the toilet to a single point of collection and treatment or outlet to water bodies. In OSS systems, faecal waste is collected in a containment

Figure 13: Single Pit



Source: (IWA and Eawag)

Figure 14: Twin pit



Source: (IWA and Eawag)

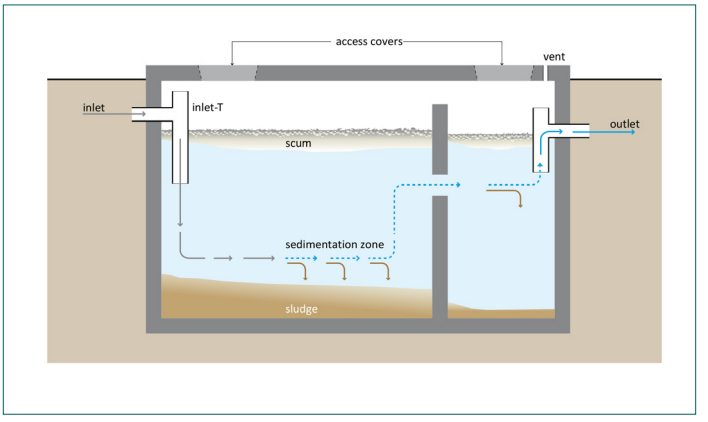
[25]BOD is the amount of dissolved oxygen needed (i.e., demanded) by aerobic biological organisms to break down organic material present in a given water sample at certain temperature over a specific time period.

system and may or may not be treated.[26] OSS systems range from a basic sanitary facility, such as single pit and twin-pit latrines, to a treatment system that connects a septic tank with a soak pit or a bio-digester toilet (aerobic and anaerobic). FSSM deals with OSS systems, which retain waste in a pit, tank or vault connected to the toilet.

Types of On-site Sanitation Systems

Single Pit: It consists of a superstructure and a pit. Faecal matter is deposited into a pit. Urine and water percolate into the soil through the bottom of the pit and wall, while microbial action degrades part of the organic fraction. Pathogenic germs are absorbed to the soil surface. In this way, pathogens can be removed prior to contact with groundwater.

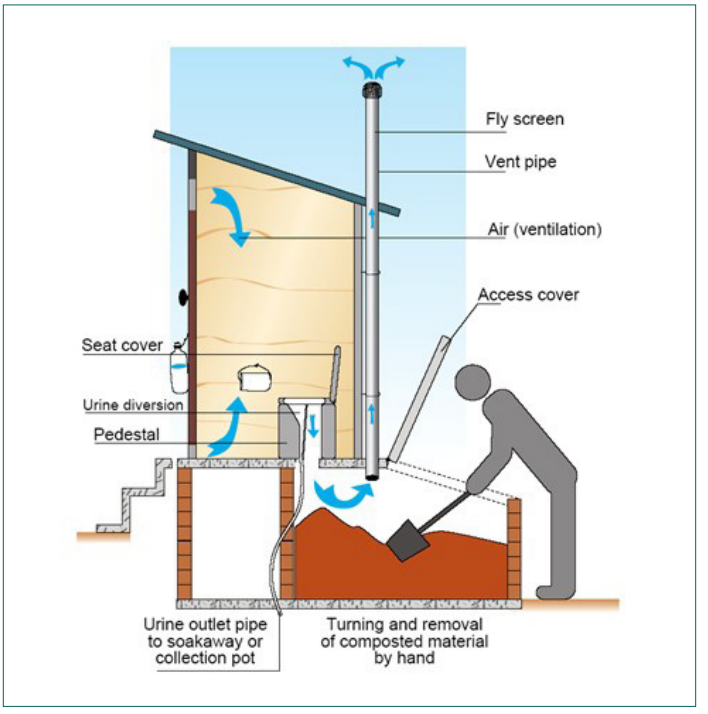
Figure 15: Septic Tank



Source: (IWA and Eawag)

Twin pit: It consists of a superstructure (toilet) and treatment units (two chambers). There are two alternating pits meant to hold faecal sludge generally connected to a pour-flush toilet. Only one pit is functional at a time while the other is allowed to rest as the liquid leaches out of the pit Pathogenic germs are absorbed into the soil while solids dry inside the pit. The filled pit can be conveniently emptied after one-and-half years, when most of the pathogens die. The sludge, also called pit humus, can safely be used as manure.

Figure 16: Urine diversion and composting toilet - ECOSAN



Source: Retrieved from http://www.borda-sa.org/fileadmin/borda-sa/images/oldnews/img4b7b70c3e13be.jpg

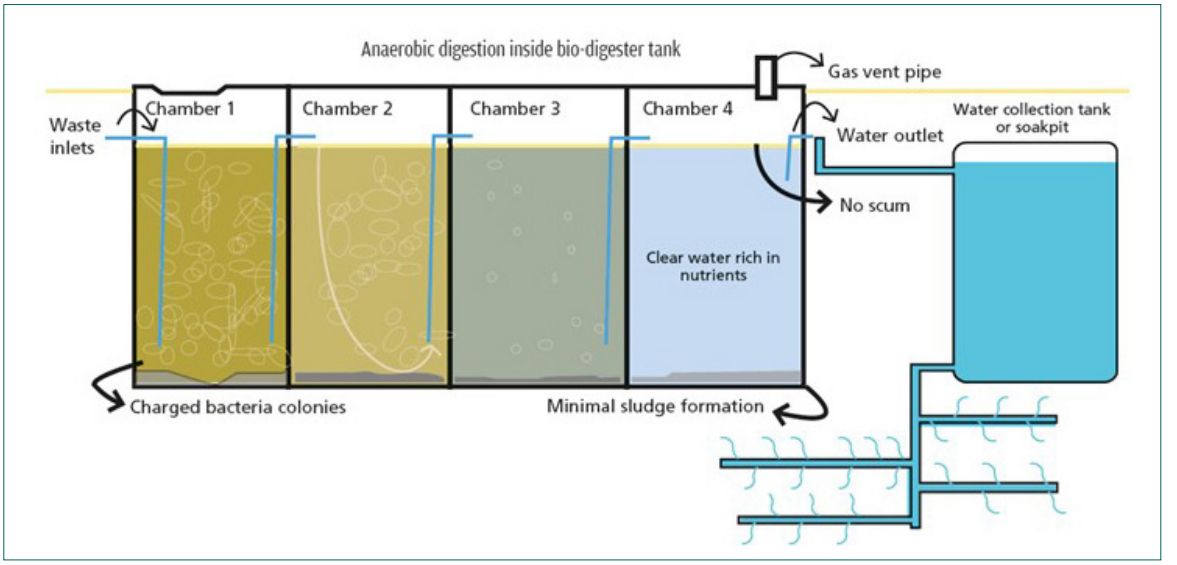
Septic tank: A septic tank is a water-tight, single-storied tank in which sewage is retained long enough to permit sedimentation and digestion. It is an underground tank that treats sewage by a combination of solids settling and anaerobic digestion. The effluents may be discharged into soak pits or small-bore sewers, and the solids have to be pumped out periodically. Bureau of Indian Standards provides a Code of Practice for Installation of Septic Tanks (IS-2470 Part-1, 1985).

Septic tank removes between 40% and 50% of BOD and between 50% and 70% of Total Suspended Solids (TSS) (CPHEEO, Part A, pg. 92) and results in an abatement of 1 log units e-coli (a faecal indicator bacteria) *Refer IS-2470 Part-1, 1985 for septic tank design codes.*

Urine diversion and composting toilet or ECOSAN: ECOSAN is a type of toilet in which human excreta,

[26] *Retrieved from Septage Management: A Practitioner's Guide,* Centre for Science and Environment, New Delhi

Figure 17: Bio-Digester toilet



Source: retrieved from http://www.bankabio.com/bio-digester-tank-system.html

urine and wash water are separated through specially designed toilet seats unlike the conventional water closets where all these are collected together. Excreta is collected in the chamber constructed below the toilet seat, urine is collected in a drum/pot kept outside the toilet and wash water is diverted to a plant bed raised near the toilet. (Ministry of Drinking Water and Sanitation)

Bio-digester toilet: A bio-digester toilet is an anaerobic multi-compartment tank with inoculum (anaerobic bacteria) which digests organic material biologically. This system converts faecal waste into usable water and gases in an eco-friendly manner.[27]

This technology has been developed by Defence Research and Development Organisation (DRDO) and advocated in SBM. These toilets are widely used for 80% treatment of black water from individual and cluster HHs or institutional buildings where there is no sewerage network.

Current status

According to Census of India 2011, 81.4% of urban HHs across the country had access to toilets and 12.6% of urban HHs, which roughly translates into 40 million individuals, were reported to be practicing open defecation. The statistics on toilet coverage reduces to 77.3% when only 'improved latrines' are considered, i.e., toilets with piped sewer connections, septic tanks and improved pit latrines. This figure reduces to 70.9% when the improved pit latrines are discounted for and even further when one considers the unaccounted/unassessed dysfunctional and partially functional toilets that are constructed as a result of hasty and uninformed construction choices.

[27] Septage Management: A Practitioner's Guide, Centre for Science and Environment, New Delhi

Figure 18: Distribution of HHs by types of toilet facilities and access to drainage

	Percentage Distribution of Households by Types of Toilets: 2011								Percentage Distribution of Households by Access to Drainage: 2011			
	Flush/pour flush toilet connected to Alternative Source				Pit Toilet	Service Toilet	Alternative Source		Drainage	No drainage	Waste water outlet connected to	
	Piped Sewer	Septic Tank	Other System	Total			Public Toilet	Open			Closed drainage	Open drainage
All India	11.9	22.2	2.3	36.4	9.4	1.1	3.2	49.8	51.14	48.86	18.13	33.01
Rural India	2.2	14.7	2.5	19.4	10.5	0.8	1.9	67.3	36.75	63.25	5.75	31.01
Urban India	32.7	38.2	1.7	72.6	7.1	1.7	6.0	12.6	81.77	18.23	44.50	37.26
Metropolitan Cities	62.2	20.3	0.9	83.5	2.8	1.5	8.2	4.0	93.98	6.02	74.3	19.66
Non-Metropolitan Class I Cities	28.1	46.8	1.9	76.8	5.3	2.3	4.8	10.7	85.12	14.88	38.12	47.01
All Towns	11.2	43.9	2.3	57.4	10.2	1.7	4.8	25.8	70.38	29.62	21.90	48.48
Class I	47.4	31.8	1.3	80.6	3.9	1.9	6.8	6.9	90.13	9.87	58.59	31.54
Class II	15.8	49.0	2.0	66.8	7.2	2.4	5.7	17.9	79.27	20.73	27.18	52.08
Class III	10.8	45.4	2.3	58.5	9.2	1.7	4.8	26.0	73.34	26.66	21.61	51.74
Class IV	8.2	40.2	2.4	50.8	12.7	1.3	4.5	30.7	64.00	36.00	18.98	42.02
Class V	7.3	35.2	2.9	45.3	15.4	1.2	3.9	34.3	54.23	45.77	16.34	37.88
Class VI	9.2	36.2	3.5	48.9	14.8	1.0	3.6	31.7	54.49	45.51	17.46	37.03

Calculations based on Census of India data 2011: Houses, Household Amenities and Assets
Source: URBAN INDIA, HSMI-HUDCO CHAIR-NIUA, 2017

Challenges

Effluents from improperly designed septic tanks are directly discharged directly into the drains. In many cases, the containment system does not exist for the toilet. Skills and knowledge of masons and construction workers also result in incorrectly constructed containment systems. They also lack knowledge of designs prescribed by Bureau of Indian Standard, National Building Code. Lack of enforcement of septic tank design recommended by CPEHEEO makes matters worse.

Role of ULB

It is the role of the ULB to ensure that the CPHEEO guidelines are strictly adhered to while building new septic tanks and converting insanitary or dry latrines into sanitary latrines. In order to do this, the ULB has to include and check safe containment (toilets) in the permission documents of building plans.

The ULB should begin by assessing existing properties in the city, which are connected with On Site Sanitation Systems (OSS) and inventorize these properties into a database. The ULB can also run awareness campaigns using IEC and BCC methods, targeting all stakeholders.

2.4.2 Emptying and Conveyance

This part of the sanitation value chain refers to the removal and transportation of septage from the OSS to the treatment facility. Emptying of OSS is done both

mechanically and manually. Motorised emptying and transport is done using a truck is fitted with a pump which is connected to a hose that is lowered down into a tank (e.g., septic tank) or a pit, and the sludge is pumped up into the holding tank on the vehicle. This type of design is often referred to as a vacuum truck. This is the most often used system in cities in India. Vehicles that carry septage act as mobile sewer.

The septage can be considered safely disposed, if it co treated with a sewerage treatment system, a farmer's field where it is safely handled and treated, a sanitary landfill, or in an FSTP.

Types of conveyance

The two main types of vehicles used in India are:

Truck-mounted vacuum tankers: These trucks have vacuum pumps with sizes based on lift elevation, pumping distance, volume of sludge to be removed, and volume of the tank. Their capacity varies between 3,000–10,000 litres.
Tractor-mounted tankers: These vehicles are locally made across India, but their capacity is similar to that of vacuum trucks. The motor, the tank and the tractor are assembled according to the complimenting capacity of each module.

Figure 19: Truck mounted tanker

Figure 20: Tractor mounted tanker

Current Status

Emptying: Of the 81.4% of 79 million urban HHs that had access to toilet, 56%[28] of these toilets are dependent either on OSS such as septic tanks and pits or do not have one. 'A large part of the waste water would be seeping into the soil since the construction quality of the tanks buried underground in populated areas is often poor' (Suresh Kumar Rohilla, Bhitush Luthra, Shantanu Kumar Padhi, Anil Yadav, Jigyasa Watwani, Rahul Sanka, 2016). About 5% of these toilets either discharge the faecal matter into open drains, do not have covered pits, or are cleaned by human/ animals, leaving a huge possibility of health risk and environmental contamination. The Manual Scavengers and Construction of Dry Latrines (Prohibition) Act 2013, makes it unlawful for anyone to engage or to allow engaging in manual scavenging for dignity as well as primarily for health risk concerns. This then leads to the issue of lack of scheduled desludging in India.

[28]The figure is derived after discounting the 12.6% urban HHs that do not have access to toilets.

The function of desludging septic tanks and soak-pits is not uniformly carried out by the ULB. Conventionally, HHs identify the need to de-sludge only when their toilets are filled, and are not able to drain the faecal matter any longer. Usually the call is for a private desludging agency. Cities lack a systematic and accurate data on HHs with toilets connected to septic tanks and pits. Even when under the SBM, they have been generating geo-tagged data on IHHLs; the data is not utilized or built upon for developing a scheduled-desludging regimen.

Also, according to the guidelines of the SBM, provision of IHHLs under this scheme would include conversion of dry and single pit latrines into twin pit latrines, since these are now identified as the most basic toilet-type permissible as 'safe'. However it is unlikely that all such IHHLs would be effectively covered due to under-reporting and feasibility (space constraints) issues.

Hence, there is a wide scope on this section of the sanitation value chain. All the more important since even the CPCB reports suggests that 75% of water contamination across India is due to poor sanitation.

Conveyance / Transportation: The status of conveyance systems in our sanitation infrastructure is also very weak. Of the 81.4% HHs in census 2011 that had access to toilets, only 32.7% had piped sewer connections. These connections would also include the illegal connections. A larger chunk, i.e. 44.6% of these toilets is connected to either septic tanks or soak-pits. This indicates an immense scope of work for the ULBs to empty septic tanks regularly and transport septage to the STP. However this happens at with a very thin frequency. First, HHs feel the need to desludge only when they find their pits/tanks no longer being able to drain off their feces. Since most of the tanks/pits are built larger than their prescribed standards, it takes years for them to reach this stage. So, only 2% - 4% of septic tanks and pits are cleaned annually in most ULBs (Ministry of Housing and Urban Affairs, 2013).

A major proportion of the emptied sludge is spilled onto the open fields and water bodies. This is more so with the private contractors who dispose the emptied sludge in open plots or water bodies or in farms.

For a city like New Delhi, only 1% of the faecal matter collected from desludging septic tanks / pits are transported to treatment plants and treated. A Rapid Assessment Study of 100 Towns of Rajasthan showed that 55% septage is dumped in agriculture farms, 25% in water bodies and 20% in open lands.[29]

Due to the lack of data on locations of septic tanks and soak-pits, ULBs are unable to establish a regular desludging regimen in their cities. Since there is no systematic information on the demand for desludging services there is a gap. ULBs that provide services for desludging are not able to assess the number of tankers/trucks, the type and sizes of desludging tankers/trucks that they need to have in their municipal fleet.

[29]CDD Society-NIUA study, 2017

Figure 21: (Below Left) Unused IHHL; (Below Right) Inappropriate outlet for black water at an IHHL

Source: Urban Management Centre

Challenges

Containment systems are not desludged regularly. No database exists of properties with OSS and those that follow a scheduled regime of cleaning. There is a scarcity of finances for procurement of desludging equipment or lack of empanelled service providers. Workers lack adequate training in the processes. Safety gears are inadequate. The practice of manual scavenging continues to persist. There is limited access of vehicles in narrow lanes.

Role of ULB

The role of ULB in case of conveyance is to safely empty as well as transport the septage from the OSS to either a treatment or disposal site. The ULB needs to prescribe safety standards and standard operating processes to be used by its own staff and teams as well as by any agencies that it outsources desludging to. These safety standards and any violation should be part of the city's public health bye laws. It has to be ensured that the desludging vehicle operators abide by all the safety norms and wear all the required safety gears while desludging. Registrations of all vehicles and vehicle operators should be done.

For safe transport, the ULB may have to procure new vehicles, for which it has to assess and derive which vehicles will be most suitable and the sources of funds for those. Initial level assessment of private players is to be conducted to see who are interested and willing to bid.

