स्वच्छ भारत
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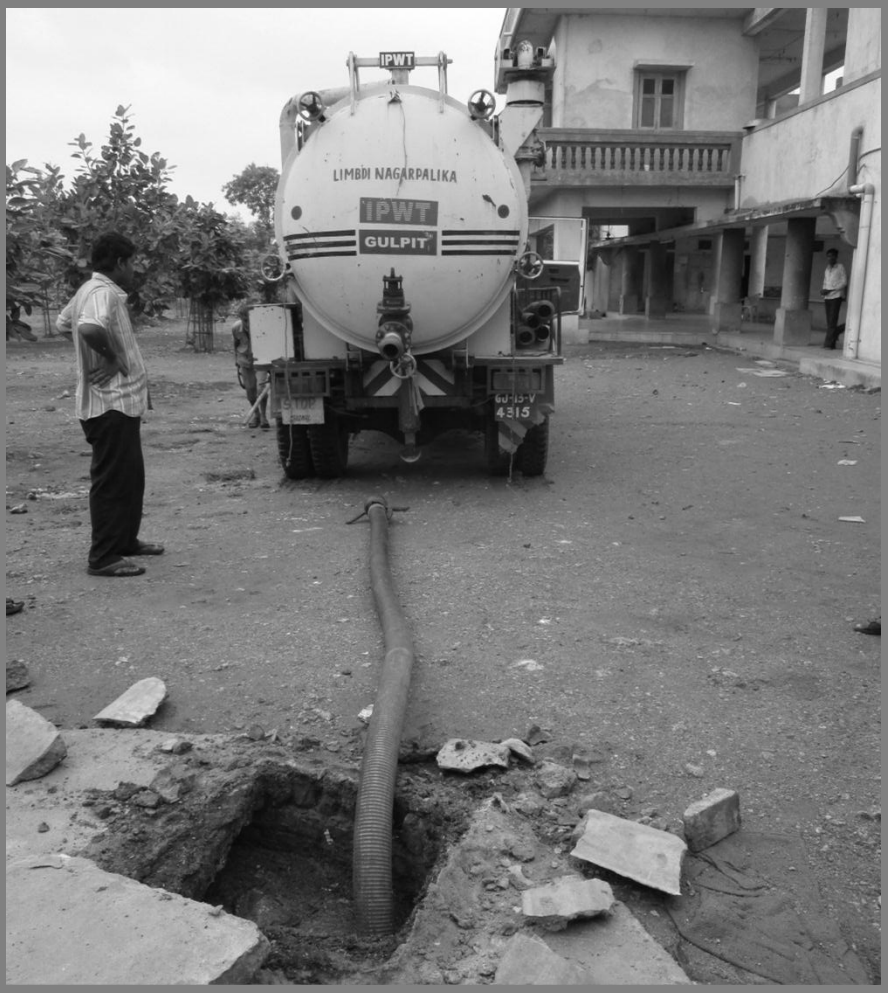
सत्यमेव जयते
Ministry of Urban Development
Government of India



FAECAL SLUDGE AND SEPTAGE MANAGEMENT (FSSM) IN URBAN AREAS OF INDIA

Standard Operating Procedures (SOP)

January 2017

Swachh Bharat Mission (SBM) - Urban

The Swachh Bharat Mission (SBM) - Urban was launched on 2nd October, 2014 with the main aim of eliminating open defecation, manual scavenging, and creating awareness regarding sanitation amongst citizens. The major components of the mission are providing individual household toilets, community toilets, public toilets, solid waste management, IEC and public awareness and capacity building and administrative & office expenses. SBM Urban is being implemented by the Ministry of Urban Development (MoUD). The Mission will be in force till 2nd October 2019.This Standard Operating Procedure is for the implementation of Swachh Bharat Mission Urban.

FOREWORD

M. Venkaiah Naidu

Minister of Urban Development, Housing & Urban Poverty Alleviation and Parliamentary Affairs

The Swachh Bharat Mission, which aims to make India a clean and open defecation free nation by October 2019, needs to become a 'janandolan' with participation from every stakeholder.

We have taken a multi-pronged approach to help cities become Open Defecation Free. In its third year since the launch, it is heartening to note that 475 cities across the country have become Open Defecation Free.

To sustain the ODF status, it becomes critical to look at the sanitation value chain in a holistic manner and address the existing implementation gaps. While sewerage systems serve parts of our large cities, many households in the country depend upon on-site sanitation systems such as septic tanks. Further, a large portion of faecal waste from onsite sanitation systems is disposed indiscriminately into water bodies and open fields. This makes it critical to adopt safe collection, transport, treatment and disposal of this faecal waste.

I am pleased to see the Standard Operating Procedures for "Faecal Sludge Management" being released by my Ministry, which helps to establish a uniform procedure for construction, routine maintenance and regular cleaning and emptying of on-site waste water disposal systems

It is my firm belief that this will go a long way in ensuring safe sanitation practices across the value chain of sanitation and help achieve a "Swachh Bharat" by 2nd October 2019.

FOREWORD

Rao Inderjit Singh

Minister of State, Ministry of Urban Development
Government of India

On 2nd October 2014, the Hon'ble Prime Minister Shri Narendra Modi launched the Swachh Bharat Mission to clean India's cities and towns. The mission focuses on two major components – sanitation and solid waste management.

It gives me immense pleasure to see cities and states working actively to make toilets available and accessible to the urban population. However, the faecal waste generated from these toilets is not being managed properly posing a significant risk to public health. The issue of faecal waste has become a pressing challenge in our cities, due to high population density and low coverage of sewerage systems.

The Ministry of Urban Development (MoUD) is committed to helping cities and states in ensuring proper faecal sludge and septage management to make our cities healthy and liveable and has developed the Standard Operating Procedures for "Faecal Sludge Management".

I encourage all states and cities to refer to this document to improve faecal sludge and septage management in your respective urban areas. The SoP has also provided case studies and existing state policies from across the country to promote cross-learning.

It is my firm belief that your active efforts in this critical area will enable our country to move towards a clean and a sanitized India.

ACKNOWLEDGEMENT

Standard Operating Procedure (SoP) for

Faecal Sludge and Septage Management (FSSM) in Urban Areas of India

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List of Abbreviations

AMRUT	Atal Mission for Rejuvenation and Urban Transformation
BIS	Bureau of Indian Standards
BOD	Biochemical Oxygen Demand
COD	Chemical Oxygen Demand
CSP	City Sanitation Plan
CPCB	Central Pollution Control Board
CPHEEO	Central Public Health & Environmental Engineering Organization
FSM	Faecal Sludge Management
FSSM	Faecal Sludge and Septage Management
GWMC	Greater Warangal Municipal Corporation
GWSSB	Gujarat Water Supply and Sewerage Board
LPCD	Liters Per Capita Per Day
MIS	Management Information System
MoUD	Ministry of Urban Development
MPN	Most probable number of coliforms
NUSP	National Urban Sanitation Policy
O&M	Operation & Maintenance
OSS	On-site Sanitation Systems
pH	Hydrogen ion concentration
RCC	Reinforced cement concrete
SOP	Standard Operating Procedure
SS	Suspended Solids
STP	Sewage Treatment Plant
TSS	Total Suspended Solids
UASB	Up flow Anaerobic Sludge Blanket
ULB	Urban Local Body
UMC	Urban Management Centre
USAID	United States Agency for International Development
USEPA	United States Environmental Protection Agency
WHO	World Health Organization
INR	Indian National Rupees

1. Background

Sanitation is defined as safe management of human excreta, including its safe confinement treatment, disposal and associated hygiene-related practices (National Urban Sanitation Policy, Ministry of Urban Development, 2008). Faecal sludge, which has not been transported into sewer, is produced from onsite sanitation technologies such as pit latrines, septic tanks, etc. It is raw and undigested, a combination of excreta and black water.

Faecal Sludge and Septage Management (FSSM) refers to the safe collection, transportation, treatment and reuse and disposal of sludge and waste water from on-site sanitation systems.

The entire chain from generation of faeces to disposal and treatment requires technical guidance so as to avoid human contact and outbreak of diseases. Therefore, it is essential to appropriately manage faecal sludge and septage, across the value chain.

Proper treatment and management of faecal sludge and septage is integral to safe sanitation practices which ensure health and well-being of citizens. According to the Census 2011 data on sanitation, 92% of urban centres have less than 50% of underground drainage coverage. Hence around 30million urban households or more than one thirds of all urban India depends on on-site sanitation solutions such as single pits, twin pits and septic tanks for safe waste water disposal.

Figure 1 Single Pit

Also in cities that have underground drainage network, the coverage of the underground network is limited. With rapid development, more and more properties especially in peripheral urban areas are making their own arrangements of waste water disposal. A rapid assessment of septage management in Asia carried out by USAID in 2010((USAID), 2010)revealed that about 148 million people in urban areas will have septic tanks by the year 2017. Though the National Urban Sanitation Policy (NUSP) emphasizes the need for proper collection, treatment and disposal of sludge from such on-site installations, very limited attention has been paid to the construction, management, maintenance and safe disposal of faecal sludge from these systems. A brief of NUSP is attached in Annexure A. It also envisages the preparation of State Sanitation Strategies by the States, and City Sanitation Plans (CSP) by the cities.

Figure 2 Twin Pit

Most urban local bodies (ULBs) in India are not able to effectively monitor the regular cleaning and maintenance of septic tanks and pits. Some ULBs provide septic tank and pit cleaning as a municipal service but the supply of such desludging services is far from adequate. In many cities private players have filled this gap by providing these services for a fee. The private contractors also sometimes sell the nutrient rich sludge to farmers in the vicinity of cities. However, the disposal of waste water is often not regulated. The sludge is dumped in storm water drains and open areas posing considerable health and environmental risks.

Figure 3 De-sludging septic tanks from residential areas

Figure 4 Disposal of sludge in open areas

Recognizing the growing importance of safe faecal sludge and septage management practices, the Ministry of Urban Development (MoUD) has recently released an advisory to provide guidance to states and cities on policy, technical, regulatory and monitoring aspects of faecal sludge and septage management. The advisory is a useful resource on faecal sludge and septage management for cities in India (Advisory Note on Septage Management in Urban India, 2013). In addition to the advisory, the guidelines on design and construction of septic tanks issued by the Bureau of Indian Standards (BIS) and the Central Public Health and Environmental Engineering Organization (CPHEEO) are also a good reference on technical design and maintenance of septic tanks. These standard operating procedures (SOP) borrows from these two resources as well as the team's extensive experience of working with cities to establish a uniform procedure for faecal sludge and septage management and present the information in a handy, comprehensive and easily accessible format.

1.1. Existing faecal sludge and septage management practices in India

In most Indian cities, faecal sludge and septage management has been neglected by the ULBs. The sector has not received enough attention because of poor understanding of O&M requirements, lack of guidance, inadequate resources and skills, shortage of –human resource and finance. While the largest Indian cities use expensive, centralized sewerage systems, the smaller towns cannot afford such systems. According to the study conducted by Water Aid India in the report 'Urban WASH: An Assessment of Faecal Sludge Management (FSM) Policies and Programs at the national and select states level' (WaterAid, 2016), only 32% of urban households having access to sanitation are connected to a sewerage network. Around 62% of the toilets are dependent on on-site sanitation systems. The toilets are connected to septic tanks/ pits and the sullage/effluent is often discharged into road side storm water drains which are covered or open.

The findings of the Census of India 2011 indicate that only 32.7 per cent of urban households are connected to a piped sewer system whereas 38.2 per cent dispose their wastes into septic tanks and about 7 per cent into pit latrines, underlining the predominance of onsite arrangements. Further, about 50 lakh pit latrines are insanitary (have no slabs or are open pits); 13 lakh are service latrines – of which 9lakh toilets dispose faeces directly into drains, 2 lakh latrines are serviced by humans (illegally) and 1.8 lakh latrines are serviced by animals. (Census 2011, Ministry of Home Affairs, Government of India, 2011)

Finally, about 18.6 per cent urban households still do not have access to individual toilets – about 6 per cent use public/community toilets and 12.6 per cent suffer the indignity of open defecation. According to a USAID (United States Agency for International Development) study (2010), by 2017 the number of urban households with toilets connected to septic tanks will increase to 148 million. Therefore, on-site pit latrines and septic tanks account for a substantial proportion of toilets in urban India – 48 per cent of urban Indian households depend on on-site facilities, and this proportion is still increasing. (Ministry of Urban Development, 2013)

Faecal sludge generated in small cities often ends up in garbage dumps, storm water drains, water bodies or is used for agriculture. In cities that have sewerage network and functional STPs, sludge is emptied in manholes or transported to STPs and treated along with the sewage conveyed through the underground network.

Prevalent on-site sanitation systems (OSS) in India

Most existing toilets in urban India use pour flush latrine interface. Insanitary latrines such as dry latrines and service latrines have been phased out. The pour flush latrines are either connected to single pit, twin pits or septic tanks.

Single pit system: It is observed that single pit system is one of the most widely used systems to dispose wastewater. These single pits are completely lined or partially lined at the top and then left un-lined. Lining materials include brick, concrete or mortar plastered onto the soil. These pits are constructed very deep (6-12m) and hence last for15 or more years without emptying. Because of their depths, the pits cannot be completely cleaned using suction machines. The sludge at the bottom hence hardens and the capacity of these pits to treat waste water keeps reducing over the years. As the pits are not cleaned often, they pose a risk of ground water contamination.

Septic Tanks: Septic tanks are the second most commonly used OSS after single pits. They are designed as watertight chambers which provide primary treatment for black water and grey water. The liquid flows through the tank and heavy particles (sludge) sink to the bottom, while scum (mostly oil and grease) floats to the top. The septic tanks should be appropriately sized and the accumulated sludge and scum must be removed every 2-3 years. However, in many cities, most septic tanks are constructed oversized and are not cleaned for 5-10 years. The effluent of the septic tank must be dispersed by using a soak pit or transported to another treatment technology. Soak pits are common all over India, especially in smaller towns. Many of these soak pits located in dense areas have lost their absorption capacity due to sludge entering into the pits because of lack of cleaning and maintenance of septic tanks. Hence soak pits also need to be emptied and cleaned frequently.

Twin pit system: The Twin pit system consists of a pour flush toilet connected to two alternating pits. Only one of the two pits is used at any time and accommodates waste generated over one or two years. Then the second pit is used. This allows the contents of the first pit to transform into Pit Humus (a sanitized soil-like material) which is safe and can be manually excavated.

Box 1Prevalent on-site sanitation systems in India

Most Indian cities also do not have any reliable data on number of households dependent on each of these above mentioned systems. Anecdotal evidence suggests that many cities are moderately aware of the functioning and difference between these systems.

The Prohibition of Employment as Manual Scavengers (and their rehabilitation) Act, 2013, prohibits manual cleaning of pit toilets and septic tanks. Adopting mechanical processes for cleaning of septic tanks such as suction emptier is seen as the only way to eliminate manual scavenging. Regrettably, part of septic tank / pit cleaning in some cities is carried out manually.

Cities often do not have access to septage sucking machines, or the fleet might be insufficient or not functioning. In the cities that have functioning machines, adequate faecal sludge treatment is not always available. Based on the Central Pollution Control Board 2015 report, Indian cities have the capacity to treat only 37% of the sewage generated, and out of the 816 municipal sewage treatment plants only 64% are functioning (2015). Septic tank cleaning hence is often addressed by the private sector with little monitoring and regulation from the ULB.

It is feared that the new Act may drive the already secretive business of faecal sludge emptying underground, and drive up the cost of emptying. Hence, it becomes essential that the ULBs recognize and register sludge emptying services as legitimate business, regulate their operations and enforce the use of

mechanized suction machines. Simultaneously, ULBs need to augment their infrastructure and resources directly or through contracting out emptying, transport and treatment of sludge.

For improving the coverage of safe sanitation in the country, the Government of India has developed a mission in 500 cities in India; the Atal Mission for Rejuvenation of Urban Transformation (AMRUT) supports the development of infrastructure, including sewerage facilities and septage management. Under this mission, assistance can be provided to underground sewerage system construction or renovation and cleaning, transportation treatment of faecal sludge. Support is also provided to the cities by the States. For instance, the Government of Gujarat is providing financial assistance for under-ground drainage projects and for establishing sewage treatment plants, under the Swarnim Jayanti Mukhya Mantri Shaheri Vikas Yojana.

States should not only provide financial support, but also operative guidelines to bridge the gap between policy and reality. The CPHEEO 2013 manual encourages states and municipal governments to produce guidelines for the faecal sludge and septage management. The States of Maharashtra, Odisha and Tamil Nadu, have already stepped forward by issuing state policies and guidelines (see Annexure B, C and D). The Greater Warangal Municipal Corporation also recently issued a Septage Management Regulation showing the way to other cities (Box 2). These policies and guidelines build the way towards a safe an efficient faecal sludge and septage management.(Advisory Note on Septage Management in Urban India, 2013)

Septage Management Regulation in the Greater Warangal Municipal Corporation

The 2013 CPHEEO Manual suggests that State and Municipal governments should draw up guidelines regarding the collection, transportation and treatment of sewerage. Following that recommendation, the Greater Warangal Municipal Corporation published comprehensive operative guidelines to improve the faecal sludge management of the town.

In this city of 0.61 million inhabitants, there is no sewerage system and the only treatment is on-site sanitation. 77% of households have access to safe sanitation, of which 59% are septic tanks and 18% have access to pit toilets. The Municipal Corporation is not providing services for sludge. According to the report, septage emptying is done by private companies without safety gears. (Greater Warangal Municipal Corporation, Bill & Melinda Gates foundation, 2016)

In order to improve sanitation in the city, the entire faecal sludge management value chain was addressed. The main highlights of the guidelines can be summarized as follow:

1. Promote and encourage design and construction of septic tanks (given in the annexure of the report) conformed to building plan. Town planning department to ensure that design conforms to the guidelines at the time of approval
2. Public Health department to survey existing insanitary latrines and notify them to convert into sanitary latrines (septic tanks and twin pit latrines). Also, in slums, twin pits may be permitted as per the specified design in the document. (Annexure 3 of the report)
3. Households, institutions, commercial entities, et cetera to undertake de-sludging of septic tanks and pits once in every three years or when they get filled up, whichever is the earliest as per the CPHEEO and NBC guidelines by licensed operators
4. Septage transportation vehicles fitted with Global Positioning System (GPS), with pre-designed routes shall be used. Penalties may be imposed on the operator in case of non-compliance with the guidelines
5. GWMC shall facilitate land and appropriate financing model for construction of septage treatment plant. GWMC shall notify penalty to operators who fail to dispose the septage at the plant

6. Information, education and communication to be given to the operators, builders, masons, suppliers of the septic tank and pits through Non-government organization, self-help groups, school children, et cetera.

7. Training programs for GWMC staff

8. Record keeping and reporting (MIS) platform for baseline data and progress

9. Dedicated help line for septage management to provide support to citizens on all aspects including septic tank designs, information on masons, periodicity of desludging, operator contacts, and so on.

This guideline bridges the gap between national guidelines and practical implementation of change. It should ensure safety and efficiency throughout the faecal sludge management value chain.

The guideline can be found on the following link:
http://smartnet.niua.org/sites/default/files/resources/Warrangal%20operative%20guidelines%20fro%20FSM%202016.pdf

Box 2 Septage Management Regulation in the Greater Warangal Municipal Corporation

and show the current sanitation value chain in two cities surveyed by the Urban Management Centre team. The line weight depicts the percentage of connections. Higher the weight, higher is the percentage. The green color denotes safe sanitation while the red ones denote un-safe practices that need to be improved. The dependence of households on on-site sanitation is higher in Himmatnagar and Amreli Municipalities of Gujarat.

2. About the SOP

This SOP is a step-by-step guide for ULBs to institute a framework for on-site sanitation system management. This SOP conforms to the advisory note on septage management released by MoUD and draws from the experience of an NGO placed in Ahmedabad, working with ULBs across India. It provides a set of written instructions on septic tank construction, cleaning and maintenance and disposal of sludge in a concise format. The SOP also contains a set of recording formats to help ULBs to document the number of septic tanks and frequency of cleaning for better decision making.

2.1. Scope and Applicability

The purpose of these guidelines and SOP is to establish a uniform procedure for construction, routine maintenance and regular cleaning and emptying of on-site waste water disposal systems. The procedures outlined in this SOP are applicable to all ULBs in which households are dependent on single pit, twin pit, septic tank system and other systems. This SOP covers the following areas:

- Design and construction guidelines for twin pits and septic tank system
- Cleaning procedure for pits and septic tanks
- Safe transportation of septage
- Septage treatment and disposal
- Appropriate re-use of treated septage

2.2. Methodology for Preparation of SOP

The SOP is prepared based on the Advisory Note on Septage Management in Urban India (January 2013), and the Guidelines for Swachh Bharat Mission (December 2014) by the Ministry of Urban Development, Government of India along with data and information collected from various cities regarding their current conducted a landscape assessment of faecal sludge and septage management procedures. The team of an NGO conducted a landscape assessment of faecal sludge and septage management across select cities to understand the existing practices in the ULBs. The team obtained firsthand information through interaction with concerned officers in ULBs regarding existing sanitation systems, infrastructure and facilities, recording and monitoring frameworks and institutional arrangements for faecal sludge and septage management in the city. The team also studied leading practices from other cities and countries in similar context to inform the preparation of the SOP for integrated FSSM.

2.3. Target Audience for SOP

This SOP is targeted to the municipal commissioners/Chief Officers, engineering staff and/ or staff in charge of sewerage sanitation in ULBs of Indian states. This SOP intends to bridge the gap in understanding of O&M requirements of faecal sludge (also called septage) and provide handy guidance to ULBs through a step by step process for faecal sludge and septage management.

3. Standard operating procedure for integrated faecal sludge and septage management

An integrated faecal sludge and septage management plan would cover aspects across the value chain of on-site sanitation including safe collection, conveyance, treatment and disposal/reuse of the treated faecal sludge.

3.1. Conduct an audit of on-site sanitation systems technologies that collect and treat faecal sludge

A ULB should conduct a comprehensive audit of on-site sanitation systems that provides the city officials with a base line of the existing situation in the city. The audit should cover the following areas:

- Number of toilets connected to various types of on-site sanitation systems (single pits, twin pits septic tanks, others)
- Assessment of local construction standards, methods and technology
- Existing issues with on-site sanitation systems
- Routine O&M by property owners
- Cleaning and emptying frequency

3.2. Provide guidance to property owners on construction of accepted OSS

Toilet and septic tank construction are regulated by the National Building Code of India, 2005. The section on drainage and sewerage specifies sizing and design of toilet, septic tank and other sanitation infrastructure.

3.2.1. Conversion of single pit systems into on-site primary treatment system

The ULBs should take proactive steps towards encouraging households to convert their exiting single pit systems to more advanced systems that include collection and primary treatment. The addition of a septic tank or other treatment system before the single pit can enable households to convert the single pits into a soak pit (if the pit adheres to construction standards and has absorption capacity). The ULBs should also ensure that the disposal system of all existing public and community toilets in the city is improved to an on-site treatment system.

3.2.2. Construction of twin pits

Twin pits system consists of two underground chambers (pits) to hold and treat faecal sludge. These are normally offset from the toilet and should be at least 1 meter apart. A single pipe leads from the toilet to a small diversion chamber, from which separate pipes lead to the two underground chambers. The pits should be lined with open-jointed brickwork. Each pit should be designed to hold at least 12 months accumulation of faecal sludge. Wastewater is discharged to one pit until it is full. Discharge is then switched to the second chamber. The filled up pit can be conveniently emptied after 1.5 to 2 years, when most of the pathogens die off. The sludge can safely be used as manure. Thus the two pits can be used alternately and perpetually. Refer Annexure E for details on construction specifications for the system for various soil types and contexts (Ministry of Urban Development & JICA, 2013)

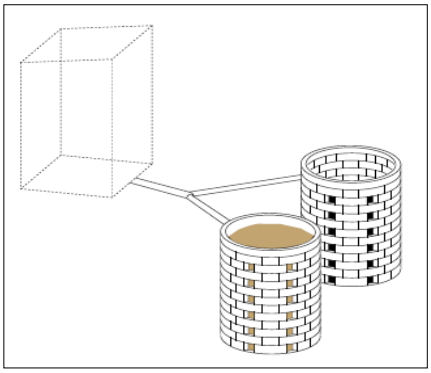


Figure 5 Twin pit system (eawag & IWA) 2014)

3.2.3. Construction of septic tank based systems

CPHEEO prescribes septic tanks as double chambered with specified sizes. Septic tanks need to be watertight and are built of bricks, stones or concrete. The recommended sizes of septic tanks and soak pits are shown in Tables 21.1, 21.2 and 21.6 of CPHEEO manual on Sewerage and Sewage Treatment Systems

Part A Engineering and are reproduced in Annexure F. Cities can adopt their own innovative techniques for septic tank construction by using locally available material and skills.

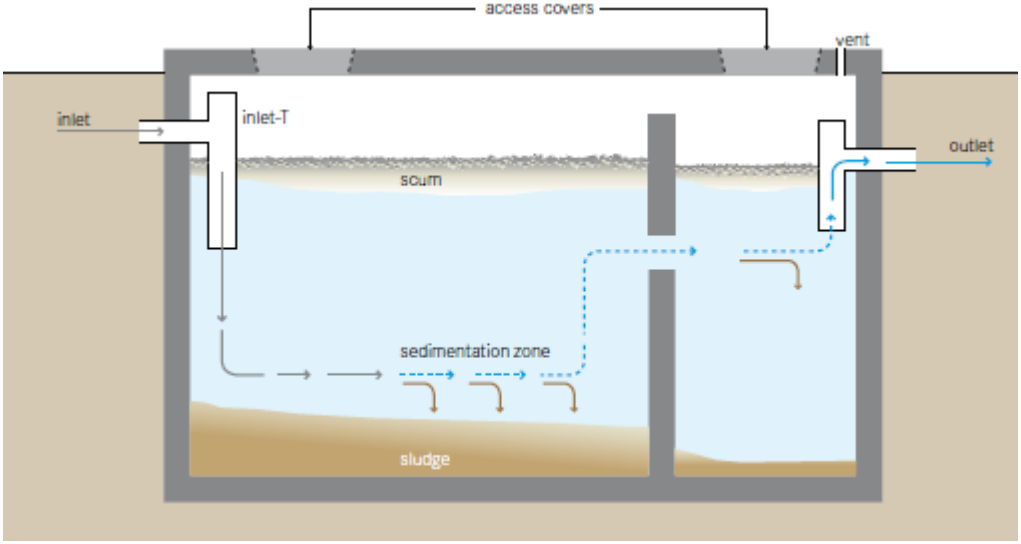


Figure 6 Double chambered septic tank
Image source: Compendium of Sanitation Systems and Technologies - 2nd Revised Edition) **(EAWAG& IWA, 2014, p. 74)**

Figure 7 Local Innovation- Readymade Septic Tanks of RCC and Plastic used in Maharashtra & Jharkhand

The process of design and construction should be done very carefully; otherwise, problems may occur due to poor design and workmanship of septic tank and soak pit. A possible solution to this can be provision of standard designs of septic tanks to the citizens by the ULB and adoption of a simple process of construction, verification and approval which can be clubbed with the house completion report.

Effluent from the septic tanks should ideally be disposed using soak pits or leach fields which allow the absorption of liquids in the ground or should be conveyed using a solids-free/ settled sewer.

Disposal of effluents using soak pits

A soak pit is a porous-covered chamber that allows effluent from septic tanks to soak into the ground. It is also known as a soak-away or leach pit. The soak pit should be connected to the septic tank by an extension pipe with a T junction to receive the over flow from the tank. The diameter of soak pit is generally 900 mm with depth varying from 2400 to 4000 mm. The soak pit is filled with bricks or broken stones and is covered with stone or RCC slab. A vent pipe should be provided to release the gases produced in the soak pit. For detailed construction guidelines on septic tanks and soak pits, refer the

Manual of Sewerage and Sewage Treatment Part A Engineering published by MoUD (Ministry of Urban Development & JICA, 2013, pp. 9-23)

Conveyance of effluent to an off-site treatment facility

In cities where discharging effluent into drains is a common practice, it is recommended that ULBs include alternative solutions in their long-term plans. ULBs can explore systems like settled or solids-free sewer system which is designed as a network of small-diameter pipes that transport pre-treated and solids-free wastewater (such as septic tank effluent). This system is economical than the conventional underground drainage system. It can be installed at a shallow depth and does not require a minimum wastewater flow or slope to function. For the detailed guidelines on settled or solids-free sewer system, refer Compendium of sanitation systems and technologies by Eawag and IWA (eawag & IWA, 2014, p. 92)

3.3. Provide guidance to property owners on routine O&M of OSS

Routine operations and maintenance of the complete on-site sanitation 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.

