#### STUDY OF FAECAL SLUDGE MANAGEMENT PRACTICES IN MUNICIPALITIES OF GUJARAT

Prepared by Urban Management Centre Under the Performance Assessment System (PAS) Project





Prepared by Urban Management Centre (UMC) August 2014

All photographs are by UMC unless otherwise mentioned.



#### Urban Management Centre (UMC)

The Urban Management Centre (UMC) is a women promoted not-for-profit organization, that works towards professionalizing urban management in India and worldwide. UMC provides technical assistance and support to city governments and facilitates change through peer-to-peer learning processes. It enhances the capacity of city governments by providing expertise and ready access to innovations on good governance implemented in India and abroad. UMC extensively works in the areas of urban water and sanitation, heritage management, planning, urban health, municipal finance, urban management, urban transportation and institutional restructuring. UMC is a legacy organization of International City/County Management Association (ICMA) and hence is also known as ICMA-South Asia. For more information, visit our website: www.umcasia.org



#### Performance Assessment System (PAS)

PAS, a seven-year action research project, has been initiated by Centre For Environment Planning and Technology (CEPT) University with funding from the Bill and Melinda Gates Foundation. PAS aims to develop better information on water and sanitation performance at the local level to be used to improve the financial viability, quality and reliability of services. It uses performance indicators and benchmarks on water and sanitation services in all the 400-plus urban areas of Gujarat and Maharashtra. Urban Management Centre (UMC) and the All India Institute of Local Self Government (AIILSG) are CEPT University's project partners in Gujarat and Maharashtra, respectively. More details are available on www.pas.org.in

#### About the PAS program

Performance Assessment System (PAS), is a five-year action research project, initiated by CEPT University with funding from the Bill and Melinda Gates Foundation.

The aim of the PAS program is to measure, monitor and improve performance of **municipal water supply and sanitation** services in 400 ULBs in the states of Gujarat and Maharashtra.

The Urban Management Centre (UMC) is a project partner in the PAS program for Gujarat. We have monitored and assessed the performance of all 167 cities in Gujarat over the last five years, and are currently working with the ULBs on various performance improvement initiatives. We believe that the comprehensive database and management system prepared under the PAS program will help decision makers and local governments bring efficiency in service delivery, effective budget allocation and inclusive coverage.

(Read more about PAS at <u>www.pas.org.in</u> and about UMC at <u>http://www.umcasia.org/content.php?id=57</u>)





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# 5. Summary and way forward





### 1. Background

According to the Census 2011 data on sanitation, around 3 Crore urban households, or more than one thirds of all urban India depends on on-site sanitation solutions for safe waste water disposal. In Gujarat too, the reliance on on-site sanitation systems is very high. 105 out of the 167 cities in the state do not have any underground drainage system and are dependent on technologies such as single pits, twin pits and septic tanks for waste water disposal. Our observations and studies in Gujarat reveal that several urban households in the state are still connected to deep single pits (called khakkuavas) which poses health risks because of its inadequacy to safely treat wastewater.

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. However the disposal of waste water is often not regulated. The septage is dumped in drains and open areas posing considerable health and environmental risks.





### 2. Methodology

Under the Performance Assessment System program, UMC's PAS team has been collecting data from all ULBs for the last five years for the sectors of water supply, sewerage, storm water and solid waste management.

Recognizing that there is high dependency and importance of onsite sanitation systems study is conducted to know the existing practices of different cities. The cities exhibiting different geographical location, soil strata, ground water table and class are chosen for the further analysis. Hence 6 towns from different locations and in Gujarat to study the existing septage management practices.

The team obtained information through interaction with concerned officers in ULB and private players working on sanitation sector. Information regarding existing sanitation systems, infrastructure facilities, monitoring frameworks and institutional arrangements for septage management has been collected. The site studies revealed that there is less attention on onsite sanitation systems.





### 3. Review of Data on On-Site Sanitation Systems

Currently data on onsite sanitation systems is limited and unreliable because the management and maintenance of these systems is largely in the private domain and ULBs do not have a regulatory and monitoring mechanism for these systems .

Existing sources of data for on-site sanitation systems in Gujarat include:

- Non-sewered indicators generated under the PAS program: From the past few years as a part of SLB framework under the PAS program information about water supply, sanitation and solid waste management sectors is collected for the cities of Gujarat and Maharashtra.
- Data from Census, 2011

Census of India gives statics on the number of households connected to various sanitation systems but it does not give the picture of whole value chain for particular city.

• Audit of wastewater systems by CPCB CPCB-CUPS report gives the information about the wastewater generation and existing treatment systems of all the cities.





#### 3.1 Gujarat's Urban Scenario: Analysis of sanitation, Census 2011

Gujarat has more coverage than nation in terms of individual toilets. 91.3 percent of households have access to individual toilet or community toilet or public toilet.