2.4.3 Conducting Assessment

It is important to conduct an assessment to understand the annual generation of septage, the processes of desludging and disposal and the roles played by various stakeholders. The data generated from such an assessment can be used to plan either a FSTP or co-treatment of septage with sewage.

Four key stakeholders are HHs, the ULB, the District Magistrate or District Collector and the elected representatives.

Parameters for assessment

Household	ULB	District Magistrate/Collector (for smaller town)	Elected Representatives
• Dimension of septic tank • Is the septic tank lined or unlined? • When was it last cleaned • Manual or mechanical desludging • Price paid • last desludged (frequency of desludging) • How long does it take to get the service (time lag in booking a request and receiving the service) • Satisfaction levels with the desludging done • Preference for desludging and suggestions for improvement (municipality and private sector	• Typology of town, different localities and sewerage/ septage coverage • Desludging operations and trucks owned by municipality • System of providing desludging services • Time lag of service provision • Payment of service • Satisfaction levels of the clients • Issues and concerns faced by the ULB • Where is septage dumped by municipal trucks if no co-treatment with sewage taking place • Whether the municipality keeps a record of private desludging tankers and operators, any licensing or monitoring	• Overview of towns falling in the district and current status and plans for the future for sewerage systems or any other options for single towns or any cluster level infrastructure development plans for liquid and solid waste management • Municipal laws that may govern the fee charged by ULB for desludging operations and any ceiling imposed on private operators • If any land has been allocated for the purpose of liquid and solid waste management	• Local condition of household level toilets • Septage generation, conveyance and operations by private sector • Municipal services • People's expectations • Suggest availability of land for setting up FSTP if convinced about decentralized treatment of faecal sludge

Group Exercise 1

Calculate the total septage to be collected per day from City X

FSSM Plan

Sr. No.	Description	No.
	Input Details	
A	Population	65,251
B	Total Households (HHs)	13,112
C	HHs having toilets with septic tanks	9,901
D	No. of community/public toilets having septic tanks	21
E	Average volume of household and community toilet septic tanks (cum)	5
F	Septic tank cleaning cycle for HHs (Years)	3
G	Septic tank cleaning cycle for CT/PT (Days)	7
H	No. of working days in a year	300
I	No. of trips possible per emptying vehicle per day (trips/day/vehicle)	4

1. **Number of tanks to be emptied in a day = _____ daily**
   - HHs toilets connected to septic tank / cleaning cycle for HHs = _____ annually
     - HHs toilets to be cleaned daily = annual cleaning / number of working days = _____ daily
   - CTs connected to septic tank / cleaning cycles for CTs = _____ daily

2. **Number of trucks required = _____ nos.**
   - Number of tanks to be emptied in a day / Number of trips per day = _____ nos.

3. **Volume of septage to be treated = _____ cu.m. / day**
   - Average volume of HHs and CTs septic tanks x Number of tanks to be emptied in a day = _____ cu.m. / day

SESSION 3

Septage Treatment and Reuse / Disposal

3.1 Learning Objectives

- Understand how septage and waste water treatment technologies works, what level of treatment do they achieve and what are the pros and cons of each.
- Gain familiarity with technology options available in the market.

3.2 Duration

30 minutes

3.3 Key Facts

1. No single technology is better than the other, on all considerations and parameters. Hence the choice has to be made by cities as to the preferred septage and waste water treatment technology options available in the market.
2. Decentralized faecal septage treatment plants are emerging as solutions to the challenge of addressing safe treatment and disposal of septage. However it does not imply that all small towns and cities need FSTPs infrastructure. Simple, decentralized, farmer-ULB solutions for safe treatment and use of septage waste and waste water needs to be promoted for smaller towns that do not generate large volumes of septage.
3. Co-treatment of septage with STPs should be the first option, subject to certain parameters.
4. There are centralized and decentralized/on-site systems for treatment of septage and waste water. While conventional sewerage may be a comprehensive system for sewage collection and transport, it also is a highly resource-intensive technology for both capital expenditure (capex) and operational expenditure (opex). Consequently, high capital cost and significant O&M cost of this system inhibits its widespread adoption in all sizes of urban areas.
5. A decentralized treatment plant is also able to provide treatment facilities close to the areas served and is also able to serve areas which are situated below the sewerage network and cannot be served by a gravity drainage network. It also obviates the need for pumping stations, thus saving on energy costs.

3.4 Learning Notes

3.4.1 What is faecal sludge and septage treatment?

Treatment scientifically is defined as the use of a chemical, physical or biological agent to preserve or give particular properties to something. In this case the 'something' is, the liquid waste received from the sewer lines in case of a centralized underground sewer network system and from the desludging vehicle carrying sludge to the inlet of the treatment plant.

The purpose of treating the sludge and septage is to reduce the number of harmful pathogens, decrease the BOD, reduce organic load present in the matter and which finally after stages of biological, mechanical or similar treatment methods, can be either discharged to farmland, garden or can be re-used for other purposes such as washing floors, gardening and other similar purposes.

3.4.2 Centralized and De-Centralized systems of treatment

Providing safe waste water conveyance and treatment systems in cities can be provided by broadly two approaches:

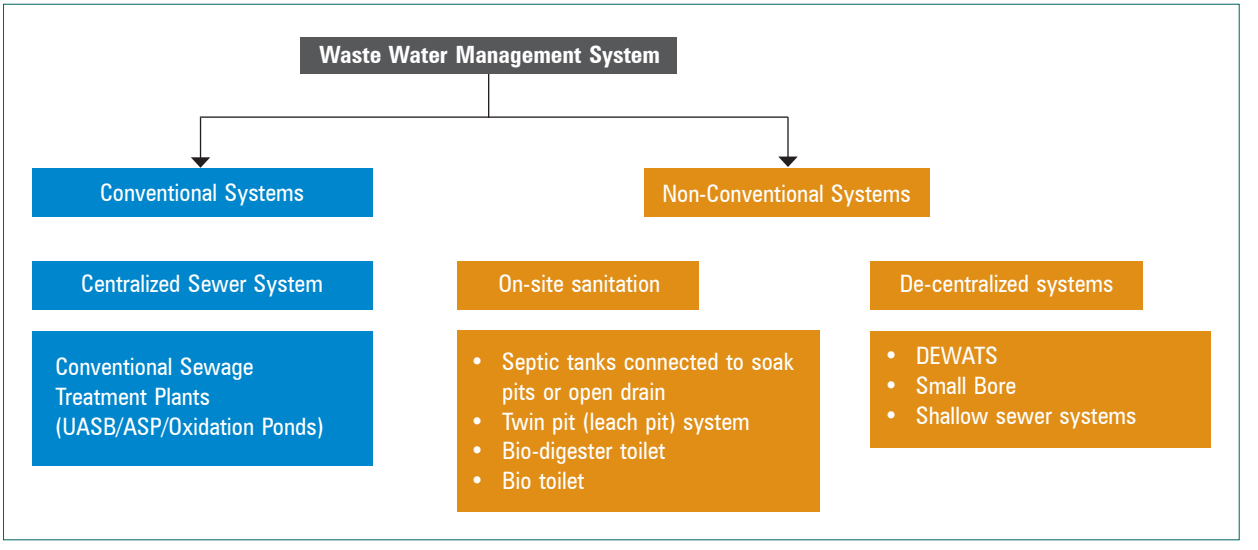
Centralized waste water treatment plant is a conventional STP which could be set up in a city and all waste water can be transported to the STP via sewer lines. A centralized sewerage is perceived as an underground sewer system to collect the sewage from all over the settlement. While the conventional sewerage may be a comprehensive system for sewage collection and transport, it also remains as a highly resource-intensive technology. Consequently, high capital cost and significant O&M cost of this system inhibits its widespread adoption in all sizes of urban areas.

In decentralized method, more than one, small capacity of treatment plant can be set up across the city. It could be in the cluster of residential areas, in commercial areas, at the individual scale or in the industrial areas. A decentralized treatment plant is also able to provide treatment facilities close to the areas served and is also able to serve areas which are situated below the sewerage network and cannot be served by a gravity drainage network. It will also obviate the need for pumping stations, thus saving on energy costs.

Decentralized systems offer the opportunity of wastewater recycling and reuse thus reducing water demand substantially. Such systems in peri-urban areas could provide treated wastewater for agricultural use and can thus improve agricultural productivity.

Usually centralized systems are adopted when there are limited challenges in terms of cost, land resources and operative finances in place. There are 2 stages in case of centralized systems. Stage -1 involves building of underground sewer network and stage 2 involves building of a STP. In both the stages there are several intrinsic challenges. Generally, sewer network is built by the ULB/parastatal organization while the STP can be either built and operated by the government or may be commissioned on a public private partnership (PPP) basis.

Figure 22: Types of waste water managemeant system



3.4.3 Centralized system: Some of the challenges of designing and O&M

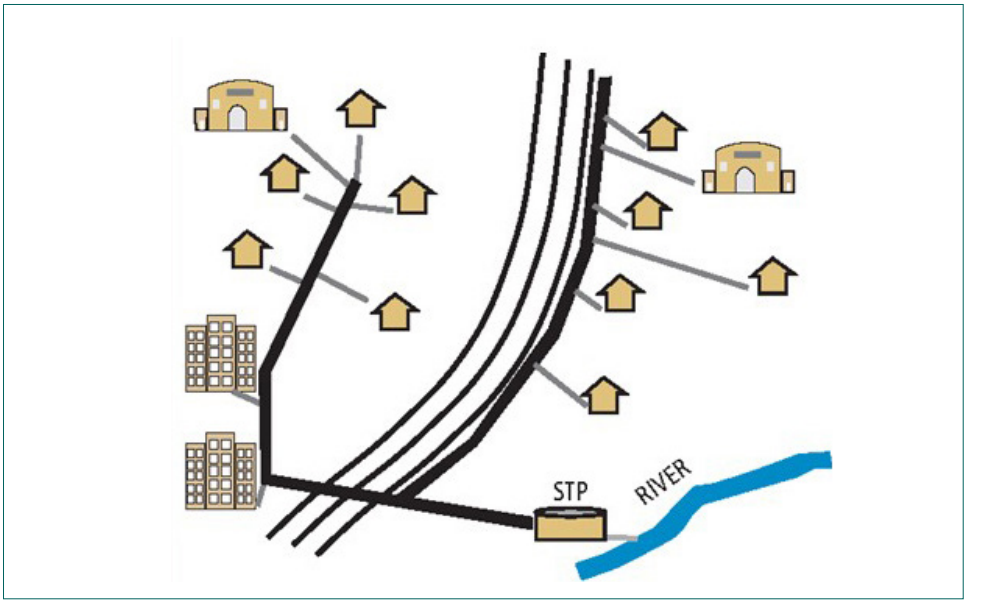
1 Network Design Issues:

Typically, each underground sewerage system is designed keeping in mind the population forecast of thirty years and the realization of the sewage volumes to use the designed sewer capacities results in idle volumes and idle expenditures. The underground sewers laid become defunct with time and eventually go into disrepair. This is a non-productive expenditure in a sense, implying that the investment could have been utilized elsewhere.

Scenario 1:

The map to the right shows a typical conventional sewerage with all the sewers discharging to a single STP. There are a few areas that are currently sparsely developed, but yet the sewers are designed for a flow for 30 years. Hence, these sewer lines do not run at optimal capacities, do not have enough water for run off and hence results in silting of sludge in the pipes. There are scenarios where manhole covers are stolen and manholes are reduced to garbage dumps, which leads to choking of the sewer system. The result is that there is a need for a massive rehabilitation program of the sewer system when these areas get fully populated and occupied. A further difficulty is the STP, which is grossly underutilized and the treated sewage quality suffers due to prolonged hydraulic retention.

Figure 23: Centralized Treatment

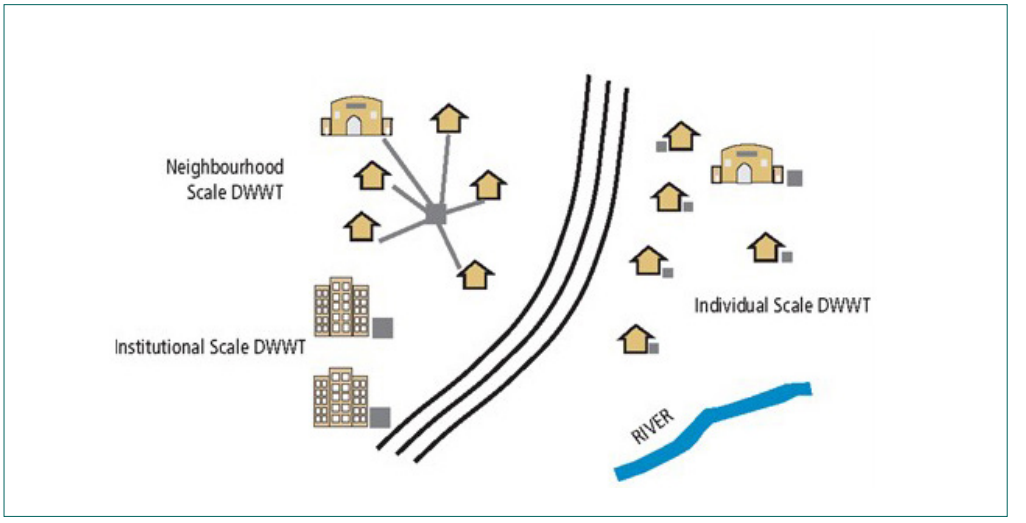


Source: (Centre for Science and Environment, 2014)

Scenario 2:

In comparison, if we consider the same low density area served by a decentralized sewer system as shown in the second map in the right, it can be seen that the above problems are solved. Financially investments are also saved to begin with.

Figure 24: Decentralized Treatment System



Source: (Centre for Science and Environment, 2014)

2 Requirement of adequate water

The CPHEEO manual on sewerage and sewage treatment engineering mentions requirement of at least 100 LPCD of water supply so as to achieve self-cleansing velocities within the sewer system. When sufficient water supply is not provided, solids accumulate and sewer lines get blocked.

In Gujarat, currently, as per the SLB of water supply by the Urban Development Department 2013-14, only 60 cities provide this minimum water supply.

3 Achieving household level connections:

Usually, while the investment on laying the sewerage lines is met out of capital grant funding, the cost of individual house level connections is to be met by the house owners. In areas which are currently un-developed, these house service connections get deferred and leading to frequent road cuts as and when the houses are built.

There are also instances of illegal connections by HHs which lead to an intensive monitoring and checking regime by the local body. This is another challenge given the limited staff of ULBs.

By opting for decentralized sewer system, the command area to be supervised for such surreptitious connections get much smaller and the monitoring mechanism becomes effective.

4 Expensive capex:

According to an estimate, the building of conveyance of one kilometer of sewerage network would range between ₹10-40 million and treating 1 MLD of sewage costs another ₹10 million through a centralized treatment system, excluding the land cost (Centre for Science and Environment, 2014). Thus one

can assume the finances involved in implementing and sustaining centralized systems to treat the huge quantum of sewage.

5 Financial Sustainability of O&M:

A centralized sewer system requires huge capital as well as huge O&M costs. The CPHEEO manual on Sewerage and Sewage Treatment O&M, mentions that about 20 to 40% of total O&M costs are towards O&M staff while 30 to 50% of the cost is incurred on energy charges and the balance amount in repair, replacements and miscellaneous charges. In most of the cities tariffs are so low that they don't even cover the annual O&M.

It is estimated that collection costs of waste water to the STP account for more than 60% of the total cost in centralized waste management systems and on-site systems reduce the collection costs to a minimum.

Whereas capital costs are mostly met out of grant funding, the O&M expenses are to be generated by the local body. The revenues generated by taxes and water and sewerage charges are too meager to even break even in the local body accounts, leave alone increasing the reserve funds.

6 O&M of STPs:

A report by the CPCB on the performance of 152 STPs across the country[30] highlighted that only about 66% of their actual treatment capacity is utilized. Out of the 152 STPs, 30 plants (20%) are non-operational and performance of 28 plants (18%) is not satisfactory in terms of O&M and method of sludge disposal. Treated effluent from 49 STPs (32%) exceeds the BOD standards and with respect to Chemical Oxygen Demand (COD), 7 STPs are violating the general standards of discharge. (Central Pollution Control Board, 2013).

The report concludes that conventional treatment technologies need considerably high demand of energy while natural treatment technology STPs requires fewer staff to operate the system whereas advanced & conventional treatment technology based STPs require large number of skilled professionals.

A study undertaken by UMC[31] to review financial sustainability of setting up a STP in Patan Municipality brought out that even if the municipality was to improve its efficiency of collection of taxes, the current sewerage charges would have to increase from current ₹200 to ₹1,100 in order to operate and maintain the STP effectively. (Urban Management Centre, 2014)

Without adequate finances, ULBs will be stressed to operate and maintain the sewer system which would lead to the deterioration of the useful life of the systems necessitating premature replacement of many system components and hence will also affect overall sanitation. Even after creating such assets

[30] Performance Evaluation of Sewage Treatment Plants under NRCD, Central Pollution Control Board, 2013

[31] Financial Viability Of Operation And Maintenance Of Sewerage System, Case of Patan Municipality, Urban Management Centre, 2014

by investing millions of rupees, ULBs would be unable to provide the services effectively to the community for which they have been constructed, as they remain defunct or underutilized most of the time.

In this light, it is essential to consider non-conventional waste water conveyance and treatment systems including on-site systems and decentralized waste water treatment systems.

The story of Kathlal Municipality in Gujarat:

Kathlal is a small municipality in the Kheda district of the state of Gujarat. During Census 2011, its population was 22,071 people. In 2016, the municipality inaugurated its first STP, having 4.75MLD capacity, and that was constructed at a cost of ₹18.77 crore under the Gujarat state Urban Development Mission (GUDM). The O&M contract was awarded to a private operator. But the operators have withdrawn unilaterally from giving their services after they received an electricity bill for the STP that they were not able to pay. This has rendered the STP out of operation. (Urban Management Centre, 2015)

Figure 25: Pumping Station at STP in Kathlal, Gujarat

Source: Urban Management Centre

3.4.4 Decentralized systems for treatment of septage and sludge

Decentralized treatment depends upon the OSS technologies used for treatment of the waste. Although at most of the times, scum and sludge are mixed at the generation point itself, both are emptied together in the septic tank or any 'containment' method being used. However, there are various technologies that are adopted separately for scum and sludge treatment. Scum treatment, i.e. treatment of water part of the septage is done through various technology options such as OSS systems and DEWATS®. Various technology options for waste water treatment/ Scum treatment are available in the market today. For sludge treatment, on-site treatment options are not practical and hence decentralized systems such as FSTP or other technologies needs to be deployed.