Figure 8 ULBs can distribute flyers and carry out IEC campaigns about proper septic tank/ soak pit usage

Image source: United States Environmental Protection Agency (USEPA)

In order to educate the property owners, ULBs can use flash cards as a means to easily communicate on the existing and available technology options and processes of on-site sanitation. Flash cards with images of the different types of system can help inform the property owners, identify the existing systems or foster discussion with different stakeholders. Examples of flashcards used by Urban Management Centre for data collection concerning on-site sanitation system are represented here:

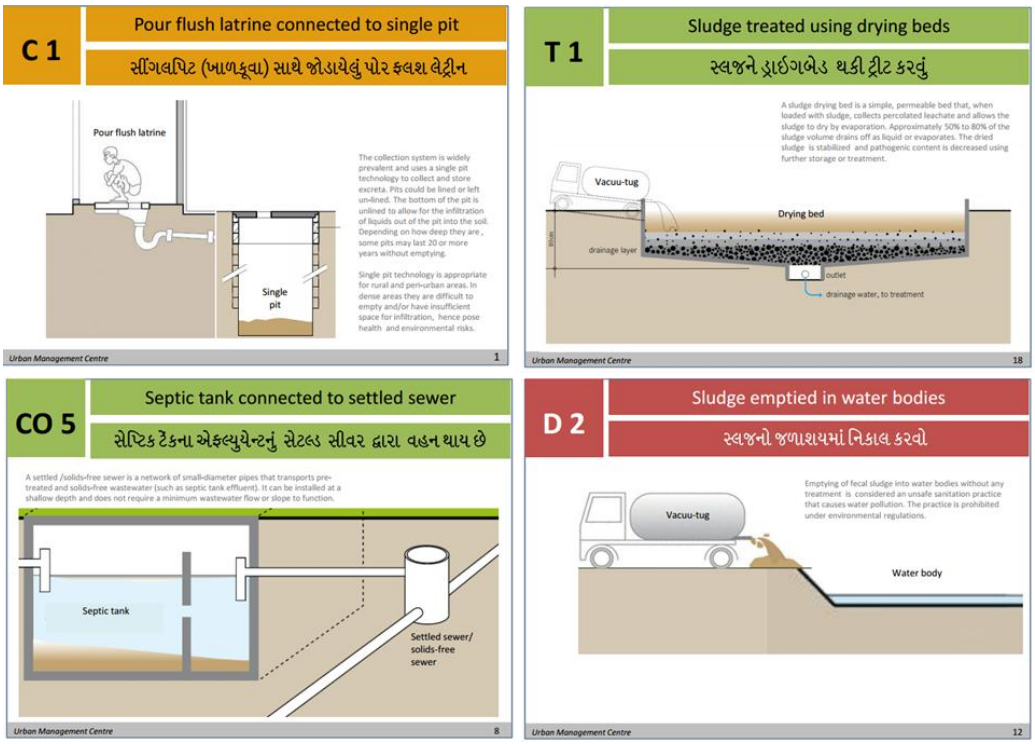


Figure 9 Flashcards used by UMC for identification and communication on on-site sanitation systems

Source: The Online Compendium of Sanitation Systems and Technologies developed by the Eawag

3.4. Prepare service plan for scheduled emptying of septic tanks

All ULBs should ensure safe emptying of on-site treatment units at regular intervals. A comprehensive study was conducted by Urban Management Centre (UMC) in the year 2013-14 in the ULBs of Gujarat (refer Table 1 for more details). The team visited and discussed with the respective city officials and it was found that most households get their septic tanks cleaned once in 8-10 years. It is evident that there is not enough awareness among households to get their septic tanks cleaned at regular intervals of maximum 2-3 years as directed by the CPHEEO Manual on Sewerage and Sewage Treatment Systems, 2013, Part B, (Ministry of Urban Development, CPHEEO, JICA, 2013). The ULB should initiate scheduled septic tank desludging services and carry out extensive awareness campaigns to ensure that the septic tanks are cleaned at least once in three years.

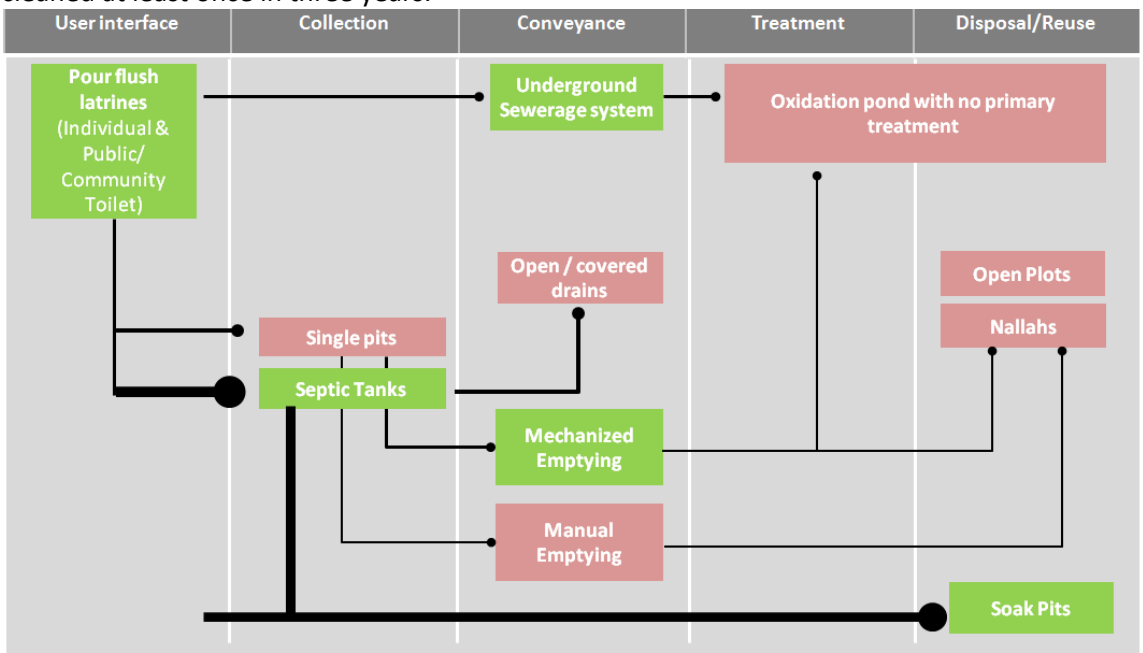


Figure 10 Sanitation value chain of Himmatnagar Municipality, Gujarat

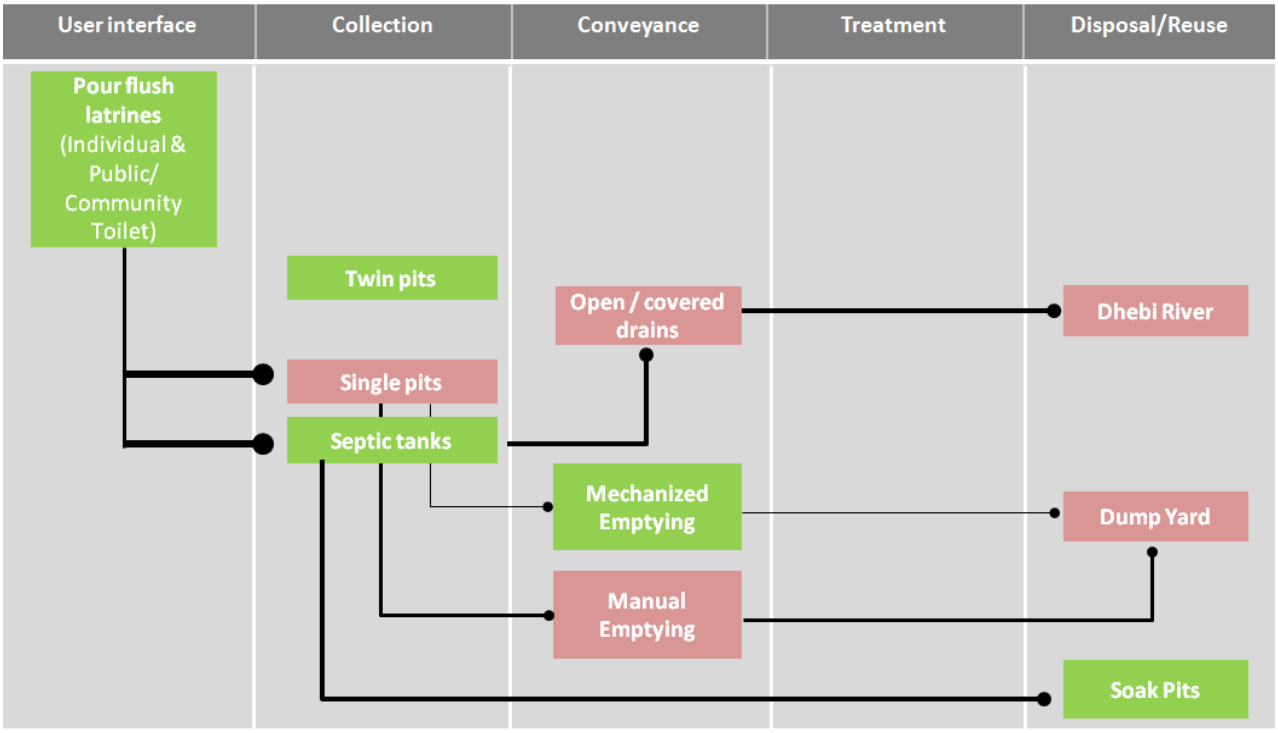


Figure 11 Sanitation value chain of Amreli Municipality, Gujarat

Table 1 List of ULBs studied by UMC to understand fecal sludge and septage management practices in cities of Gujarat

Sr. No.	Name of the ULB	Population (Census 2011)	Households (Census 2011)
1	Deesa	1,11,149	21,144
2	Amreli	1,09,712	21,986
3	Himmatnagar	79,000	16,390
4	Dhangadhra	71,000	14,520
5	Limbdi	42,000	8,960
6	Lathi	21,236	4,231

The scheduled emptying services should be provided on a rotating, three to five-year cycle. In order to comply with The Prohibition of Employment as Manual Scavengers (and their rehabilitation) Act, 2013, ULBs need to ensure that all septic tanks and pit systems in the city are cleaned mechanically. The ULBs should either provide the emptying services themselves or enter into service contracts with private agencies. The contracts could also include construction and operation of treatment options like sludge drying beds. If the private players are providing the service, ULB should monitor their services. Suggestive criteria for selecting private emptiers should include:

- Provision of safety and protective gear to the cleaners
- Availability of mechanical cleaning equipment (Vacuum emptiers)
- Availability of a doctor on call
- Adequate number of trained staff
- Agreement to follow procedures listed in SOP

Since the households will be unlikely to pay for the scheduled services, the ULBs can consider raising their local taxes or charge a fixed amount as user charges for sanitation every year. The private service providers could then be compensated by the ULB.

Scheduled emptying of septic tank, Experience from Marikina city, Philippines

Source: A Rapid Assessment of Septage Management in Asia, Policies and Practices in India, Indonesia, Malaysia, the Philippines, Sri Lanka, Thailand, and Vietnam, January 2010, USAID

To achieve its goal of desludging all septic tanks in the city by 2011, Marikina City is implementing the "Oplan Todo Sipsip" program with Manila Water Company, Inc. (MWCI). Developed with support from the ECO Asia program, the initiative mobilizes local barangay leaders to educate communities about desludging septic tanks. As a result, Marikina City has increased the percentage of households using desludging services from 40 to 55 percent. Cooperative actions include the following:

- Community meetings are held to explain the program in advance of the desludging;
- A sound truck and fliers advertise desludging in a community the day before it is done;
- Local barangay staff accompany MWCI desludging crews to encourage homeowners to cooperate and open inaccessible septic tanks;
- MWCI places stickers on houses that have been desludged, so a second visit can be made later to the homes without stickers; and
- Promotion campaigns are conducted that include distributing informative calendars, art contests, and hand washing events.

The project aims to desludge all 90,000 septic tanks in Marikina City on a rotating five-year cycle. At the time of writing, however, MWCI had only desludged 5,400 septic tanks.

Box 3 Scheduled emptying of septic tank, experience from Marikina city, Philippines

3.5. Investment in capital infrastructure

3.5.1. Procure cleaning equipment

Septic tank needs emptying in regular intervals of depending on its design capacity. The ULBs need enough vacuum emptiers to effectively service all septic tanks in a city. The ULB can buy these emptiers or can ensure adequate equipment through signing service contracts with private contractors. Indicative capacities and other details of sludge emptying equipment available in India are listed in the table below:

Table 2 Indicative details of faecal sludge emptying equipment

Tank capacity (litres)	Gross Vehicle Weight (Tonnes)	Vacuum (%)	Displacement (litres per minute)	Positive pressure (bar)
1000 & 1500	5	80	1500 – 4500	2.0
3000	10	80	1500 -4500	1.5
6000	16	90	3200 – 9000	1.5
9000	25	90	4500 – 12000	2.5

ULBs can also procure dedicated small footprint (1500 – 3000 litre capacity) vacuum emptiers to service slums and other areas where access is narrow. For areas with wide roads (>9m), vacuum emptiers of capacity 5000-9000 liters can be deployed. The following box shows indicative requirement of cleaning equipment for city of Patan. (Ministry of Urban Development, 2013, p. 40).

Calculation of vacuum emptiers required, Patan

Number of septic tanks in the ULB (Census 2011)	8692
Existing number of emptiers	1
If septic tank needs to be cleaned once in three years ,then number of septic tanks need to be cleaned in a day	(8692/305*3) = 9.5 (Approx. 10)

Assuming that present emptier cleans 5-6 septic tanks /day ,then additional number of septic tank emptiers needed	1
Cost of emptier @ Rs. 1,500,000 (incl. prime mover)	Rs. 15 lakh
Annual O&M cost per emptier	Rs. 2 lakh
Annual Salary of staff involved in septic tank emptying process	Rs. 2.5 lakh
Income earned per emptier per annum by emptying 500 septic tanks @service fee of Rs. 500-Rs 1500 / tank	Rs. 2.5 Lakh-Rs. 7.5 lakh

Source:(Ministry of Urban Development, 2013)

Box 4 Calculating requirement for vacuum emptiers for Patan, Gujarat

3.5.2. Construction of sludge drying beds

The ULB needs to construct sludge drying beds to appropriately treat the faecal sludge. As the sludge is partially treated in the septic tank, it requires appropriate treatment before the usage. Drying of the sludge in the drying beds is considered as one of the septage treatment system. The following table presents the area requirement for sludge drying beds if the quantum of sludge generated is 100 cum/day:

Table 3 Calculation of Sludge drying beds and area required

	Sludge drying Beds	
1	Quantum of sludge to be treated (cum/day) – HHs level	100
2	Single Drying Bed area (12m x 12 m)	144
3	Max. Sludge depth (m)	0.3
4	Capacity per bed (cum) = 144*0.3	43
5	Sludge drying cycle (days) (Considering a drying cycle of 10 days)	10
6	Total No. of sludge drying beds required (SDB) = (100/43)*10	23
7	Total site area (SD Bed area + 10% SD bed area + area of office and dried storage + area of ancillary units) (sq.m.) = (3312+331+5000+2250)	10.893 m^2

Source: (Ministry of Urban Development, 2013, p. 36)

3.6. Establish customer service protocols

Once the ULB has procured the vacuum emptiers or made required arrangements with private contractors, the ULB should establish customer service protocols and convey it to the citizens by publishing in the local newspaper, holding meetings and displaying the information at citizen service centers. The ULB should also establish a helpline number and publicize it widely. Follow operating procedure for cleaning septic tank/ soak pit

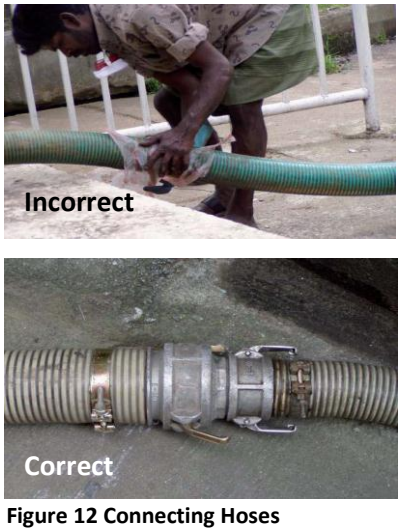


Figure 12 Connecting Hoses

3.7. Daily Preparation for the ULB / emptying and transport service

- Receive work orders for the day
- Check the functioning of vacuum emptier and equipment
- Check personal protective equipment – All employees should be responsible for maintaining their own personal protective equipment (such as gloves, boots, hat, face mask, Davy's lamp) in good condition

- Check Disinfecting and spill control equipment – Operators should be trained on identifying spills and proper methods of disinfecting. Sprinkle lime over spilled area, wait 15 minutes, then wash with water
- Check Hoses – inspect hoses for cracks and wear– discard or repair worn and broken hoses. Connecting the Hose in the correct manner using the clamp style fitting ensures a tight and leak proof connection. Use of twine and plastic for making connections causes leaks and require cleanup.

Figure 13 Protective Gears and Vacuum Emptier

3.7.1. Operating the vacuum emptier

Operators should become familiar with the proper operation of the equipment in use for each operation. This includes the physical operation of the truck, and all valves, piping, power take-offs and ancillary equipment for the vacuum emptier (including the tank, valves, hoses, and fittings). The following steps can be followed for operating the vacuum emptier:

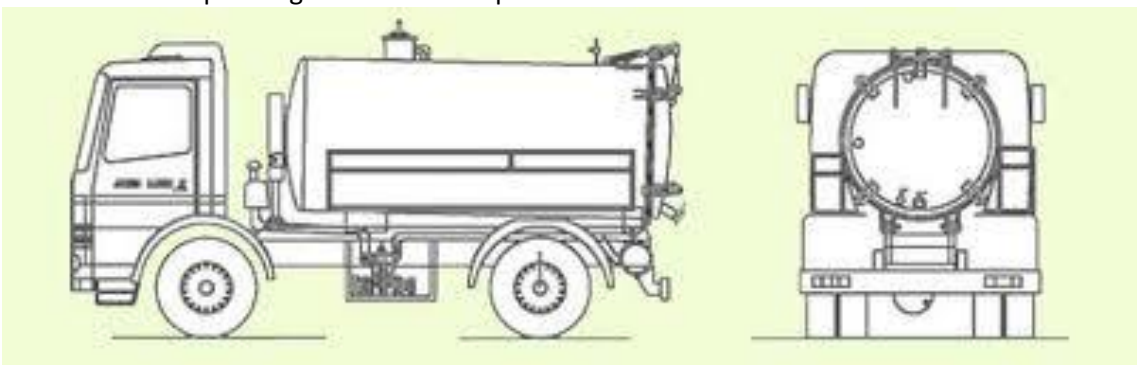


Figure 14 Operating the vacuum emptier
Image source: (Robbins, 2007)

- Reach the first site and meet the building owner.
- Before pumping, check the tank to look for obvious damage to the structure and to verify proper piping is in place.
- Check the water level to get clues as to tank condition: high levels (above outlet level) indicate a clogged outlet; low levels (below outlet level) indicate a leaking tank (or tank not in use).
- Check for back flow into tank during pumping and when pumping is complete. Flow back may indicate a problem with plumbing in the house or clogged disposal.
- Open the access covers, inspect the interior and exterior of the tank. If more than one, locate and remove lids (for at least 2 hours) from all compartments.
- Each compartment will require pumping after ventilating. Probe the tank with the last length of hose. This will provide an indication on the volume of sludge to pump.
- Start the pump or vacuum equipment. The operator will make sure there is suction and that the pump is operating.
- Volume in the tank should start decreasing rapidly. Use hose to break up sludge and scum to the extent possible.

After pumping is complete, check the tank for remaining sludge. If there are accumulated solids remaining, initiate the pump-back procedure, which is to send the pumped faecal sludge under pressure back into the tank and direct this flow toward the sludge mass.

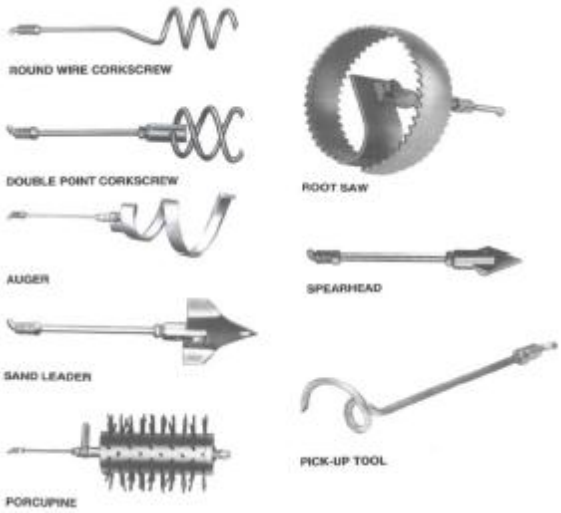


Figure 15 Rod heads for scraping septic tanks and sewer lines recommended by CPHEEO
Source:(Manual on Sewerage and Sewage Treatment Systems Part B Operation and Maintenance, 2013)

This will break up the mass, making it possible to pump out. Rod heads as shown in Figure 15 can be attached to the cleaning machine for cleaning or scraping of septic tanks and sewer lines (Ministry of Urban Development, CPHEEO, JICA, 2013, pp. 2-32). When pump-back is complete, pump out the tank again (suction). When pumping is complete, wash the hoses and replace the tank lids. Clean up any spills and disinfect with lime or bleach solution.

3.7.2. Cleaning and desludging on site systems

Septic tank emptying: The process of septic tank emptying can be broken down into the following three simple steps:

From septic tanks firstly a small quantity of scum in the vicinity of the suction pipe is withdrawn.
Liquid septage is extracted until sludge at the bottom is reached.
Sludge comes off last and is fully sucked out only if there is bottom slope in the septic tank towards outlet. It is important to empty the tank completely including sludge.

Figure 16 Septic tank emptying procedure

If tanks are emptied partially, they become more and more filled with hardened sludge, washout of solids occurs and quality of effluent deteriorates. Septic tanks must be emptied once in 2-3 years or even earlier intervals when they are overloaded. If the single pits are not dug very deep and cleaned regularly at an interval of 2 to 3 years, the sludge from the pits can be emptied mechanically. If the hardened sludge is to be mechanically removed, the pit should be back washed and the sludge should be diluted and then emptied.

Soak pit cleaning

In most cities septic tanks are not cleaned regularly due to which sludge enters soak pits and gets accumulated resulting in diminishing the capacity of soil. In high water table or in stony, gravely soils where percolation capacity of soil is limited, the soak pits get filled and hence need to be cleaned. It is essential

that ULBs and State do not permit soak pits deeper than 3m.For emptying typical soak pits, the following steps can be followed:

Remove the Soil Cover (1-1.5m) and puncture the concrete cap to make a hole to insert the suction pipe

For soak pits till the depth of 3.5m vacuum emptier can be used to completely empty the pit

Pump water into the pit to make the pit contents dilute to enable smoother flow

Figure 17 Soak pit cleaning procedure

However, in the long term, it is recommended that in areas where the percolation capacity has reduced ULBs should consider alternate systems like settled sewerage system or connect to open drain system as an intermediate solution

Cleaning twin pits

Once a pit is full, in a twin pit system, it should be closed and the wastewater should be channelized to the second pit. The full pit should be emptied only after one to two years after the contents of the pit have transformed into a partially sanitized, soil-like material called pit humus. Pit humus can be manually excavated.

3.8. Safely transport faecal sludge to sludge treatment site

If cities have an oxidation pond or a sewage treatment plant, the emptier should dispose faecal sludge into STP inlet chamber or into the manhole on the outfall sewer or in the sludge drying beds. In case of partial sewerage, it is not advisable to dispose these in the sewers since it will end up as sludge in open drains and make the situation worse.

If the ULB do not have any provision of the treatment system, ULB can select the suitable treatment and the following actions at faecal sludge receiving site are summarized below.

- Plan the trip so as to arrive at the disposal site within the specified disposal site operating hours
- Report equipment malfunctions or required repairs immediately to supervisors.
- At the Disposal Facility position the truck so that the faecal sludge may be directed to the receiving chamber with only one length of hose
- Open the valve and allow the sludge to flow via gravity into the receiving chamber
- When the tank is empty, disconnect hose and clean tank and hose with water
- Use all safety precautions at disposal site and keep site clean

Figure 18Septage emptying vehicle
Image source: Urban Management Centre

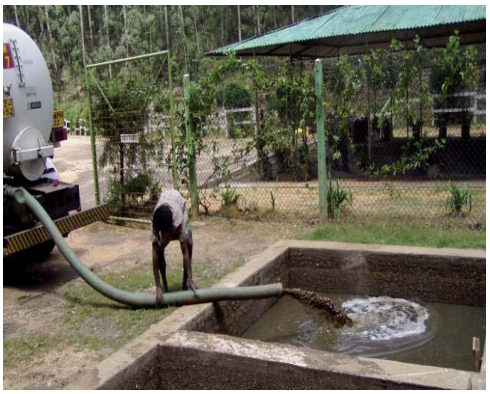
In the Annexure G, a model checklist is attached which provides a ready reference to the operator for ensuring safe work practices of handling faecal sludge and septage in a confined space such as sewer, septic tanks or soak pits.

3.9. Treat and dispose faecal sludge

Sludge has a much higher concentration of pollutants than the septic tank effluent. Biological Oxygen Demand (BOD) and Total Suspended Solids (TSS) are two common measurements of the strength of wastewater. Sludge may have BOD concentrations between 440to78, 600 mg/l and TSS values in excess of 90,000 mg/l, where septic tank effluent has values averaging 200 mg/l BOD and 300 mg/l TSS. As septic tanks fill with sludge, the effluent begins to resemble faecal sludge with higher pollution values. Therefore, regular desludging provides dramatic improvements in effluent quality. Detailed sludge characterization (BOD, TSS &other microbial characteristics) as well as its dewatering characteristics (specific resistance etc.) should be done prior to the design of any faecal sludge and septage management facility. Treatment of sludge can be of two types, treatment at sewage treatment plants and at independent septage treatment plants. The details of these two types of treatment are given in the section below:

3.9.1. Treatment of faecal sludge at Sewage Treatment Plants

Co-treatment of faecal sludge along with municipal sewage at a STP if available in the city is the most desirable option. Though sludge is more concentrated in its strength than domestic sewage, its constituents are similar to municipal wastewater. The sewage treatment plants should have adequate capacity to accept the sludge without hampering the functioning of the sewage treatment plant. Another possible way (needs checking for STP shock load or overload) is to dispose faecal sludge into easily accessible manholes at steep gradient sections on outfall sewers.



Sludge could be added to sewage immediately upstream of the screening and grit removal processes. Faecal sludge could be processed with the sludge processing units of STP. If faecal sludge is to be co-treated with sewage, it will be necessary to construct a faecal sludge receiving chamber. Chemicals such as lime or chlorine can also be added to the faecal sludge in the storage tank to neutralize it, to render it more treatable, or to reduce odors.

Figure 19 Sludge disposal into inlet chamber of STP

Image Source: septage management guide for local governments, 2007, David M. Robbins

3.9.2. Treatment at independent Faecal Sludge Treatment Plants

When a city does not have a sewage treatment plant, a treatment plant specially meant for sludge treatment becomes the option to consider. These include:

a) Lime stabilization – odor control, conditioning and stabilization of the sludge.
b) Dewatering – sludge drying beds or mechanical dewatering.
c) Anaerobic / aerobic wastewater treatment – liquid from the sludge drying beds and mechanical dewatering systems.
d) Co-composting with organic solid waste.

Lime stabilization

Lime stabilization is practiced to stabilize, control odor, vector and pathogen destruction. Lime stabilization involves adding and thoroughly mixing lime (lime powder slaked with water in 1:3 proportions, 15 litres of slaked lime for 4000 litres of septage) with each load of septage to ensure that the pH is raised to at least 12.

Lime addition could be done at any of these three points:

- In the septage emptier
- In a septage receiving tank where septage is discharged
- Spread septage in a pit and apply lime every time septage is dumped

Figure 20 Lime stabilization

Sludge drying bed

An unplanted drying bed is a simple, permeable bed that, when loaded with sludge, collects percolated leachate and allows the sludge to dry by evaporation. Approximately 50% to 80% of the sludge volume drains off as liquid or evaporates. The sludge, however, is not effectively stabilized or sanitized.

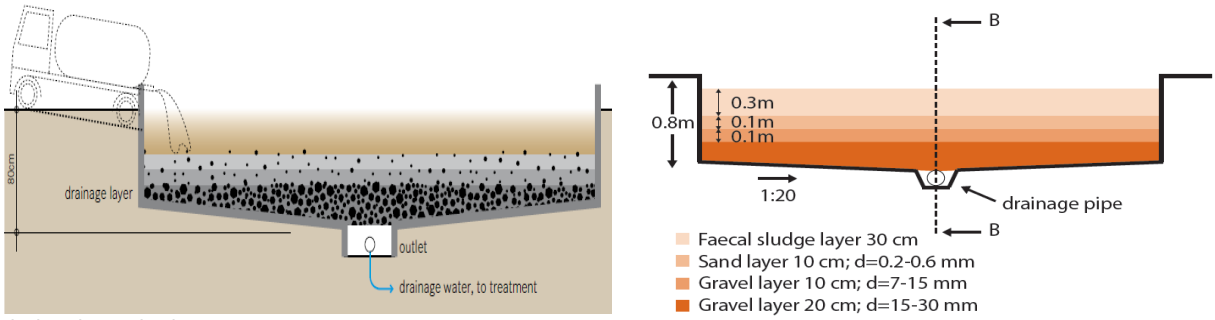


Figure 21 Sludge drying beds

Image source: Compendium of Sanitation Systems and Technologies - 2nd Revised Edition and Advisory on septage management

Planted Sludge drying bed

A planted drying bed is similar to an Unplanted Drying Bed, but has the added benefit of transpiration and enhanced sludge treatment due to the plants. The key improvement of the planted bed over the unplanted bed is that the filters do not need to be desludged after each feeding/drying cycle. Fresh sludge can be directly applied onto the previous layer; the plants and their root systems maintain the porosity of the filter.

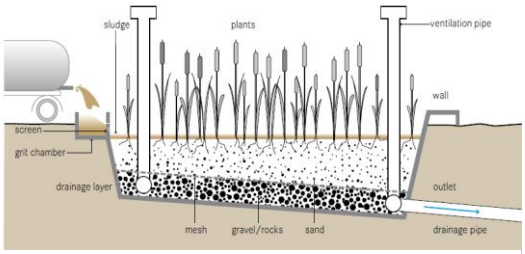


Figure 22 Planted Sludge drying bed

Image source: Compendium of Sanitation Systems and Technologies - 2nd Revised Edition

Septage dewatering

The septage after lime dosing is pumped to screw press or any other mechanical dewatering machine. Polyelectrolyte (a chemical commercially available for use as a coagulant in water supply and sewage treatment) is added to improve the dewatering efficiency. The liquid residual/ filtrate from dewatering machine needs to be further treated before disposal. The dewatered sludge needs to be dried or composted prior to reuse as soil conditioner / organic fertilizer. Instead of Screw Press the other options could be to use centrifuge or belt press or a filter press. Many companies in India manufacture these.

Figure 23 Septage dewatering

Composting of Septage

Composting is a popular method of treating septage. During the composting process organic material undergoes biological degradation to a stable end product. Approximately 20%to 30% of the organic solids are converted to carbon dioxide and water.

Figure 24 Septage composting

Image Source: Cao Dzien co composting plant in Hanoi, Vietnam. Business Analysis of Faecal sludge and septage management, Sept 2012, Gates Foundation

As the organic material in the septage decomposes, the compost heats temperatures in the range of 50 to 70 degrees Centigrade and harmful pathogens are destroyed. The resulting humus-like material is suitable as a soil conditioner and source of nitrogen and phosphorus. The basic procedure for composting is as follows:

- Septage is mixed with a bulking agent (e.g. agricultural residue, cow dung, organic part of municipal solid waste) to decrease moisture content of the mixture, increase porosity, and assure aerobic conditions during composting.
- The mixture is aerated by mechanical turning ("agitated") for about 28 days. The most common "agitated" method is windrow composting: the mixture of septage or wastewater solids and bulking agent is pushed into long parallel rows called "windrows", about 1 to 2 meters high and about 2 to 4.5 meters at the base. The cross-section is either trapezoidal or triangular. Several times a week the mixture is turned over using a front-end loader to move, push, and turn the mixture. Factors affecting the composting process (USEPA 1984) include moisture content (40 percent to 60 percent); oxygen (5 percent to 15 percent); temperature (must reach 55 to 65^0 C); pH (6 to 9); and carbon-to-nitrogen ratio (30:1).
- Pit composting is simple, does not need any equipment and has been practiced in many Indian cities before. The process involves digging many pits (1.2m wide, 1.5m deep and 4m long) and covering with soil (2-3 inches) every time septage is dumped until it gets filled. Contents of the pit are emptied and can be used for soil enrichment after 6 months, by this time most pathogens die off and composting is complete. Treated septage is safe for agricultural use.

Innovative Approach for Septage Management

Source: Business Analysis of Faecal sludge and septage management, Sept 2012, Gates Foundation

Recent innovative method of using a geo tube for septage storage and transfer has been introduced in Malaysia. The geo-tube material is made of a porous membrane with the sludge received through a hose from a truck. Discharge can be achieved by using a pump or gravity. Sludge in the geo-tube is gradually dewatered by leaching through a porous membrane and the leach ate is treated in the nearby STP while the solids are retained inside. Exposure to the outdoor heat further dries the sludge and the geo-tube is eventually transported to a landfill or recovery facility. Geo-tube before and after use in Malaysia

Box 5 Innovative Approaches of Septage Management

Dewatered septage/sludge can be used as a fertilizer in agriculture application

- A faecal coli form density of less than 1000 MPN/g total dry solids
- Salmonella species density of less than 3 MPN per 4 g of total dry solids.
- WHO (2006) suggests helminth egg concentration of < 1/g total solids and E-coli of 1000/g total solids in treated septage for use in agriculture.

Properly treated sludge can be reused to reclaim parched land by application as soil conditioner, or as a fertilizer in agriculture. Deteriorated land areas, which cannot support the plant vegetation due to lack of nutrients, soil organic matter, low pH and low water holding capacity, can be reclaimed and improved by the application of treated septage.

Septage sludge, as a result of lime stabilization has pH buffering capacity that is beneficial for the reclamation of acidic soils. Treated septage is applied with agricultural manure spreaders. Liquid sludge, typically with solid content less than 6 percent are managed and handled by normal hydraulic equipment. Treated septage contains nutrients in considerable amounts, which supports the growth of a number of plants.

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

Aquaculture can be practiced for settled septage effluent when freshwater is available to achieve dilution to ensure dissolved oxygen is above 4 mg / l. Fish species of tilapia and carp are preferred since they tolerate low dissolved oxygen. Both drip irrigation and aquaculture need land and are feasible at city outskirts.

Devanahalli: The First Faecal Sludge Treatment Plant of India

Devanahalli, a Town Municipal Council with a population of 28,039 (as per 2011 census), has shown the way in addressing faecal sludge and septage management in a comprehensive manner. The town used to rely on one of Bangalore's sewage treatment plant for the treatment of its sludge. However, this disposal was not efficient because of the distance between the sewage generated and the plant. As a result, the sludge had to travel too far before being treated, or was disposed indiscriminately.

To ensure safe disposal of sewage, the town purchased honey suckers for the sewage collection an outsourced the operation to 5-6 private operators. Then, with the support of the Bill and Melinda Gates Foundation, a 6000L per day capacity faecal sludge treatment plant was built. The plant is operated by CDD – the Consortium for DEWATS dissemination- on build-operate-transfer basis for a year.

The technology of the plant is based only on gravity and does not require electricity or mechanical equipment. When into the tank, the solid and liquid of the sludge separate, both are then treated separately. The liquid is treated by filtration and used for landscape watering. The solid is digested in an anaerobic biogas digester and the gas produced is used by the plant operator. The remaining sludge is sent to a dry bed and turned into compost. The compost is then sold to local farmers at Rs.1 per kg.

The Devanahalli Town Municipal Council has undertaken to create an FSM Policy, including licensing of operators, penalties and the monitoring of various stakeholders.

Devanahalli was the first city in India to build a faecal sludge treatment plant, but beyond the infrastructure, it is the whole faecal sludge and septage management value chain that was improved.

Box 6 **Box 7 Devanahalli: the First Faecal Sludge Treatment Plant of India**

Cochin: Brahmapuram Septage Treatment Plant

Cochin is a Municipal Corporation having population of 6,02,046 (As per census 2011), generating septage approximately 725.09 m^3/day from both urban and rural areas. Earlier, there was no any treatment plant established in the city and hence, waste water collected was disposed in water bodies, open drain and open spaces which cause health hazards to the citizens.

Figure 25 Septage Treatment Plant, Cochin

To manage this issue, the corporation has established a septage treatment plant at Brahmapuram, which was inaugurated on December 19, 2015 with an investment of Rs.4.24 crore. The capacity of the plant is 100 m^3/day, which can handle 20 tankers from the corporation, neighboring municipalities, and panchayats. By establishing this plant, the corporation is expecting to bring an end to the practice of dumping toilet waste in open drains, water bodies and other places. Kerala Sustainable Urban Development Project (KSUDP), under the

Urban Affairs Ministry of the state government is the nodal agency for implementing the project.

Brief Outline of Technology adopted for the Plant:

The plant uses anaerobic digestion of Septage followed by aerobic treatment. The plant is designed with cutting edge technology which includes:

- Up Flow Sludge Blanket Type Anaerobic Reactor - suggested to digest the septage and shall reduce the pollution load and pathogens
- Aeration tank with MBBR technology - aerobic treatment of the discharge from digester tank shall be done in this aeration tank.
- Clarifier - The effluent from the aeration tank is taken to clarifier for separating the solids.
- Carbon Filtering
- Sand Filtering
- Chlorination
- Drying bed: Thickened sludge is discharged to the drying bed with the help of pumping system for dewatering

Box 8 Cochin: Brahmapuram Septage Treatment Plant

3.9.3. Full cost recovery

To be sustainable, the septage management programs should be funded from the users in the form of user fees. This fee can be added to either the property tax or it can also be used as a pay and use system. This fee should include cost of staff, transportation, treatment, disposal and operation and maintenance.
An example of cost recovery is Marikina City, Philippines. Manila Water Company, the service provider, will purchase eight new septage pumping trucks and fund a mechanized treatment facility in exchange for a 10% surcharge added to the monthly water bill. The program will fund septage pumping of 55,547 septic tanks every 5.25 years.(Robbins, 2007)

3.9.4. Social marketing

This includes initiating programs for educating the citizens at large. Dedicated Information, Education and Communication (IEC) programs need to be undertaken to inculcate education on sanitation for school children, youth and women in the city.

The social marketing system has different steps, these can include surveying the existing perceptions, conducting meetings with stakeholders, developing technical committees and outreach tools for media outlets, pre testing the tools, performing final surveys and deploying the messages to gauge results.

In Muntinlupa, the city and the technical team developed a campaign plan with target audiences and messages and then developed a mascot, fliers, posters, newspaper ads and a video about the market treatment facility that was aired on a local cable TV station (Robbins, 2007).

3.10. Recording and Reporting

Keeping accurate records regarding tanks and volume pumped is important for billing and compliance. Recordkeeping is an integral part of a comprehensive septage management program.

The “manifest system” is a tracking and compliance tool. It helps ensure that all of the septage pumped arrives at the disposal site and minimizes the opportunity for illegal discharge. It is also a record that some septage programs may choose to use for paying septage hauling subcontractors.

Manifest forms are simple receipts that specify:

- the location or address of the pumped septic tank
- septage characteristics (residential or commercial)
- the name and address of the property owner or occupier

- the volume of septage pumped
- any notes regarding tank deficiencies, missing pipes or fittings, improper manholes or access ports, cracks or damage observed

All ULBs should keep a manifest form record for each septic tank / soak pit emptied (A sample manifest form is shown in Annexure H). Once completed, a copy of the manifest is given to the property owner as a receipt. When the septage load is delivered to the disposal site, the disposal site operator:

- accepts the load
- verifies the volume
- takes a sample if needed
- signs the manifest proving receipt of the volume of septage disposed of

It may be advantageous for the operator (ULB or private) to pump out multiple tanks before going to the disposal site. In this case, a multiple-load manifest form should be completed as well as in addition to individual manifest/receipt forms. The completed document or documents should be given to the ULB for their records. Cities with more than one lakh population should maintain the records at ward level for on-site sanitation system cleaning.

3.11. Ensure safe practices

Never enter a septic tank / soak pit which has not been well ventilated. Check for gas levels before entering septic tanks, manholes and closed chambers. Following steps should be followed as safety measures for septage management:

- Always keep first aid kit, gas detection lamp and fire extinguisher in the septage emptier vehicle
- Provide training to workers handling septage on safety and hygiene practices
- Provide fencing or compound around septage treatment facility premises
- Train staff and compel them to wear helmets, gum boots and gloves while on work.
- Ventilate covered tanks/pits by keeping them open for sufficient period before entering
- Paste list of emergency numbers on septage emptier and at a prominent place in septage treatment / disposal unit

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Annexure

Annexure A

National Urban Sanitation Policy

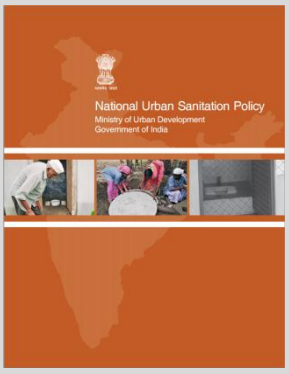
National Urban Sanitation Policy (NUSP), 2008
The National Urban Sanitation Police lays out a vision for urban sanitation in India. It instructs states to come up with their own detailed state-level urban sanitation strategies and City Sanitation Plans. Under environmental and health considerations, the policy promotes proper disposal and treatment of sludge from on-site installations (septic tanks, pit latrines, etc.)
States will be encouraged to prepare State Level Sanitation Strategies within a period of 2 years. Identified cities will be urged to prepare model City Sanitation Plans within a period of 2 years. At least 20% of the funds under the sanitation sector should be earmarked for the urban poor.
The policy also involves setting up standards at State level. One of these is processes such as safe disposal of on-site septage) and infrastructure (e.g. design standards) (PHEDs/ Para-statals) and coverage of the informal sector activities like disposal of waste water, solid waste etc.

A City Sanitation Task Force is to be prepared with stakeholders like agencies directly responsible for sanitation including on-site sanitation, sewerage, water supply, solid waste, drainage, etc. including the different divisions and departments of the ULB, PHED, etc. representatives from the civil society, NGOs working on water and sanitation, urban development and slums, health and environment, private firms/contractors formally or informally working in the sanitation sector (e.g. garbage collectors, septic tank de-sludging firms etc.).
Following are the policy goals:

a. Awareness Generation and Behaviour Change
b. Open Defecation Free Cities
c. Integrated City-Wide Sanitation
d. Sanitary and Safe Disposal
e. Proper Operation & Maintenance of all Sanitary Installations
f. Implementation Support Strategy

Role of Task Force constituted by the Urban Local Bodies under National Urban Sanitation Policy

1. Safe sanitary arrangements at unit level (household, establishment).
2. Designs and systems for safe collection.
3. Norms for transport/conveyance.
4. Treatment and final disposal.



(Ministry of Urban Development, Government of India, 2008)

Annexure B

Maharashtra Septage Management Guidelines

February 2016

सत्यमेव जयते

Government of Maharashtra

स्वच्छ भारत
एक कदम स्वच्छता की ओर

सप्तपदी स्वच्छतेची

हगणदारीमुक्त शहर

pas performance assessment system

Guidelines for Septage Management in Maharashtra

February, 2016

Swachh Maharashtra Mission (Urban)

Urban Development Department, Government of Maharashtra

Disclaimer

This report is compiled from various government reports and guidelines. It draws from the Ministry of Urban Development, Government of India's Advisory Note on Septage Management in Urban India-2013, manuals of Central Public Health Engineering and Environmental Organization, and Operative guidelines for septage management for urban and rural local bodies in Tamil Nadu.

The report is to be used solely as a reference guide by various stakeholders. Urban local bodies are advised to seek guidance and technical approval from appropriate authorities before implementation. The Urban Development Department, Government of Maharashtra and CEPT University are not responsible for the content or the consequences of any action taken on the basis of the information provided in this report.

Guidelines for Septage Management in Maharashtra

Table of Contents

Guidelines for Septage Management in Maharashtra

1 Septage Management and its importance

1.1 Introduction:

"Septage" is the liquid and solid material that is pumped from a septic tank, cesspool, or other treatment facility after it has accumulated over a period of time. A septic tank will usually retain 60 to 70% of the solids, oil, and grease that enter it. The scum accumulates on top and the sludge settles at the bottom, comprising 20 to 50% of the total septic tank volume when pumped. Septage has an offensive odor and appearance and contains significant levels of grease, grit, hair, and debris. It is a host for many disease-causing organisms.

Septage management Plan covers the entire service chain starting from design of septic tank, collection, conveyance, safe treatment and reuse or safe disposal of septage.

Proper treatment and management of faecal sludge is integral to safe sanitation practices. According to the Census 2011 around 30 million urban households, are not connected to any sewer system. Even if the cities create more underground sewerage infrastructure, the septic tank often remains an integral component of the sewerage scheme. A rapid assessment of septage management in Asia carried out by USAID in 2010 revealed that in India about 148 million people in urban areas depend on septic tanks. This was recognized by the National Urban Sanitation Policy (NUSP), 2008, which emphasizes the need for proper collection, treatment and disposal of sludge from on-site installations. In this context, more attention needs to be paid to proper construction of toilets and septic tanks, their maintenance and safe collection, conveyance and disposal of faecal sludge from these systems.

In addition to this, most urban local bodies (ULBs) in India do not effectively monitor the regular cleaning and maintenance of septic tanks. Some ULBs provide septic tank cleaning as a municipal service. This is generally treated as a

complaint redressal activity. So when the septic tank/pit overflows a complaint is registered with the ULB. However, many ULBs do not have adequate number of emptying trucks and are unable to provide prompt service. In many cities private players have filled this gap by providing these services. However, their fees are quite high and their services are not regulated. Disposal of collected septage/faecal sludge is not regulated, and sludge is dumped in open drains or in water bodies, or near garbage dumps. Such practices pose considerable health and environmental risks.

1.2 Current septage management practices and its need in Maharashtra

Septage management has been neglected in cities in Maharashtra, as in most Indian cities. The sector has not received any attention because of poor understanding of septage, lack of proper technical guidance, inadequate resources and skills, shortage of manpower and lack of finance.

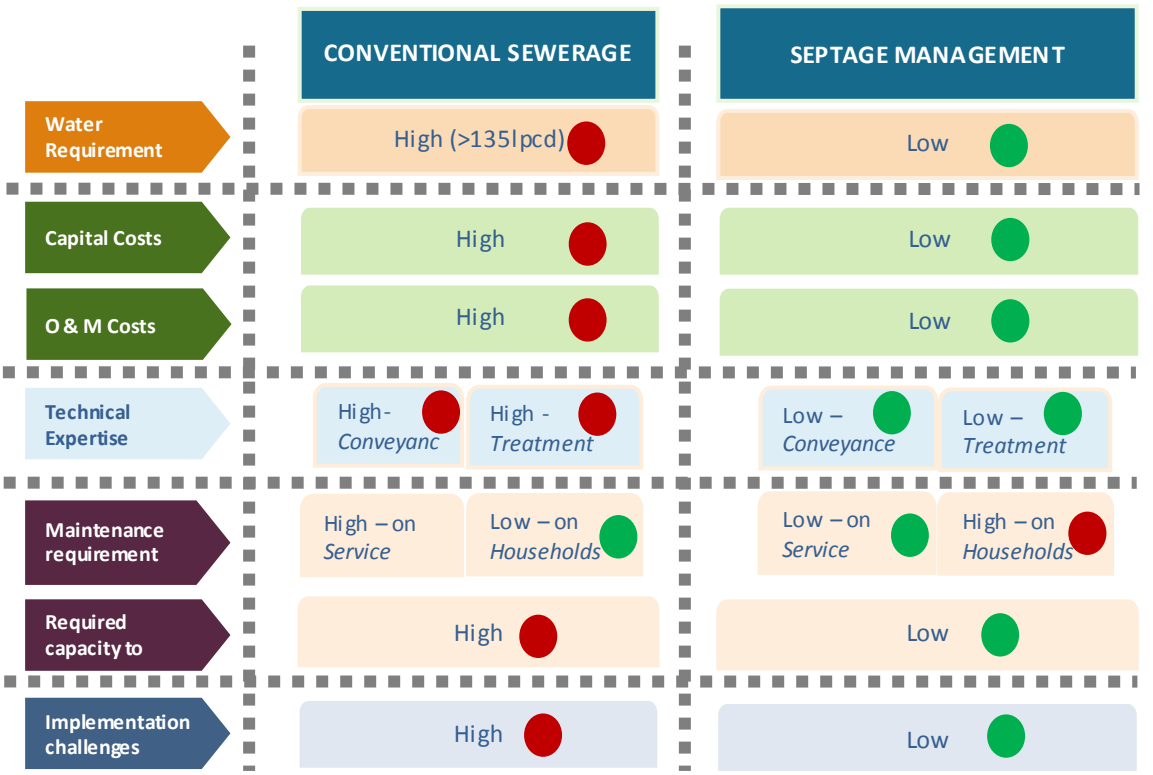
In Maharashtra, only 32 cities have at least a partial conventional underground sewerage system. Hence, the reliance on on-site sanitation systems is very high in state of Maharashtra However, most cities in the state depend on on-site technologies such as single pit, and twin-pit or septic tank based toilets. As per Census 2011, In Maharashtra, around 70% of households have individual toilets of which 53 % are connected to sewer network, 40 % to septic tanks and around 7% to pits and other systems. The toilets that are connected to septic tanks/ pits often discharge the effluent into road side open drains. As per CPHEEO norms septic tanks need to be cleaned periodically at an interval of 2-3 years (see for example Annexure 1. However surveys conducted in a few cities Maharashtra suggest that septic tanks/pits are emptied only once in 8 to 10 years and only when they overflow.

As per the Prohibition of Employment as Manual Scavengers (and their rehabilitation) Act, 2013, manual cleaning/emptying of pit toilets and septic tanks is prohibited. All ULBs are required to adopt mechanical processes for cleaning of pits/septic tank. Most ULBs in Maharashtra provide mechanised cleaning. However, since the tanks are emptied only once in 8 to 10 years, the sludge that is solidified at the bottom of the pit/septic tank is hard to remove

with the small powered emptier that is typically used. As a result, the pits/tanks are not emptied properly.

On the whole, sludge treatment the situation in Maharashtra is quite grim. Currently there is a lack of adequate infrastructure for adequate faecal sludge treatment in most Municipal councils. Even in cities that have sewerage network and functional sewage treatment plants (STPs), only 6 ULBs treat the septage/faecal sludge at the STPs.

The benefits of septage management over the conventional sewerage systems are as follows:



Recognizing the growing importance of safe faecal sludge management practices, there is an emerging need for framing an operative guideline for Septage management for ULBs

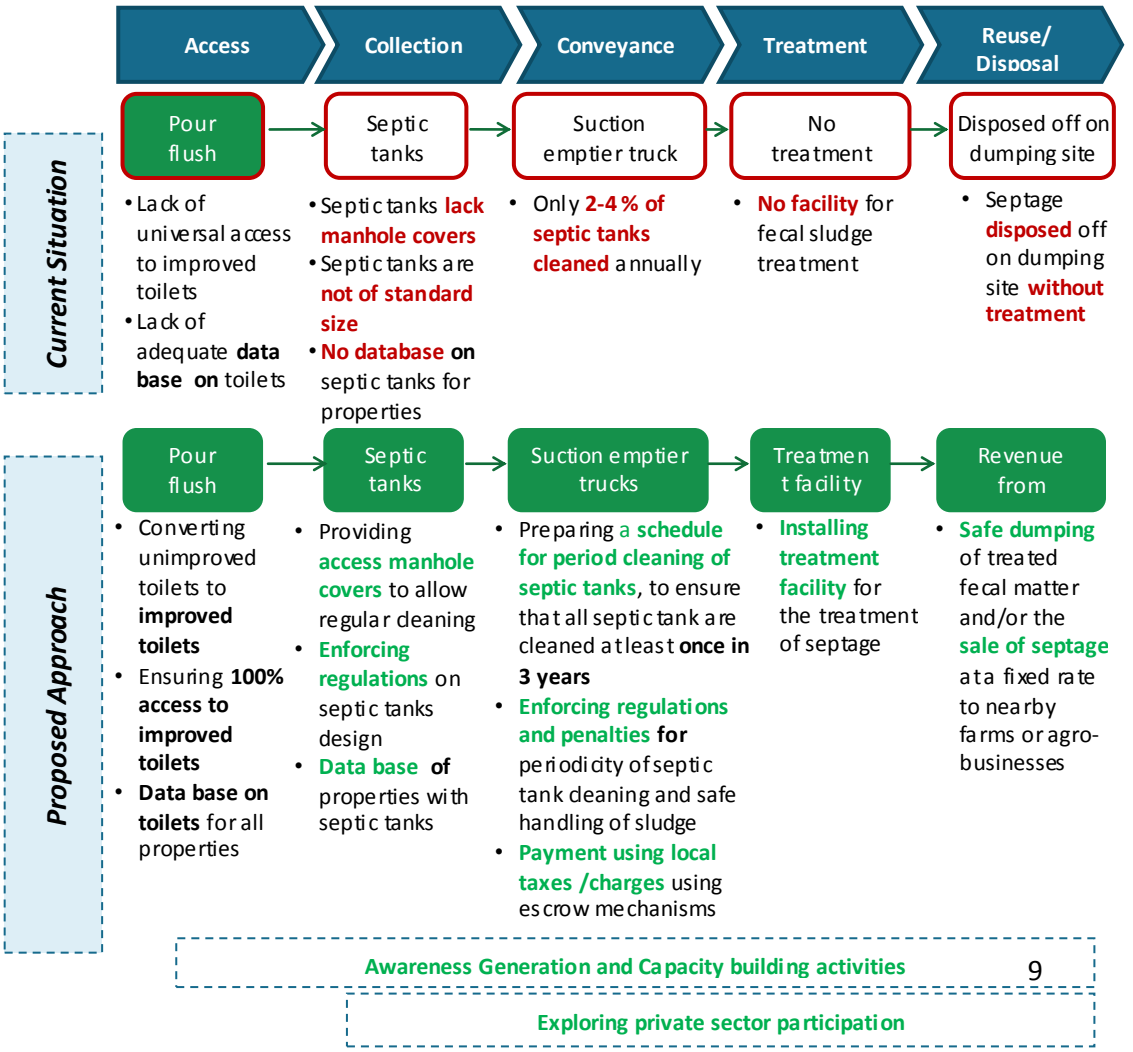
2 Objectives

The objective of this guideline is to facilitate all ULBs in Maharashtra to prepare an integrated faecal sludge management plan and implement a full septage management service in their cities. This would cover aspects across the service chain of on-site sanitation including safe collection, conveyance, treatment and disposal/reuse of the treated faecal sludge for all type of residential and non-residential properties (except industrial properties). These guidelines for seek to provide urban local bodies with knowledge and procedures of preparing a septage management plan. These guidelines also discuss other aspects related to regulation, monitoring and awareness generation that are needed in sustainable implementation of septage management in their cities. The septage management plan would help ULBs improve overall sanitation in their towns.

3 Guideline for ULBs for effective implementation of Septage Management Plan

Septage management Plan covers the entire service chain starting from design of septic tank, collection, conveyance, safe treatment and reuse or safe disposal of septage. The objective of these guidelines is to help city achieve improved sanitation situation in the city through implementation of septage management plan

The following figure depicts the existing situation assessment of on-site sanitation status across service chain in majority urban local bodies of Maharashtra and proposed framework for action to achieve improved sanitation through Septage management.



3.1 Step by step approach: Operationalize of septage management plan

The following is the step by step guide for effective implementation of septage management plan:

A. Preparation of plan for Septage management

1. Existing situation assessment across sanitation service chain
    - Steps for assessment of existing toilets and septic tanks and creation of database
    - Steps for Scheduled septic tank empting services
    - Steps for Planning of septage treatment facility
2. Explore private sector participation for septage management activities
3. Awareness generation and capacity building activities
4. Record-keeping , reporting (MIS), monitoring and feedback systems

B. Financial Resource Mobilization Plan

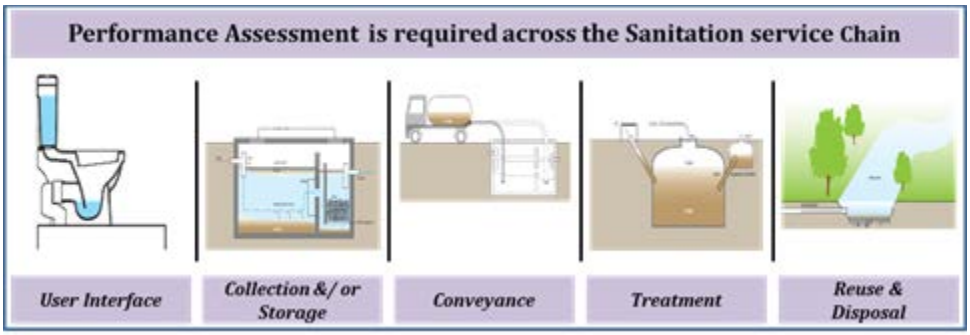
- Sources of revenues for septage management
- Mobilize financial resources to implement septage management plan

A. Preparation of plan for Septage management

1. Existing situation assessment across sanitation service chain

Assessing service performance across the service chain through a city level assessment is the first step in planning process. It is an important exercise, which provides an initial sense of the state of septage facility in the city, help in understanding the context and identifying gaps in key services.

The sanitation service chain considers the following 5 stages:



Detailed assessment of services will need to be done across each link in the chain through appropriate field assessments:

a) Access & Collection:

- **Access** describes the type of toilet and captures if the HH uses individual, shared or community facility. The choice of User Interface will depend on the availability of water. At city level it also measures the availability of public toilets. For sullage disposal, it captures access to bathroom facilities and drainage outlets.
- **Collection** and Storage/Treatment describes the ways of collecting, storing, and sometimes treating the excreta, grey water generated at the User Interface. The toilet may be connected to sewerage system; onsite systems like septic tank with soak pits, pits or may be functioning as Ecosan / composting toilets. Similarly for grey water disposal, the HHs may be connected to sewerage system or drains of any kind (Open/covered).

Steps for assessment of existing toilets and septic tanks and creation of database

a. City level assessment of coverage of toilet and on-site sanitation facility using the existing database (like property tax module, Census 2011 etc.) or based on recent survey carried out under SBM.
b. If the ULB do not have database, then ULB shall create database of toilets and septic tanks based on questionnare given in ***Annexure 2.*** All

ULB shall link the key result related to toilet availability, type of toilet and its connection with waste water outlet with property tax database on e-governance platform.

c. ULB shall keep updated database related to toilet availability and on-site sanitation through property tax assessment survey carried out at every four years of interval

d. Evaluate existing septic tank designs and other storage/treatment systems and modify (in case of variation) based on design mentioned in ***Annexure 1***.

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

f. Identify insanitary toilets[1] and convert them to sanitary latrines for safe collection and disposal of waste as per norms set out in ***Annexure 1.***

g. All existing septic tanks should have access covers for each chamber, so that they can be easily opened during emptying process. Where such covers are not available, it should be made compulsory for all property owners to provide proper covers.

h. The new septic tanks need to be designed and constructed as per the norms suggested in National Building Code, 2005 and CPHEEO Manual, 2013 which takes reference of design norms from IS: 2470 on Code of practice for installation of septic tanks - Part 1: Design and Construction and Part 2: Secondary treatment and disposal of septic tank effluent 1985 (Reaffirmed 1996). The design norms CPHEEO Manual, 2013 is compiled in ***Annexure 1.***

b) Conveyance

Conveyance describes the transport of products across the service chain. ULB should plan for scheduled septic tank emptying services for effective implementation of septage management plan. Prior to plan for the same,

[1] Insanitary toilet / latrines in households are those where night soil is removed by human, serviced by animals or/and night soil is disposed into open drain or pit into which the excreta is discharged or flushed out, before the excreta fully decomposes. As mentioned in Swachh Bharat mission guidelines, single pit toilets will also be considered as an insanitary toilet/latrine.