3.4.5 Technology Options for Decentralized Systems

Septic tanks

Septic tank in itself is a primary treatment option that reduces the BOD by 40%. This can be considered as first level of treatment of the input waste. Various types of septic tanks and their details are already covered in the previous session of containment and conveyance.

CPHEEO manual on sewerage has recommended sizes of septic tanks based on number of users.

Table 7: Recommended sizes of septic tanks

No.	Number of Users	Length (m)	Breadth (m)	Liquid depth for Cleaning once/2 years	Liquid depth for Cleaning once/3 years
1	5	1.5	0.75	1.0	1.05
2	10	2.0	0.9	1.0	1.40
3	15	2.0	0.9	1.3	2.0
4	20	2.3	1.1	1.3	1.8
5	50	5.0	2.0	1.0	1.24
6	100	7.5	2.65	1.0	1.24
7	150	10	3.0	1.0	1.24
8	200	12	3.3	1.0	1.24
9	300	15	4.0	1.0	1.24

Source: CPHEEO Manual on Sewerage, Part A: Engineering, Tables 9.7 and 9.8

Anaerobic Baffled Reactors

Anaerobic Baffled Reactors (ABR) is an improvised version of a simple septic tank which has several compartments placed in a series, which reduces the BOD through a series of anaerobic process.

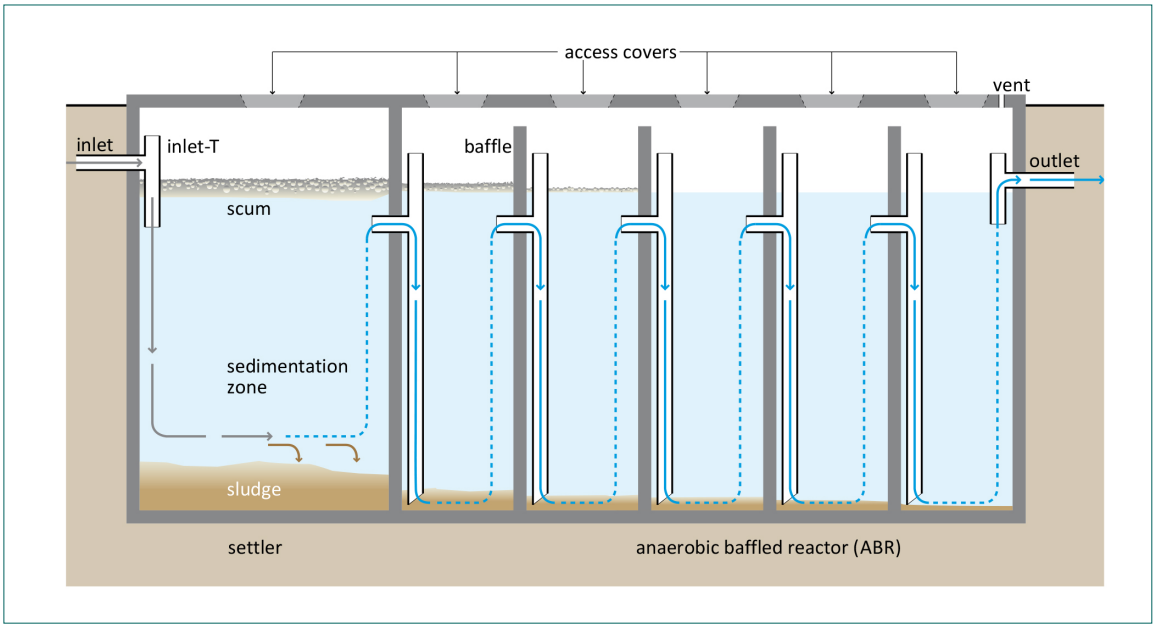
The waste water filters and it settles in the last chamber, which can be released to the next stage of purification through a planted gravel filter technology. The up-flow chambers provide enhanced removal and digestion of organic matter. BOD may be reduced by up to 90%, which is far superior to its removal in a conventional septic tank. (IWA and Eawag)

Unplanted drying bed

The main objective of the energy-saving unplanted drying bed method is dewatering. The bed is filled with filter material, usually gravel at the bottom and sand on top. The bottom is sloped and lined with perforated pipes to drain away the effluent.

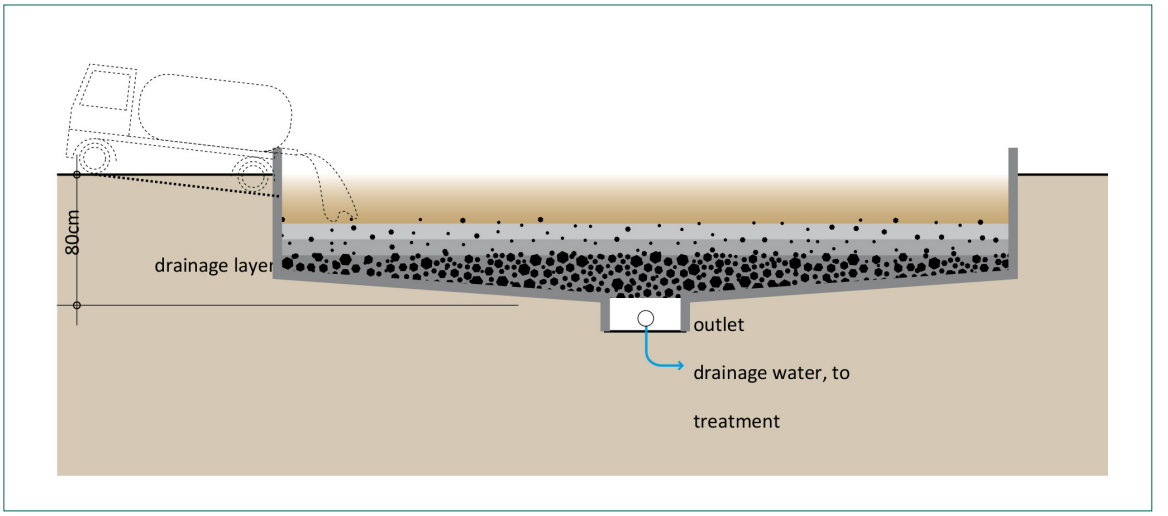
Unplanted drying beds are operated in batches. Sludge is placed on the surface of the bed and the liquid flows through the sand and gravel for a period of days. The

Figure 26: Anaerobic Baffled Reactor



Source: (IWA and Eawag)

Figure 27: Unplanted drying bed



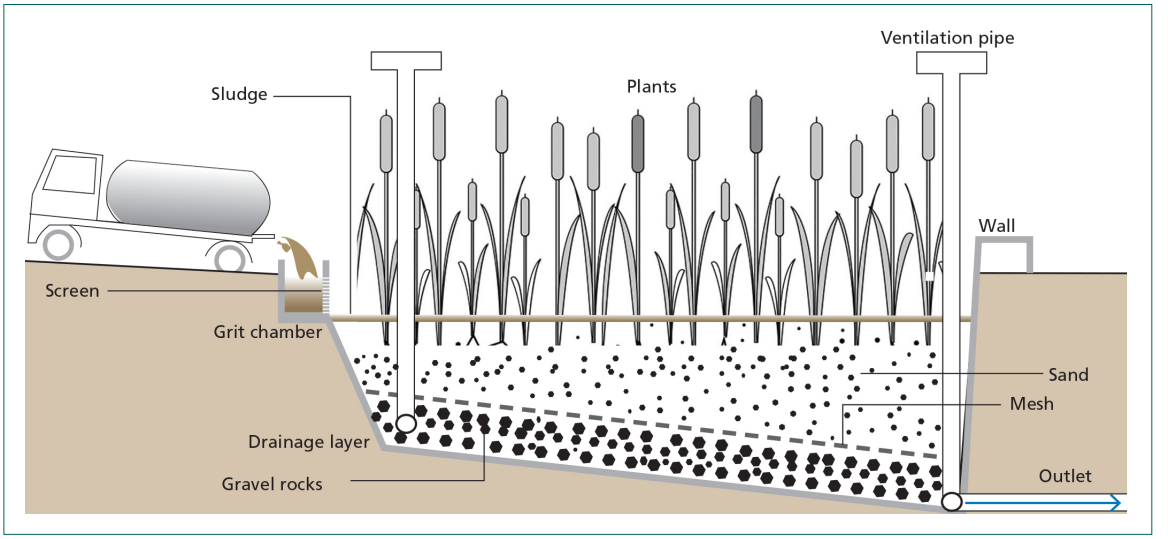
Source: (IWA and Eawag)

majority of the solid portion of the sludge stays on the surface. The remaining water in the sludge is removed by evaporation. The dewatered sludge is then removed from the surface manually or mechanically, once every few weeks or months. (Centre for Science and Environment, 2017)

Planted Drying Bed

The main objective of the energy-saving planted drying bed method is dewatering and stabilization. The bed is filled with filler material, usually gravel at the bottom and sand on top. Plants selected for a specific climate grow in the filter media. The bottom of the bed is sloped and lined with perforated pipes to drain away the

Figure 28: Planted drying bed



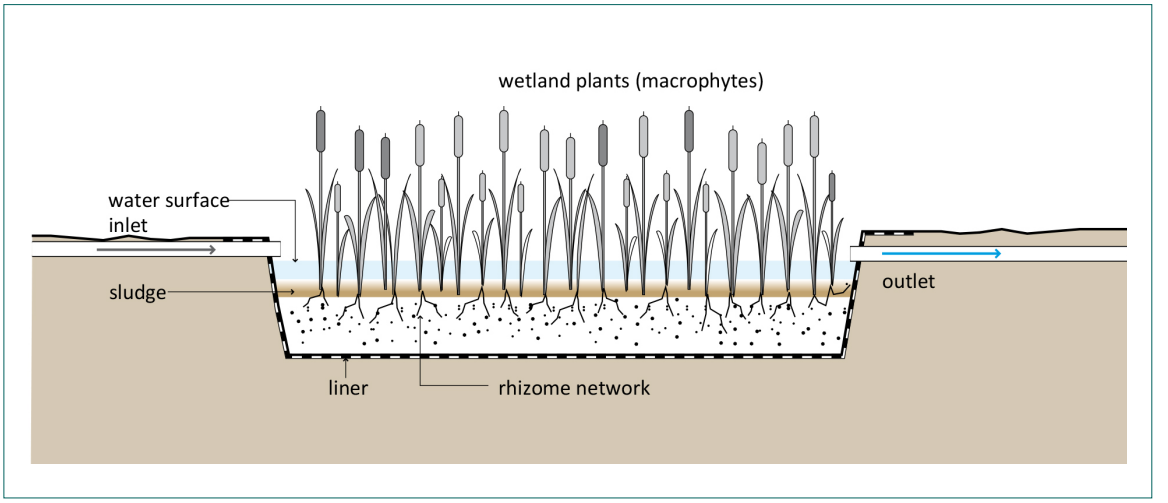
Source: (Centre for Science and Environment, 2017)

effluent. Faecal sludge is placed on the surface of the bed and the liquid flows through the sand and gravel. The majority of the solid portion of the sludge stays on the surface. Some of the remaining water in the sludge is removed by evapo-transpiration. Sludge can be loaded on the beds without removal for a period of one–three years. Dewatered sludge is stabilized. Dewatered sludge is removed every few months to years. Plants are harvested according to their growth cycle. (Centre for Science and Environment, 2017)

Constructed Wetland

A constructed wetland is a large gravel and sand-filled horizontal or vertical sub-surface channel that is planted with aquatic vegetation (see Figure 29: Horizontal flow constructed wetland). As wastewater flows through the channel, the filter

Figure 29: Constructed Wetland



Source: (IWA and Eawag)

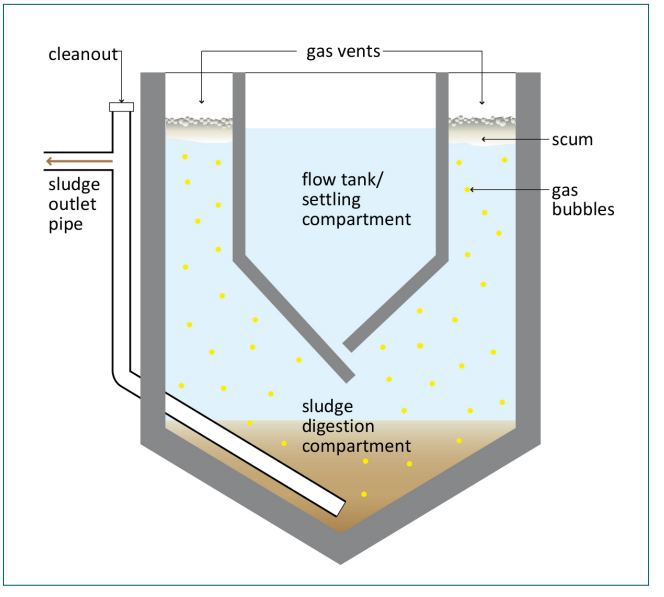
material sieves out particles and attached micro-organisms degrade organic material. The water level in a horizontal sub-surface flow constructed wetland is maintained at 5–15 cm below the surface to ensure sub-surface flow. Horizontal flow constructed wetlands are relatively inexpensive to build where land is affordable and they can be easily maintained by the local community as they require no high-tech spare parts, electrical energy or chemicals. It has been established that a horizontal filter bed area of about 2 sq.mt. per person equivalent is sufficient for the complete secondary and tertiary treatment of wastewater, including the removal of pathogenic germs. (Centre for Science and Environment, 2017)

3.4.6 Other Technologies Practiced Globally

Imhoff tank

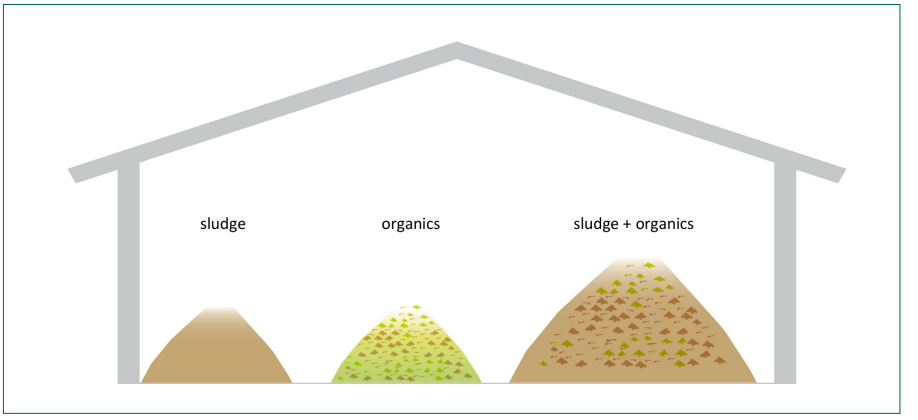
The Imhoff tank is a primary treatment technology for raw wastewater, designed for solid-liquid separation and digestion of the settled sludge. It consists of a V-shaped settling compartment above a tapering sludge digestion chamber with gas vents. The Imhoff tank is a robust and effective settler that causes a suspended solids reduction of 50 to 70%, COD reduction of 25 to 50%, and leads to potentially good sludge stabilization – depending on the design and conditions. The settling compartment has a circular or rectangular shape with V-shaped walls and a slot at the bottom, allowing solids to settle into the digestion compartment, while preventing foul gas from rising up and disturbing the settling process. Gas produced in the digestion chamber rises into the gas vents at the edge of the reactor. It transports sludge particles to the water surface, creating a scum layer. The sludge accumulates in the sludge digestion compartment, and is compacted and partially stabilized through anaerobic digestion. (IWA and Eawag)

Figure 30: Imhoff Tank



Source: (IWA and Eawag)

Figure 31: Co-Composting with municipal solid waste



Source: (IWA and Eawag)

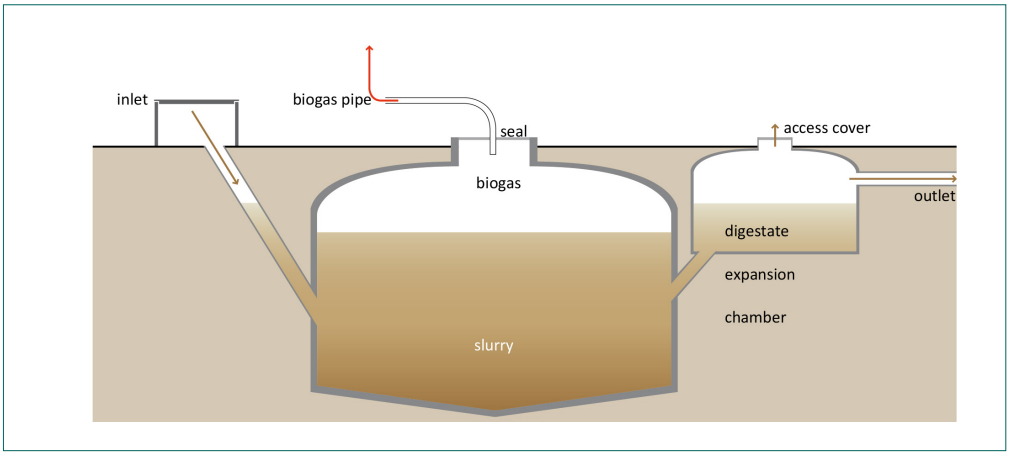
Co-composting with municipal solid waste

Co-composting is the controlled aerobic degradation of organics, using more than one feedstock (faecal sludge and organic solid waste).

Faecal sludge has a high moisture and nitrogen content, while biodegradable solid waste is high in organic carbon and has good bulking properties (i.e., it allows air to flow and circulate). By combining the two, the benefits of each can be used to optimize the process and the product. (IWA and Eawag)

There are two types of co-composting designs: open and in-vessel. In open composting, the mixed material (sludge and solid waste) is piled into long heaps called windrows and left to decompose. Windrow piles are periodically turned to provide oxygen and ensure that all parts of the pile are subjected to the same heat treatment. In-vessel composting requires controlled moisture and air supply, as well as mechanical mixing. Therefore, it is not generally appropriate for decentralized facilities. Although the composting process seems like a simple, passive technology, a well-functioning facility requires careful planning and design to avoid failure. (Ibid)

Figure 32: Biogas Digester



Source: (IWA and Eawag)

Biogas settler and digester

A biogas reactor or anaerobic digester is an anaerobic treatment technology that produces –

- Digested slurry (digestate) that can be used as a fertilizer and,
- Biogas that can be used for energy. Biogas is a mix of methane, carbon dioxide and other trace gases which can be converted to heat, electricity or light.

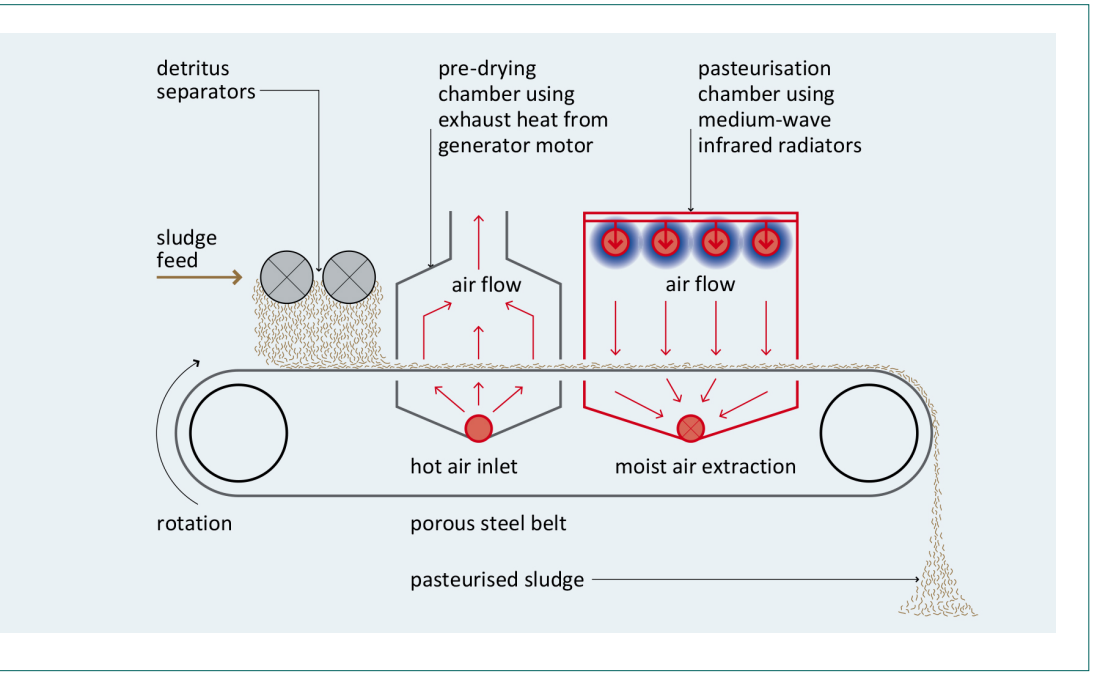
A biogas reactor is an air-tight chamber that facilitates the anaerobic degradation of blackwater, sludge, and/or biodegradable waste. It also facilitates the collection of the biogas produced in the fermentation processes in the reactor. The gas forms in the slurry and collects at the top of the chamber, mixing the slurry as it rises. The digestate is rich in organics and nutrients, almost odorless and pathogens are partly inactivated. (IWA and Eawag)

3.4.7 Emerging technologies

LaDePa Sludge Pelletizer

The Latrine Dehydration and Pasteurization (LaDePa) pelletizer is a sludge drying and pasteurization technology capable of producing a dry, pelletized soil amender from pit latrine sludge. It can be fed at a rate of about 1,000 kg/h sludge (30- 35% solids content) and the output rate is about 300 kg/h dried pellets (60-65 % solids content). Garbage that ends up in pits (plastic bags, shoes etc.) is separated from

Figure 33: LaDePa Sludge Palletizer



Source: (IWA and Eawag)

Figure 34: Geo Tube

Source: Indah Water Konsortium, Malaysia

the sludge by a screw compactor; the screw pushes the sludge through 6mm holes onto a porous, continuous steel belt, while the waste material is ejected through a separate outlet so that it can be collected and disposed of. (IWA and Eawag)

The extruded sludge falls in an open matrix of spaghetti- like strands, in a layer varying in thickness from 25-40 mm, onto the porous belt and passes first through a pre-drying section that utilizes the waste heat from the internal combustion engine of the power plant. The partially dried sludge pellets then travel through a patented *"Parseps Dryer"* that makes use of medium-wave infrared radiation. The pellets are, thereby, pasteurized and dried by using an extractor fan that draws the hot air through the porous belt and the open matrix of sludge. This increases the drying capability without increasing the energy output. The pellets that emerge are free of pathogens and suitable for all edible crops. The whole process takes 16 minutes. An important disadvantage of the LaDePa process is that it is relatively energy intensive and relies on a constant source of energy (electricity/diesel). (Ibid)

Geo tubes

Geo bags are porous tubular containers fabricated with high strength woven geo-textiles (polyethylene material) mainly used for dewatering sludge. Bags will help to achieve the capture of 98% of solids from the sludge. Polymer will have added to increase the solid settling. Filtrates from the container should be collected and treated properly before discharge.

3.4.8 Disposal and Re-use of treated septage

There are numerous usages of treated septage. The discharged treated water can be disposed in lakes, river or open farm fields. However, it is important to check the parameters of the treated discharged water before disposal. The disposed water in the farm fields is actually a re-use of the treated water. This helps in improving the yield of the soil as the treated water still contains nitrogen and relevant required nutrients for crops to grow. However, this treated water should be released only in those farmlands which do not grow vegetables or edible crops. The other uses of this water could be for use in gardening or flushing.

The treated sludge is converted into cakes or pellets that are then, packaged or sold loose as manure. This manure is rich in nutrients otherwise nowadays absent in the natural land. As these manures are free from any manufactured chemicals, it is organic in nature and biochemically not harmful to the yield crop.

3.4.9 Faecal Sludge Treatment Plant

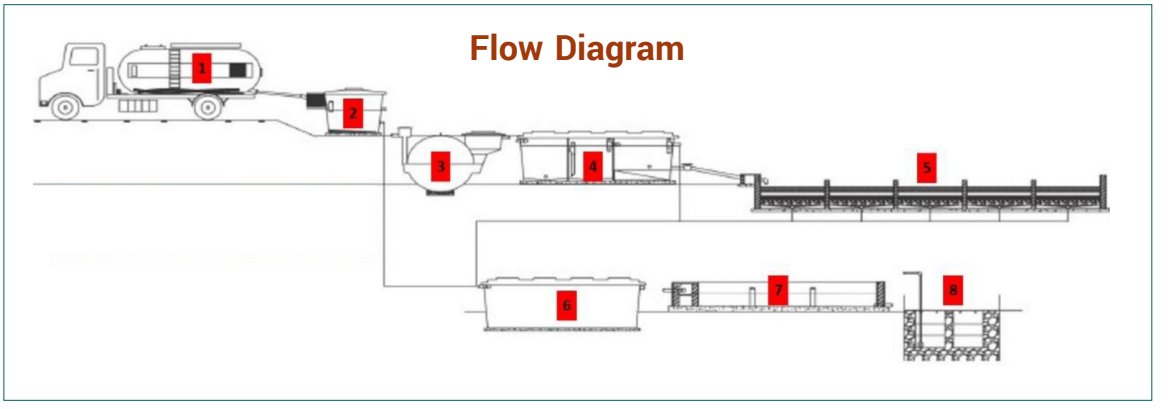
The FSTP is a combination of various individual technologies scientifically sequenced together, to treat both liquid waste water as well as sludge, received in from the conveyance. The diagram below shows the sequential arrangement of the technologies that makes a FSTP.

This session will explain the concept of FSTP with a case study of FSTP at Devanahalli, Karnataka. A film on the Devanhalli FSTP will be shown in this session. However, to brief the participants, an overview of the FSTP is shown below.

Features of the FSTP at Devanahalli, Karnataka

- Serves 30,000 people
- Based on a gravity based biological treatment process
- Spread in an area of around 650 sq.mt.
- Odorless, underground and completely covered
- Per capita capital cost ₹300. (Total capex of the plant: ₹90 lakh)
- Per capita annual O&M cost ₹80. (Total opex of the plant: ₹24 lakh)

Figure 35: FSTP work flow diagram



The above flow diagram shows how the Devanahalli FSTP is designed by sequentially arranging various independent modules together. Each module is named below the diagram for referring back the technologies discussed earlier in this session.

1. Vacuum De-sludger.
2. Emptying tank.
3. Biogas settler and digester.
4. Anaerobic Baffled Reactor.
5. Sludge Drying Beds.
6. Anaerobic Baffled Reactor.
7. Planted Gravel filter.
8. Discharged Water collection tank.

The detailed case of the Devanhalli FSTP has been discussed in a film uploaded on the e-learning portal of SBM[32]. Course number is "703 – Faecal Sludge Treatment Plant in Devanahalli"

3.4.10 Benefits and Challenges of OSS and Decentralized treatment systems

There are numerous benefits of decentralized treatment systems as seen

1. **Cost efficient**
   a. The requirement for the underground sewer system is completely eliminated or partially required (within the settlement area from the HH to the DEWATS system).
   b. Lower capital cost and O&M costs, due to absence of complex mechanical as well as electrical systems associated.

2. **Environment Friendly**
   a. Complete absence or lower electric consumption and hence power saving.
   b. Due or absence of underground sewer system, negligible possibility of ground water contamination.
   c. Odorless, hence can be built within a living habitat also.

3. **High user acceptance**
   a. Minimal O&M needs and costs as lower human resources capacity levels needed.
   b. Easy and efficient user involvement and participation (e.g. in decision making and O&M).

4. **Flexibility in scale**
   a. Can be built easily at remotest places, even by regularly skilled labours.
   b. Can be built for a scale fit for a HH, cluster as well as community level or a town level.

3.4.11 Challenges

1. Lack of awareness about FSSM and its related benefits is the prime challenge at present.
2. Lack of effective mechanisms at the ULB level, to effectively manage the FSSM value chain
3. Lack of funding and banking channels for ULBs to implement complete FSSM project.

[32]Register for the course on SBM e-portal: https://swachhbharat.cloudapp.net/

3.4.12 Role of the ULB

1. Scheduled monitoring and maintenance of existing FSM infrastructure.
2. Undertake effective IEC and awareness campaigns
3. The ULB shall build capacity of its staff by organizing exposure visits and training programs for them on FSSM, how various technologies are available in the market and strive for its improvement.
4. Invest in appropriate technologies for safely treating all septage.

SESSION 4

Planning for FSSM and its Financing

4.1 Learning Objectives

- To understand factors and decisions guiding the planning of septage (generation and its conveyance and treatment) management.
- To learn about the tools used for assessments.
- To know the sources of financing FSSM for towns
- To understand challenges and criteria for selection of faecal sludge treatment technologies

4.2 Duration

45 minutes

4.3 Key Facts

1. **Cities cannot become truly ODF,** till all insanitary toilets are made sanitary and till all sewage and septage is treated and safely disposed.
2. **On an average, the per capita septage generated is 230 litres**[33] **per year.** Decision makers may assume this figure for FSSM planning in their cities and jurisdictions. Septage generated varies from town to town (towns with even similar populations may have very different septage generation) and is dependent on the density of residential population, size and type of septic tanks and on the desludging frequency.
3. **Scheduled desludging (septic tanks) operations are cost effective and allows for planned desludging at town level.** Regular scheduled desludging operations (once in 2-3 years) can cost as less as ₹1 per HH per day for a FSTP for a small town of less than 1 lakh population. Zone wise regular desludging operations make the business cost effective for the operators.
4. **Compared to Sewerage Treatment Plants O&M cost,** the O&M cost of FSTPs is much lower, especially where gravity flow treatment systems are adopted.
5. **Several Septage Assessment Tools exist**
   a. Rapid Assessment Tool by MoHUA[34]
   b. SANIPLAN by CEPT[35]
6. **Different technology options for septage treatment** may be adopted by the ULB. It is important to do a quick feasibility of the technology options considering availability of land, infrastructure, skilled human resources for O&M, energy. Most importantly, it is important to ensure that the ULB is able to cover the opex.
7. **Urban sanitation is a public health challenge.** Sanitation and water are accepted as Human Rights (UN Declaration, 2010)[36]. The primary duty bearers are the municipality and state government in the Indian context. It is important that the ULB and parastatal provide the services to all; cost consideration and aiming to achieve full cost recovery may not be drivers of an appropriate solution.
   a. Involvement of private sector for O&M could be an option that needs to be tried and tested based on the criteria of affordability and the type of clientele of a town. Commercial and tourist towns with fledgling hotel industry, or towns with concentration of institutions (armed forces, government offices) – may be better suited for a full scale private operations for both conveyance and treatment of septage.
   b. Public private partnership (PPP) models may work in cities where there is a good mix of income, income and low income settlements and commercial-residential areas.
   c. While, there might be a few towns where the ULB will have to entirely fund the FSSM operations.

[33](Ministry of Housing and Urban Affairs, January, 2013) and The United States Environmental Protection Agency (USEPA), 1984

[34]Rapid Assessment tool can be downloaded from https://smartnet.niua.org/sites/default/files/Rapid%20Assessment%20Tool%20for%20City%20Septage%20Budgeting.xlsx

[35]SANIPLAN tool is available on http://ifsmtoolkit.pas.org.in/SaniPlan_FSM.xlsm?attredirects=0&d=1

[36]http://www.un.org/waterforlifedecade/human_right_to_water.shtml

4.4 Learning Notes

4.4.1 Assessment of existing situation

The first step of the FSSM planning process is to assess the existing situation in the city. This assessment needs to be undertaken across the value chain:

Containment: An assessment to find out number of properties connected with OSS and number of properties which will be connected with OSS in future where there is no possibility of laying sewer lines. Creation of a database of such properties connected to OSS is required. This can be done through a one-time survey and then regularly updated through linkages with building permission process or with the regular property tax reassessment process. A survey questionnaire is shown in below figure, which the ULB may use for conducting baseline survey.

Figure 36: Survey questionnaire for assessing sanitation facility

Survey questionnaire for assessing sanitation facility				
1	**Name of the Enumerator:**			
2	**Date (dd/mm/yyyy):**			
3	**Ward Number:**			
4	**Property Number:**			
5	**Name of the Respondent:**			
6	**Address:**			
7	**Number of family members / daily users:**			
8	**Type of sanitation facility (tick)**			
○ Septic tank without soak pit		○ Septic tank with soak pit	○ Single pit latrine	○ Twin pit latrine
○ Sewer system		○ Directly disposed to open drain	○ No Toilet facility	
9	**Size of the on-site sanitation facility (tick):**			
1. Rectangular / Square		Length (m)	Breadth (m)	Height (m)
2. Circular / Cylindrical		Diameter (m)	Depth (m)	
10	**Date of construction of on-site facility? (dd/mm/yyyy) .....**			
11	**When was the last time you emptied the facility? (dd/mm/yyyy) .....**			

Conveyance: an assessment to chart out the existing systems of desludging septic tanks and availability of appropriate vehicles (with adequate capacity) with the ULB as well as with any private contractors operating in the city.

Treatment: it is important to assess whether the existing STPs of the city have adequate capacity to handle additional septage load and that they are designed to treat septage BOD. To determine the septage BOD, a sample based BOD testing of few septic tanks from different areas, of different sizes and with different periods of retention should be undertaken. This should be compared with the BOD handling capacity of the STP.

In case the city does not have a STP, the ULB should assess if there is availability of

land for constructing a FSTP. If land is available, the capacity of the treatment plant needs to be derived. Uninterrupted power supply is needed to run the plant.

Disposal: the ULB should also assess the current practice of septage disposal, whether it is disposed at the solid waste dump site or in a vacant plot or farms or in the sewer line.

Once such a baseline assessment is done, the city can then initiate planning for FSSM.