ULB shall first assess its role and capacity for implementation of septage management plan. ULB should assess various aspects of septic tank empting like how many septic tanks required to be emptied annually as per CPHEEO norm versus how many are emptied in a year, how many vaccum emptying trucks/ capacity of trucks are required if number of septic tank emptied as per CPHEEO norm versus how many trucks are available/working with capacities of emptier trucks, assessing the cost per emptying visit, method of maintaining the register for septic tank emptying services database etc.

If private player is involved in septic tank emptying business in the city, then, ULB shall also review the role of private septic tank emptier and assess their capacity in lines with the number of septic tank empting annually, charges/fees for empting services, location of disposal, registration/licensing with ULB or not etc.

Steps for Scheduled septic tank empting services

a. ULBs should initiate pre-determined scheduled septic tank empting services and develop a route plan for the same.
b. Mobilize or procure adequate number of suction emptier trucks to maintain a three year rotating cycle. Number and type of vehicles to be purchased based on the sizes of septic tanks or septage generation rate[2] for the city, distance from the location of septic tanks to the septage treatment facility, cleaning frequency of septic tanks and available road width for the suction truck operations.
c. ULBs should either provide the emptying services themselves or enter into appropriate management contracts with private agencies. In case of private sector contract, ULBs should certify and license private septage transporters to de-sludge and transport waste to the

[2] Septage generation rates vary widely from place to place depending on practices of septic tank use, number of users, water used for flushing, and the frequency of cleaning the septage. Adopting the (U.S. EPA, 1984) estimate of septage generation of 230 litres/year and an average household size of four, the septage generation/ household would be 920 litres/year. So for a three year cycle the septage generation rate would be 2760 litres or 2.76 cum. Alternatively, assuming an average septic tank volume of 3 m3 and emptying of septage when one-third of the septic tank is filled with settled solids, the volume of septage emptied would be 1 m3.

designated treatment facility. The license/septage transporter permit is detailed out in ***Annexure 3.1*.**

d. All septage transporters need to maintain a collection and transport receipt such as the one detailed out in ***Annexure 3.2***. This needs to be filled duly by the private / ULB service provider and submitted to ULB office.

Measures to be taken during Desludging of septic tanks

a. While desludging the following norms should be followed:
    - The septic tanks should not be fully emptied; small amount of sludge of around 1 to 2 inches should be left in the septic tank to facilitate decomposing of incoming faecal waste.
    - No fire or flame should be used near the septic tanks as there may be inflammable gases inside septic tanks
    - Proper safety gears should be used by the operator while desludging / emptying the septic tanks
b. Septage transportation vehicle operators (whether from ULB or private sector) should be well trained and equipped with protective safety gears, uniforms, tools and proper vacuum trucks, to ensure safe handling of sewage/septage. The rules under the Prohibition of Employment as Manual Scavengers and their Rehabilitation Act, 2013 provide for a comprehensive list of safety gear that should be used while providing these services. The operating procedure for cleaning of septic tanks is detailed out in ***Annexure 3.3.***

c) Treatment and disposal

Treatment: ULB must not dispose the septage collected from septic tank without any treatment and ULB must comply with CPCB and MPCB norms before disposal of septage. ULB should assess the load of septage and assess the requirement of capacity for treatment plant. ULB should first try and assess the possibility of setting up septage treatment facility at the solid waste treatment/disposal site and at the STPs within the city or in nearby city.

Reuse/disposal refers to the methods in which products are ultimately returned to the environment, as either useful resources or reduced-risk materials. The

treated septage can be used as a soil enricher or as filling material at construction sites. ULB should carry out primary assessment for availability of market and demand for reuse.

Steps for Planning of septage treatment facility

a. Septage collected from the septic tanks or pits should not be disposed without any treatment.

b. ULB should first assess the possibility of septage treatment at existing STP in the city or STP of nearby city through appropriate agreements with STP operators and receiving ULBs. A list of cities that have STPs in Maharashtra is given in ***Annexure 4.***

c. If STP is not available in the city or nearby that can receive the sludge, then ULB should plan for new septage treatment facility. Various treatment options are given in ***Annexure 5.*** Such a new septage treatment facility should be designed to cater to expected volumes of septage generated in urban local body and if faecal waste is expected from nearby urban local bodies.

d. Input quality of the collected septage should be tested at the treatment facility for checking presence of any metal or traces of industrial waste.

e. The faecal sludge treatment plant should be operational during working hours only and a responsible person should be appointed in the facility to ensure that no commercial or industrial waste is unloaded in these facilities.

f. Septage should be reused / safely disposed only after it meets the parameters mentioned in **Annexure 6**. Various possible reuse options are outlined in ***Annexure 6.***

Measures to be taken while planning for Septage treatment facility

Identification of septage treatment site [3] is crucial for effective implementation of septage management plan. Following parameters to be taken into consideration before finalization of treatment sites:

[3] Referred to: Faecal Sludge Management: Systems Approach for Implementation and Operation, Linda Strande, Mariska Ronteltap, Damir Brdjanovic, IWA 2014

Distance of treatment site: Distance from emptying to delivering and accessibility of the treatment site are major issues. The transport of relatively small fecal sludge volumes (5-10m^3 per truck) on congested roads over long distances in large urban areas is financially unfeasible. A site that is too far away implies fewer trips per day, less revenue and more fuel costs to private operators.

Reliability of electricity: It is also important to assess the availability and reliability of electricity if treatment technology has mechanical operated parts; as in case of fluctuations it will increase treatment time and will affect optimal utilization of treatment capacity.

Neighborhood: A treatment site may generate nuisance, especially bad odors. For this reason it should be located at an appropriate distance from the residential areas.

Land availability: Projects are often delayed because of non-availability or high price of land. ULB should identify the land bank for treatment facility. ULB should also explore the possibility of developing septage treatment facility at solid waste dumping or treatment site.

Geological Parameters: Assessment of existing geological conditions on site like groundwater table, type of soil, prone to flooding is always recommended as it may directly affect selection of technology option.

Indicative Decision making framework for Evaluation of Septage treatment site

Sr. No.	Particulars	Unit	Treatment location 1	Treatment location 2	Treatment location 3	Treatment location 4
Identification of treatment sites						
1	Distance of existing septage disposal site	km				
2	Distance of SWM treatment or disposal facility	Km				
3	Type of SWM treatment facility					
4	Average distance and duration of emptying trip	Km & mins.				
5	Electricity availability					
6	Neighborhood (Residential/ institutional/commercial/ irrigation/farming areas)					
Land availability						
7	Government or private land					
8	Available/ Non-available for developing site					
Geological parameters						
9	Water table	**mt**				
10	Type of soil					
11	Prone to flooding	**Yes/No**				

2. Explore private sector participation for septage management activities

For effective operationalize of scheduled septic tank emptying service and treatment facilities, ULB may also explore the option for private sector participation. Following points to be taken into consideration by ULB:

a. Explore private sector participation for various activities like procurement, operations and maintenance of the suction emptier trucks, construction and operations of septage treatment facility and possible re-users of treated septage within the city as well as in nearby cities.
b. Develop performance based contracts such that payment is linked to the performance of private sector for providing the services.

3. Awareness generation and capacity building activities

Awareness generation activities need to be taken up for successful implementation of faecal sludge management plan and community acceptance and adherence to regulations and service plan set up by the ULBs. Associated training and capacity building of municipal staff as well as private sector contractors also needs to be taken up.

a. **Awareness generation for residents**: Members of Resident Welfare Associations, community organizers, self-help groups and the general public should be made sensitized periodically regarding the need for a sound faecal sludge management system including a 3-year cycle. The health hazards associated with improper collection and treatment of waste, and the ill-effects of sewage discharge into fresh water/storm water drains should be explained to the residents. Sample material for awareness generation is in ***Annexure 7.*** Awareness generation activities should be carried out at the beginning of introducing a scheduled service in all wards and then repeated periodically over the three year cycle.
b. **Capacity building for municipal staff**: Municipal Commissioners/ Chief Officers, Engineers, Sanitary Inspectors, Health Officers, and Sanitary Workers should be well trained in safe septage management and its best practices. This involves regular training sessions on safe collection, treatment and disposal. Information regarding standard septic tank

design, the need for periodic inspection and desludging of septage, design of a treatment facility, tender details for engaging licensed transporters, etc. should be disseminated widely to achieve a safe faecal sludge management system. Training should also be provided on safety standards.

c. **Capacity building for septage transporters / private vendors**: Local Bodies should ensure all safety norms are clearly explained to the septage transporters. Private Operators and Transporters should be well trained in safe collection and transportation of sewage including vehicle design, process of desludging, safety gears and safe disposal at the nearest treatment facility.

4. Record-keeping, reporting (MIS), monitoring and feedback systems

a. **Recordkeeping and manifest forms** should be an integral part of a comprehensive septage management program. Recordkeeping requirements should be codified into the law governing the program. A sample manifest form is detailed out in ***Annexure 3.2***

b. The completed document or documents with signatures of the household/property, suction truck operator and treatment plant operator should be submitted to the local government for their records. Payment to the suction truck operator should only be made if there are signatures of all the stakeholders. A possible monitoring framework for septic tank emptying services is detailed out in ***Annexure 8***

c. An **MIS system** such as the one discussed in access and collection will need to be developed and maintained.

d. Where possible, **GIS** should be used to be plan the route of suction emptier trucks and tracking these for regular record keeping.

e. **Consumer grievance redressal system** for faecal sludge management should also be set up as a part of urban local body record keeping systems and helpline numbers to be shared with residents as a part of monitoring and record keeping systems for faecal sludge management.

B. Financial resource mobilization

1. Sources of revenues for septage management

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

b. If ULB explore the possibility of Private sector involvement in septage management, then an **escrow account** can be set up where revenues from the sanitation tax/ charge are transferred. The contractual amount for FSM services to the private party can be paid from this escrow account to avoid delays.

c. **Periodic revisions for the taxes/ charges** to be effected based on revisions in costs involved

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

2. Mobilize financial resources to implement septage management plan

a. ULB may utilize the funds from 14th FC to implement the various components related to septage management plan. Creation of database for toilets and septic tanks, procurement of suction emptier trucks and construction of septage treatment facilities are the permissible components to utilize the 14th FC funds. The funds would also be provided as preparatory activity like preparing detailed project report and prefeasibility report for septage management.

b. **IEC & Capacity building funds:** IEC funds under SBM shall be utilized for various awareness generation activities undertaken for implementing septage management plan includes capacity building activities for ULB staff, septage transporters, treatment plant operators and residents of city.

c. Convergence with existing schemes/activity: If any ULB is going to undertake the water audit survey under MSNA or survey under SBM or property tax assessment etc, then ULB should integrate the sanitation survey with the respective activity.

Annexures

1. Conventional septic tank design as per CPHEEO, 2013[4]

1.1 Conventional septic tank

A septic tank is a combined sedimentation and digestion tank where the sewage is held for one to two days. During this period, the suspended solids settle down to the bottom. This is accompanied by anaerobic digestion of settled solids (sludge) and liquid, resulting in reasonable reduction in the volume of sludge, reduction in biodegradable organic matter and release of gases like carbon dioxide, methane and hydrogen sulphide. The effluent although clarified to a large extent, will still contain appreciable amount of dissolved and suspended putrescible organic solids and pathogens.

Therefore, the septic tank effluent disposal merits careful consideration. Due to unsatisfactory quality of the effluent and also the difficulty in providing a proper effluent disposal system, septic tanks are recommended only for individual homes and small communities and institutions, whose contributory population does not exceed 300. For larger communities, septic tanks may be adopted with appropriate effluent treatment and disposal facilities. However, in both cases the sewage from the septic tank should be discharged into a lined channel constructed along with storm water drain as an interim measure till a proper sewerage system is laid. The outfall from such drains should be connected to a decentralised or centralised sewage collection system.

1.2 Design

Several experiments and performance evaluation studies have established that only about 30% of the settled solids are anaerobically digested in a septic tank. In case of frequent desludging, which is necessary for satisfactory effluent quality, still lower digestion rates have been reported. All these studies have proved that when the septic tank is not desludged for a longer period i.e., more

[4] Source: Central Public Health and Environmental Engineering Organization (CPHEEO) and Japan International Cooperation Agency. (2013). Manual on Sewerage and Sewage Treatment Systems, Part A – Engineering, Chapter 9 – Onsite Sanitation, Page no: 9-15 to 9-21.

than the design period, substantial portion of solids escape with the effluent. Therefore, for the septic tank to be an efficient suspended solids remover, it should be of sufficient capacity with proper inlet and outlet arrangements. It should be designed in such a way that the sludge can settle at the bottom and scum accumulates at the surface, while enough space is left in between, for the sewage to flow through without dislocating either the scum or the settled sludge. Normally, sufficient capacity is provided to the extent that the accumulated sludge and scum occupy only half or maximum two-thirds the tank capacity, at the end of the design storage period. Experience has shown that in order to provide sufficiently quiescent conditions for effective sedimentation of the suspended solids, the minimum liquid retention time should be 24 hours. Therefore, considering the volume required for sludge and scum accumulation, the septic tank may be designed for 1 to 2 days of sewage retention.

The septic tanks are normally rectangular in shape and can either be a single tank or a double tank. In case of double tank, the effluent solids concentration is considerably lower and the first compartment is usually twice the size of the second. The liquid depth is 1-2 m and the length to breadth ratio is 2-3 to 1. Recommended sizes of septic tanks for individual households (up to 20 users) and for housing colonies (up to 300 users) are given below in table below

Table 1: Recommended size of septic tank up to 300 users ***(Source CPHEEO, 1993)***

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

No. of Users	Length(M)	Breadth(M)	Liquid Depth (Cleaning interval of)	
			2 Years	3 Years
200	12.00	3.30	1.00	1.24
300	15.00	4.00	1.00	1.24

Note 1: The capacities are recommended on the assumption that discharge from only WC will be treated in the septic tank
Note 2: A provision of 300 mm should be made for free broad.
Note 3: For population over 100, the tank may be divided into independent parallel chambers of maintenance and cleaning.
Note 4: The sizes of septic tank are based on certain assumption on peak discharges, as estimated in IS: 2470 (part 1) and while choosing the size of septic tank exact calculations shall be made

1.3 Construction details

The inlet and outlet should not be located at such levels where the sludge or scum is formed as otherwise; the force of water entering or leaving the tank will unduly disturb the sludge or scum. Further, to avoid short-circuiting, the inlet and outlet should be located as far away as possible from each other and at different levels. Baffles are generally provided at both inlet and outlet and should dip 25 cm to 30 cm into and project 15 cm above the liquid. The baffles should be placed at a distance of one-fifth of the tank length from the mouth of the straight inlet pipe. The invert of the outlet pipe should be placed at a level 5 to 7 cm below the invert level of inlet pipe. Baffled inlet will distribute the flow more evenly along the width of the tank and similarly a baffled outlet pipe will serve better than a tee-pipe.

For larger capacities, a two-compartment tank constructed with the partition wall at a distance of about two-thirds the length from the inlet gives a better performance than a single compartment tank. The two compartments should be interconnected above the sludge storage level by means of pipes or square openings of diameter or side length respectively of not less than 75 mm. Every septic tank should be provided with ventilation pipes, the top being covered with a suitable mosquito proof wire mesh. The height of the pipe should extend at least 2 m above the top of the highest building within a radius of 20 m. Septic tanks may either be constructed in brick work, stone masonry or concrete cast

in situ or pre-cast materials. Pre-cast household tank made of materials such as asbestos cement / HDPE could also be used, provided they are watertight and possess adequate strength in handling and installing and bear the static earth and superimposed loads. All septic tanks shall be provided with watertight covers of adequate strength. Access manholes/covers (minimum two numbers one on opposite ends in the longer direction) of adequate size shall also be provided for purposes of inspection and desludging of tanks. The floor of the tank should be of cement concrete and sloped towards the sludge outlet. Both the floor and side wall shall be plastered with cement mortar to render the surfaces smooth and to make them water tight. A typical two compartment septic tank is shown in figure below

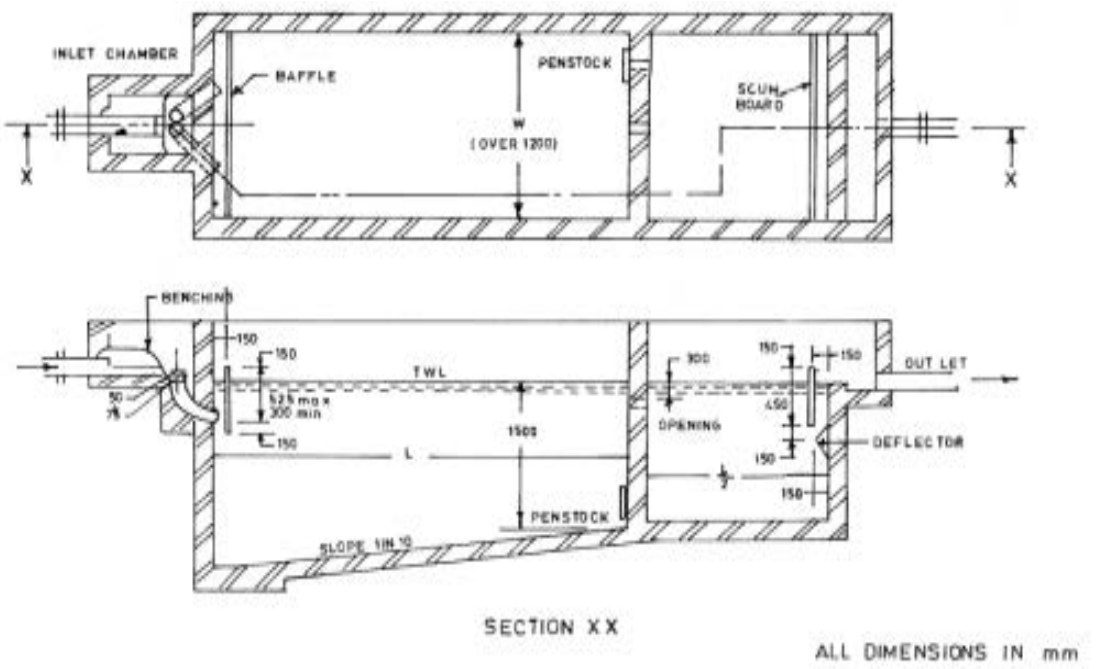


Figure 1: Typical sketch of 2 compartment septic tank for population over 50 (Source: CPHEEO, 1993)

Annexure 2. Questionnaire for septage management database creation[5]

Q No	Question		Options
1	Form id		
2	Locality type	1	Slum
		2	Non-Slum
3	What is the name of the locality?		Locality Name _____
4	Ward no:	1	Number ____
5	Property number as per Council property tax records:	1	Number ____
6	Status of property during the survey	1	Open
		2	Locked
		3	Vacant
7	Type of Property	1	Residential
		2	Institutional
		3	Commercial
		4	Mixed
8	Mark the house typology (only if 7 = Residential)	1	Bungalow
		2	Apartment
		3	Row House
		4	Wada
		5	Chawl
		6	Hut
		7	Others, specify _____
9	Select the type of Institution (only if 7 = Institutional)	1	Hospital
		2	Dispensary
		3	School/College
		4	Religious Institutions
		5	Government Office
		6	Others, specify _____
10	Select the type of commercial	1	Industry

[5] Source: Questionnaire developed by CEPT University / AIILSG

Q No	Question		Options
	(only if 7 = Commercial)	2	Shop
		3	Hotel / Lodge
		4	Others, specify _____
11	Name of Apartment/Building:		
12	Number of Blocks		Number
13	Name of the respondent/ building secretary:	1	First name _____ Middle name _____ Last name _____
14	Contact no. of building secretary:	1	Number ____
15	How many flats are there in this apartment?	1	Number ___
		2	Don't know
16	How many toilets are there in this property?	1	Number ____
		2	Don't Know
17	Number of flats that are occupied	1	
18	How many households are there on this property?		Number ___
19	Name of the respondent/Head of the Household	1	First name _____ Middle name _____ Last name _____
20	Pl provide a mobile Contact no. of head of the household	1	Number ____
21	What is the tenure status of this property?	1	Owner occupied
		2	Tenant occupied
22	Pl provide the name of the owner of this property:	1	Name _____
	-	2	Don't Know
23	Pl provide a mobile contact no. of owner	1	Number ____
		2	Don't Know
24	How many persons are there in this household? (for Commercial, approx numbers of toilet users)		children (less than 6 year):___, Other Male: ___ Other female: ___
25	Do you have your own toilet on your premises?	1	Yes
		2	No
26	What is your own toilet	1	Sewer Network

Q No	Question		Options
	connected to for disposal?	2	Septic tank with soak pit
		3	Septic tank connected to open/closed drain
		4	Single Pit
		5	Double pit
		6	Directly to open/closed drains
		7	Others, specify _____
27	No. of septic tanks in the property	1	1
		2	2
		3	3
		4	Don't Know
28	Type of septic tank: 1. Individual 2. Shared	1	Individual
		2	Shared
29	This property shares septic tank with: _____		
30	What is the shape of your septic tank	1	Rectangular
		2	Circular
		3	Don't Know
31	Provide dimensions:	1	Don't know
	("L" relevant only if rectangular)	2	Length (ft.) _____
	-	3	Breadth/Diameter (ft.) _____
	-	4	Depth (ft.) _____
32	Septic tank outfall is connected to	1	Soak pit
		2	Open drain
		3	Covered drain
		4	Open land
		5	Others, specify
		6	Don't Know
33	When was the septic tank emptied the last time?	1	Last 6 months
		2	From 6 to 12 months
		3	12-24 months
		4	24-36 months
		5	More than 36 months
		6	Never emptied

Q No	Question		Options
		7	Don't know/Remember
34	Why was the septic tank emptied?	1	Blocked toilet
		2	Overflow from access hole/manhole
		3	Smell
		4	Others, specify
		5	Don't know/remember
35	Were there any problems during emptying of septic tanks?	1	Access or distance for suction truck to house
		2	Break floor tiles to access septic tank
		3	Break concrete manhole to access septic tank
		4	Difficult to locate the septic tank
		5	Smell during emptying
		6	Made a mess
		7	No problem found
		8	Others, specify
		9	Don't know
36	Is the septic tank accessible from road for cleaning by using a suction emptier truck?	1	Yes
		2	No
37	Is there proper access with manholes/covers for any of the chamber of septic tank which can be easily opened	1	Yes
		2	No
B	GPS Location ID		
C	Photographs		

Annexure 3. Scheduled septic tank emptying services

3.1 Septage transporter permit (License)[6]

Septage Transporter Permit for _____ Municipality

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

NAME OF PERMITTEE:

_____

ADDRESS:_____

_____

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

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

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

EFFECTIVE DATE:

EXPIRATION DATE:

____ CHECK IF RENEWED PERMIT

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

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

3.2 Collection and transport records form / manifest forms[7]

Sample Form to be filled by Operator / Transporter of Septage

i. Identification of Waste:

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

ii. Details of Waste Generator

a) Name:
b) Phone Number:
c) Address:
d) Pin:
e) Property tax no.:
f) Any kind of deficiencies, missing pipes or fittings, improper manholes or access covers, any other cracks or damage observed: _____

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

Date: _____ Signature: _____

iii. Details of Transporter / Operator

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

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

e) Signature of authorized agent and title: _____

iv. Acceptance by _____Municipality's authorized STP

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

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

Signature of authorized signatory and title: _____

[7] Adapted from operative guidelines for septage management for urban and rural local bodies in Tamil Nadu.(2014)

3.3 Operating procedure for cleaning of septic tanks[8]

3.3.1 Daily Preparation for the ULB / private emptying and transport service

- Receive work orders for the day
- Check the functioning of vacuum emptier and equipment
- Check personal protective equipment – All employees should be responsible for maintaining their own personal protective equipment (such as gloves, boots, hat, face mask, Davy's lamp) in good condition
- Check disinfecting and spill control equipment – Operators should be trained on identifying spills and proper methods of disinfecting. Sprinkle lime over spilled area, wait 15 minutes, then wash with water
- Check Hoses – inspect hoses for cracks and wear– discard or repair worn and broken hoses. Connecting the Hose in the correct manner using the clamp style fitting ensures a tight and leak proof connection. Use of twine and plastic for making connections causes leaks and require cleanup.

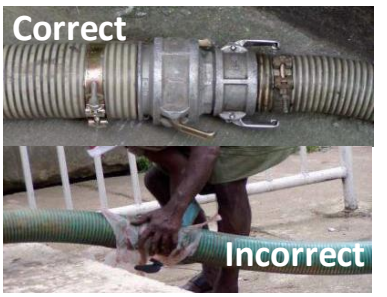


Figure 2: Connecting Hoses

3.3.2 Operating the vacuum emptier

Operators should become familiar with the proper operation of the equipment in use for each operation. This includes the physical operation of the truck, and all valves, piping, power take-offs and ancillary equipment for the vacuum emptier (including the tank, valves, hoses, and fittings). The following steps can be followed for operating the vacuum emptier:

- Reach the first site and meet the building owner.

[8] Source: Guidelines for 'Open defecation Free Towns' under Mahatma Gandhi Swachhata Mission, Government of Gujarat.(2015)

- Before pumping, check the tank to look for obvious damage to the structure and to verify proper piping is in place.
- Check the water level to get clues as to tank condition: high levels (above outlet level) indicate a clogged outlet; low levels (below outlet level) indicate a leaking tank (or tank not in use).
- Check for back flow into tank during pumping and when pumping is complete. Flow back may indicate a problem with plumbing in the house or clogged disposal.
- Open the access covers, inspect the interior and exterior of the tank. If more than one, locate and remove lids from all compartments.
- Each compartment will require pumping after ventilating. Probe the tank with the last length of hose. This will provide an indication on the volume of sludge to pump.
- Start the pump or vacuum equipment. The operator will make sure there is suction and that the pump is operating.
- Volume in the tank should start decreasing rapidly. Use hose to break up sludge and scum to the extent possible.

After pumping is complete, check the tank for remaining sludge. If there are accumulated solids remaining, initiate the pump-back procedure, which is to send the pumped faecal sludge under pressure back into the tank and direct this flow toward the sludge mass. This will break up the mass, making it possible to pump out. When pump-back is complete, pump out the tank again (suction). When pumping is complete, wash the hoses and replace the tank lids. Leave back small amount of sludge of around 1 to 2 inches in the tank so that it microorganisms can act upon the new incoming faecal waste. Clean up any spills and disinfect with lime or bleach solution. Chemicals such as lime can also be added into the suction trucks to neutralize the septage, to render the septage more treatable and to reduce odours.

Annexure 4. ULB Wise Capacity of STPs, present flow and utilization[9]

Sr. No	Class of ULB	Name of the ULB	Capacity* (MLD)	Technology	Present flow (MLD)	% Utilization	Data source year
1	M. Corp	Aurangabad	216	SBR-ASP	100	46	2014-
2	M. Corp	Bhiwandi	17	UASB	17	100	2014-
3	M. Corp	Greater	ND	Aerated Lagoon	ND	ND	2014-
4	M. Corp	Kalyan Dombivli	153	SBR, Soil based technology (IIT)	153	100	2014-15
5	M. Corp	Kolhapur	120	SBR	68	57	2014-
6	M. Corp	Mira	30	MBBR	30	100	2013-
7	M. Corp	Nagpur	200	UASB	150	75	2014-
8	M. Corp	Nanded	174	Extended Aerator with	25	14	2013-14
9	M. Corp	Nashik	271	UASB	239	88	2014-
10	M. Corp	Navi	848	C-TECH	420	50	2014-
11	M. Corp	Pimpri	564	ASP, SBR	432	77	2014-
12	M. Corp	Pune	1134	ASP, SBR, Biotech with extended	1134	100	2014-15
13	M. Corp	Sangli	22	Oxidation pond	22	100	2013-
14	M. Corp	Thane	304	SBR	180	59	2014-
15	Class A	Ambernath	56	UASB	49	87	2013-
16	Class A	Ichalkaranji	40	UASB	30	75	2013-
17	Class A	Panvel	28	C-TECH	8	29	2014-
18	Class B	Karad	8	Aerobic, anaerobic,	8	100	2014-15
18	Class B	Lonavala	8	Aeration tank, clari- floculator,	8	100	2014-15
19	Class B	Pandharpur	31	UASB	8	26	2013-

[9] Source: www.pas.org.in

20	Class C	Mahabalesh	3	Multimedia Bio	2	67	2013-
21	Class C	Pachgani	2	UASB	2	100	2014-
22	Class C	Shirur	6	Aeration type	6	100	2013-
23	NP	Shirdi	26	Sludge bed	12	46	2013-

Note: * - Capacity = Installed capacity of primary treatment plant + Installed capacity of secondary treatment plant

Annexure 5. Faecal sludge / septage treatment options

Septage is the settled solid matter in semi-solid condition usually a mixture of solids and water settled at the bottom of septic tank. It has an offensive odour, appearance and is high in organics and pathogenic microorganisms, whereas septic tank effluent is the liquid part which flows out from septic tank (since solids are trapped in septic tank). Septage has a much higher concentration of pollutants than the septic tank effluent. Biological Oxygen Demand (BOD) and Total Suspended Solids (TSS) are two common measurements of the strength of septage. As per U.S. EPA, 1984 septage in tropical countries may have BOD concentrations between 440 to 78,600 mg/l and TSS values in range of 310 to 93,378 mg/l, where septic tank effluent has values averaging around 200 mg/l BOD and 300 mg/l TSS. As septic tanks fill with septage, the effluent begins to resemble faecal sludge with higher pollution values. Therefore, regular desludging provides dramatic improvements in effluent quality. Detailed septage characterization (BOD, TSS &other microbial characteristics) as well as its dewatering characteristics (specific resistance etc.) should be done prior to the design of any faecal sludge management facility. Treatment of septage / faecal sludge can be of two types, treatment at sewage treatment plants and at independent septage treatment plants. The details of these two types of treatment are given in the section below:

5.1 Treatment of septage/faecal sludge at sewage treatment plants:

Co-treatment of septage along with domestic sewage at a sewage treatment plant (STP), if available, is the most desirable option. Though septage is more concentrated in its strength than domestic sewage, its constituents are similar to municipal wastewater. But care should be taken that the STP should have adequate capacity to accept the septage without hampering the functioning of the sewage treatment plant. The municipality should monitor the incoming wastewater load to the STP and accept the septage, if the design norms are not violated with the increased load (on account of the septage). *Annexure 4* provides a list of ULBs with their capacity of the STPs and the present flow received at STPs. The treatment plants that are under-utilized can serve as treatment plants for septage from nearby ULBs and if the STPs are working close

to the design capacity, additional loads due to disposal of septage will necessitate expansion or up-gradation of the STP capacity.

The septage could be added at various locations for treating it along with STP wastewater:

1. **Septage addition at the nearest sewer manhole**: Septage could be added to a sewer upstream of the STP, and substantial dilution of septage occurs prior to it reaching the STP, depending on the volume of sewage flowing in the sewer
2. **Septage addition at the STP:** Septage could be added to sewage immediately upstream of the screening and grit removal processes
3. **Septage addition to sludge digesters/sludge drying beds:** Septage could be processed with the sludge processing units of STP.

If septage / faecal sludge are to be co-treated with sewage, it will be necessary to construct a septage /faecal sludge receiving chamber. Chemicals such as lime or chlorine can also be added to the faecal sludge in the storage tank to neutralize it, to render it more treatable, or to reduce odors.

Treatment of septage/faecal sludge at independent septage treatment plants

When an STP does not exist for a city, or the distance or the capacity of the available plant becomes a limiting factor, it is not a feasible option to transport and treat the septage at the sewage treatment facilities. Hence, a treatment plant especially meant for septage treatment becomes the option to consider. Independent septage treatment plants are designed specifically for septage treatment and usually have separate unit processes to handle both the liquid and solid portions of septage. These include:

- Lime stabilization – odor control, conditioning and stabilization of the sludge.
- Dewatering – sludge drying beds or mechanical dewatering.
- Anaerobic / aerobic wastewater treatment – liquid from the sludge drying beds and mechanical dewatering systems.

- Co-composting with organic solid waste

The choice of mechanical dewatering or sludge drying beds would be dependent on the land availability, with mechanical dewatering systems being preferred where land is scarce and sludge drying beds being adopted where land availability is not a constraint. The benefit of using these treatment plants is that they could provide a regional solution to septage management. Many septage

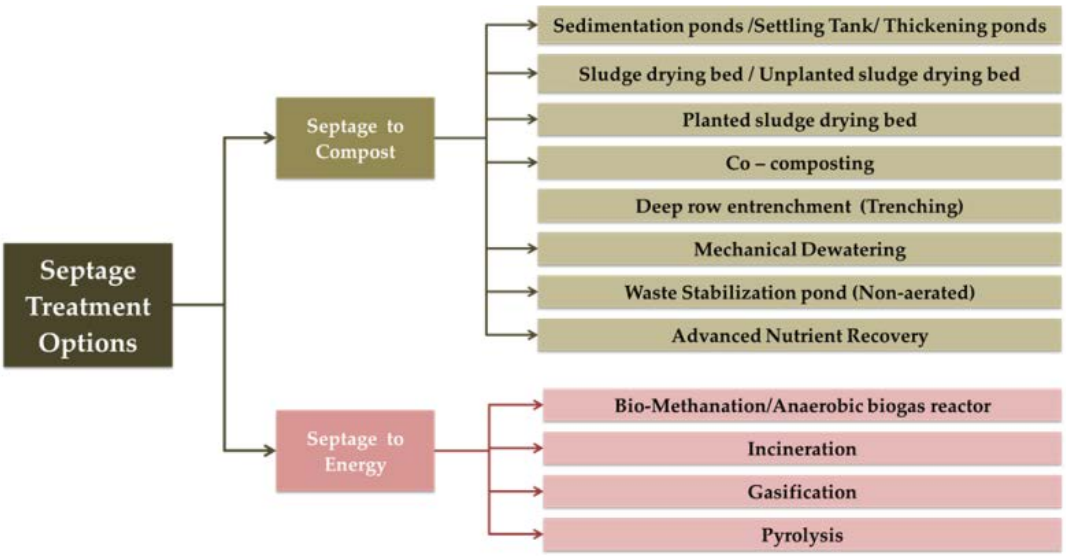


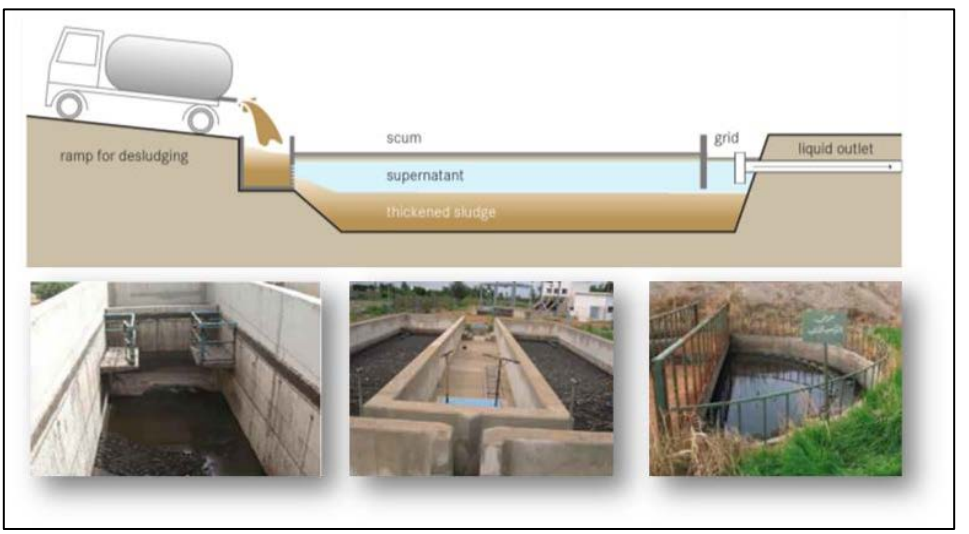
Figure 3: Septage treatment

treatment plants use lime to provide both conditioning and stabilization before the septage is dewatered, and this dewatered sludge can be used as organic fertilizer after drying and composting. Additionally, lime stabilization also helps to reduce/ minimize odour. The common practice is to add lime to raise the pH to 12 and hold it for a period of 30 minutes. The filtrate from the dewatering units needs to be further treated through treatment process such as waste stabilization ponds, anaerobic baffled reactor, constructed wetland or aerobic treatment systems before discharging into the environment.

However, the choice of an appropriate septage management system is dependent on land availability, local site conditions, level of treatment required,

hauling distance, technical requirements, costing , requirement of expertise for construction and operation, availability of skilled labour, legal and regulatory requirements. The management option selected should be in conformity with local, state, and central regulations. From review of various options for the Septage treatment, it was observed that treatment options could broadly be divided into two types. One form of technology is to convert faecal sludge/septage to compost and another is to convert septage to energy. These technologies can be grouped as shown in the figure. Details of these technologies is detailed out in section below

1. **Sedimentation ponds /Settling Tank/ Thickening ponds**
   Sedimentation or Thickening Ponds are simple settling ponds that allow the sludge to thicken and dewater. The effluent is removed and treated, while the thickened sludge can be treated in a subsequent technology. Settling tanks provide a liquid retention time of a few hours (enough to ensure quiescent settling of settle able solids).

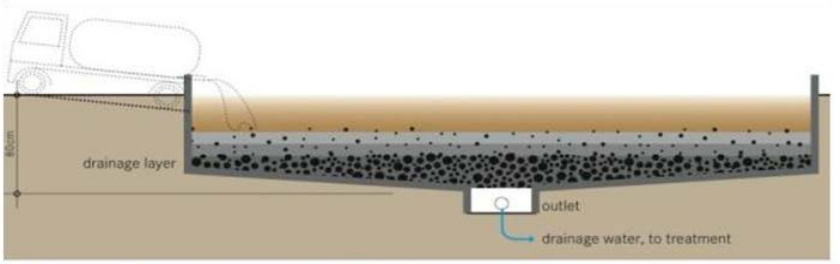


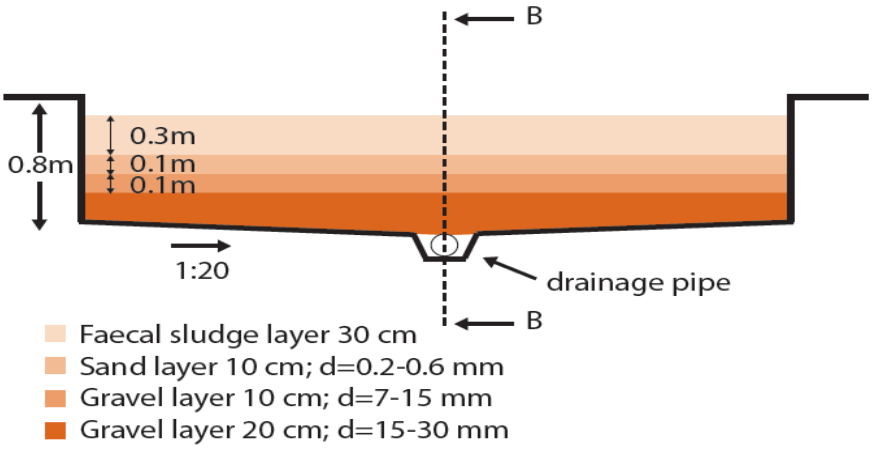
Here input is faecal sludge and output is dried Septage and effluent, which can be used in agriculture, arboriculture and pastures. This treatment option can be coupled with sludge drying bed or co-composting for treatment of thickened sludge. This technology is affected by seasonal changes and can be efficiently used in hot and temperate climate. The discharging area must be maintained

and kept clean. The thickened sludge must be removed mechanically when the sludge has thickened sufficiently. Septage and effluent may require further treatment.

2. Sludge drying bed / Unplanted sludge drying bed

An unplanted sludge drying Bed is a simple, permeable bed that, when loaded with sludge, collects percolated leachate and allows the sludge to dry by evaporation. Approximately 50% to 80% of the sludge volume drains off as liquid. The bottom of the drying bed is lined with perforated pipes that drain away the leachate. On top of the pipes are layers of sand and





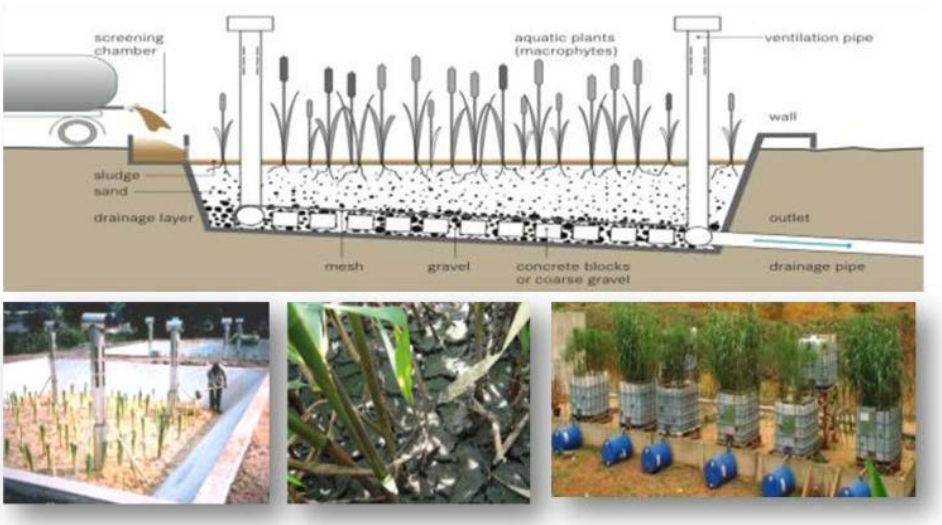
gravel that support the sludge and allow the liquid to infiltrate and collect in the pipe.

In this technique input is faecal sludge and output is treated sludge and effluent, which can be use in agriculture, arboriculture and pastures. Sludge drying bed can be coupled with co-composting for further treatment. This technology is affected by seasonal changes and can be used in hot and temperate climate. Excessive rain may prevent the sludge from proper settling and thickening or this can be avoided by providing transparent sheds over the sludge drying bed.

Over most of the year, the septage drying time is expected to be about seven days; however, an average of 10 days is considered to accommodate longer drying periods during the rainy season. Dried sludge must be removed every 10 to 15 days. Sand must be replaced when the layer gets thin. Treated Septage and leachate may require further treatment based on output quality.

3. Planted sludge drying bed

Planted sludge drying bed is similar to an unplanted drying bed with the benefit of increased transpiration. The key feature is that the filters do not need to be desludged after each feeding /drying cycle. Fresh sludge can be applied directly onto the previous layer; it is the plants and their root



systems that maintain the porosity of the filter. The roots of the plants create pathways through the thickening sludge to allow water to escape more easily.

In this technique input is faecal sludge and output is treated sludge and effluent, which can be use in agriculture, arboriculture, pastures and as cattle fodder. Planted sludge drying bed can be coupled with co-composting for further treatment. It is affected by seasonal changes.

The drains must be maintained and the effluent must be properly collected and disposed off. The plants should be periodically thinned and/or harvested. Treated Septage and Leachate may require further treatment based on output quality

4. Co-composting

Co-Composting is the controlled aerobic degradation of organics using more than one feedstock. Faecal sludge has a high moisture and nitrogen content while biodegradable solid waste is high in organic carbon and has good bulking properties. There are two types of Co-Composting designs: open and in-vessel. A Co-Composting facility is only appropriate when there is an available source of well-sorted biodegradable solid waste. Mixed solid waste with plastics and garbage must first be sorted.

In this technique input is faecal sludge and biodegradable organic solid waste and output is compost which can be use in agriculture, arboriculture and pastures. It is affected by seasonal changes and depending on the climate (rainfall, temperature and wind) the Co-Composting facility can be built to accommodate the conditions. At places where there is heavy rainfall covered facilities are especially recommended.

Careful monitor of the quality of the input materials & track of the inflows, outflows, turning schedules, and maturing times is required to ensure a high quality product. Turning must be done periodically.

5. Deep row Entrenchment (Trenching)

It consists of digging deep trenches, filling them with sludge and covering them with soil. Trees are then planted on top, which benefit from the organic matter and nutrients that are slowly released from the FS. Availability of land is a major constraint & distance to groundwater bodies. This technology is feasible in areas, where the water supply is not directly obtained from the groundwater and groundwater table is low.

6. Mechanical Dewatering

Mechanical dewatering is normally associated with large wastewater treatment plants and is used to separate sludge (residual sludge from wastewater treatment plants or faecal sludge from on-site sanitation) into a liquid and a solid parts. These techniques are usually sophisticated and costly for smaller systems to be implemented on community level. The process does not treat the sludge, it only separates solid from liquid parts.

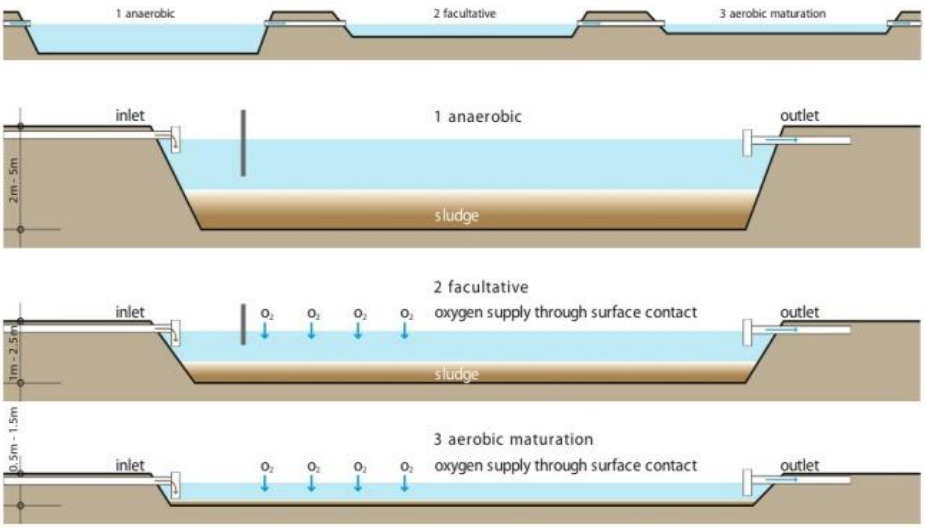
Both solid and liquid parts still contain pathogens and pollutants and further treatment is necessary. Mechanical parts need periodical inspection and replacement.

In this technique input is faecal sludge and output is black water, organic solid waste, compost/biosolids which can be use in agriculture, arboriculture and pastures. It requires to be coupled with co-composting or incineration treatment technique. This technology is not affected by seasonal changes as it is entirely depends on mechanical process. This technology requires less space.

7. Waste Stabilization Pond (Non - aerated)

WSP comprises pre-treatment units (tanks or ponds) for solid-liquid separation followed by a series of one or more anaerobic ponds and one facultative pond.

A number of problems may arise where waste stabilisation ponds are used to treat municipal wastewater and co-treat FS. In many instances, the problems are linked to the fact that the wastewater ponds were not originally designed and equipped to treat any additional FS load. In this technique input is faecal sludge and output is sludge & effluent, which can be use in agriculture, arboriculture, pastures, ground water recharge in deep aquifer and in desert areas. It requires to be coupled with co-composting or sludge drying bed. It can be implemented at neighbourhood level or city level. This technique is affected by seasonal changes.



As per sanitation experts and review of various technical documents, it was analysed that waste stabilization pond is good option for treatment of wastewater but not a good option for treatment of Septage.

8. Advanced nutrient recovery

Wastewater, municipal sludge or the ash after dried sludge, which is incinerated or disposed of, can be a very rich source for nutrients, in particular phosphorus and nitrogen. There is a wide range of promising technologies emerging which can convert septage to phosphorus and nitrogen. Some of these techniques are still not fully developed. These technologies are expensive and require engineering knowledge to guarantee a sustainable and long-term operation of the facility.

In this technique black water, faecal sludge and grey water is converted to fertilizer and treated waste which can be use in agriculture, arboriculture, pastures, ground water recharge in deep aquifer and desert areas. This technology is highly expensive.

The following table details out advantage, disadvantages and prevalence of this composting technologies.

Table 2: Advantages, Disadvantages & Prevalence of Septage to Compost technologies

Sr. No.	Description	Advantages	Disadvantages	Prevalence in India/Abroad
1	**Sedimentation ponds /Settling Tank/ thickening ponds**	• Can be built with local available materials • Low capital and operating cost • No energy requirement • After sedimentation, sludge is used for agriculture / tree plantation.	• A major minus is the smell, especially if fresh undigested Septage is coming from public toilets. • Large land requirement • Post treatment required for both solid and liquid effluent through SDB or Co-composting	Accra/Ghana & Bangkok, Alcorta (Argentina)
2	**Sludge drying bed / Unplanted sludge drying bed**	• No energy requirement • Can be built with local available materials • Moderate capital cost and low operating cost	• Requires large area • Only applicable during dry seasons or needs a roof during rainy season	Punjab (100 villages) World Bank Project; Accra, Ghana, USA , Dakar, Senegal, Malaysia
3	**Planted sludge drying bed**	• Can handle high loading • Moderate capital cost; Moderate operating cost • No energy requirement	• Requires large land area • Long storage time • Requires expert design and operation • Leachate requires	Europe, USA, Thailand, Dakar senegal, Africa

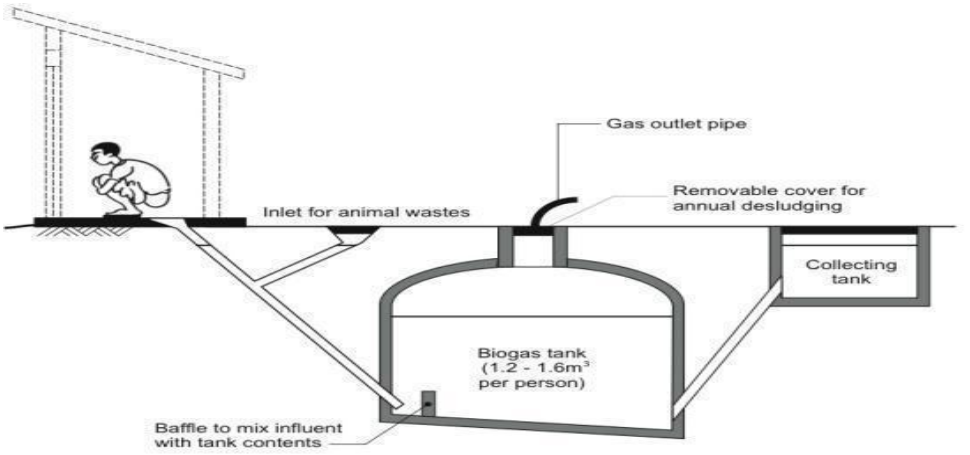
Sr. No.	Description	Advantages	Disadvantages	Prevalence in India/Abroad
		• Widely used by DEWATS for sewage treatment; could as well be used to treat Septage after diluting by mixing with sewage.	secondary treatment • Large de-sludging cycle hence larger area required • More capital and O&M cost as compared to unplanted SDB	
4	**Co - Composting**	• Best combination of cheap bio-technology and agriculture • Good choice for most Indian hot weather cities. • Low capital & operating cost • Easy to set up and maintain and can be built with local materials • No energy requirement	• Requires large land area • Requires segregated organic waste • Long storage times • Operational issues in terms of constant mixing required	Massachusetts, U.S.A; Kalpabriksha Compost Plant in Kathmandu, Bangladesh. Till recently in Dhrangadhra (Gujarat) and Barshi (Maharashtra)
5	**Deep row entrenchment (Trenching)**	• No expensive infrastructure or energy required • Odours are eliminated. • Risk of exposure to pathogens is reduced	• Large land requirement • Not feasible where GW is high	China, south-East Asia, Africa
6	**Mechanical Dewatering**	• Reduces volume of sludge • Process can be fully automated • Requires less space	• Constant power supply required • Need expert design • Both dewatered sludge and effluent requires post treatment	Vizag: built and operated by Pune based Thermax company, Malaysia
7	**Waste**	• No energy	• Not a good option	

Sr. No.	Description	Advantages	Disadvantages	Prevalence in India/Abroad
	stabilization pond (Non - aerated)	requirement • Low O&M cost	for treatment of Septage alone • Requires wastewater for process to work • Requires large area • Requires expertise for design and operation	
8	**Advanced nutrient recovery**	• Recovery of nutrients • Effluent requires no further treatment • Production of fertiliser	• Highly expensive technology • Requires expert knowledge • Some processes are still in development stage • Not proven technology • Sludge requires further treatment	

Septage to energy

1. **Bio-Methanation/Anaerobic biogas reactor**

   In this treatment technology there is microbes driven anaerobic decomposition of organic components in faecal sludge to biogas. Faecal sludge & organic solid waste is converted to treated sludge, effluent and Biogas. Pretreatment of sludge is required but not compulsory. To start the reactor, active sludge (e.g. from a septic tank) should be used as a seed. The tank is essentially self-mixing, but it should be manually stirred once a week to prevent uneven reactions. However once stable state reached, stirring not essential. Gas equipment should be cleaned carefully and regularly so that corrosion and leaks are prevented. Grit and sand that has settled to the bottom should be removed once every year. Bio-Methanation/ Anaerobic biogas reactor option is popularised by Sulabh organization in India.



Advantages:

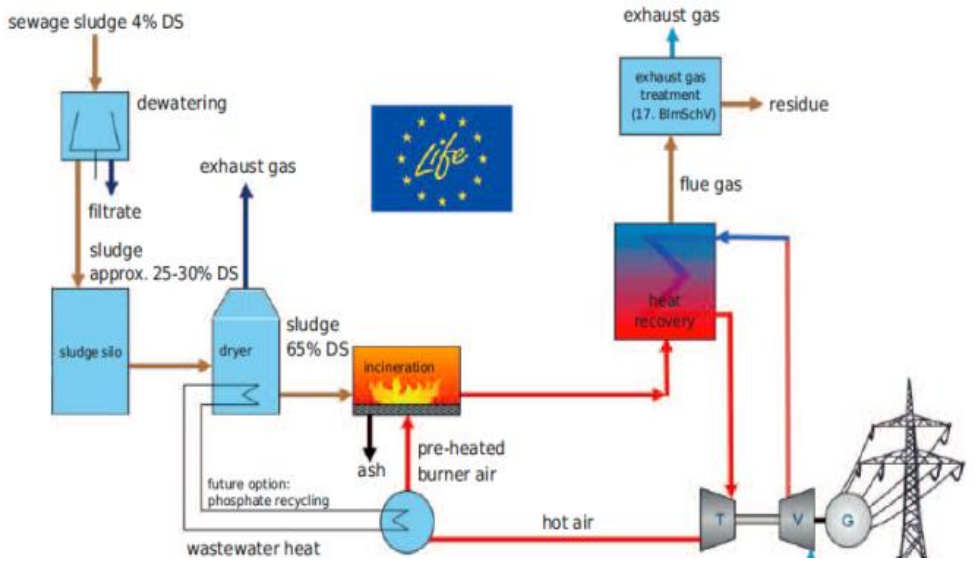
- Established and mature technology.
- Best suitable for wastes with high moisture content.
- Technology could be optimized for any scale.
- Considerable reduction in the emission of greenhouse gases like methane is possible.

Disadvantages:

- There are concerns with odour and pathogen dissemination from the digestate.
- Issues are there in controlling microbial activity if the digester is beyond a certain size.
- Affected by temperature less efficient in colder climates

2. Incineration

In Incineration treatment option there is oxidation of organics in the sludge under the conditions of complete aeration or oxygenation and requires high temperature. Incinerators are a useful technology to combust household waste, medical waste, slaughter waste, etc. instead of discharging it in a landfill. Furthermore, heat and energy may be recovered and it helps to avoid open burning of municipal waste which creates much more harmful emissions and endanger human health and environment. In this treatment sludge is converted to heat. Drying of sludge is required prior for treatment in incinerators. This technology requires trained operators. There is risk of malfunction if not properly maintained and operated.



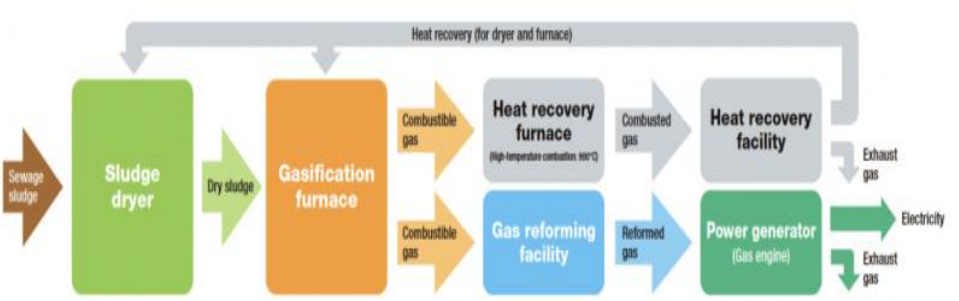
Advantages: Incineration is relatively a simple technology for treating all kinds of wastes.

Disadvantages:

- Liberates considerable amounts of emission
- Sludge incineration costs are not attractive to be used in India
- Sludge incineration is not proven in India

3. Gasification

In Gasification treatment technology there is thermal transformation of organic mass under limited supply of air/oxygen to Syngas. In this technology sludge is converted to syngas & biochar. Drying of sludge is required prior for treatment in incinerators. This technology also requires trained operators and there is risk of malfunction if not properly maintained and operated.



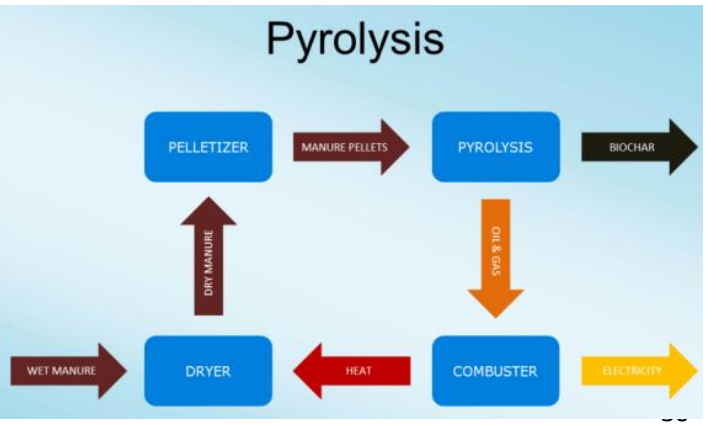
Advantages: Technology best suitable for dry feed stocks. The produced gas can be converted into any type of fuel by FT synthesis.

Disadvantages:

- Gasification of faecal sludge is a relatively new concept in India.
- Process is very energy intensive, as wet feedstock cannot be used directly in a gasifier.
- The process is economically less viable.

4. Pyrolysis

In pyrolysis treatment technology there is thermal conversion of carbonaceous materials in sludge to



produce complex oil in the absence of air/oxygen. In this technology sludge is converted to Bio-oil, Pyrolytic Gas and Bio-char. Here also drying of sludge is required prior for treatment in incinerators. This technology requires trained operators and there is risk of malfunction if not properly maintained and operated.

Advantages: Energy recovery efficiency is high.

Disadvantages:

- Pyrolysis has been attempted only for the treatment of plastic and related feed stocks so far.
- This process is also energy intensive like gasification, as more energy is needed to dry of feedstock.
- High capital and operational costs make the process economically less viable.

Annexure 6. Safe reuse/disposal of treated septage[10]

For dewatered septage/sludge can be used as fertilizer in agriculture application, it should satisfy the following criteria of Class A Bio-solids of US EPA: A faecal coliform density of less than 1000 MPN/g total dry solids, Salmonella sp. density of less than 3 MPN per 4 g of total dry solids. WHO (2006) suggests Helminth egg concentration of < 1/g total solids and E coli of 1000/g total solids in treated septage for use in agriculture

MSW Rules (2000) recommended the quality for compost as referred to Table below.