Planning for FSSM

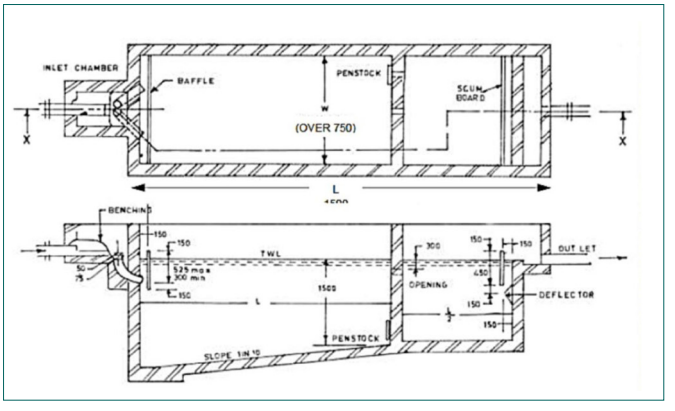
FSSM planning needs to be done for:

1. Planning for technology options for containment
2. Planning for desludging and conveyance
3. Planning for technology options of treatment and reuse

4.4.2 Planning for technology option for containment

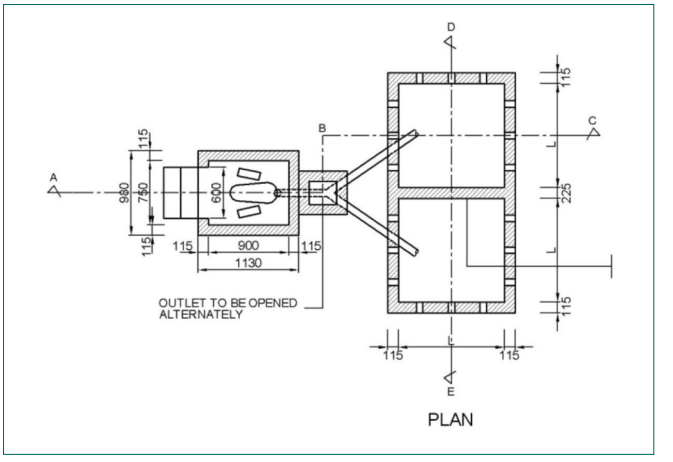
Having looked at the containment systems in the previous session, it is important to understand the deciding factors for selecting a suitable and appropriate containment system. For example, areas with clay, tightly packed or rocky soils, a high groundwater table or where there is frequent flooding are not appropriate for twin pit latrines. But otherwise, if sufficient water and land is available, twin pits can be a viable option. A vacuum truck should be able to access the location as the septic tank must be emptied at regular interval. A typical diagram[37] of both the systems is shown below.

Figure 37: A typical layout of a septic tank



Source: CPHEEO manual, Part A: Engineering

Figure 38: A typical plan of twin pit system



[37]Typical diagram of both septic tank and twin pit is taken from Manual on sewerage and sewage treatment systems, Part A: Engineering, CPHEEO, 2013

Table 8: Comparison of a septic tank system with a twin pit

Parameters	Septic Tank	Twin Pit
Applicability	• Non-availability of sewer network • Suitable in peri-urban settlements without centralized system	• Water use 25-50 LPCD
O&M requirement	• Desludging is required once in 2-3 years • Septage must be transported for further treatment before disposal	• Desludging is required once the pit is full • Safe to desludge manually after 2-3 years
Risk and Limitation	• Cost and space requirements are high • Retention time is insufficient if it receives too much waste water • Unregulated desludging may violate the manual scavenging act, 2013	• Manual desludging of excreta and its disposal before the cleaning cycle of 2-3 years • Bottom of the pit should be atleast 2m above the groundwater table • Not designed to cater grey water
Soil characteristic	• Must be suitable for infiltration of effluent	• Highly permeable soil

Criteria for selection of containment system:

- Availability of space
- Soil and groundwater characteristics
- Type and quantity of input
- Desired output
- Availability of technologies for subsequent transport
- Financial resources
- Management considerations

4.4.3 Planning for desludging and conveyance

Desludging can be done in broadly two ways – either on demand based or by a scheduled based system. In a 'demand based desludging system', HHs raise a service request for desludging services by the ULB or private contractors. The ULB could then decide to undertake desludging itself or through its empanelled panel of operators. The ULB levies emptying charges on the HHs. This is currently being practiced in predominantly all of the ULBs across India. Whereas, in a scheduled desludging system, the ULB prescribes a scheduled regime and provides services either itself or through its empanelled operators at a fixed time interval. For e.g.; the ULB will send alert and scheduled desludging of OSS systems in 3 years. Here, the charges are built into the annual property tax levied on the HH. This is the system being practiced in Malaysia.

In a scheduled based system, the ULB will require additional vacuum trucks compared to demand based system, as in the demand based system, HHs generally request for emptying their OSS systems once in 8-10 years against the recommended cleaning cycle of 2-3 years by CPHEEO.

Demand Based Desludging:

1. Cleaning is done on the request by HHs only when the OSS overflows or begins to smell.

2. The cleaning services of the ULB are presently treated as part of complaint redressal system for overflowing OSS system rather than regular cleaning and maintenance service.
3. The ULB operates the trucks on their own or engages private players when the demand arises.
4. HHs pay a certain amount for desludging.

Scheduled Based Desludging:

1. OSS systems will be emptied on a pre-determined schedule.
2. Regulations and penalties will be set in place to ensure periodic cleaning.
3. The ULB may require additional vacuum trucks to meet the service standards.
4. Local taxes levied by the ULB can be used to recover the opex for regular cleaning.
5. Awareness generation activities to educate HHs about the need for regular cleaning of their OSS systems.

Scheduled Based Emptying System – A Case Study of Malaysia

Malaysia has developed itself as a pioneer in sewerage and septage management services in the Asian continent. Today the country has nearly 100% coverage of safe and improved sanitation system. 70% urban HHs is connected with sewerage system and 27% urban HHs is dependent on septic tanks. The federal law had mandated to desludge the septic tanks every three years.

Since a large portion of HHs is connected with septic tanks, a regular desludging is required for well-maintained OSS. Indah Water Konsortium (IWK) private limited, a professional sanitation organization, was handed over the O&M, collection of service charges and also, the development of new sewage treatment systems of peninsular Malaysia, except for some areas that chose to retain the functions. In the year 2000, IWK was taken over by the Ministry of Finance.

In order to do desludging at every three years, IWK carried out an intensive survey of properties to find out details of each septic tank in the area of operation. Each property has been given a unique water account and sewer account number. The data from both the accounts was matched to remove duplication of the data. A list of unique properties was prepared, which is called the database.

This comprehensive database of all individual septic tanks covering details such as address of the property, unique ID of septic tanks, size of septic tanks, location and indication on how to reach the septic tank and the length of hose pipes required to desludge, so that the desludging vehicle may come well prepared. Since the database is created adequately, desludging activities are able to be not only coordinated well with the owners, but also the workers come prepared adequately.

4.4.4 Desludging Operations

There are primarily two models for provision of desludging services in a city:

Model 1: ULB manages the desludging on its own

In this model, the ULB owns, operates and maintains the desludging vehicles. The ULB has to ensure adequate number of vehicles of different sizes. The ULB has to also ensure adequate number of skilled human resources to operate these vehicles for desludging. There is a dedicated number where citizens could call to avail the service. ULBs should prepare a standard operating procedure (SOP) to define standard processes of service provision.

Model 2: ULB outsources the desludging to private agencies

In this model, the ULB outsources the desludging service to private contractors. The selection of private agencies for emptying OSS should generally include the service providers' past experience, availability of mechanical emptying vehicles, trained human resources and adequate safety gears.

In this model, after receiving the desludging request from the HH, the ULB diverts the service requests to the empanelled agency. Even after outsourcing, the ULB should ensure appropriate monitoring of the service providers and compliance with the ULB's standard operating procedures.

4.4.5 Technology options for emptying and conveyance of septage

Currently many ULBs do not have appropriate vehicles as well as adequate numbers for desludging septic tanks. It has been seen that if ULBs have the desludging vehicles, they do not have adequate drivers or helpers to run the vehicles and provide the service. HHs thus find it easier to call private contractors to desludge their septic tanks which may not be undertaken in a safe manner.

Selection of appropriate vehicles is the first step and various selection criteria have to be considered to select the appropriate vehicle. If the city has procured certain large capacity of desludging vehicles, but does not have adequate and skilled human resources to run those vehicles or has an area of the city where the roads are narrow and cannot be accessed by the large trucks, then the desludging plan for the city is bound to fail. The criteria for selection of appropriate vehicles should include the following:

- Road widths/ condition/ terrain
- Quantity of faecal sludge and septage generated
- Financial resources available
- Availability of skilled human resources to operate and maintain the vehicles
- After sale service/ skill for repair of the vehicle
- Method of desludging – (will affect the number of vehicles)

The first and most important criterion is to assess the quantity of septage generated in the city, and from which parts of the city. Smaller sized vehicles would be more useful for a city which has narrow lanes.

Demand based desludging may require lesser number of vehicles than scheduled based desludging. This initial level assessment has to be made before procuring the vehicles. Types of vehicles generally used for desludging are-

- conventional vacuum trucks used for desludging septic tanks which can be accessed through broader roads,
- mini vacuum tankers which can be used where the septic tanks are located on narrow lanes and do not have proper access to roads, and
- Gulper which is smaller mechanized tricycle or motor cycle mounted collection tanks of 20-40 litres capacity with smaller vacuum pumps at the primary level backed by a secondary transport system and which can be used in informal and slum and slum like settlements and very narrow road lanes.

4.4.6 Planning for Technology Options of Treatment and Reuse

Estimating quantity of septage generation in the ULB

Quantity of septage generation in the city is required prior to establishing a treatment plant. Based on an 'Advisory Note on Septage Management in Urban India, MoHUA' and United States Environmental Protection Agency (USEPA) 1984, per capita septage generation can be assumed at 230 litres per year. This means, by multiplying the current year's population of the ULB with 230 litres/year, the ULB can estimate the quantity of total septage generation in the city in a year.

For more precise estimation of septage generation, the ULB could conduct a sample survey of different types of properties connected with OSS. From the survey, the ULB could then derive the total septage volume generated across the city.

4.4.7 Planning for Treatment and Disposal Site

The ULB has to assess the existing infrastructure available in the city before planning to establish a FSTP. If the ULB is partially covered with sewerage network and has a functional STP, then the septage can be disposed in the sewer line. Before that, the ULB needs to ensure the capacity of STP to take the additional load for treatment of septage. Gazette for standards for waste water treatment at STP is attached as Annexure 2.

If the ULB currently has no sewerage network but has plans to establish the same with functional STP in next 2-3 years (in case these have been approved as part of service level improvement plan (SLIP) under the AMRUT or any other state

government supported schemes or self-financed), it is advisable to construct sludge drying beds and dispose the septage in sludge drying beds till the STP become functional. This is an interim solution to manage faecal sludge and septage safely.

If the ULB is currently not covered with sewerage network or a STP, and it has no plans to establish the same; the ULB can decide to construct a FSTP similar to Devanahalli. To establish FSTPs, let us discuss the parameters to be considered to identify a new septage treatment site.

4.4.8 Identification of New Faecal Sludge Treatment Site

To identify a new treatment site, the following parameters should be assessed:
Land availability: Availability of government land for establishing a treatment plant. Private land will cost more to acquire it for setting up a treatment plant.
Distance of treatment site: Long distance of treatment site will lead to higher fuel cost and might result in lesser trips.
Neighborhood: the treatment plant needs to be appropriately distanced from a residential area. The site's immediate environs need to be assessed.
Uninterrupted electricity: The treatment plant will require a reliable power supply for its efficient functioning, if the treatment technology has mechanical parts for its operation.
Geological parameters: Geological parameters such as depth of groundwater table at the selected location and type of soil should be considered. Also it will be an advantage if the selected site is not prone to flooding and it should not be a low-lying area.

4.4.9 Factors to be considered for Choosing Treatment Technology

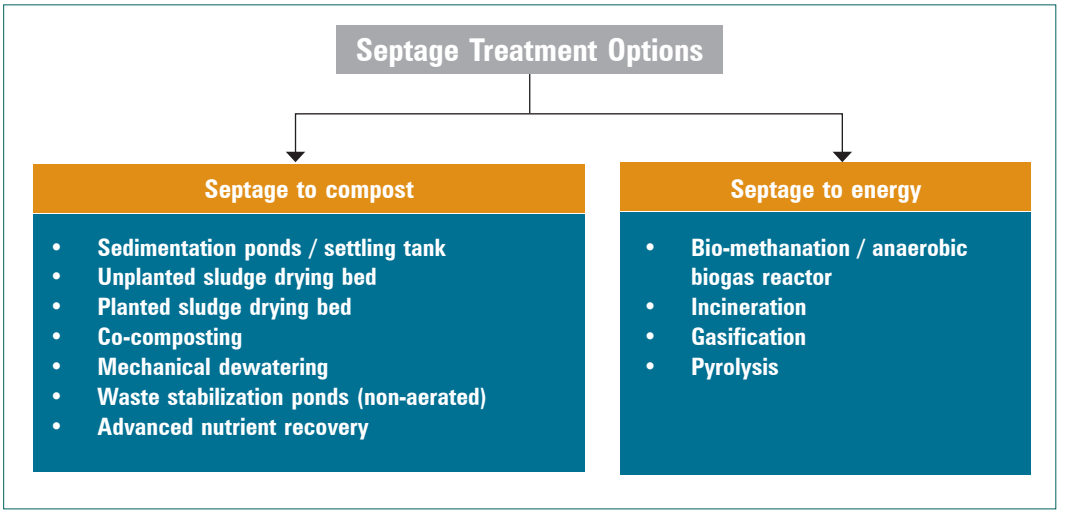
Various treatment technologies are available and the ULB should carefully assess based on the selection criteria and then decide a suitable technology. ULBs need to know the advantages and disadvantages of the treatment technology and should assess how much mechanization is required to run the treatment plant. ULBs should also assess the geological condition of the site and requirement of capex and opex for the treatment technology. A full life cycle cost of the plant should be worked out for the technology and it should be viable for the city to comfortably operate and maintain the same.

Some of the treatment technologies will also require before and after treatment of the septage, which also needs to be considered.

4.4.10 Septage Treatment Options

Septage can be converted into compost or energy after its treatment. Various available options for septage treatment are listed below. The ULB may choose a combination of these technologies. These technologies are identified based on the national and international case studies.

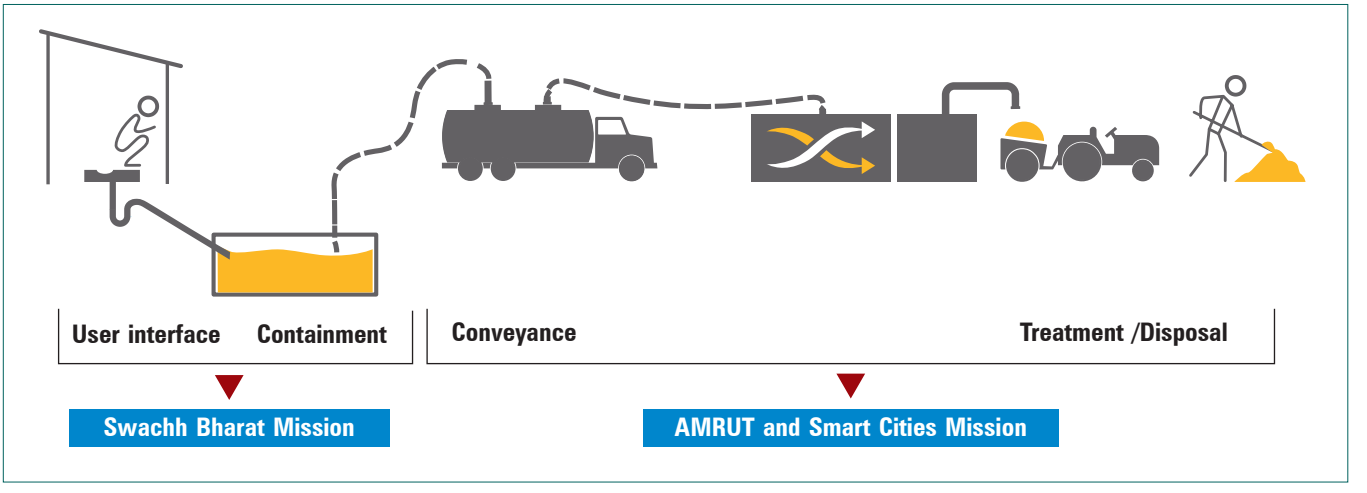
Figure 39: Various technologies of septage treatment



4.4.11 Financing of the FSSM

After understanding all the components of the FSSM value chain, it is essential to identify the possible financial sources to implement the FSSM plan in the city. Currently, SBM, Smart Cities Mission and AMRUT are the missions which have fund allocation for implementing FSSM in the city. Funds can be availed from the SBM for

Figure 40: Source of funding across the FSSM value chain



construction of individual toilets, public toilets, community toilets and OSS systems. Whereas fund for procuring vehicles and equipment for conveyance of septage, establishing treatment plant and disposal site, can be availed from the Smart Cities Mission and AMRUT mission.

4.4.12 Assessment of Financing Requirement across the FSSM Value Chain

The ULB needs to assess the requirement of capex and opex across the value chain for better planning of FSSM.

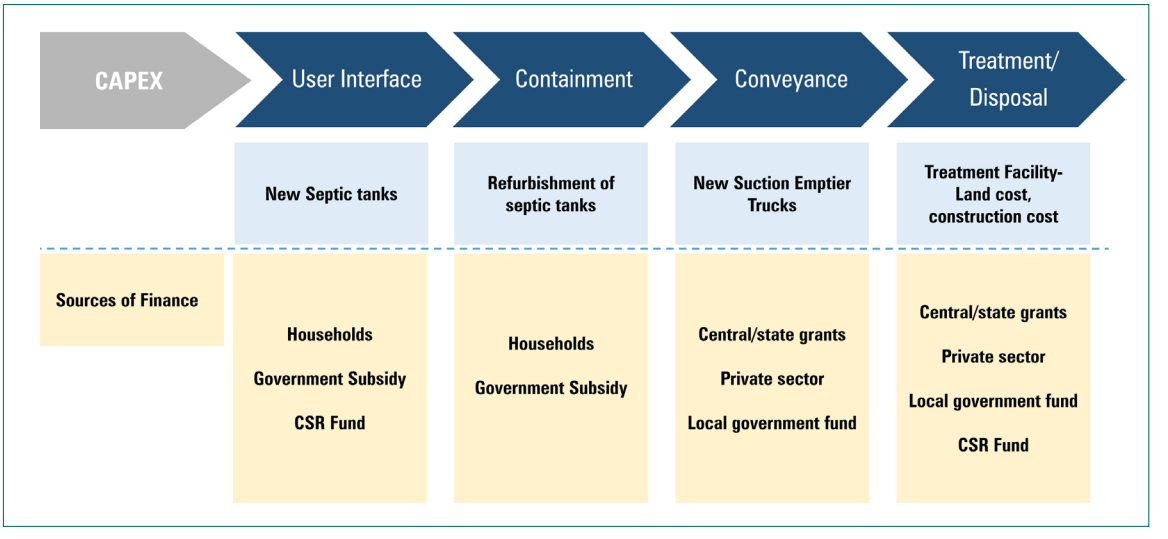
Table 9: Assessment of capex and opex across FSSM value chain

	User interface	Containment	Conveyance	Treatment/Disposal
capex	Construction of new individual toilets, PTs and CTs	Construction of new septic tanks and refurbishments of septic tanks	Procurement of new suction emptier trucks	Land cost and construction cost of treatment plant
opex	Maintenance of PTs and CTs	-	Fuel cost for emptier trucks, salaries of drivers, maintenance of machines etc.	Operations of the treatment facility: Staff salaries, electricity bill etc.