Table 3: Compost Quality as per MSW Rules, 2000

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

In the absence of any standards, it is recommended that these be adopted until such time standards are notified by the Central Pollution Control Board.

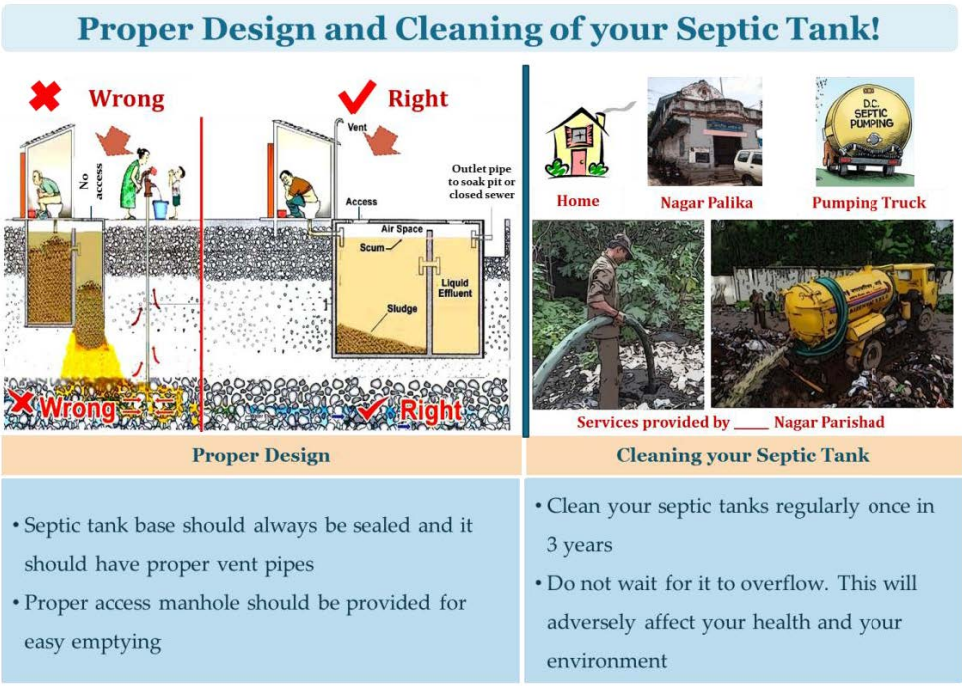
Properly treated sludge can be reused to redaim parched land by application as soil conditioner, and/or as a fertilizer. Deteriorated land areas, which cannot support the plant vegetation due to lack of nutrients, soil organic matter, low pH and low water holding capacity, can be reclaimed and improved by the application of treated septage. Septage sludge, as a result of lime stabilization has pH buffering capacity that is beneficial for the reclamation of acidic soils. Treated septage contains nutrients in considerable amounts, which supports the growth of a number of plants.

[10] Source: Advisory note: Septage Management in Urban India, Ministry of Urban Development, Government of India. (2013) and Guidelines for 'Open defecation Free Towns' under Mahatma Gandhi Swachhata Mission, Government of Gujarat.(2015)

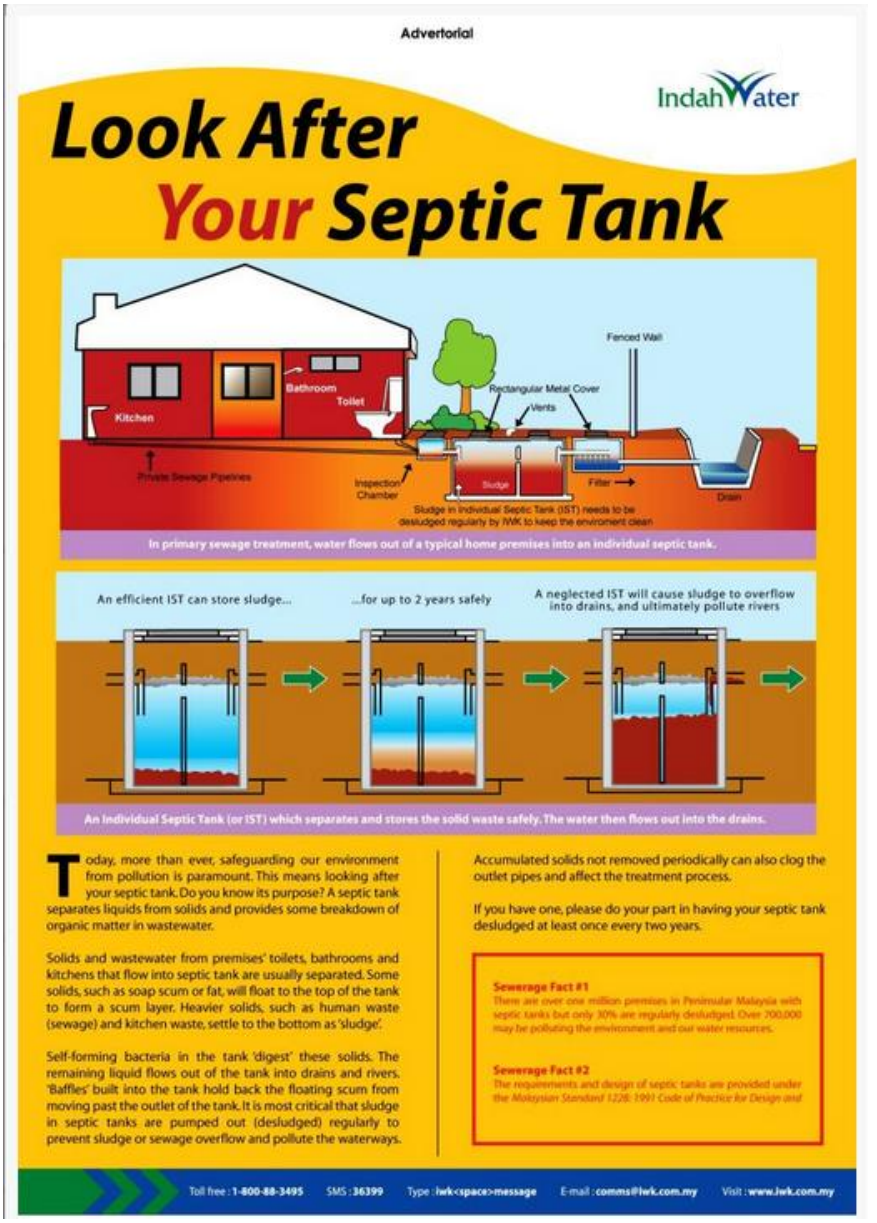
Drip irrigation is the preferred irrigation method for settled septage effluent when irrigation is feasible. Crops which could be safely grown are corn, fodder, cotton, trees including fruit trees, eucalyptus and poplar.

Aquaculture can be practiced for settled septage effluent when freshwater is available to achieve dilution to ensure dissolved oxygen is above 4 mg / l. Fish species of tilapia and carp are preferred since they tolerate low dissolved oxygen. Both drip irrigation and aquaculture need land and are feasible at city outskirts.

Annexure 7. Sample IEC materials

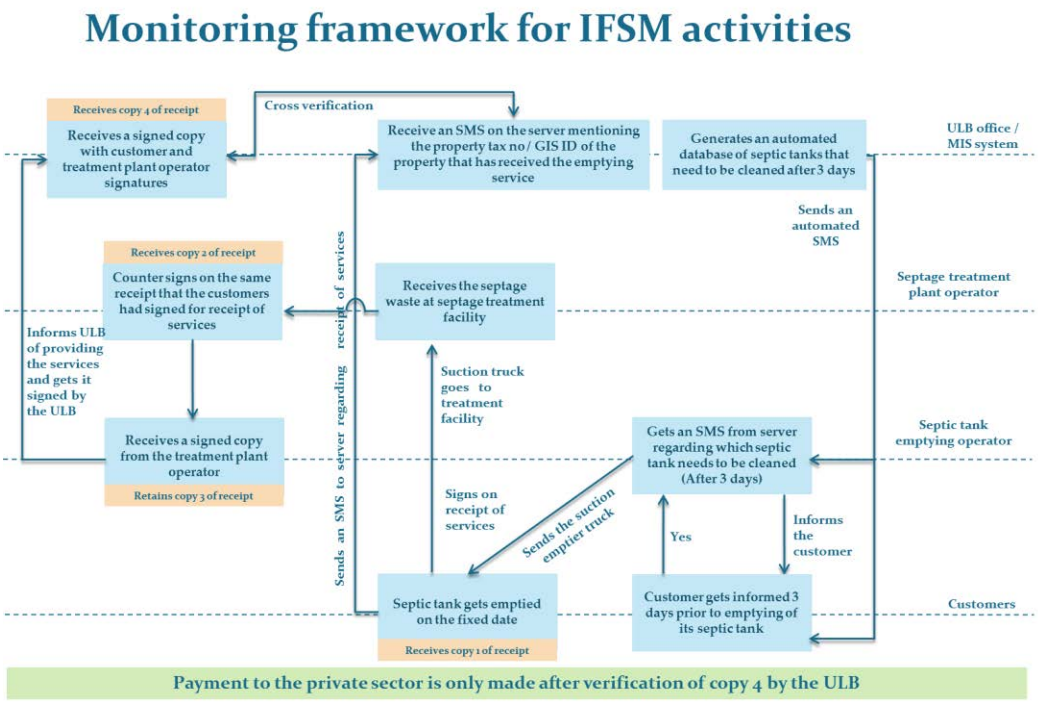


Source: IEC material used for awareness generation activities in Wai and Sinnar by CEPT University / AIILSG



Source: Indah Water, Malaysia, as shown in advisory note: Septage Management in Urban India, Ministry of Urban Development, Government of India. (2013)

Annexure 8. Monitoring framework for IFSM activities[11]



[11] Source: Monitoring framework to be used for monitoring septage management activities in Wai and Sinnar by CEPT University / AIILSG / Urban Local Body

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10. Performance Assessment System. www.pas.org.in

These Guidelines are prepared with support of CEPT University under Performance Assessment System (PAS) Project in consultation with Government of Maharashtra.

pas performance assessment system

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Annexure C

Odisha Urban Septage Management Guidelines, 2016

For Urban Local Bodies in Odisha

Contents

1. Background

The overall goal of the Odisha Urban Sanitation Strategy, 2011 on the lines of the National Urban Sanitation Policy (NUSP) of India is to transform urban areas in Odisha into community-driven, totally sanitized, healthy and liveable cities and towns since efficient sanitation services has a profound impact on quality of life of citizens. To attain this goal, safe management of human excreta including its safe containment, transport, treatment
and disposal is of utmost importance.

The "on-site sanitation" systems like septic tanks ensure containment of human excreta at the household level, thus reducing the risk of human exposure to hazardous pathogens present in human excreta. Septic tanks generate both a liquid and solid (sludge or septage) waste streams, however the liquid waste is designed to discharge into the surrounding soil through a soak pit.

In the absence of functional sewerage systems and treatment facilities in all the Urban Local Bodies (ULBs) in Odisha the reliance on on-site sanitation systems for treatment of human excreta is very high (around 45% of the urban households are connected to septic tanks as per Census 2011) and the septage removed from the on-site sanitation systems in ULBs of Odisha are currently discharged locally, thus creating negative impact on the urban environment and on public health.

Given this context, Housing & Urban Development Department, Government of Odisha intends to put in place a set of operative guidelines for ULBs that will formalize and provide for safe handling of septage in the entire sanitation delivery chain (containment, emptying, transport, treatment, and disposal/reuse) and aim to achieve the goals of Odisha Urban Sanitation Strategy, 2011.

These guidelines conform to the advisory note on septage management developed by Ministry of Urban Development (MoUD), Government of India and the guidelines on design and construction of septic tanks issued by the Bureau of Indian Standards (BIS) and the Central Public Health and Environmental Engineering Organization (CPHEEO). Further, these guidelines are intended to strengthen the existing framework focused on implementing the provisions of the Prohibition of Employment as Manual Scavengers and their Rehabilitation Act, 2013 in the state of Odisha.

The operational procedures outlined in these guidelines are applicable to all ULBs of Odisha and covers following areas:

- Framework on septic tanks including standard design and construction;
- Adoption of desludging procedure for the septage generated;
- Safe Transportation of septage from collection point to receiving facility;
- Technological intervention for proper treatment of septage, disposal and re-use;
- Public awareness

2. Design of Septic tanks

Septic tank is a watertight, on-site treatment system for human excreta. If properly located, designed and constructed, septic tank can provide long-term, effective treatment of human excreta.

2.1 Standard size and design for the construction of Septic tanks

2.1.1 The design, construction and installation of septic tanks shall be in accordance with the provisions of the a) National Building Code of India, 2005; b) Bureau of Indian Standards, Code of Practice for Installation of Septic Tanks; c) Manual on Sewerage and sewage treatment systems, CPHEEO, 2013; d) Swachh Bharat Mission Guidelines, 2014 and all relevant laws or directions prevailing at the time. The specifications for the construction of septic tanks are described in ***Annexure I.*** The indicative sizes of septic tank as recommended by IS:2470 of Bureau of Indian Standards and CPHEEO Manual for Sewerage and Sewage Treatment for 5 users and up to 300 users are given below:

No of Users	Length(m)	Breadth(m)	Liquid depth for 2yrs. Cleaning period(m)	Liquid depth for 3yrs Cleaning period (m)
5	1.5	0.75	1.0	1.05
10	2.0	0.90	1.0	1.40
15	2.0	0.90	1.3	2.00
20	2.3	1.10	1.3	1.80
50	5.0	2.00	1.0	1.24
100	7.5	2.65	1.0	1.24
150	10.0	3.00	1.0	1.24
200	12.0	3.30	1.0	1.24
300	15.0	4.00	1.0	1.24

The typical sketches of septic tanks for 5 to 20 users is presented in ***Annexure II A & II B.***

2.2 Standardization of Septic tanks

2.2.1 If it comes to the notice of ULB, that a household does not have any on-site treatment facility or the septic tank does not meet the standard design and construction norms, the ULB may issue a notice to the owner of the premise to construct, replace or appropriately modify the septic tank in order to meet the standard design and construction norms.

3. Desludging of septic tanks

When the sludge in septic tank exceeds 2/3rd of its total depth, it is time to remove sludge from the septic tank by adopting certain definite procedures. It is pertinent to highlight that regular desludging improves the performance of septic tanks and effluent quality. For proper desludging, involvement of owners of the premises connected to septic tanks are also necessary.

3.1 Regular Operation and Maintenance

3.1.1 The owner of a premise connected to septic tank shall be responsible for:

(a) Operation and maintenance of the septic tank and ensuring that, its parts and components are fit for purpose, operational and kept in good order so as to prevent risks to human health or the environment.

(b) Checking the sludge level at least once in a year, so that the sludge shall not emit, discharge, seep, leak or otherwise escape from the septic tank, or part thereof into surface water or onto the surface of the ground.

(c) Ensuring that roof water or surface water run-off shall not enter a septic tank.

(d) Informing the ULB for emptying the septic tank, when the sum of the depth of scum and the sludge exceeds two-third of the depth of the tank or as and when required.

3.2 Desludging

3.2.1 The ULB shall ensure that desludging shall be carried out by the sanitary workers of the ULB or by the registered and authorized septage transporters. Only registered vehicle shall be engaged by the registered septage transporter in the collection and transportation of septage. The ULBs shall develop detailed Regulations for registration of septage transporters and septage transportation vehicle. A sample permit/registration certificate is presented in ***Annexure III***.

3.2.2 The ULB shall ensure that the operation and cleaning of septic tanks shall be carried out only by using mechanical devices. The desludging trucks shall be fully equipped with required tools, equipment and spares for the operation. A checklist of tools and equipment is presented in ***Annexure IV***.

3.3 Precautions to be taken before/during desludging

3.3.1 The septage transporter shall take the following precautions before/during desludging:

(a) The vehicle driver shall ensure that the vehicle is parked properly, check wheels, set parking brakes, place safety cones and prepare the vehicle for pumping.

(b) It should be ensured that the sanitary workers are provided with all required safety gears.

(c) The septic tank shall be ventilated by keeping cover open for sufficient time before starting the operation.

(d) The sanitary workers shall never enter septic tank since entry of man into septic tank is banned.

(e) Care should be taken during the pump back operation when, friction fittings may come apart thus exposing workers to unintended hazards

(f) Entire contents of a tank should never be emptied at locations of high ground water. If the ground water level is above the bottom of the tank, floating condition will occur. In such conditions, enough contents in the tank shall be left out to counter act the uplift pressure. Local enquiry may be made from the area to obtain this information.

3.4 Desludging Procedure

3.4.1 After adhering to the necessary precautions, the desludging may be carried out by the sanitary workers following the procedure given below:

(a) The sanitary workers shall undertake visual inspection of the interior and exterior of the tank after opening the access covers and check for:

i. Level of water/sludge with respect to the flow line of outlet pipe

ii. Back pressure

iii. Whether inlet pipe and sanitary tee are in place

iv. Cracks in the wall using mirror on a long pole

v. Number of compartments - If more than one, sanitary worker needs to locate and remove lids from all the compartments. Each compartment will need separate pumping.

vi. Indication for high ground water, saturated soils.

(b) The sanitary workers shall use a long handle-rod to determine the sludge level in a septic tank.

(c) Workers shall take out the hoses and fittings from the tool box required to complete pumping.

(d) To probe the tank, the hose shall be lowered slowly to the last length of hose, to get an indication on the volume of sludge to be pumped

(e) Then the hose shall be connected to the truck. Screw or clamp fittings shall be used in case back pressure is required to break up the sludge masses.

(f) Next, the pump or vacuum equipment shall be engaged. The worker must:

i. Ensure suction and operation of pump by checking rapid decrease in volume of tank.

ii. Monitor the level gauge on the septage cleaning tank. Always ensure there is adequate volume in the cleaning tank to accommodate the load. If only partial load can be pumped, monitor the levels closely.

iii. Monitor the septic tank as pumping progresses. Also check for blockages at the inflow and outflow pipes

iv. Check the tank for remaining sludge after pumping. Ensure that 1-2 inch of sludge should be left in the tank to facilitate future decomposition

(g) If accumulated solids are still remaining, the workers shall initiate the pump back procedure, which will send the pumped septage back to the septic tank under pressure and direct this flow towards the sludge mass. This will break the mass, making it possible to pump out again. As little as 200-300 litres will be enough to break the mass.

(h) After pump-back is completed, pumping out of the septic tank shall be done again. The above steps can be repeated if required. Pumping from the tank shall be continued till about 100-200 litres of septage remains in the tank after cleaning.

(i) On completion of pumping, the hose shall be washed with water by directing water stream back to the tank, and the cleaned hoses shall be placed back in the truck tool box.

(j) Before leaving the site, the workers shall ensure that the tank lids/access cover is securely placed.

3.5 User charges and its collection

3.5.1 All the owners of the premises connected to a septic tank shall pay a user charge, as notified by the ULB under the Regulations, from time to time for desludging their septic tanks, transport and treatment of septage.

3.5.2 All the owners of the premises who have their own on-site wastewater treatment system certified by the ULB as functional and compliant and also those who are connected to the existing sewage network may be exempted from paying user charge.

3.5.3 The ULB shall revise the charges based on revisions in costs involved from time to time. Such user charges shall include cost of desludging, transportation, treatment and disposal.

3.5.4 The user charges may be collected from the owners of the premises by any of the following mode of collection:

(a) The ULB may authorize any person including septage transporter to collect user charges from the owners of the premises connected to a septic tank. A Memorandum of Understanding (MOU) shall be entered into and executed between the ULB and authorized septage transporter which authorizes the latter to collect the charges and remit the amount to the ULB.

(b) The user charges may be added to monthly water charges or property tax, or could be a special municipal environment fee or pay-as-you-desludge programme.

3.6 Safety Measures

3.6.1 The desludging shall be carried out using appropriate procedures, equipment, safety gear and operating practices which are in compliance with all relevant laws or directions prevailing at the time.

3.6.2 The safety of the workers engaged for desludging are vested with the transporter and he must ensure that:

(a) all desludging workers must wear appropriate protective attire, carry safety gear and accessories including shoulder length fully coated neoprene gloves,

rubber boots, a face mask, and eye protection as specified in the Prohibition of Employment as Manual Scavengers and their Rehabilitation Rule, 2013;

(b) all the safety equipments are checked for proper working before proceeding to the collection site;

(c) first aid kit, gas detection lamp and fire extinguisher are kept in the vehicle before it goes to the collection site;

(d) there are sufficient disinfectant on the vehicle before it goes to the collection site;

(e) all desludging workers are to be trained to use the safety gear and follow hygiene practices;

(f) smoking should be strictly prohibited while working at the septic tank;

(g) all desludging workers must be immunized for tetanus, hepatitis A and B;

(h) desludging workers shall never enter into the septic tank as entry into manholes/septic tanks is banned;

(i) children must be kept away and the tank lids are always secured with screws and locks;

(j) all desludging workers must wash their hands immediately after contacting with septage / septage handling tools and equipment, and always before eating and drinking;

(k) the workers must be cautious while performing desludging process as excessive weight on lid or manhole cover may result breakage.

3.7 Monitoring Mechanism

3.7.1 The ULB shall devise a framework for monitoring the desludging services provided by the authorized private septage transporters and define the performance metrics that may be linked to the payment in terms of performance incentive or penalty in case of non-performance. An indicative monitoring mechanism for septage management activities is given in ***Annexure V.***

4. Septage Transportation

After desludging of septage from premises, it has to be transported to the approved treatment site designated by the ULBs for safe disposal or reuse. The septage transporter is primarily responsible for the safe transport of septage. The ULBs shall need to ensure that handling, transport and disposal are in compliance with the Environment Protection Act, the Water Act, and the Municipal Solid Waste Management (Handling) and Management Rules.

4.1 Transportation Plan

4.1.1 To ensure safe transportation of septage, the septage transporter in consultation with ULB shall prepare a transportation plan which shall include:

(a) Scheduling and routing for trucks; and

(b) Customer service protocols

4.2 Responsibility of Septage Transporter

4.2.1 The septage transporter must ensure that:

(a) the registered septage transport vehicle including all equipments used for the transport of septage shall have a leak-proof body and lock to secure the septage; comply with applicable standards and must be able to withstand a collision with another vehicle or any permanent structure;

(b) the tank and equipments used to transport septage shall not be used for the transportation of any other materials or liquids;

(c) the vehicles used to transport septage shall be equipped, at all times, with spill control or absorbent materials and disinfectant materials such as lime or chlorine bleach;

(d) the company name, contact number, company logo, and body number of the septage transportation vehicle are displayed on both sides of the vehicle. The information shall be marked using permanent and legible lettering at least 3 inches high and of reflective material;

(e) list of emergency contact numbers are pasted at the prominent place in all vehicles involved in septage transport;

(f) most competent trained driver are employed for transportation of sludge and septage;

(g) each worker wears a proper uniform with company logo on dress and hold identity cards;

(h) the vehicle involved in transportation is cleaned and washed inside as well as outside every day; the vehicles and equipment shall be serviced, and greasing, oiling, minor repairs, etc. are done at least twice a month;

4.2.2 The septage transporter shall retain the documentation relating to all stages of septage management i.e. desludging and transportation for a minimum period of 5 years.

4.2.3 The septage transporter shall retain registration related documentation permanently and shall present such documentation on request by any authorized official.

4.3 Septage Transportation Procedure

4.3.1 All the septage transportation vehicles shall be directed to transport septage to the designated treatment sites. Movement of vehicle without a valid license by the ULB shall attract fine and/or even seizure of vehicle.

4.3.2 Prior to starting the journey, the driver shall ensure that the vehicle is well equipped with spill control or absorbent materials and also disinfectant materials like lime and chlorine bleach.

4.3.3 The driver of the vehicle shall take the most convenient and congestion free route considering traffic flows and plan the trip to arrive at the treatment site within the specified operating hours.

4.3.4 While transporting septage, the driver and worker shall ensure that there is no discharge or emptying of septage into locations other than designated treatment sites.

4.3.5 At the disposal site, the truck must be parked in such a way that the septage may be directed to the inlet chamber with one length of hose, wheels need be checked and parking brakes need be placed properly, then the valves be opened and septage allowed to flow by gravity into the collection chamber.

4.4 Accidental Spillage

4.4.1 In the event of accidental spillage of sludge/ septage, the septage transporter must:

(a) Immediately take action to contain the sludge/septage, minimize the environmental impact, and begin clean-up procedures

(b) Disinfect the area of spillage by sprinkling bleach solution or lime in the area and wash it with water after 15 minutes

(c) Notify the ULB authority immediately

4.4.2 In the event that a septage transporter fails to perform cleanup operations, the ULB shall perform the clean-up and charge all the related expenses incurred to the septage transporter including applicable fines and penalties.

5. Septage Treatment and Disposal

The onsite sanitation system may fail if the collected sludge has not been properly treated in a suitable treatment system and disposed. Septage can be treated in a variety of ways, and there is no single best option, given the wide varying conditions of the septage. The treatment options like using natural processes, including lime treatment, stabilization ponds, drying beds and composting, are the most cost-effective and widely used solutions in treating septage.

The first stage of septage treatment, mostly involves the stabilization of the septage and the separation of the solid and the liquid. In this way, the liquid part can be treated separately with natural wastewater treatment technologies. The solid part can be treated to enhance its characteristics for either landfilling or agricultural reuse.

Hence, septage treatment involves different treatment options and in choosing the most appropriate treatment option, a balance between treatment cost and land requirement must be achieved to suit local factors like population density, hauling distance, technical capacity of the ULB and private operators.

Furthermore, septage treatment facilities can be either privately or publicly owned. The privately owned systems relieve ULBs of the burden of operating and maintaining a facility, and monitoring septage deliveries.

5.1 Designated Treatment Facilities

5.1.1 Only approved and designated treatment facilities by the ULBs shall be used for processing and treatment of the septage.

5.2 Service Provider and accreditation

5.2.1 The ULB may operate a treatment facility and in the absence of service facilities, may contract with private service providers, provided that, they must have necessary funds to support capital expenditures and operating and maintenance expenses of their septage management systems. To become accredited, service providers shall be required to obtain the permits/certifications as required by the ULB from time to time.

5.3 Treatment & Disposal

The septage can be treated either at sewage treatment plant or at independent septage treatment facility. A brief description of these two types of treatment is given below.

5.3.1 Treatment at Sewage Treatment Plant:

If a sewage treatment plant (STP) exists or planned in an ULB, septage can be co-treated with sewage, provided the STP has sufficient capacity to treat the additional septage load.

The septage arriving at the STP shall usually be discharged into a receiving facility which consists of an unloading area (sloped to allow gravity draining of septage) with screen arrangements, a septage storage tank designed based on expected volume of septage generated in ULB.

The septage in storage tank shall be properly mixed by mixers/air diffusers. The septage shall be transferred from the storage tank to the treatment unit with grinder pumps.

When the capacity of the STP is not sufficient to treat raw septage, the option of co-treatment of sewerage with effluent from septage treatment can be considered. Since the primary treatment eliminates the suspended solids, the STP can then treat much higher volumes of liquid effluent than of raw septage.

5.3.2 Treatment at Independent Septage Treatment Facility:

When STPs is not available or the existing plant is of insufficient capacity or its location is too far, a treatment facility specially meant for septage treatment becomes the option to consider. Specified location of treatment facility is to be authorized and notified by the ULBs from time to time, in compliance with the Environment (Protection) Act, 1986 and the Water (Prevention and Control of Pollution) Act, 1974.

The key treatment steps at a septage treatment facility are:

Pre-treatment of septage – Pre-treatment is a physical treatment to ease handling the sludge for further treatment. The plant site is to have an unloading area with screen arrangements to remove large size particles like plastics, rags from the septage.

Digestion of Sludge **-** As the septage brought to the treatment facility is in partly digested condition, it produces noxious odour and hence the sludge has to be treated by anaerobic process to degrade the organic matter under controlled conditions. This can be achieved in an anaerobic digester/ Anaerobic baffled reactor (ABR). Also it is imperative to remove the liquid portion of the sludge for the effective treatment of septage.

Solid and liquid separation – The solid and liquid portions can be separated and they can be treated depending upon its loading pattern and various relevant parameters. The solids can be separated in a planted / unplanted drying bed or a geomembrane tube. The liquid can be treated in a ABR / CW / Stabilization Pond.

Further treatment of solid sludge can be achieved by composting for reuse. Composting is the aerobic decomposition of the organic matter in the sludge to a relatively stable humus-like material similar to fertilizer.

The final effluent can be discharged into surface water after chlorination or can be re-used for gardening, agricultural purpose without causing any harm to the environment and risk to public health.

In addition to the existing technologies, any other emerging technology may be considered for treatment at independent septage treatment facility.

5.3.3 Disposal

The dried sludge shall be spread on designated land and disposed for land filling purposes. The ULB shall ensure that the sanitary landfill is located above the highest ground water level and located in close proximity to septage treatment plant. The types of area to be avoided for landfills are:

(a) Sources of ground water and groundwater recharge aquifers,

(b) Wetland, habitat and ecological areas with conflicting land use like parks, historical monuments and recreational areas.

(c) Prone to landslides, underlying mine areas, sinkholes, or near earthquake faults.

The ULB shall select the site for treatment & disposal in consultation with the District Collector, Pollution Control Board and the general public.

5.3.4 Reuse

The dried sludge acts as organic fertilizer hence it may be applied to agricultural field, forests and plantation areas. Co-composting of septage with the organic fraction of municipal solid waste (MSW) like food wastes, paper, leaves, branches etc. is also possible.

The reuse of sludge must be in accordance with the WHO Guidelines on the reuse of human excreta, wastewater and grey water, 2006.

5.4 Responsibilities of the Treatment Plant Operator

5.4.1 The operator of the treatment facility shall be responsible for:

(a) Operating the septage treatment facility during working hours only;

(b) Testing the input quality of the collected septage for presence of any metal or traces of industrial waste and ensuring that no commercial or industrial waste is unloaded in these facilities;

(c) The sanitary landfill workers shall cover the disposed sludge/septage with 15 cm of soil cover every day and final cover of 2 feet within a week after the placement of final lift;

(d) Maintenance of minimum amenities at the treatment facilities including hand wash facilities and toilet/ bathroom, drinking water, medicated soaps and approved hand-drying machines and first aid kits.

6. Administration and Enforcement

For effective and efficient administration and enforcement of septage management system in the city or town, the ULBs shall monitor through a Committee constituted at the ULB level, with such composition as it may deem fit through a notification.

6.1 Functions of the Committee

6.1.1 The function of the Committee shall be to:

(a) Oversee the conduct of a survey of all properties and premises to determine if a septic tank is present, and if it is accessible for desludging

(b) To accredit and license septage transporters, service providers or treatment facilities

(c) To review and approve the applications for accreditation of service providers and to recommend the same for approval

(d) To receive and hear complaints from residential owners and issue directions for their appropriate redressal

(e) Serve notices of non-conformance to the provisions of the Regulation prepared by the ULB to the owners/administrators, or occupants

(f) Visit properties for the purpose of inspection, observation, measurement, sampling and testing

(g) Plan and implement an information, education and communication (IEC) program for municipal staff, resident welfare association, community organizers, self-help groups, general public, septage transporters and private operators on wastewater management and the city's septage management.

6.2 Violations and Penalties

6.2.1 The ULB shall by way of Regulation list the violations and prescribe penalties thereto if a person is found guilty of contravention of the provisions of the Regulations. The Committee shall review implementation of the Regulation with regard to compliance and penalties, and recommend revisions.

6.3 Record keeping and reporting

6.3.1 The ULB shall be responsible for record keeping of information relating to all stages of septage management i.e. desludging, transportation, treatment and disposal. These information includes, but are not limited to, the following:

(a) Data on the households and other properties with septic tanks

(b) Buildings and structures who have desludged their septic tanks

(c) Volume of septage generated, treated and disposed

(d) Septage Transporter's information including operator-in-charge for each location, vehicle details

(e) Name and location of Treatment Facilities earmarked for disposal of septage

(f) Public Grievances

6.3.2 The service provider shall retain other documentation relating to all stages of septage management i.e. desludging, transportation, treatment and disposal for a minimum of 5 years, and shall, on request by an authorized official, present such documentation.

6.4 Complaint redressal system

6.4.1 The ULB shall set up a complaint redressal system to monitor the performance of the private sector operators in terms of whether they are emptying the septic tanks properly or not and to monitor whether they are dumping the septage at the designated site or not.

7. Information, Education and Communication

The information, education and communication needs pertaining to septage management must be addressed to ensure successful implementation of the guidelines.

7.1 Public Awareness

7.1.1 Members of the Resident Welfare Associations, community-organisers, self-help groups and the general public shall be periodically sensitized about:

(a) the need for a robust septage management system including health hazards associated with improper collection and treatment of septage and the ill-effects of unscientific disposal of septage;

(b) the standard design and construction of septic tanks, proper desludging procedures, transportation, treatment and safe disposal methods of septage;

7.2 IEC for ULB officials

7.2.1 The State Government shall organize periodic training for the ULB officials on:

(a) septage management and its best practices;

(b) the standard design and construction of septic tanks, proper desludging procedures, transportation, treatment and safe disposal methods of septage;

(c) need for periodic inspection of tanks; and

(d) safety standards.

7.3 IEC for septage transporters and other private operators

7.3.1 ULB shall conduct periodic training programmes for all septage transporters and private operators for safe handling of septage at the time of desludging and transporting.

8. Public Private Partnership for Septage Management

For sustainability of septage management in the city, the ULB shall be required to draw a long term financing and investment plan. While public funding shall be needed to finance septage management systems, facilities, equipment and manpower, the ULB may innovatively explore Public Private Partnership (PPP) options wherever possible.

8.1 Structuring of an appropriate PPP Option

8.1.1 Prior to structuring of an appropriate PPP option, the ULBs need to assess work profile, interests and capacity of private sector players doing septage management activities in Odisha and explore their willingness to undertake various activities in the sanitation value chain as per their competencies and interests.

8.1.2 The ULBs need to consider the following aspects before selecting an appropriate PPP structure:

(a) Operational role of the private player;

(b) Source of revenue to meet the private players' return expectations;

(c) Investment/ownership of capital assets;

(d) Payment structure;

(e) Contract length and value;

(f) Risk mitigation and allocation measures for the private player and the ULB.

Annexure I

Specifications for septic tank design and construction

- The sizes of septic tanks as recommended by IS:2470 of Bureau of Indian Standards and CPHEEO Manual for Sewerage and Sewage Treatment for 5 users and up to 300 users are to be adopted.The septic tank is to be sized properly with appropriate detention time and volume;
    - Septic tanks are normally designed as rectangular tanks with a length to breadth ratio of 2:1 keeping liquid depth as 1-2m considering cleaning (desludging) interval of 2-3 years
    - A free board of minimum 30 cm should be kept over the liquid depth.
    - The walls of septic tanks preferably are of RCC structure having minimum thickness of 150 mm. It can also be constructed in brick with wall thickness not less than one brick length in cement mortar 1:4, and should be plastered both inside and outside in cement mortar 1:3.(1cement:3sand).The bricks used shall be KB bricks, the compressive strength of which shall not be less than 35 kg/ cm^2.
    - It should be water tight
- Concrete is a common material for septic tank construction. Steel, wood, or other materials that are subject to decomposition in soil should never be used.
- There shall be proper inlet and outlet arrangements;
    - The inlet and outlet should be located as far away as possible from each other (preferably on both ends) and at different levels to avoid short circuiting of liquid
    - The floor should have minimum slope of 1:10 sloping towards the sludge outlet to facilitate easy removal of sludge.
- Septic tanks of more than 2000 litres capacity may have 2 compartments separated by a baffle wall, the second compartment being half of the capacity of 1_{st} one. For septic tanks of more than 100 users capacity, 2 chambers are to be constructed each of half of the total capacity.
- Hanging baffles of 45-60cm wide shall be provided after the inlet to make the inflow quiescent, and before the outlet, so as to prevent scum going out with the effluent. The baffles should dip 25-30cm into the liquid and project 15cm above the liquid surface. A ventilation pipe not less than 50mm dia should be provided and the top of which should be covered with mosquito proof wire mesh.
- There should be an access port for each compartment that allows inspection and pumping

Annexure D

Tamil Nadu

Septage Management Guidelines, 2014

ABSTRACT

Septage Management - Operative Guidelines for Septage Management for Urban and Rural Local Bodies in Tamil Nadu - Approved - Orders - Issued.

Municipal Administration & Water Supply (MA. 3) Department.

G.O.(Ms) No. 106. Dated : 01.09.2014

Read:

From the Commissioner of Municipal Administration Letter Roc. No. 47718/2013/UGSS-2, dated 31.07.2014.

ORDER:

Sanitation is one of the important works of the Urban Local Bodies. However due to absence of Under Ground Sewerage Scheme in many of the Local Bodies in the State, untreated sewage and waste is disposed on unscientifically, resulting in large scale population and environmental degradation. Vision 2023 of the Hon'ble Chief Minister envisages to ensure that all have access to safe sanitation including open defecation free and garbage free environment which includes the implementation of underground sewerage scheme and waste water Treatment Plants across local bodies in order to provide better sanitation facilities.

2) The Commissioner of Municipal Administration, in his letter read above, has stated that adequate attention needs to be given to septic tank design, operation and even to collection of sewage from their tanks, their transportation and processing and he has prepared a draft Operative Guidelines on Septage Management, which can regulate periodical cleaning of septic tanks, Transport, Treatment, Re-use and scientific disposal.

3) The Commissioner of Municipal Administration has requested the Government to issue orders to implement the Operative Guidelines for Septage Management in Urban and Rural Local Bodies in Tamil Nadu.

4) The Government, after careful examination of the above proposal, approve the Operative Guidelines for Septage Management in Urban Local Bodies and Rural Local Bodies in Tamil Nadu. The Operative Guidelines for Septage Management is annexed to this order.

5) The Principal Secretary/Commissioner, Corporation of Chennai, Commissioner of Municipal Administration, Director of Town Panchayats and the Director of Rural Development & Panchayat Raj are requested to strictly follow the above guidelines and communicate the guidelines to the concerned officials under their control.

(By Order of the Governor)

K. PHANINDRA REDDY,
PRINCIPAL SECRETARY TO GOVERNMENT

To

The Principal Secretary/Commissioner,Corporation of Chennai,
Chennai – 3 (with enclosure)
The Commissioner of Municipal Administration,
Chennai – 5 (with enclosure)
The Director of Town Panchayats,
Chennai – 108 (with enclosure)
The Director of Rural Development &
Panchayat Raj, Chennai – 15 (with enclosure)
The Principal Secretary to Government,
Rural Development & Panchayat Raj Department,
Chennai – 9 (with enclosure)
The Principal Secretary to Government,
Agriculture Department, Chennai – 9 (with enclosure)
The Secretary to Government,
Health & Family Welfare Department,
Chennai – 9 (with enclosure)
The Principal Secretary to Government,
Transport Department, Chennai – 9 (with enclosure)
The Managing Director, Tamil Nadu Water Supply &
Drainage Board, Chennai – 5 (with enclosure)
The Managing Director, Chennai Metro Water Supply &
Sewage Board, Chennai – 2 (with enclosure)
The Chairman & Managing Director, Tamil Nadu Urban
Infrastructure Financial Services Limited,
Chennai – 17 (with enclosure)
The Chairman & Managing Director, Tamil Nadu Urban Finance &
Infrastructure Development Corporation Limited,
Chennai – 35 (with enclosure)

Copy to

The Senior Personal Assistant to Hon'ble Minister (MA, RD, Law,
Cts. & Pri.), Chennai – 9 (with enclosure)
The Municipal Administration & Water Supply (MA.II/MA-IV/
MC-I/MC-II/MC-VI/MW/WS.I/WS.II/WS.III/WS.IV/TP.II/
OP.II) Department, Chennai – 9 (with enclosure)
Stock File/Spare Copies.

// Forwarded By Order// 2.9.2014
SECTION OFFICER.

MA&WS (MA.3) DEPT.

ANNEXURE TO G.O. (Ms) No. 106, MA&WS, dated 01.09.2014.

OPERATIVE GUIDELINES FOR SEPTAGE MANAGEMENT FOR LOCAL BODIES IN TAMIL NADU

Table of Contents

Glossary of Terms

ULB	Urban Local Body / Urban Local Bodies
TNUDP	Tamil Nadu Urban Development Project
NRCP	National River Conservation Programme
NTADCL	New Tiruppur Area Development Corporation Limited
UGSS	Underground Sewerage System
STP	Sewerage Treatment Plant
MLD	Million Liters per Day
MIS	Management Information System
IEC	Information, Education and Communication
GIS	Geographical Information System
TP	Town Panchayat
VP	Village Panchayat
CPHEEO	Central Public Health and Environmental Engineering Organisation
TNIUS	Tamil Nadu Institute of Urban Studies

1. Introduction

The partially treated sewage that is stored in a septic tank is commonly called as Septage. It includes the liquids, solids (sludge), as well as the fats, oils and grease (scum) that accumulate in septic tanks over time. Septage management includes the entire process of design, collection, safe treatment& disposal of septage based on generation of sewage. A comprehensive program that regulates periodic septic tank cleaning, as well as septage transport, treatment, re-use,and disposal is important in the context of our rapidly urbanizing economies.

1.1 Current Scenario in Tamil Nadu

Tamil Nadu is one of the most urbanized states in India with around 48.45% (Census 2011) of the population living in urban areas. In terms of Septage Management, Tamil Nadu has accorded highest priority (Vision 2023) to the implementation of Underground Sewerage scheme and waste water treatment plants across local bodies in order to provide better sanitation facilities.

There are 12 Corporations, 124 Municipalities, 528 Town Panchayats and 12808 Panchayats functioning in the state. The implementation of UGSS in erstwhile Chennai Corporation is cent percent covered and out of the 42 ULBs annexed in the process of expansion, only few towns are having sewerage system and others are in proposal stage. With respect of other Municipalities and Corporations, implementation of UGSS scheme is underway in 41 ULB's with financial assistance from Government of India, World Bank assisted TNUDP-III, German Bank assisted KfW, NRCP & NTADCL. Out of these 41 ULBs, UGSS has been so far completed in 20 ULBs with limited coverage. Another 22 UGSS schemes have been announced during 2012-13 of which work is in progress in Ariyalur, Perambalur and Tiruchirapalli to extend UGSS to under-served areas and core areas of Nagercoil.

The ULB wise capacity of the STPs and the present flow received at STPs is given in the table below.

Table 1 - ULB Wise Capacity of STP's, Present Flow and Percent Utilization

#	Name of the ULB	Year of Commissioning	Capacity (in MLD)	Technology	Present flow (in MLD)	% Utilization
1	Chennai	-	649.00	ASP	500.00	77.04%
2	Chinnamanur	2012	4.00	ASP	2.00	50.00%
3	Coimbatore	2010	70.00	SBR	25.00	35.71%
4	Dharmapuri	2013	5.00	ASP	0.02	0.40%
5	Dindigul	2012	13.00	ASP	0.50	3.85%
6	Kanchipuram	2012	14.70	WSP	6.00	40.82%
7	Karur	2007	15.00	ASP	6.00	40.00%
8	Kumbakonam	2009	15.00	ASP	7.00	46.67%
9	Madurai (2 Nos)	2011	172.00	SBR	25.00	14.53%
10	Maraimalai Nagar	2010	2.50	EAP	0.50	20.00%

#	Name of the ULB	Year of Commissioning	Capacity (in MLD)	Technology	Present flow (in MLD)	% Utilization
11	Mayiladuthurai	2007	10.83	WSP	6.00	55.40%
12	Namakkal	2012	7.00	ASP	1.20	17.14%
13	Pallavapuram*	2011	0.00	ASP	9.00	0.00%
14	Perambalur	2013	5.00	ASP	1.50	30.00%
15	Ramanathpuram	2013	7.00	ASP	1.00	14.29%
16	Thanjavur	2007	24.00	ASP	8.00	33.33%
17	Thiruvannamalai	2013	8.70	ASP	0.02	0.23%
18	Tirunelveli	2007	28.00	WSP	8.00	28.57%
19	Tiruppur	2008	15.00	ASP	8.00	53.33%
20	Trichirapalli	2007	58.00	WSP	40.00	68.97%
21	Udgamandalam	2000	5.00	ASP	2.00	40.00%
TOTAL			**1128.73**	**-**	**656.74**	

* (linked with CMWSSB STP)

1.2 The Need for Decentralized Septage Management system in Tamil Nadu

Even as cities create more underground sewerage infrastructure, the septic tank often remains an integral component of the sewerage scheme. So far, only 35% of Tamil Nadu's urban population is covered by UGSS. Many **local bodies do not have the capacity** to create and manage assets for treatment of liquid waste as these involve **large investment and long gestation** periods. On the other side, there are reports of **underutilization of existing STPs**, and disposal of **untreated waste into fresh water bodies**. As per Census 2011, 55% of the population continues to dispose waste into **septic tanks, many of which are not designed properly**, and hence sewage does not get treated effectively resulting in fecal contamination.

Presently many institutions, commercial establishments and high rise buildings and even households may let the sewage water into storm water drains illegally and regulators are not able to make these offenders to comply. In areas un-served by sewer systems, there is dumping of sewage collected in underground tanks into water bodies in and around cities. Tankers employed for disposing the sewage may dump the sewage at the closest point from where it was collected.

There is a felt need for framing guidelines for regulation of collection, provision for treatment and safe disposal of septage. This document details out these guidelines.

2. Operative Guidelines for Local Bodies for effective implementation of Septage Management

Septage Management for the local bodies includes both residential and non-residential / commercial waste (excluding industrial waste). These Operative Guidelines for septage management seek to empower the local bodies with knowledge, procedures and facilities.

Box 1 Key Elements of Septage Management

The key elements of Septage Management are:

I. Design and Construction of Septic Tanks
II. Septic Tank Pumping & De-Sludging
III. Septage Transportation
IV. Treatment & Septage Disposal
V. Fees/Charges for Collection, Transportation and Treatment
VI. Information, Education and Communication
VII. Record-keeping and Reporting (MIS)

21 clusters of Local Bodies have been identified based on the existing location of STPs. The local bodies have been grouped in such a way that all collections points are situated at around 18-20 kms of radius of the chosen STP. The clusters have been given in the Annexure. These clusters can be revised as new STPs made under the ongoing Underground Sewerage Schemes are taken into service.

The Operative Guidelines for each of these key elements are as follows.

I. Design and Construction of Septic Tanks

a) **Evaluate existing septic tank designs** and other storage/treatment systems and modify (in case of variation) based on design given in Annexure 1.

b) Issue notice to owners of septic tanks that do not meet the standard septic tank design under Tamil Nadu Public Health Act, 1939

c) Identify **insanitary latrines**[1] **and convert them to sanitary latrines** for safe collection and disposal of waste

II. Pumping and De-Sludging

a) **Conduct Periodic and routine De-Sludging** based on capacity of septic tank.

b) **Collection system for cluster Local Bodies**:Wherever sewage is currently discharged into fresh water or storm water drains, Local Bodies to ensure proper collection (transportation) system, and treatment of septage at the nearest STP and safe disposal.

III. Septage Transportation

a) **Local body clusters** have been identified for treatment of collected septage at earmarked STP locations. All Septage Transportation Vehicles should be directed to transport septage to their designated STP as given in Annexure 2.

b) **Only certified and licensed Septage Transporters to de-sludge and transport waste to the designated STP.** The transporters should be selected in accordance with The Tamil Nadu Transparency in Tenders Act, 1998, as per the terms and conditions detailed in Annexure 3 and Annexure 4.

c) Septage Transportation Vehicle Operators involved in the process of collection, treatment and disposal of sewage should be well trained and equipped with protective safety gears, uniforms, tools and proper vacuum trucks, to ensure safe handling of sewage. The rules under the Prohibition of Employment as Manual Scavengers and their Rehabilitation Act, 2013 provide for a comprehensive list of safety gear that should be used.

IV. Treatment & Final Disposal

a) **Design of Decantation Facility:** Decantation facility should be designed based on expected volumes of septage generated in local body clusters with adequate capacity for the next five years based on urbanization trend in the cluster. The design of a typical Septage Receiving / Decanting Facility is provided in the Annexure 7.

b) **Quality Check:** Input quality of the collected septage should be tested at the decant facility for presence of any metal or traces of industrial waste.

[1] Insanitary Latrines in households are those where night soil is removed by human, serviced by animals or/and night soil is disposed into open drain or pit into which the excreta is discharged or flushed out, before the excreta fully decomposes.

The septage receiving facility should be operational during working hours only and a responsible person should be appointed in the facility to ensure that no commercial or industrial waste is unloaded through these facilities.

V. Information, Education and Communication

a) **IEC for Municipal staff:** Municipal Commissioners, Engineers, Sanitary Inspectors, Health Officers, and Sanitary Workers should be well trained in safe septage management and its best practices. This involves regular training sessions on safe collection, treatment and disposal. Information regarding standard septic tank design, the need for periodic inspection and De-Sludging of sewage, design of a decant facility, tender details for engaging licensed transporters, etc.should be disseminated widely to achieve a safe septage management system. Training should also be provided on safety standards. In this regard, CMWSSB and CMA will design the course material and draft a calendar for training to ensure complete coverage before December2014.

b) **IEC for Residents**: Members of Resident Welfare Associations, community organizers, self help groups and the general public should be sensitized periodically regarding the need for a sound septage management system. The health hazards associated with improper collection and treatment of waste, and the ill-effects of sewage discharge into fresh water/storm water drains should be clearly explained to the residents. CMA will produce sample IEC material and also draft a campaign for residents.

c) **IEC for Septage Transporters** / **Private Vendors**: Local Bodies should ensure all safety norms are clearly explained to the septage transporters. Private Operators and Transporters should be well trained in safe collection and transportation of sewage including vehicle design, process of de- Sludging, safety gears and safe disposal at the nearest STP. CMWSSB and CMA will draft tentative

training calendar for septage transporters / private vendors.

VI. Fees/Charges for De-Sludging, Transportation and Treatment

a) Fees for De-Sludging to be collected from residents by the certified / licensed tanker operators.

b) Transport charges should be determined based on market rates while ensuring that residents are not exploited by the tanker operators.

c) For treatment, the on-going rate of Rs. 150-200 can be charged for 9000litres of waste collected. Periodic revisions for the charges to be effected based on revisions in costs involved.

VII. Record Keeping and Reporting through MIS

a) **Management Information Systems (MIS):** Information related to septage generation from residents and commercial establishments needs to be collected by the Local Bodies. Household level details of insanitary latrines, identification of septic tank location, Operator in-charge for each location, Vehicle Details, Name & Location of STP earmarked for disposal of septage, and decant facility details should be duly collected by all Local Bodies.

b) **Geographical Information System (GIS):** GIS can be used to be plan the **route of septage vehicles** and tracking these for regular record keeping. **Public Grievance Redressal** to also form part of ORFDO_ERGLHV¶ record keeping. Helpline numbers to be also shared with residents.

3. Deliverables for the Local Bodies in the next six months effective from June 2014

Table 2 Activities to be undertaken by Urban Local Bodies for Septage Management

Key Elements of Septage Management	Objectives and Outcomes	Activity to be undertaken by Local Bodies	Timeframe	Means of Verification
1. Design and Construction of Septic Tanks	To ensure all septic tanks are constructed as per standard design and all insanitary latrines are converted to sanitary ones. To ensure that proper design is submitted at time of building plan approval process.	• **Evaluate existing septic tank designs** and other storage/treatment systems and identify cases where septic tank is not constructed as per design. Initial evaluation may be outsourced.	2 months	Records at Local Body of all septic tanks
		• **Modify septic tank** (in case of variation) based on design given in Annexure 1	3 months	Submit correction report to Municipal Commissioner
		• **Issue notice** for septic tanks that do not meet the standard septic tank design as per Tamil Nadu Public Health Act, 1939	1 month	Record of notice issued
		• Identify **insanitary latrines and convert to sanitary latrines** for safe collection and disposal of waste	2 months	Record of all insanitary latrines and progress of conversion
2. Pumping and De-Sludging	Periodic and safe collection of all sewage generated in the Local Body by residential and commercial establishments	• Identify locations where sewage is getting mixed with water bodies or storm water drains and organize collection at designated points. • Create facility to collect sullage water	1 month	Survey sheet as per Annexure 5 to be maintained along with progress report

Key Elements of Septage Management	Objectives and Outcomes	Activity to be undertaken by Local Bodies	Timeframe	Means of Verification
3. Septage Transportation	Safe transportation of sewage by licensed septage transporters in vacuum trucks and safety gears for all staff	• Call for Expression of Interest • Grant licenses (valid for 6 months at a time) for transporting sewage on rate contract basis based on permit licenses given in the Annexure 3 & 4. • Payments to be made directly to the Transporter. • Regional Transport Offices may be contacted for gaining information on vehicles registered	3 months	Tender details, details of selected septage transporters
		• Ensure proper vacuum trucks are transporting sewage with staff adequately equipped with safety gears and other protective equipment required to safely collect and transport sewage	3 months	Vehicle details to be kept with the local bodies
		• Ensure collection efficiency is increased by 10% of the collectable sullage in every 6 months compared to latest figures reported by Local Bodies.	Every 6 months	Maintain records for proof of increase
		• As per the clusters given in Annexure 2, organize efficient routes to the designated STPs or Septage Receiving Facility	3 months	Records of routes Use GIS platform as next phase

Key Elements of Septage Management	Objectives and Outcomes	Activity to be undertaken by Local Bodies	Timeframe	Means of Verification
4. **Treatment and Final Disposal**	Ensure construction of Decanting Facility / Sewage Receiving Facility at all the STPs. Ensure Safe Treatment of Sewage. Hours of operation of decanting facility to be Working Hours. Ensure Increase in Capacity Utilized.	• Design of Decant Facility should be from the approved list as per CPHEEO norms. • Completion of Construction	3 months	Maintain record of each facility and indicate clearly whether it meets prescribed standards
		• Input quality of sewage to be tested to ensure source of collected sewage is residential or commercial establishment and not industrial sources. Tests may be carried out at the Laboratories maintained within the STP	Every 3 months	Submit test reports periodically
		• Increase utilization of STP by 10% every 6 months until the STP is utilized to its full capacity.	Every 6 months	Maintain records for increase
		• Appoint a qualified person on outsourcing basis for monitoring and record keeping.	6 months	
5. IEC Activity	All stakeholders in the septage management system including residents, civic bodies, personnel handling sewage, municipal officials to be given periodical training on safe and best practices in septage management. The importance of safe collection, treatment and disposal of	• **Ensure one training session every 3 months to Local Body staff** on safe collection, treatment and disposal. • Information regarding standard septic tank design, design of a decant facility, tender details for engaging licensed septage transporters, etc. should be disseminated widely to achieve a safe septage	2 Months	Certification by TNIUS.

Key Elements of Septage Management	Objectives and Outcomes	Activity to be undertaken by Local Bodies	Timeframe	Means of Verification
	sewage and the health hazards resulting from improper sewage treatment should be explained clearly to all.	management system. Commissioner of Municipal Administration to arrange for the training		
		• **Ensure monthly engagement with Residents** including Resident Welfare Associations, community organizers, self-help groups. • The general public should be sensitized regarding the need for a sound septage management system. The health hazards should be clearly explained to the residents. • Residents should also be informed about the standard designs for septic tanks.	2 Months	Photographs and Video of the campaign.
		• **Local Bodies to organize orientation session for Septage Transporters / Private Vendors**: Local Bodies should ensure all safety norms are clearly explained to the transporters. Private Operators should be well trained in safe collection and transportation of sewage including vehicle design, process of de-Sludging, safety gears and safe disposal at the nearest STP.	2 Months	Photographs and Video of

Key Elements of Septage Management	Objectives and Outcomes	Activity to be undertaken by Local Bodies	Timeframe	Means of Verification
6. Record Keeping		**Local Bodies** to have proper records and registers of licensed transporters, septic tank locations, De-Sludging activities, household level details, etc.	1 month	Records and registers

Annexure 1: Septic Tank Design

Depending on the geography, soil condition, water seepage capacity of the soil the design can be prepared and approved by the Local Bodies. Proper septic tank design considers the following factors:

- Sized properly with appropriate **sludge detention time, volume and hydraulic retention time**[2]
- **Proper inlet and outlet** structures
- At least **one baffle** separating the tank into multiple compartments
- **Water tight**
- **Access port for each compartment** that allows for inspection and pumping

Table: Recommended sizes of Septic Tank upto 20 users

No. of Users	Length(M)	Breadth(M)	Liquid Depth (Cleaning interval of)	
			2 Years	3 Years
5	1.50	0.75	1.00	1.05
10	2.00	0.90	1.00	1.40
15	2.00	0.90	1.30	2.00
20	2.30	1.10	1.30	1.80
50	5.00	2.00	1.00	1.24
100	7.50	2.65	1.00	1.24
150	10.00	3.00	1.00	1.24
200	12.00	3.30	1.00	1.24
300	15.00	4.00	1.00	1.24

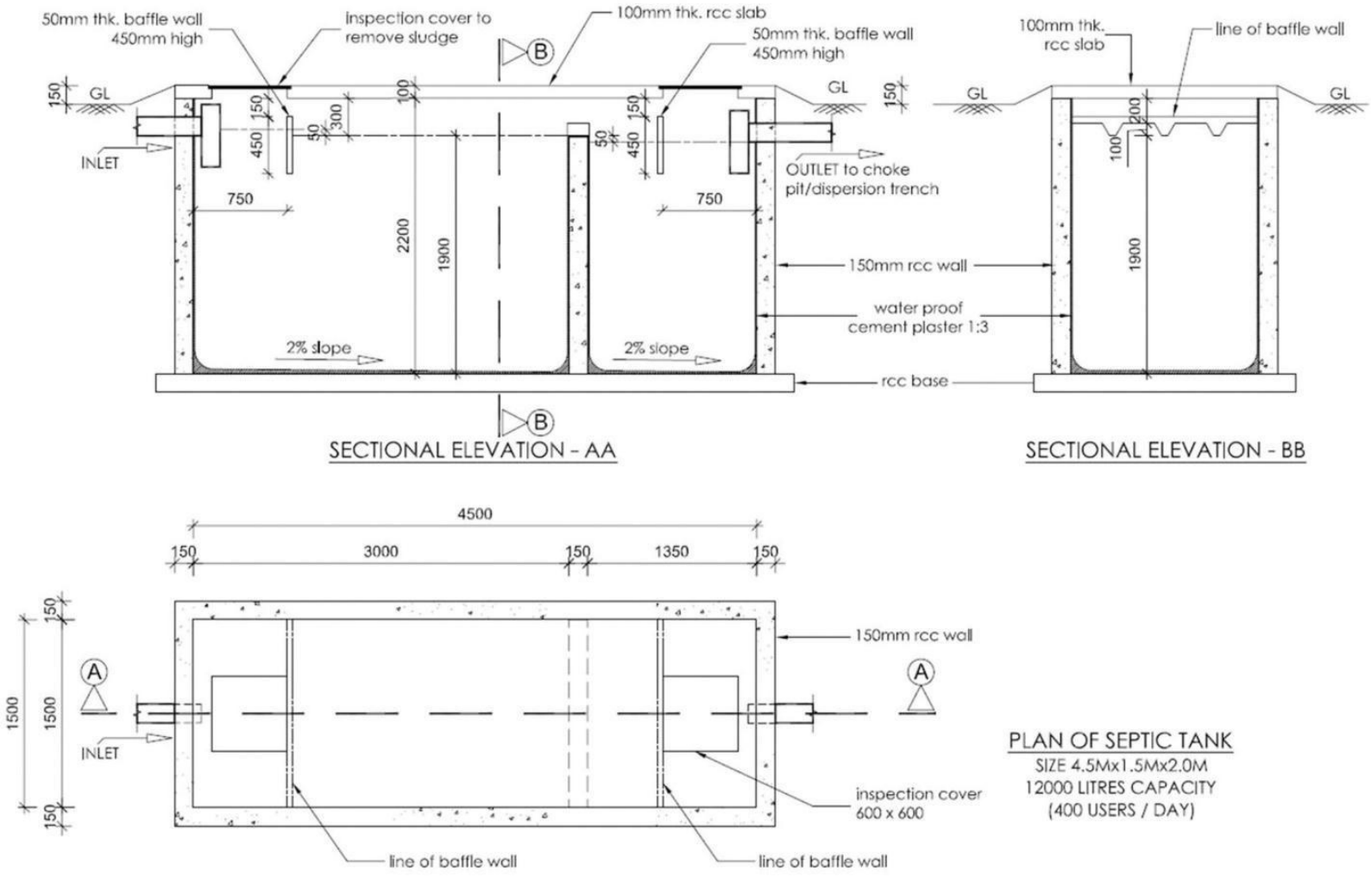
Notes

1. A provision of 300 mm should be made for free board.
2. The sizes of septic tank are based on certain assumption on peak discharges, as estimated in IS: 2470 (Part -1) - 1985 and while choosing the size of septic tank exact calculations shall be made.
3. For population over 100, the tank may be divided into independent parallel chambers of maintenance and cleaning.