4.4.13 Potential Sources of Financing for Capex and Opex

To ensure financial sustainability of FSSM services, it is important to assess capacity for financing of both capex and opex over the planned period. This can start with an assessment of financial requirements for both capex and opex, along with subsequent tariff restructuring, to make the system sustainable. The

Figure 41: Potential sources of financing for capex

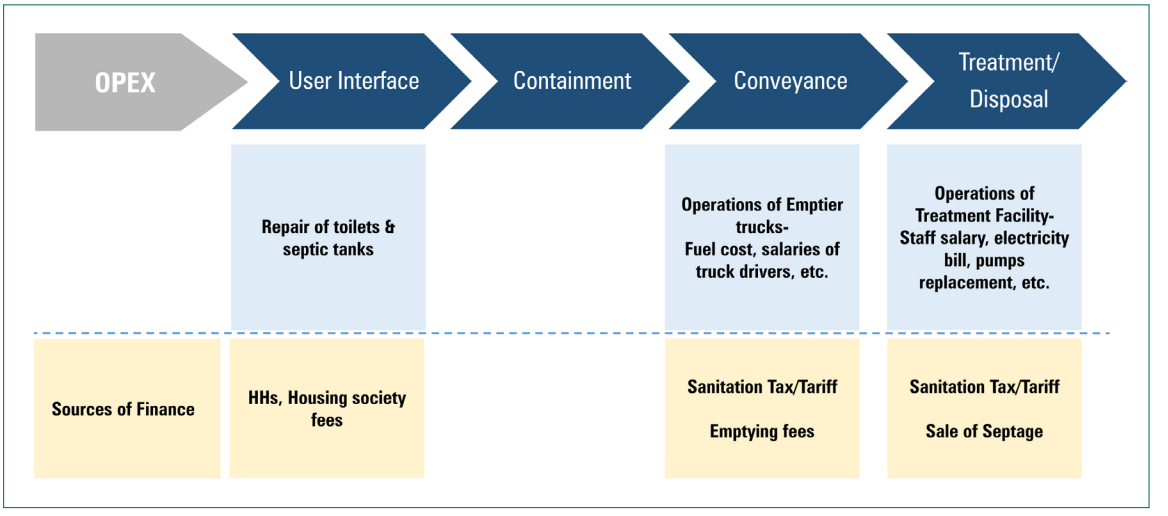


Source: (Ministry of Housing and Urban Affairs, 2013)

assessment also provides guidance on potential sources of finance for meeting these expenditures including funding through external grants, private sector investments, user contributions, external debt or through local government internal resources. (Ministry of Housing and Urban Affairs, 2013)

The ULB needs to identify the potential financial sources available to avail fund for capex across the value chain. For construction of new septic tanks, possible sources for supporting capex include HHs, government subsidy and CSR funds. For refurbishment of septic tanks, which is a part of containment, the predominant source of capex would be government subsidy or HHs have to borne the capex. For conveyance of septage, capex can be sought from central or state grants, and under local government schemes. Private sector participation is also a potential source for capex to procure vehicles. Establishing the FSTP and the disposal site are major areas where more funds will be required if any private land needs to be procured. Possible sources from where capex can be obtained would be grants from central and state governments, funds from local government and CSR funds. Private sector participation is also a potential source of finance but willingness of the private sector is to be assessed.

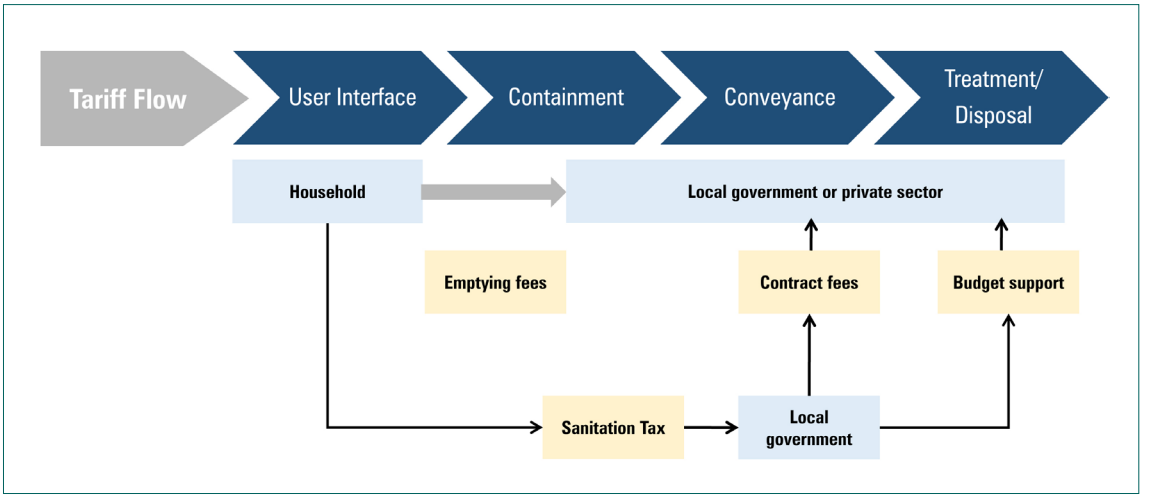
Figure 42: Potential sources of financing for opex



Source: (Ministry of Housing and Urban Affairs, 2013)

The government typically will support only for the capex and not for opex; the ULBs have to explore possible sources to cover opex costs. Potential sources for opex may include housing society fees, annual sanitation tax, and desludging fees taken from the property owners on the request of desludging their OSS systems. Revenue generated by selling of product after the treatment of septage will also feed into opex revenues.

Figure 43: Tariff flow diagram



Source: (Ministry of Housing and Urban Affairs, 2013)

4.4.14 Identification of Revenue Sources

The ULB can decide to levy taxes/user charges or both, on the HHs for FSSM services. Opex can be recovered by levying taxes and user charges from HHs. The ULBs could introduce a sanitation tax. Such a sanitation tax will be paid by the HHs to the ULB as part of annual property taxes. An exercise is designed on how to fix the amount of tariff for sanitation tax for the properties.

4.4.15 Citywide FSSM Planning

A Rapid Assessment Tool is available which can be used for planning FSSM services in the city. Apart from this, the Centre for Water and Sanitation (C-WAS) has released a tool called SANIPLAN. With the help of these tools, FSSM planning will become quite easier for the city managers.

Rapid Assessment Tool

"Rapid Assessment Tool for City Septage Budgeting"[38] is a tool designed and released by the MoHUA. The tool helps cities to assess cost estimates for faecal sludge management. Census data of 100 smart cities and 31 AMRUT Cities is built into the tool. The Ministry aims to support 131 designated cities in India to implement citywide faecal sludge management.

[38]Rapid Assessment tool can be downloaded from https://smartnet.niua.org/sites/default/files/Rapid%20Assessment%20Tool%20for%20City%20Septage%20Budgeting.xlsx

The objective of this tool is to estimate:

- Number of vehicles for FSSM service
- Capex for creating infrastructure for treatment of septage
- Opex for maintaining infrastructure and equipment

The ULB needs to fill up general information such as demographics, number of public and community toilets, individual toilets constructed, number of toilets with septic tanks and twin pits to be constructed in the remaining mission period, cleaning cycle of OSS systems, number of HHs using community toilets, existing number of vehicles for emptying septic tanks etc. After filling up the information asked in the tool, capex and opex will be calculated automatically.

SANIPLAN Tool for FSSM

SANIPLAN is a decision support tool that provides a structured approach to planning for urban sanitation. It focuses on integrated service performance with a detailed assessment of finances. It is a planning tool which can support more informed stakeholder participation. Based on local priorities, users can identify key actions for service improvement. Its dashboards also support more informed interaction with decisions makers. Sources of required data are also available[39].

SANIPLAN has three modules: 1) performance assessment, 2) planning and 3) financial planning. It provides a multi-year planning framework for improving performance on five service themes: access, equity, service levels and quality, efficiency and financial sustainability. A key feature of SANIPLAN is to develop a feasible financing plan for both capital and operating expenditures in context of local finances. SANIPLAN can be used for various sectors - water, sanitation, solid waste; and can also be customized for a specific context. (Centre for Water and Sanitation)

SaniTab

SaniTab[40] is an easy to use app (android based only) for conducting sanitation surveys. It can be used to generate baseline information and to create a database for properties connected with OSS systems. It can be used for planning and monitoring ODF and faecal sludge management activities in cities, or for impact assessment. It is easy to administer and allows quick analyses.

Key features of SaniTab app:

- Citywide digital data collection tool
- Providing enabling environment for spatial analysis
- Quick and ease in survey, minimizing human error
- Real time monitoring of survey activity

[39]Sources of required data: http://ifsmtoolkit.pas.org.in/Data%20for%20SaniPlan%20Input%20List%20of%20sources%20.xlsx?attredirects=0&d=1
[40]http://www.pas.org.in/Portal/document/UrbanSanitation/uploads/SANI%20Tab%20Sanitation%20Survey.pdf

Group Exercise 2

Calculate the tariff requirement to recover the O&M cost
2A. Requirement of opex for scheduled emptying service

Assumptions

Fuel efficiency of a truck as 5 km/litre
Fuel cost is ₹70/litre
Avg. distance of septage disposal site is 15 km
Avg. repair and maintenance cost of an emptier truck is ₹2,000/month
Requirement of human resource is 2 per truck and salary is ₹ 10,000/month per person
Emptying service is provided 300 days a year

Calculation Guide

Fuel cost for scheduled emptying service No. of septic tanks to be emptied daily * 300 * Average distance * 2 * fuel cost / fuel efficiency	
Repair and maintenance cost of emptier trucks Number of emptier trucks required * 12 * 2000	
Establishment cost No. of emptier trucks required * 12 * No. of human resource * monthly salary	
Sub Total (1+2+3)	
Total annual O&M cost for scheduled cleaning (including 10% overhead charges such as insurance and other miscellaneous cost) Sub Total (1+2+3) * 1.10	

Group Exercise 2

Calculate the tariff requirement to recover the O&M cost
2B. Requirement of opex for septage treastment plant

Assumptions

< 25 cu.m./day = ₹5,000 per month
25-50 cu.m./day = ₹10,000 per month
50-75 cu.m./day = ₹15,000 per month
> 75 cu.m./day = ₹20,000 per month
Avg. repair and maintenance cost is ₹10,000/month
Requirement of human resource in two shifts is 4 and salary is ₹10,000/month per person
Assume all the HHs as individual properties

Calculation Guide

Energy cost for septage treatment facilities Energy cost per month * 12	
Repair and maintenance cost of the plant 12 * 10,000	
Establishment cost No. of human resource * monthly salary * 12	
Sub Total (1+2+3)	
Total annual O&M cost for septage treatment plant (including 10% overhead charges such as insurance and other miscellaneous cost) Sub Total (1+2+3) * 1.10	

A. Annual O&M cost = 2A +2B = ₹_____

B. Per property tariff requirement for septage management = ₹_____

(Annual O&M cost (A) / total number of properties) * Tax collection efficiency

- *Consider tax collection efficiency = 70%*
- *Note: Participants may calculate differential tariff structure across the properties uses; properties with toilet facility v/s properties dependent on the community toilets etc.*

SESSION 5

IEC and BCC for FSSM

5.1 Learning Objectives

- Behaviour Change Communication in sanitation is more than just conveying a message through mass media campaigns, films and posters. We need to learn from past failures and understand barriers for adoption of new/improved behaviours.
- Messaging for urban sanitation should be proof tested for any gender, caste and class stereotyping. Negative messaging can strengthen status quo of a deprived social group or class, and gains made in behaviour change may be short lived at best.
- Understanding the audience amounts to understanding deeper level self-perception barriers that prevent adoption of improved behaviours at the individual and community level.
- BCC in the containment and access (individual and public toilets) has been researched and lessons learnt need to be tested for other parts of the FSSM value chain.

5.2 Duration

20 minutes

5.3 Key Facts

1. Lack of knowledge and awareness of negative health impacts are not the primary barriers to behaviour change in rural sanitation and are unlikely to be a case in urban sanitation as well.

2. Lack of public toilet/sanitation infrastructure particularly in slums and poor settlements needs to be addressed first, before addressing behaviour change. As long as there is a lack of public individual and toilet infrastructure in slums (adequate, functional and clean toilets and urinals for women and men that are connected to sewerage systems) as long as there are waste dumps in poor settlements and along market yards, public bus stands and hospitals that are not cleaned up by public authorities on a regular basis - no amount of individual awareness and motivation can address urban sanitation challenge.

3. Before initiating a general BCC-IEC mass media or a community wide awareness campaign for construction and usage of toilets:
   a. An assessment needs to be done to find out if there are any deeper individual and community level self-perception barriers of gender, caste and class – for not using toilets or keeping them clean. BCC research in rural sanitation has shown that there are major barriers to adoption at individual level.
   b. Whether gender, caste and class impact on the access to public toilets in poor settlements need to be explored.[41]
   c. Whether administrative bottlenecks of SBM subsidy release are resulting in low toilet construction and usage.

4. BCC messaging through mass media needs to be gender sensitive and not re-enforce the stereotype role of men (as earners and decision makers) and women (as care givers).

5. BCC messaging should recognize and honour the hard lives and work that the working poor do, and gently motivate them to also improve their sanitation and hygiene behaviours. Mocking people or making fun of their habits or using threats and coercion, without understanding deeper self-perception barriers, may fall on deaf ears and at best bring temporary change in sanitation behaviours.

6. Behaviour Change priorities for FSSM can be for:
   a. Understanding the barriers to adopting toilet usage
   b. Construction of a standard septic tank
   c. Regular scheduled desludging and
   d. Preventing indiscriminate disposal and dumping of septage waste.

7. BCC strategies for FSSM need to reach out to multiple stakeholders – HHs, community, masons, emptier operators, ULB officials, elected representatives

8. Appropriate BCC strategies and content need to be developed for different audience groups

[41] http://indiawashforum.com/wp-content/uploads/2016/05/Sanitation-Behaviour-Change-Formative-Research-2016.pdf

9. How to deliver BCC in urban sanitation:
   a. Hiring an army of sanitation workers was one recommendation for rural sanitation behaviour change[42] , work for urban sanitation.
   b. A more incremental and long lasting approach can be to address practical infrastructure and O&M challenges that impede toilet usage first, and then address behaviour change and affordability challenges of individual and community/public sanitation.

5.4 Learning Notes

5.4.1 Definition of IEC and BCC

As per the definition given by UNESCO[43], IEC is the process of working with individuals, communities and societies to:

- Develop communication strategies to promote positive behaviours which are appropriate to their settings." Providing information is the first and most crucial stage, where people are informed about the subject; in this case FSSM and its components.

BCC is a process of working with individuals, communities and societies to:

- Develop communication strategies to promote positive behaviours which are appropriate to their settings; and
- Provide a supportive environment which will enable people to initiate and sustain positive behaviours.

How is BCC different from IEC?

Experience has shown that providing people with information and telling them how they should behave ("teaching" them) is not enough to bring about behaviour change. While providing information to help people to make a personal decision is a necessary part of behaviour change, BCC recognizes that behaviour is not only a matter of having information and making a personal choice. Behaviour change also requires a supportive environment. Community and society provide the supportive environment necessary for behaviour change. IEC is thus part of BCC while BCC builds on IEC.

BCC is a process of working with individuals, families and communities through different communication channels to promote positive behaviours and support an environment that enables the community to maintain that positive behaviours taken on. In order to meet this goal, various strategies including mass media, local and folk media, outdoor media, social mobilization, social marketing, community dialogue, interpersonal communication are employed.

[42]http://indianexpress.com/article/opinion/columns/a-sanitation-sena-for-india/

[43]http://www.unescobkk.org/education/hivaids/adolescent-reproductive-sexual-health-arsh/information-resources-publications/advocacy-iec-bcc/

Before deciding to plan for a BCC strategy, it is important to know the target audience and their level of understanding. Different target groups require different approaches. Being more of a demand creating and sustaining strategy, BCC plans have to include motivational parameters for the target audience. It requires research and has to have a direct approach towards changing behaviour of the target group.

The stages of BCC are explained as follows:

Figure 44: Stages of BCC

Sources: Grimley 1997 (75) and Prochaska 1992 (148)

5.4.2 Need for IEC and BCC for FSSM

We have started giving toilets to all. Now for sustaining the use of toilet, it has to be ensured that citizens as well as other stakeholders that are involved are up-to-date with all information. We had seen the views and issues faced by citizens, contractor, farmer, city engineer, and chief officer of the ULB. To bridge the gap between these issues and the lack of knowledge, it is essential to disseminate IEC and behaviour change information to the stakeholders.

Provision of toilets and vehicles is one thing, but to make sure that the toilets are used and maintained properly, and that the desludging and disposal is done safely, certain activities involving the stakeholders and their education and awareness is essential.

For example, training sessions can be held for elected representatives to make them aware about the existing FSSM of the city, and help in better management.

Routine O&M of the complete OSS system is critical to ensuring safe and efficient sludge management practices. ULBs should educate and inform property owners

about the proper functioning and maintenance requirements of these systems and encourage them to clean them often.