Source: CPHEEO manual on sewerage and Sewage treatment (Second Edition)

[2] Hydraulic retention time is the volume of the aeration tank divided by the influent flow-rate. HRT is usually expressed in hours (or sometimes days).

Figure: Sample Septic Tank Design



Annexure 2: Clusters

Existing STP's and Nearby Town Panchayats and Panchayat Union

#	Name of the Municipality	Nearest Town Panchayats	Panchayat Unions
1	Chennai Corporation (7 No's)	Minjur, Thiruinravur, Thirumazisai, Naravarikumppam, Thiruneermalai, Chitlapakkam	
2	Chinnamanur	Kuchanur, Markeyenkottai	Chinnamanur
3	Coimbatore	Sarkar Samakulam, Vedapatty, Perur, Vellalur, Irugur	Periyanaickenpalayam, Sarkarsamakulam, Thondamuthur, Sulur
4	Dharmapuri	Papparapatti	Dharmapuri
5	Dindigul	Thadikombu, Agaram	Dindigul, Athoor, Reddiarchattiram, Shanarpatti, Vedasandur, Vadamadurai
6	Kancheepuram	Walajabad	Kancheepuram, Walajabad, Uthiramerur
7	Karur	Puliyur	Karur, Thanthoni
8	Kumbakonam	Thirunageswaram, Swamimalai, Dharasuram	Kumbakonam
9	Madurai	Paravai	Madurai East, Madurai West, Thiruparankundram
10	Maraimalinagar	N.Guduvancherry	Kattankolattur
11	Myladuthurai	Kuthalam, Vaitheeswarankoil	Mayiladuthurai, Kuthalam, Sembanarkoil
12	Namkkal	Sendamangalam	Elaichipalayam, Erumaipatti, Mohanur, Namakkal, Puduchatram, Paramathi, Senthamangalam
13	Pallavaram	Thiruneermalai, Peerkankarani, Perungulathur, Chitlapakkam	St. Thomas Mount
14	Perambalur	Kurumbalur	Perambalur
15	Ramanathapuram	Nil	Ramanathapuram
16	Thanjavur	Thiruvaiyaru, Vallam	Thanjavur, Thiruvaiyaru, Orathanadu, Ammapettai, Kumbakonam, Thiruvidaimarudur, Papanasam
17	Thiruvannamalai	Nil	Tiruvannamalai, Thurinjapuram, Thandrampet
18	Tirunelveli	Sankar Nagar, Naranamalpuram, Melasheval, Gopalasamudram	Palayamkottai
19	Tiruppur	Thirumurganpoondi	Uthukuli, Avinashi, Palladam, Pongalur, Thiruppur
20	Trichy	Kuthapur	Andanallur, Manikandam, Thiruverambur, Manachanallur
21	Udagamandalam	Kethi, Jagathala	Udagamandalam

Annexure 3: Sample Septage Transporter Permit

Septage Transporter Permit for XXX Municipality

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

NAME OF PERMITTEE:_____
ADDRESS:_____

For the disposal of septage from domestic septic tank or commercial holding tank at the _____ STP.

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

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

EFFECTIVE DATE:

EXPIRATION DATE:

__ CHECK IF RENEWED PERMIT

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

Annexure 4: Collection and Transport Records

Sample Form to be filled by Operator / Transporter of Septage

i. Identification of Waste:

a) Volume

b) Type: ____ Septic Tank ____ Others

c) Source: ____ Residential ____ Commercial ____ Restaurant ____ Portable Toilet ____Others

ii. Details of Waste Generator

a) Name

b) Phone Number

c) Address

d) Pin

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

Date: _____ Signature: _____

iii. Details of Transporter / Operator

a) Company Name

b) Permit #

c) Vehicle License #

d) Pump out date

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

e) Signature of authorized agent and title: _____

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

Disposal date: _____ Amount Collected from Transporter:_____

Signature of authorized signatory and title: _____

NOTE: SUBJECT TO THE TERMS AND CONDITIONS OF _____MUNICIPALITY.

Annexure 5: Sample Survey for Identifying Locations of Sullage Water

This survey may be carried over a period of 7 days to observe the general trend of sullage water being discarded in the open.

Municipality / Corporation Name:

Location Details:

Approximate Quantity of Sullage

Date: - - 2014 / Monday : KL

Date: - - 2014 / Tuesday : KL

Date: - - 2014 / Wednesday : KL

Date: - - 2014 / Thursday : KL

Date: - - 2014 / Friday : KL

Date: - - 2014 / Saturday : KL

Date: - - 2014 / Sunday : KL

Average Sullage Generated Per Day (Sum of the above divided by 7):

Comment on the Method of Observation:

Annexure 6: Sample House Hold Survey for Identifying Septic Tanks, etc.

This is a sample plan for a household survey that can be conducted for Septic Tanks. This form may be considered by ULBs and may be expanded to add new fields.

Municipality / Corporation Name:

Property Details: [These details can be readily obtained from the Property Tax Register of the ULB]

No. of Bedrooms in the Household:

Actual Number of People Living in the Household:

Does the Household have a Water Connection:

Septic Tank Details:

Capacity as Per Plan: [Can be gained from the ULB records]

Actual Capacity:

Location of Septic Tank: Front of House Entrance / Back of House

Can a Septic Tank Cleaning Truck easily reach the tank outlet:

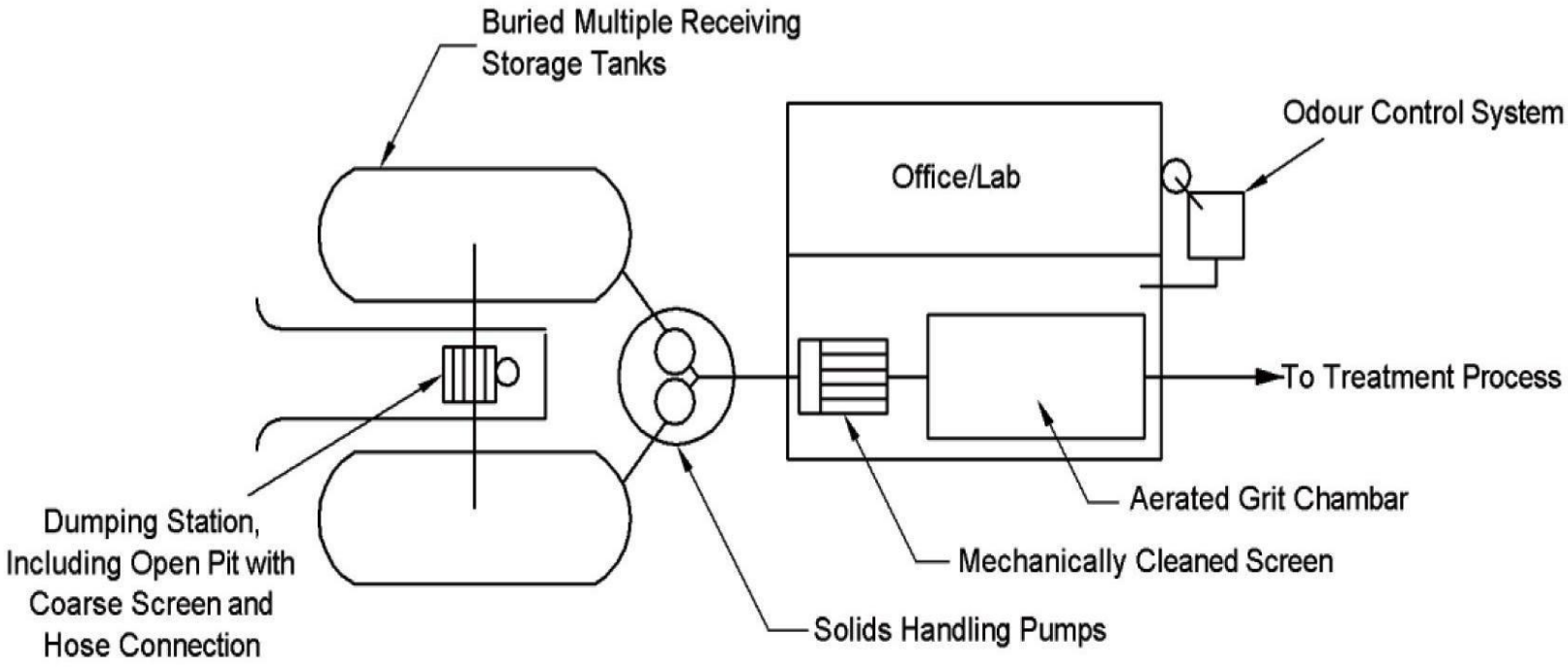
Cleaning Frequency: Every 6 months / Every Year / Every 2 Years / Never

Who is contacted to Provide Septic Tank Cleaning Services: (Name of Agent / Tank Operator, etc.)

Is waste water let out in the open (Yes / No)

Annexure 7: Decant Facility Design

Figure: Sample Septage Receiving Facility



K. PHANINDRA REDDY
PRINCIPAL SECRETARY TO GOVERNMENT COPY//

//TRUE COPY//

N. Shaila 2.9.2014
SECTION OFFICER.

Annexure E

Specifications of twin pit system (From CPHEEO manual)

In water logged area: The pit top should be raised by 300 mm above the likely level of water above ground level at the time of water logging. Earth should then be filled well compacted all-round the pits up to 1.0 m distance from the pit and up to its top. The raising of the pit will necessitate rising of latrine floor also. A typical pour flush latrine in water logged areas is shown in Figure 26

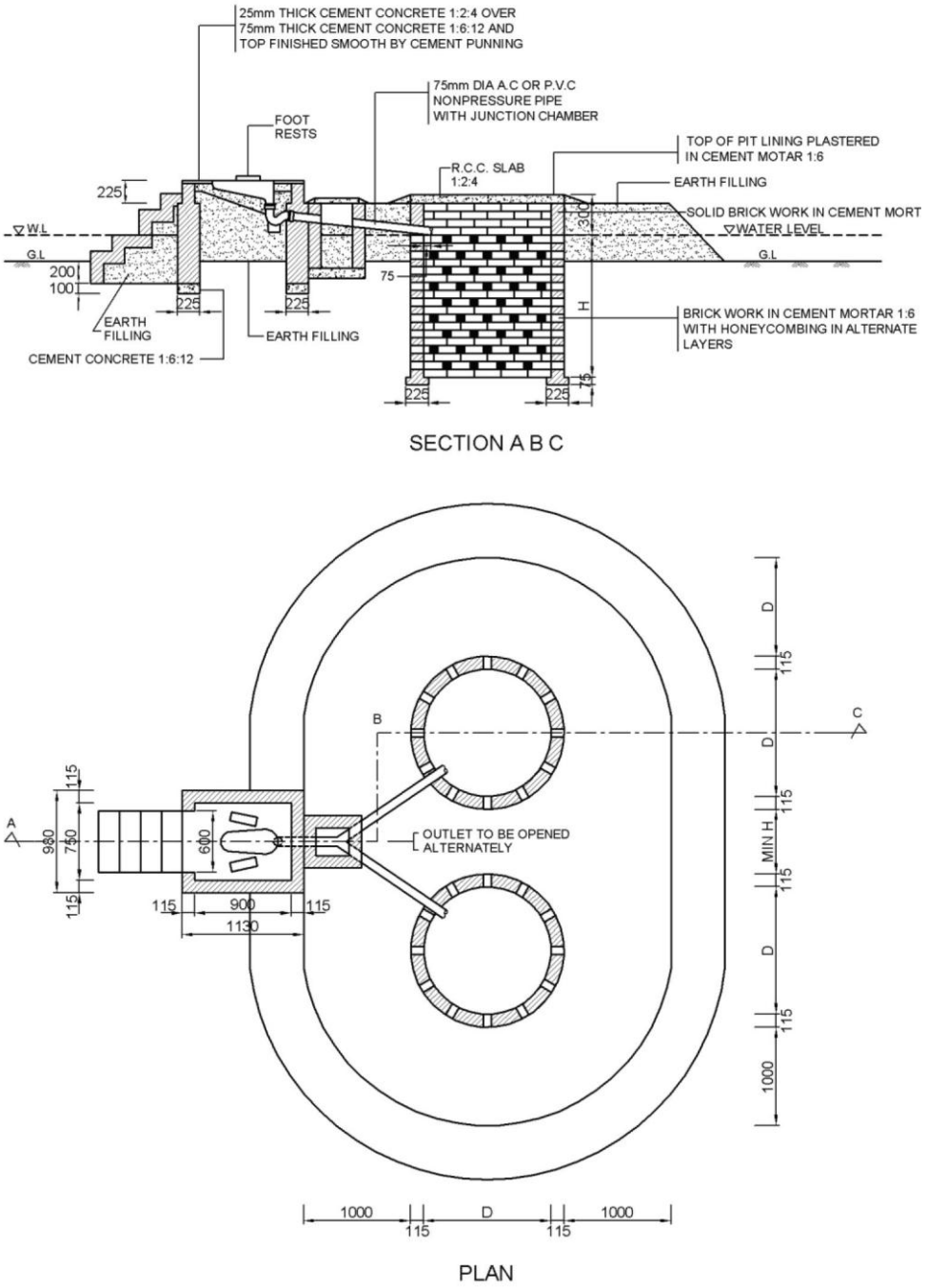


Figure 26 Twin pit for water logged area

In high subsoil water level: Where the subsoil water level rises to less than 300 mm below ground level, the top of the pits should be raised by 300 mm above the likely subsoil water level and earth should be filled all around the pits and latrine floor raised as stated above. A typical pour flush latrine with leach pits in high subsoil water level is shown in Figure 27

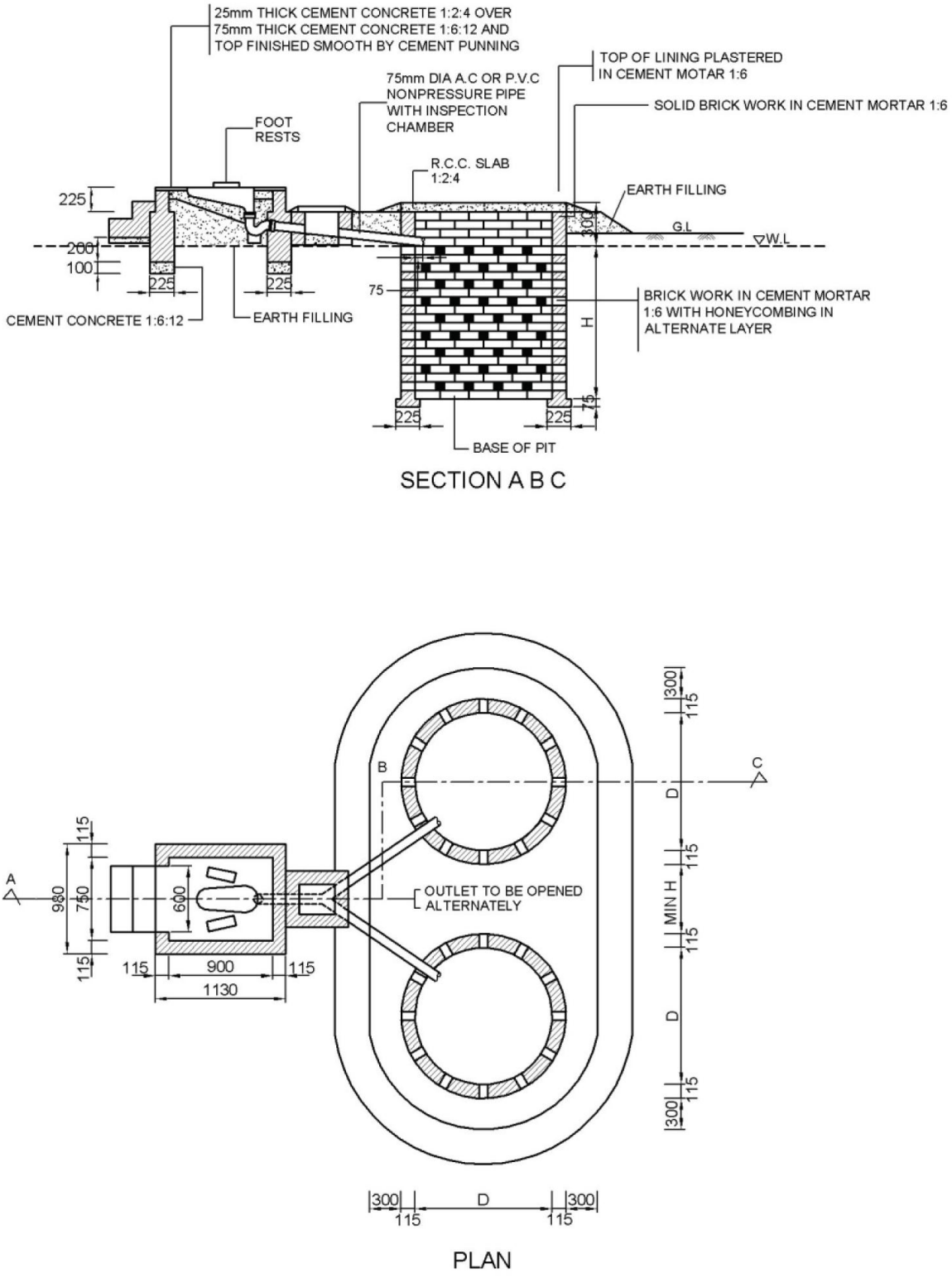


Figure 27 Twin pit in high subsoil water level

In rocky strata: In rocky strata with soil layer in between, the leach pits can be designed on the same principle as those for low subsoil water level and taking the long term infiltrative capacity as 20 l/m2/d. However, in rocks with fissures, chalk formations, old root channels, pollution can flow to very long distances; hence these conditions demand careful investigation and adoption of pollution safeguards as stated in paragraph below.

In black cotton soil: Pits in black cotton soil should be designed taking infiltrative rate of 10 l/m2/d. However, a vertical fill (envelope) 300 mm in width with sand, gravel or ballast of small sizes should be provided all round the pit outside the pit lining.

Where space is a constraint: Where circular pits of standard sizes cannot be constructed due to space constraints, deeper pit with small diameter (not less than 750 mm), or combined oval, square or rectangular pits divided into two equal compartments by a partition wall may be provided. In case of combined pits and the partition wall should not have holes. The partition wall should go 225 mm deeper than the pit lining and plastered on both sides with cement mortar. A typical pour flush latrine with combined pits is shown in Figure 28

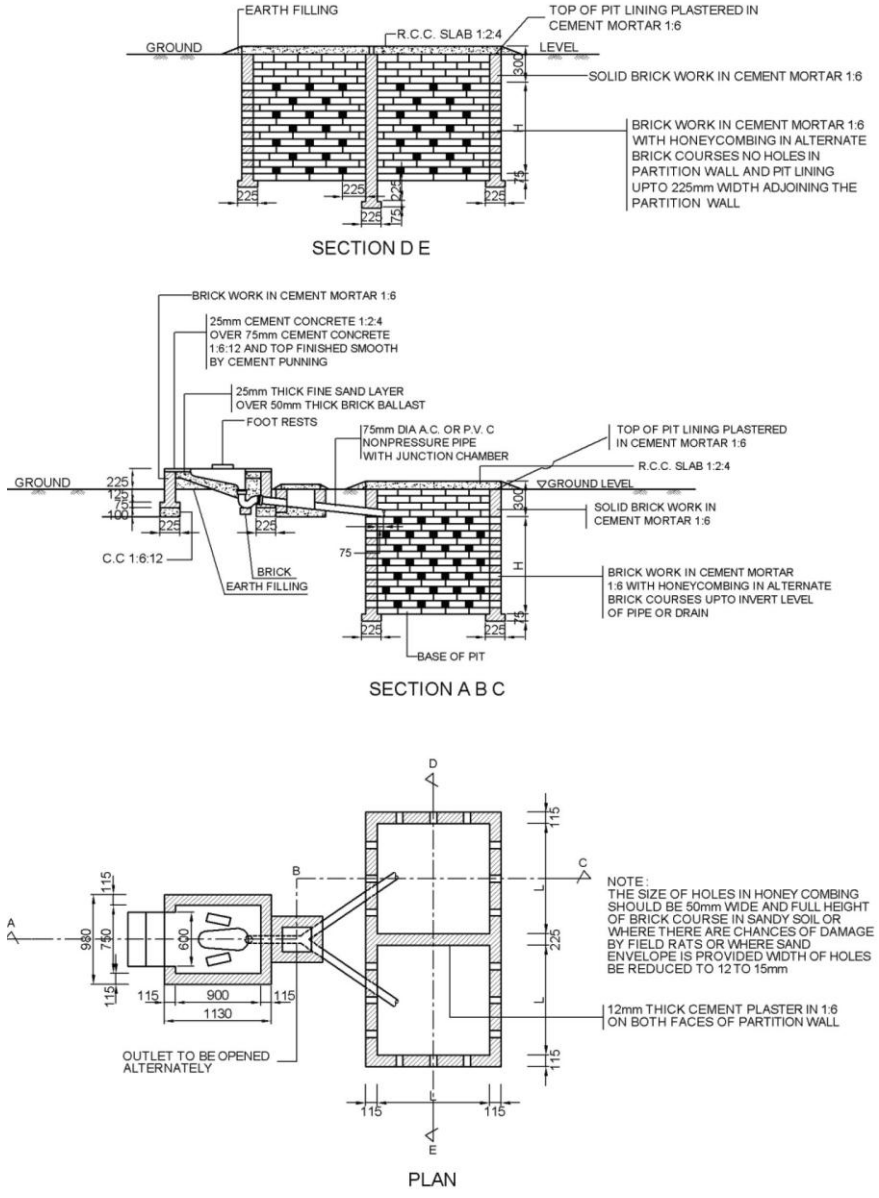


Figure 28 Twin pits in Space constrain location

Annexure F

Recommended sizes of septic tanks (From CPHEEO manual)

Sl. 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

Recommended sizes of twin pits

Pit type	5 users		10 users		15 users	
	Diameter	depth in m	diameter	depth in m	diameter	depth in m
Dry pits	0.9	1.0	1.1	1.3	1.3	1.4
Wet pits	1.0	1.3	1.4	1.4	1.6	1.5

Notes:

1. Depth from bottom of pit to invert level of incoming pipe or drain
2. When groundwater table is below the pit bottom it is a dry pit, when groundwater table is above the pit bottom it is a wet pit

Annexure G

MODEL CHECKLIST

The following checklist provides a ready reference of major considerations that apply for work in a confined space such us sewer, septic tank or soak pit.

PRE-ENTRY

The pre-entry considerations should be at least as follows:

a. **Employee selection**, including evaluation of an employee's aptitude and fitness for task and confined space entry.

b. **Employee training should include the following:**
   - Emergency entry and exit procedures.
   - Use of respiratory protective devices.
   - First aid including cardio-pulmonary resuscitation (CPR).
   - Safety equipment use.
   - Rescue drills.
   - Fire protection.
   - Communications.

c. **Actions required before execution are as follows:**
   - Coordinate planning of work.
   - Coordinate supervising of work.
   - Implement emergency rescue plan.
   - Initiate safe work practices.
   - Signpost work area.
   - Isolate confined space.
   - Evaluate confined space environment.
   - Comparison of initial test results with existing standards to determine
   - Ventilation and/or personal protection requirements.
   - Ventilate and/or provide personal protection.
   - Provide for monitoring of confined space during work.
   - Ensure that standby staff is available for rescue of workers and operation of essential equipment.
   - Ensure rescue equipment is readily available and in order.
   - Authorize entry by permit.
   - Suspend work/evacuate space if conditions change to present real/
   - Potential danger.

DURING ENTRY AND RE-ENTRY

The minimum considerations prior to the entry and re-entry should be as below

- A comparison of initial test results with an existing standard to determine whether ventilation or personal protective equipment will be used.
- Continuous or periodic monitoring of confined space atmosphere.
- Ensure safe work practices followed.
- Reissue permit if conditions change.
- Confirmation that all persons and equipment are accounted for.

AFTER EXIT

The consideration after exit should include the following:

- Ensure safe work practices followed.
- Review of operation - comment on any unsatisfactory aspects.
- Acceptance of completed job.
- Secure the entry point
- Clean the equipment and store it in safe place.

Annexure H

Sample Septage Manifest Form (ULBs should modify this to fit their needs)

Name of the City_____

Date _____ Time _____ am/pm

1. Basic Information (Must be completed by the septage emptier (person)

a. What is the Volume of septage emptied (liters) _____?
b. What is the type of container emptied? (Tick the correct option)
___ Holding Tank ___ Septic Tank ___ Soak Pit___ Other (specify) _____
c. Source: ___ Residential ___ Restaurant ___ Office/commercial ___ Industrial ___ other(__specify___)

2. Generator of septage (Not to be filled in case of Oxidation Pond)

a. Complete name: _____
b. Phone number: _____
c. Complete address with landmarks:
_____
_____

The undersigned being duly authorized hereby certifies to the accuracy of the source and type of collected septage identified above and subject to this manifest.

Date: _____ Signature: _____

3. Information about the wastewater emptier (vehicle):

a. Company Name: _____
b. Type of Vehicle: _____
c. Vehicle Number: _____

d. Where was the waste taken for treatment?
_____
e. Where was the waste dumped?
_____
f. Was the treated septage used for any other purpose?
_____

4. Acceptance by _____Municipal Council

FORM AT COMPOSTING SITE or SEWAGE TREATMENT PLANT
Emptier (Name) _____
Vehicle Number: _____
The above emptier delivered the described septage to this disposal facility and it was accepted.
Disposal date: _____
Signature of authorized official and title: _____

Glossary

Sewer: An underground conduit or pipe for carrying off human excreta, besides other waste matter and drainage wastes.
Source: Manual on Sewerage and Sewage Treatment Systems Part A Engineering, CPHEEO

On-site sanitation: It is underground waste collection system which is used in the absence of piped sewer system. When the wastes are collected, treated and disposed of at the point of generation, it is called an on-site system like pit latrines and septic tank systems.
Source: Manual on Sewerage and Sewage Treatment Systems Part A Engineering, CPHEEO

Faecal sludge: It is a mixture of solids and liquids, containing mostly Excreta and water, in combination with sand, grit, metals, trash and/or various chemical compounds.
Source: Compendium of Sanitation Systems and Technologies, by The International Water Association.

Septage: A historical term to define sludge removed fromseptic tanks.
Source: Compendium of Sanitation Systems and Technologies, by The International Water Association.

Septic tank: A water-tight settling tank or chamber, normally located underground, which is used to receive and hold human excreta, besides other waste matter and drainage waste.
Source: Manual on Sewerage and Sewage Treatment Systems Part A Engineering, CPHEEO

Soak Pit: Porous-covered chamber that allows wastewater to soak into the ground. It is also known as a soak-away or leach pit.
Source: Septage management in Urban India, Water and sanitation Program, National Urban Sanitation Policy

Single-pit system: It is a sanitation technology. Excreta, along with anal cleansing materials (water or solids) are deposited into a pit. Lining the pit prevents it from collapsing and provides support to the superstructure. A single pit latrine consists of a toilet superstructures and a single pit to be filled up, emptied and filled up again. To improve pit latrines, aeration or an additional pit can be added (see single VIP, double VIP or double pit latrine).
Source: Compendium of Sanitation Systems and Technologies. 2nd Revised Edition

Twin-pits: A *sanitation technology* consisting of two alternating pits connected to a *pour flush toilet*. The *black water* (and in some cases *grey water*) is collected in the pits and allowed to slowly infiltrate into the surrounding soil. Over time, the solids are sufficiently dewatered and can be manually removed with a shovel.
Source: Compendium of Sanitation Systems and Technologies. 2nd Revised Edition

Solids-Free Sewer: A solids-free sewer is a network of small-diameter pipes that transports pre-treated and solids-free wastewater (such as Septic Tank effluent). It can be installed at a shallow depth and does not require a minimum wastewater flow or slope to function. Solids-free sewers are also referred to as settled, small bore, variable-grade gravity, or septic tank effluent gravity sewers.
Source: Compendium of Sanitation Systems and Technologies. 2nd Revised Edition

सत्यमेव जयते

Ministry of Urban Development
Government of India