The on-site O&M responsibilities of sanitation infrastructure (private) for which property owners are responsible include:

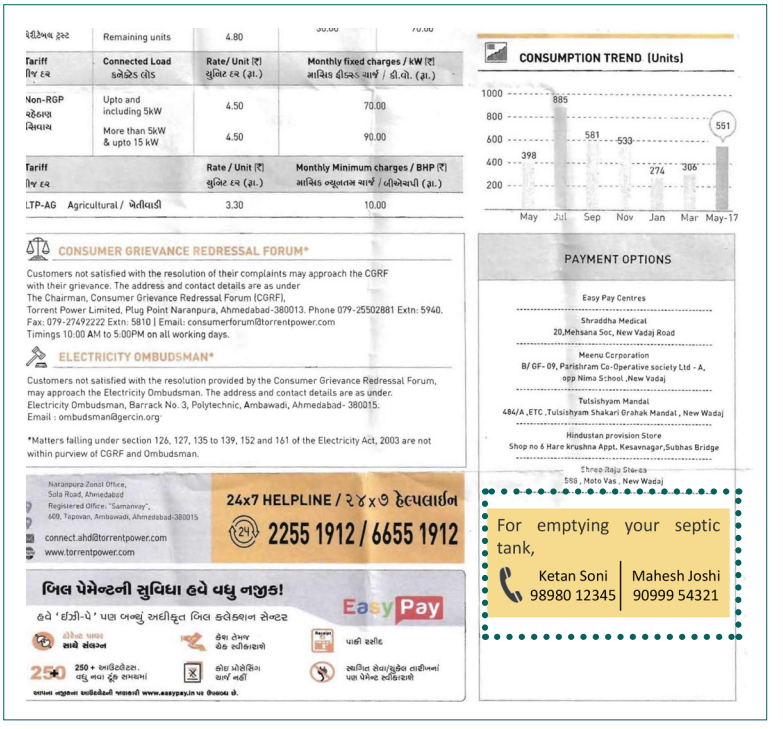
- Repair and maintenance of toilets, septic tank, soak pit and piping
- Clearing pipe blocks
- Getting faecal sludge emptied from private or municipal vacuum emptier at an interval of 2-3 years

5.4.3 IEC-BCC for different audiences

The subjects or key messages to be passed to the municipal staff shall include septic tank design standards, need for periodic desludging, tender details for engaging licensed transporters, and so on. It has to be decided what mode of IEC would be most suitable for the said audience. These could be in the form of manuals, training sessions, etc. where the municipal staff is taught about appropriate methods of FSSM.

For septage transporters, operators and private vendors, the subject of interest can be safe disposal methods, vehicle design, importance of using safety gears while desludging, correct and incorrect methods of desludging, and so on.

Figure 45: Contact details of service providers on backside of bills



IEC for residents can be done in various ways. The sub-groups among residents include citizens, self-help groups, community organizers, and Resident Welfare Association (RWA) members.

According to a DO letter released by SBM (Urban) as attached in Annexure 3, if capacity building fund under SBM is unutilized, then it can be used for capacity building initiatives for septage management projects for non-AMRUT but ODF cities.

5.4.4 Examples/case studies of IEC BCC activities

Following are some of the examples of cases where IEC BCC activities, specifically for FSSM are done.

The Adventures of Buland Babu: A Sludge Story

A Sludge Story, a comic book published by the Bengaluru-based organization Consortium for DEWATS (Decentralized Wastewater Treatment Systems) Dissemination Society or CDD Society. Buland Babu is a common man who wishes nothing but the best for his city. Buland Babu[44] was launched by the organization in February 2017. The copies of the comic book were shared with multiple ULBs across Karnataka and Tamil Nadu, and have been well-received. It engages the reader

Figure 46: A Sludge Story: Buland Babu

Source: https://www.thebetterindia.com/wp-content/uploads/2017/06/Relax8-1.jpg

For your free copy (limited free copies available), please write to bangalore@cddindia.org with your full address and phone number, and CDD Society will be more than happy to send across a copy to you.

[44]http://swachhindia.ndtv.com/comic-book-returns-time-teach-india-importance-human-waste-treatment-8807/ https://www.thebetterindia.com/104803/buland-babu-a-sludge-story-cdd-society-bengaluru/

regarding issues like open defecation and lack of proper human waste management.

The initial issue deals with faecal sludge management and how the citizens come together and tackle their own 'dirt' successfully. This form of a comic book format is new and fresh. In a lighthearted, yet effective way, the book gives the message and solution on how cities across India can too adopt a good FSTP which effectively treats human waste. The story tries to break down the current treatment facilities available for human waste in India and explains about the unsafe repercussions to the environment and as well as human life if we continue to follow the poor sanitation management. The adventures of Buland Babu comes to an end by setting up a FSTP in the city, passing on the strong message that it is possible to set up an effective treatment plant for human waste.

Bhutan BCC Strategy: Septic System Manual

The aim of the program by the Ministry of Works and Human Settlement and the Netherlands Development Organization (SNV), is to enhance access to improved sanitation and hygiene practices and services in three small pilot towns under Chukka District in Bhutan. Septic system is the most common on-site disposal system in Bhutan.

The handbook is particularly intended to be used by municipal engineers, building inspectors and technicians as a quick reference to understand the basic principles of how a septic system functions and its O&M. Further, leaflets within the handbook are targeted towards building owners for their technical know-how on O&M of septic

Figure 47: Do's and Don'ts as mentioned in the Septic Tank Manual

Stop, look, and smell!

DO'S

- Check the sludge depth in your septic tank every year and empty when it is two thirds full.
- Promptly repair leaky water faucets and toilets.
- Prevent surface water runoff from entering into your septic tank.
- Prepare and keep the "as-built" drawing for any further reference.
- Keep the records of emptying, inspection, and other maintenance works done.
- Ensure that tenants understand how to safely operate and maintain the septic system.

DON'TS

- Avoid driving or parking over any part of your septic system. The area over the system should be left undisturbed with just a mowed grass cover. Roots from nearby trees or shrubs may damage your system.
- Don't put any large quantity of cooking oil or grease into the septic system.
- Don't throw non-biodegradable materials such as disposable diapers, sanitary products or plastic into the septic system.
- Don't pour petrol, diesel, oil, paint, paint thinner, pesticides, antifreeze or other chemicals into the system.
- Don't wait for the signs of system failure. Use this manual to help you check the state of your septic tank.

Source: https://www.slideshare.net/BhimUpadhyaya/bhutan-septicsystemmanual

Figure 48: IEC for FSSM by Bhutan

Source: http://www.watercentre.org/services/events/wash2014/conference-program/wash-posters/yetsho-improving-bhutan2019s-urban-sanitation-services-through-behaviour-change-communication

tanks. Taking respective responsibilities within their abilities will ultimately help in improving sanitation and protecting the health and environment. This manual has details about all components of septic tank, function of each, the Do's and Don'ts and also the process of emptying.

"SepticSmart Week", EPA

The United States Environmental Protection Agency or EPA has prepared a Septic

Figure 49: Certification Workshops for Septic tank inspection

Source: https://www.epa.gov/septic/septic-systems-outreach-toolkit

Figure 50: IEC material by EPA under "SepticSmart Week"

Source: https://www.epa.gov/sites/production/files/2016-08/documents/septicsmart_infographic_v2_081215.eps_508.pdf

Tank Outreach Toolkit. This is because across the country, local environmental groups, health departments, and governments face challenges posed by improperly maintained and failing septic systems. EPA assists these local agencies in promoting homeowner education and awareness. It has numerous downloadable brochures, fliers, invitations, door hanger, and other such materials to get in touch with maximum number of citizens and invite them to this annual event. The event focuses on educating the homeowners on proper care and maintenance of their septic tank systems. They are given information regarding whom to contact.

Various promotional methods are used under this, ranging from a Facebook page, extensive outreach through sending emails, partnership with septic tank installer, schools, U.S. Geological department, and so on. To incentivize attendance at the workshops, the first 60 attendees at each event received a free arsenic test for their well water.

The Septic pumpers reported increase in calls as a result of such events.

In the line of such workshops and seminars, various universities in the USA such as the Washington State University also hold certification workshops. Using social media such as Facebook helps in easy and quick outreach of such events.

Indah Water Konsortium "Infomercials"

These "Infomercials" present a series of short advertisements for the citizens on making them aware regarding various subjects like bill payment, IWK's efforts to manage waste water, and why it is important to appropriately manage and treat the waste water.

These can be viewed through the link:
https://www.iwk.com.my/news-and-advertisement/tv-advertisements

Figure 51: Involving residents, Sanitation Mapping of Visakhapatnam

Source: Urban Management Centre

Focused Group Discussions, Sanitation Mapping in Visakhapatnam, Andhra Pradesh, India

In the Sanitation Mapping exercise in Visakhapatnam, one of the very important stages was to interact with the slum residents, and make them aware regarding their issues regarding open defecation and toilets. They were asked to map their locality and their house. They were then asked to map the houses which had water connection and toilets.

For the houses not having toilets, they were asked to map spots which were used for defecation. Then they were asked the reasons for it. Reasons like not having enough space to construct a toilet came up. They were also asked whether they were willing to have a toilet. The discussion ended with the residents replying that they need 2 good community toilets, which they shall maintain themselves. Such a kind of FGD can be done in case of stakeholders for FSSM as well. The target audience can be identified and they could be asked whether they have a toilet or not. If they have, whether it is connected to a sewer line, or an OSS; in case of OSS systems and what are the kinds of desludging system they have. (Urban Management Centre, 2016)

Answer Key to Group Exercises

Answer key to group exercises 1:

Number of tanks to be emptied in a day	14
Number of trucks required	4
Volume of septage to be treated	70 cu.m.

Answer key to group exercise 2:

2A. Requirement of opex for scheduled emptying service

Sr. No	Particular	Cost (in ₹)
1	**Fuel cost for scheduled emptying service**	**17,64,140**
2	Repair and maintenance cost of emptier trucks	96,000
3	**Establishment cost**	**9,60,000**
4	Sub Total (1+2+3)	28,20,140
5	**Total annual O&M cost for scheduled cleaning (including 10% overhead charges such as insurance and other miscellaneous cost)**	**31,02,154**

2B. Requirement of opex for septage treatment plant

Sr. No	Particular	Cost (in ₹)
1	**Energy cost for septage treatment facilities**	**1,80,000**
2	Repair and maintenance cost of the plant	1,20,000
3	**Establishment cost**	**4,80,000**
4	Sub Total (1+2+3)	7,80,000
5	**Total annual O&M cost for septage treatment plant (including 10% overhead charges such as insurance and other miscellaneous cost)**	**8,58,000**

Total annual opex: ₹39,60,154

Per property tariff requirement for septage management = ₹211 per year

Sanitation Capacity Building Platform

Goal

To build the capacity of cities and other stakeholders working in urban sanitation to ensure improved delivery of sanitation services through decentralized approaches.

What is the Sanitation Capacity Building Platform?

Sanitation Capacity Building Platform (SCBP) is designed to support and build the capacity of towns/cities to plan and implement decentralized sanitation. The platform also aims to facilitate knowledge and experience sharing among cities on decentralized. Decentralized sanitation is a key solution to accomplish national missions like Swachh Bharat Mission, AMRUT, Smart Cities Mission and Namami Gange programme.

The platform supports the Ministry of Urban Development (MoUD), Govt of India's focus on urban sanitation. It assists states and cities to move beyond open defecation free status by addressing safe disposal and treatment of human faeces.

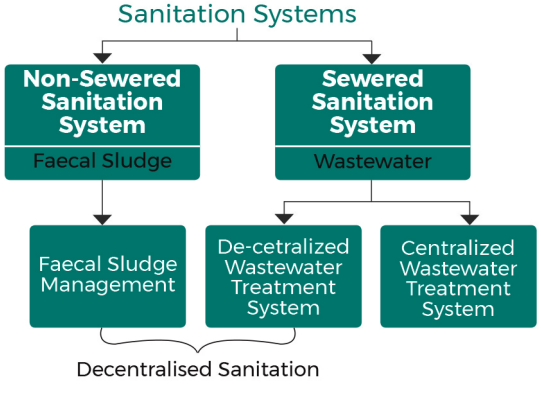
How Does the Platform Work?

National Institute of Urban Affairs (NIUA) is the anchor organization for this platform which comprises a network of partners who are credible national and international expert agencies. These partners include prominent universities, training centres, resource centres, nongovernmental organizations, consultants and experts such as CEPT University, CDD and BORDA, iDeCK, ASCI, CPR, CSE, WASHi and UMC.

NIUA actively reaches out to towns and states to understand the sanitation situation, assess needs, and develop customized capacity building programmes. NIUA then connects each state and city with the appropriate capacity building partners of the platform. The partners deliver capacity building activities for all stakeholders involved in sanitation value chain, including officials from Urban Local Bodies (ULBs), elected representatives and private sector. NIUA responds to requests and enquiries from states and cities.

Why Decentralized Sanitation?

Ambitious goals of various national missions such as Swachh Bharat Mission, AMRUT and the Smart Cities Mission cannot be achieved solely through conventional, centralized wastewater treatment systems. Given that, 49% of the urban population in India relies on on-site sanitation such as septic tanks and pits, decentralized sanitation options such as Faecal Sludge Management (FSM) and Decentralized Wastewater Treatment Systems are very much critical for achieving the goals for urban sanitation under various national missions. Decentralized sanitation options are scientifically proven solutions to complement centralized systems, serving the underserved, particularly in peri-urban areas and informal settlements.



Faecal Sludge Management is the collection and transportation of faecal sludge from containment system, treatment of the sludge in a designated site, and then safe disposal or reuse of the treated sludge. Decentralized Wastewater Treatment Systems comprises of sewers to convey domestic wastewater from a neighbourhood or local catchment to a small, local treatment plant where it is treated through a natural processes without any requirement for external energy to operate the system.

Services Offered

- Undertaking FSM situation assessment and diagnostic study of existing sanitation situation of cities
- Orientation and exposure visits for state and ULB officials and elected representatives for understanding Septage and Faecal Sludge risks and challenges
- Supporting national, state and city level FSM Policy and Regulatory reforms
- Institutional capacity strengthening of nodal state/regional level Training Institutions for delivering high quality FSM Trainings
- Facilitating capacity building activities for stakeholders involved in the FSM value chain - government officials, masons, private sector
- Creating knowledge resources and advocacy material on FSM technology, institutional, legal and financial eco-systems
- Preparation of model Detail Project Report (DPRs) for FSM and Learning materials
- Promoting Behaviour Change for moving beyond Open Defecation free status.

Capacity Building

- Orientation and exposure visits for understanding Septage and Faecal Sludge risks and challenges
- Institutional capacity strengthening through training of trainer programmes
- Capacity building activities for stakeholders involved in the FSM value chain - government officials, masons, private sector
- Creating knowledge resources and advocacy material on FSM technology, institutional, legal and financial eco-systems

Planning

- Baseline data collection on FSM
- FSM situation assessment
- Diagnostic study of existing sanitation situation
- Stakeholder mapping and analysis
- Analysis of legal and institutional framework
- Policy and guideline formulation

Implementation

- Model DPRs for Faecal Sludge Treatment Plants and Decentralized Wastewater Treatment System
- Planning for emptying and transport services
- Transaction advisory for FSM
- Designing of Behaviour Change Strategy

Partners of the Platform

Currently there are 10 partners delivering capacity building services on decentralized sanitation. Partners have extensive experience working in the sanitation sector in India and internationally. They have worked closely with many cities in various states and have an excellent understanding of the context and stakeholders. Additional partners will be added to the platform in the future.

About NIUA

NIUA is a premier national institute for research, capacity building and dissemination of knowledge in the urban sector, including sanitation. Established in 1976, it is the apex research body for the Ministry of Urban Development (MoUD), Government of India.

NIUA is also the strategic partner of the MoUD in capacity building for providing single window services to the MoUD/States/ULBs.

The Institute includes amongst its present and former clients, the Ministry of Urban Development (MoUD), the Ministry of Housing & Urban Poverty Alleviation (MoHUPA), Housing and Urban Development Corporation (HUDCO), the Planning Commission of India, City and Industrial Development Corporation (CIDCO) of Maharashtra USAID, World Bank, Asian Development Bank, GIZ, UNICEF, UNEP, UNOPS, Cities Alliance, Bill & Melinda Gates Foundation, Rockefeller Foundation, Global Green Growth Institute (GGGI), and the Bernard van Leer Foundation (BvLF). Some of the major areas of work include:

- Provide research support to MoUD
- Conduct research studies on contemporary urban issues
- Coordinate capacity building and training activities
- Disseminate information through networks and knowledge hubs
- Analyze and promote policy change agenda
- Monitor and evaluate Government of India's urban programs/schemes

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Annexure

Annexure 1: Assigning responsibilities for FSSM

PRAVEEN PRAKASH, IAS
Joint Secretary & Mission Director (SBM)
GOVERNMENT OF INDIA
MINISTRY OF URBAN DEVELOPMENT

प्रवीण प्रकाश, आई.ए.एस.
संयुक्त सचिव एवं मिशन निदेशक (एस.बी.एम.)
भारत सरकार
शहरी विकास मंत्रालय

सत्यमेव जयते

स्वच्छ भारत
एक कदम स्वच्छता की ओर

D.O No. MD-SBM/AA/63/2016

30th May, 2016

Sub: Assigning responsibility for Fecal Sludge Management (FSM) / Septage Management - Reg.

Respected Sir/Ma'am,

As you are aware, one of the key objectives of Swachh Bharat Mission (Urban) is to help all 4041 cities/towns achieve 100% Open Defecation Free (ODF) status by 2nd October 2019.

2. As we move towards 100% coverage of toilets, we need to look ahead at managing the large volume of fecal sludge from the growing number of septic tanks and single pit latrines. Proper **fecal sludge management (FSM) or Septage Management** that maximizes safety and sustainability is essential and we need to develop a model that will cater to the country's future needs. Fecal sludge comprises partially stabilized excreta and slurry from improved single pit latrines, septic tanks, as well as latrines based on other improved and unimproved technologies. Unless managed appropriately, this fecal sludge poses a huge risk to public health and the environment. At present about 64 million Indian households must be supported with safe FSM services.

3. In this regard, a key intervention proposed is to assign the responsibility of Septage Management/Fecal Sludge Management to the respective Water and Sanitation Board. The Water and Sanitation Board may also be renamed as "**Water, Sanitation and Septage Management Board**".

4. I request you to kindly issue instructions to the concerned officers for implementing the recommendations as per para 3 above. They may reach out to me in case any clarifications are required.

In anticipation of your kind support.

With regards,

Yours sincerely,

(Praveen Prakash)

To,
Chief Secretaries of all states/UTs

Copy to:
Mission Directors (SBM) – of all states
DS (SBM) – MSS
DA-CPHEEO

Office: 140-C, Nirman Bhawan, New Delhi-110011 ♦ Mob: 9013133636, Phone: 011-23062309, Fax: 23062477
praveenprakashud@gmail.com, praveen.prakash71@nic.in

Annexure 2: Waste water treatment standards

रजिस्ट्री सं० डी० एल०-33004/99 REGD. NO. D. L.-33004/99

भारत का राजपत्र
The Gazette of India

असाधारण
EXTRAORDINARY
भाग II—खण्ड 3—उप-खण्ड (i)
PART II—Section 3—Sub-section (i)
प्राधिकार से प्रकाशित
PUBLISHED BY AUTHORITY

सं. 843] नई दिल्ली, शुक्रवार, अक्तूबर 13, 2017/आश्विन 21, 1939
No. 843] NEW DELHI, FRIDAY, OCTOBER 13, 2017/ASVINA 21, 1939

पर्यावरण, वन और जलवायु परिवर्तन मंत्रालय

अधिसूचना

नई दिल्ली, 13 अक्तूबर, 2017

सा.का.नि. 1265(अ).—केन्द्रीय सरकार, पर्यावरण (संरक्षण) अधिनियम, 1986 (1986 का 29) की धारा 6 और धारा 25 द्वारा प्रदत्त शक्तियों का प्रयोग करते हुए, पर्यावरण (संरक्षण) नियम, 1986 का और संशोधन करने के लिए निम्नलिखित नियम बनाती है, अर्थात् : —

1. **संक्षिप्त नाम और प्रारम्भ :—**(1) इन नियमों का संक्षिप्त नाम पर्यावरण (संरक्षण) संशोधन नियम, 2017 है ।

   (2) ये राजपत्र में उनके प्रकाशन की तारीख को प्रवृत्त होंगे ।

2. पर्यावरण (संरक्षण) नियम, 1986 की अनुसूची-1 में, क्रम संख्यांक 104 और उससे सम्बन्धित प्रविष्टियों के पश्चात्, निम्नलिखित क्रम संख्यांक और प्रविष्टियां अन्तःस्थापित की जाएगी, अर्थात् :—

क्र. सं.	उद्योग	मानदंड	मानक	
1	2	3	4	
		बहिर्स्राव निस्सारण मानक (निपटान के सभी ढंगों को लागू)		
"105	मल उपचार संयंत्र (एसटीपी)		अवस्थान	सांद्र का निम्नलिखित से अधिक न होना
			(क)	(ख)
		पीएच	देश में कहीं भी	6.5-9.0
		जैव-रासायनिक ऑक्सीजन मांग (बीओडी)	महानगर* अरूणाचल प्रदेश, असम, मणिपुर, मेघालय, मिजोरम, नागालैण्ड, त्रिपुरा, सिक्किम, हिमाचल प्रदेश, उत्तराखंड, जम्मू-कश्मीर राज्यों और	

			अंदमान और निकोबार द्वीप, दादरा और नागर हवेली, दमण और दीव और लक्षद्वीप के सिवाय, सभी राज्यों की राजधानी ।	
			ऊपर उल्लिखित से भिन्न क्षेत्र/प्रदेश	30
		कुल निलंबित ठोस पदार्थ (टीएसएस)	महानगर* अरूणाचल प्रदेश, असम, मणिपुर, मेघालय, मिजोरम, नागालैण्ड, त्रिपुरा, सिक्किम, हिमाचल प्रदेश, उत्तराखंड, जम्मू-कश्मीर राज्यों और अंदमान और निकोबार द्वीप, दादरा और नागर हवेली, दमण और दीव और लक्षद्वीप के सिवाय, सभी राज्यों की राजधानी ।	<50
			ऊपर उल्लिखित से भिन्न क्षेत्र/प्रदेश	<100
		फेकल कोलीफॉर्म (एफसी) (अतिसंभाव्य संख्या प्रति 100 मिलीलिटर एमपीएन/100 मिलीलिटर	देश में कहीं भी	<1000

*मुम्बई, दिल्ली, कोलकाता, चेन्नई, बेंगलूरू, हैदराबाद, अहमदाबाद और पुणे महानगर हैं ।

टिप्पण :

(i) पीएच और फैकल कौलीफॉर्म के सिवाय, मिलीग्राम/लिटर में सभी मूल्य ।

(ii) ये, मानक जलाशयों में निस्सारण और भूमि निपटान/अनुप्रयोगों के लिए लागू होंगे ।

(iii) फैकल कौलीफॉर्म के लिए मानक औद्योगिक प्रयोजनों के लिए उपचारित बहिर्स्राव के उपयोग के सम्बन्ध में लागू नहीं होंगे ।

(iv) ये मानक 1 जून, 2019 को या उसके पश्चात् कमीशन किए जाने वाले सभी मल उपचार संयंत्रों (एसटीपी) को लागू होंगे और पुराने/विद्यमान मल उपचार संयंत्र (एसटीपी) राजपत्र में इस अधिसूचना के प्रकाशन की तारीख से पांच वर्ष की अवधि के भीतर इन मानकों को प्राप्त करेंगे ।

(v) समुद्र में उपचारित बहिर्स्राव के निस्सारण के मामले में, इसे उचित समुद्री मुहाने के माध्यम से किया जाएगा और विद्यमान तट निस्सारण को समुद्री मुहानों में संपरिवर्तित किया जाएगा और उन मामलों में, जहां समुद्री मुहाना निस्सारण के बिन्दु पर 150 गुणा न्यूनतम आरम्भिक तनुकरण और निस्सारण बिन्दु से दूर 100 मीटर के किसी बिन्दु पर 1500 गुणा न्यूनतम तनुकरण प्रदान करता है, तब विद्यमान सन्नियम साधारण निस्सारण मानकों में विनिर्दिष्ट किए गए अनुसार लागू होंगे ।

(vi) उपचारित बहिर्स्राव का पुनःउपयोग/पुनःचक्रण तथा उन मामलों में, जहां उपचारित बहिर्स्राव के भाग का पुनःउपयोग और पुनःचक्रण किया जाता है जिसमें मानवीय सम्पर्क की सम्भावना अन्तर्वलित है, ऊपर यथा विनिर्दिष्ट मानक लागू होंगे ।

(vii) केन्द्रीय प्रदूषण नियंत्रण बोर्ड/राज्य प्रदूषण नियंत्रण बोर्ड/प्रदूषण नियंत्रण समितियां, पर्यावरण (संरक्षण) अधिनियम, 1986 की धारा 5 के अधीन स्थानीय परिवेश को ध्यान में रखते हुए, अधिक कठोर सन्नियम जारी कर सकेगा/कर सकेंगी ।

[फा. सं. क्यू-15017/2/2008/-सीपीडब्ल्यू]

अरुण कुमार मेहता, अपर सचिव

टिप्पण : मूल नियम भारत के राजपत्र, असाधारण, भाग II, खंड 3, उप-खंड (i) में का.आ. सं. 844(अ), तारीख 19 नवम्बर, 1986 द्वारा प्रकाशित किए गए थे और तत्पश्चात् उनमें निम्नलिखित अधिसूचनाओं द्वारा संशोधन किए गए थे, अर्थात् :— का.आ. 433(अ), तारीख 18 अप्रैल, 1987; सा.का.नि. 176(अ), तारीख 2 अप्रैल, 1996; सा.का.नि. 97(अ), तारीख 18 फरवरी, 2009; सा.का.नि. 149(अ), तारीख 4 मार्च, 2009; सा.का.नि. 543(अ), तारीख 22 जुलाई, 2009; सा.का.नि. 739(अ), तारीख 9 सितम्बर, 2010; सा.का.नि. 809(अ), तारीख 4 अक्तूबर, 2010; सा.का.नि. 215(अ), तारीख 15 मार्च, 2011; सा.का.नि. 221(अ), तारीख 18 मार्च, 2011; सा.का.नि. 354(अ), तारीख 2 मई, 2011; सा.का.नि. 424(अ), तारीख 1 जून, 2011; सा.का.नि. 446(अ), तारीख 13 जून, 2011; सा.का.नि. 152(अ), तारीख 16 मार्च, 2012; सा.का.नि. 266(अ), तारीख 30 मार्च, 2012; सा.का.नि. 277(अ), तारीख 31 मार्च, 2012; सा.का.नि. 820(अ), तारीख 9 नवम्बर, 2012; सा.का.नि. 176(अ), तारीख 18 मार्च, 2013; सा.का.नि. 535(अ), तारीख 7 अगस्त, 2013; सा.का.नि. 771(अ), तारीख 11 दिसम्बर, 2013; सा.का.नि. 2(अ), तारीख 2 जनवरी, 2014; सा.का.नि. 229(अ), तारीख 28 मार्च, 2014; सा.का.नि. 232(अ), तारीख 31 मार्च, 2014; सा.का.नि. 325(अ), तारीख 7 मई, 2014; सा.का.नि. 612(अ), तारीख 25 अगस्त, 2014; सा.का.नि. 789(अ), तारीख 11 नवम्बर, 2014; का.आ. 3305(अ), तारीख 7 दिसम्बर, 2015; का.आ. 4(अ), तारीख 1 जनवरी, 2016; सा.का.नि. 35(अ), तारीख 14 जनवरी, 2016; सा.का.नि. 281(अ), तारीख 7 मार्च, 2016; सा.का.नि. 496(अ), तारीख 9 मई, 2016; सा.का.नि. 497(अ), तारीख 10 मई, 2016; सा.का.नि. 978(अ), तारीख 10 अक्तूबर, 2016; और अंतिम बार अधिसूचना संख्यांक सा.का.नि. 1016(अ), तारीख 28 अक्तूबर, 2016 द्वारा संशोधित किए गए थे ।

MINISTRY OF ENVIRONMENT, FOREST AND CLIMATE CHANGE

NOTIFICATION

New Delhi, the 13th October, 2017

G.S.R. 1265(E).—In exercise of the powers conferred by sections 6 and 25 of the Environment (Protection) Act, 1986 (29 of 1986), the Central Government hereby makes the following rules further to amend the Environment (Protection) Rules, 1986, namely:-

1. **Short title and commencement.**—(1) These rules may be called the Environment (Protection) Amendment Rules, 2017.

(2) They shall come into force on the date of their publication in the Official Gazette.

2. In the Environment (Protection) Rules, 1986, in Schedule – I, after serial number 104 and the entries relating thereto, the following serial number and entries shall be inserted, namely:—

Sl. No.	Industry	Parameters	Standards	
1	2	3	4	
		Effluent discharge standards (applicable to all mode of disposal)		
"105	Sewage Treatment Plants (STPs)		Location	Concentration not to exceed
			(a)	(b)
		pH	Anywhere in the country	6.5-9.0
		Bio-Chemical Oxygen Demand (BOD)	Metro Cities*, all State Capitals except in the State of Arunachal Pradesh, Assam, Manipur, Meghalaya Mizoram, Nagaland, Tripura Sikkim, Himachal Pradesh, Uttarakhand, Jammu and Kashmir, and Union territory of	20

			Andaman and Nicobar Islands, Dadar and Nagar Haveli Daman and Diu and Lakshadweep	
			Areas/regions other than mentioned above	30
		Total Suspended Solids (TSS)	Metro Cities*, all State Capitals except in the State of Arunachal Pradesh, Assam, Manipur, Meghalaya Mizoram, Nagaland, Tripura Sikkim, Himachal Pradesh, Uttarakhand, Jammu and Kashmir and Union territory of Andaman and Nicobar Islands, Dadar and Nagar Haveli Daman and Diu and Lakshadweep	<50
			Areas/regions other than mentioned above	<100
		Fecal Coliform (FC) (Most Probable Number per 100 milliliter, MPN/100ml	Anywhere in the country	<1000

*Metro Cities are Mumbai, Delhi, Kolkata, Chennai, Bengaluru, Hyderabad, Ahmedabad and Pune.

Note :

(i) All values in mg/l except for pH and Fecal Coliform.

(ii) These standards shall be applicable for discharge into water bodies as well as for land disposal/applications.

(iii) The standards for Fecal Coliform shall not apply in respect of use of treated effluent for industrial purposes.

(iv) These Standards shall apply to all STPs to be commissioned on or after the 1st June, 2019 and the old/existing STPs shall achieve these standards within a period of five years from date of publication of this notification in the Official Gazette.

(v) In case of discharge of treated effluent into sea, it shall be through proper marine outfall and the existing shore discharge shall be converted to marine outfalls, and in cases where the marine outfall provides a minimum initial dilution of 150 times at the point of discharge and a minimum dilution of 1500 times at a point 100 meters away from discharge point, then, the existing norms shall apply as specified in the general discharge standards.

(vi) Reuse/Recycling of treated effluent shall be encouraged and in cases where part of the treated effluent is reused and recycled involving possibility of human contact, standards as specified above shall apply.

(vii) Central Pollution Control Board/State Pollution Control Boards/Pollution Control Committees may issue more stringent norms taking account to local condition under section 5 of the Environment (Protection) Act, 1986".

[F. No. Q-15017/2/2008-CPW]

ARUN KUMAR MEHTA, Addl. Secy.

Note : The principal rules were published in the Gazette of India, Extraordinary, Part II, Section 3,Sub-section (i) *vide* number S.O. 844 (E), dated the 19th November, 1986 and subsequently amended *vide* the following notifications, namely:—

S.O. 433 (E), dated the 18th April 1987; G.S.R. 176(E) dated the 2nd April, 1996; G.S.R. 97 (E), dated the 18th February, 2009; G.S.R. 149 (E), dated the 4th March , 2009; G.S.R. 543(E), dated the 22nd July,2009; G.S.R. 739 (E), dated the 9th September, 2010; G.S.R. 809(E), dated the 4th October, 2010, G.S.R.

215 (E), dated the 15th March, 2011; G.S.R. 221(E), dated the 18th March, 2011; G.S.R. 354 (E), dated the 2nd May, 2011; G.S.R. 424 (E), dated the 1st June, 2011; G.S.R. 446 (E), dated the 13th June, 2011; G.S.R. 152 (E), dated the 16th March, 2012; G.S.R. 266(E), dated the 30th March, 2012; and G.S.R. 277 (E), dated the 31st March, 2012; and G.S.R. 820(E), dated the 9th November, 2012; G.S.R. 176 (E), dated the 18th March, 2013; G.S.R. 535(E), dated the 7th August, 2013; G.S.R. 771(E), dated the 11th December, 2013; G.S.R. 2(E), dated the 2nd January, 2014; G.S.R. 229 (E), dated the 28th March, 2014; G.S.R. 232(E), dated the 31st March, 2014; G.S.R. 325(E), dated the 7th May, 2014; G.S.R. 612, (E), dated the 25th August 2014; G.S.R. 789(E), dated the 11th November 2014; S.O. 3305(E), dated the 7th December, 2015; S.O.4(E), dated the 1st January 2016; G.S.R. 35(E), dated the 14th January 2016; G.S.R. 281 (E), dated the 7th March, 2016; G.S.R. 496(E), dated the 9th May, 2016; G.S.R.497(E), dated the 10th May, 2016; G.S.R.978(E), dated the 10thOctober, 2016; and lastly amended vide notification G.S.R. 1016(E), dated the 28th October, 2016.

Uploaded by Dte. of Printing at Government of India Press, Ring Road, Mayapuri, New Delhi-110064
and Published by the Controller of Publications, Delhi-110054.

Annexure 3: Using unutilized capacity building fund of SBM for capacity building initiatives for septage management for Non-AMRUT but ODF declared ULBs

PRAVEEN PRAKASH, IAS
Joint Secretary & Mission Director (SBM)
GOVERNMENT OF INDIA
MINISTRY OF URBAN DEVELOPMENT

सत्यमेव जयते

प्रवीण प्रकाश, आई.ए.एस.
संयुक्त सचिव एवं मिशन निदेशक (एस.बी.एम.)
भारत सरकार
शहरी विकास मंत्रालय

D.O. MD-SBM/AA/95/2016 **10th June, 2017**

Dear Sir,

As you are well aware, MoUD's AMRUT scheme provides funding for sewerage and septage projects for 500 chosen towns/cities, in accordance with its guidelines.

2 For non-AMRUT towns and cities which have become ODF, septage management becomes a natural extension of the Swachh Bharat Mission objectives. These cities, in addition to managing solid waste, are looking towards adopting integrated waste management or incorporating liquid waste management, especially as they move towards total sanitation.

3 For this purpose, they are considering funding liquid waste management projects through different sources such as the 14th Finance Commission Funds, State grants, Donor funding etc.

4 In this context, in these ODF, non-AMRUT towns, capacity building initiatives for such septage management projects, namely, DPR preparation, TA advisory for kickstarting implementation, IEC/BCC activities etc (as described in Section 13.2 of AMRUT guidelines) can now be undertaken if a part of the SWM capacity building fund is unutilized by the city.

5 Needless to say, AMRUT towns and cities can continue to undertake septage management activities under AMRUT scheme.

I hope that these measures will be instrumental in furthering the cause of septage management.

With regards,

Yours sincerely,

(Praveen Prakash)

To,

Mission Directors (SBM)

Copy to:

Director (SBM), CPHEEO

National Institute of Urban Affairs

National Institute of Urban Affairs

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