Gujarat has more number of households toilets connected to sewerage system (69 percent) and septic tank (20 percent)

Within Gujarat, municipal corporations have high dependency on sewerage system and class D cities high reliance on onsite sanitation systems.



Source: Census 2011& 2001





### 3.2 Gujarat's Urban Scenario: Analysis of sanitation, PAS 2013

#### 1. DEPENDENCY ON ONSITE SANITATION

• In Gujarat, 47% on an average, of properties are connected to onsite wastewater disposal system. The highest dependence on onsite sanitation system is in Class D cities. Overall, there is a higher dependence on septic tanks and soak pits in municipalities to that of municipal cooperation.

• 74% of urban properties have **individual toilets** out of which 53% properties are connected to sewer network and **28% of properties are dependent on onsite sanitary disposal system.** 

#### 2. SEPTAGE MANAGEMENT PRACTICE

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• 40 cities do not have sewerage system nor have reported to have septage management services. The septic tank-soak pit cleaning is serviced by private sector operators in these cities. Rest of the cities have not provided data. Others cities have reported having some septage management practices.

Source: UMC, Analysis of data collected for PAS program



#### Dependency on onsite sanitation

#### **3.2 Gujarat's Scenario: Analysis of septage management**

## 3. AVAILABILITY OF EQUIPMENT FOR SEPTAGE MANAGEMENT

• 77% cities have reported having sucking machines for emptying septic tanks. A few cities also use private sucking machines which are licensed by the ULBs for service provision. The following table shows the equipment with various classes of ULBs. 56% cities have reported to have at least one sucking machine, while 10 cities have reported three or more machines.

# 4. PROPORTION OF SEPTAGE EMPTYING MACHINES AND SEPTIC TANKS

• There is a wide variation in adequacy with the equipment across cities. This leads to many of the households resorting to privatized emptying services who may be dumping the sludge in open drains and or open areas posing considerable health and environmental risks and their workers also work mostly without adequate protective gear and equipment.

• The other issues that the UMC team has observed is that the septic tanks/single pits that are built are huge in size in the fear of not having to clean the tank often.

Source: UMC, Analysis of data collected for PAS program, 2009-12

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machines available	<sup>5</sup> NA/ND	0	1	2	3	>3
Municipal Corporation	2	1	2	0	1	2
Class A	2	0	8	4	3	1
Class B	1	3	21	7	1	0
Class C	9	1	24	9	2	0
Class D	15	4	37	7	0	0
Grand Total	29	q	92	27	7	3

#### Source: PAS, 2013



#### 5. SEPTAGE TREATMENT FACILITIES

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• 4 cities in the state have treatment facilities. In most of the cities, filed visits have revealed that the sludge is either disposed in a water-nalah or water body or in the open field or dumping yards or is sold to farmers.

### 4. Review of septage management practices

A comprehensive review of existing septage management practices was carried out in six cities to identify the prevalent technologies, OSS cleaning and maintenance frequencies, capacity of ULBs to provide FSM services, presence of private players in the sector and potential opportunities for reuse of sludge.

The team obtained information through interaction with concerned officers in ULB and private players regarding existing sanitation systems, infrastructure facilities, institutional frameworks and institutional arrangements for septage management in the cities.

The site studies revealed that in all cities management of onsite sanitation systems is a neglected area. There is evidence of manual scavenging in all cities. Most households gets their systems cleaned through private players who do have proper gears and equipment. No city has a functioning septage treatment facility and septage removed from septic tanks and pits is often disposed at the dumping yard, open plots or in some cases in agricultural farms. None of the ULBs have carried out any awareness campaigns to inform & educate households regarding proper operation and maintenance of OSS.







#### **Basic Profile**

Class B Municipality Population: 81,137 Area: 8.82 sq km Number of Wards: 12

Source of Water: Soil Type: Sandy loam to sandy soils Groundwater table: 10 to 20 M

#### Access to Sanitation Facilities (Census, 2011)

Total Number of Households	16,390	100.0%
Households with Individual Toilets	14,335	87.4%
Toilets connected to UGD	2,184	13.3%
Toilets connected to OSS	11,664	71.1%
Toilets disposing wastewater in open drains	83	0.5%
Pit latrines and other insanitary toilets	662	4.0%
Households dependent on public facilities	470	2.8%
Households defecating in the open	1,585	9.6%





- More than 70% households in the city use septic tank systems for collection and treatment of waste-water.
   Few toilets are connected to single pits. The effluent from the septic tanks is disposed off using soak pits or is discharged into SW drains. Grey water from kitchens and bathrooms is directly disposed off in the soak pits.
- Sludge from the on-site sanitation systems is removed mechanically and in some cases manually and disposed in the oxidation ponds.
- Underground drainage has recently being laid in newer parts of the city, but is yet to be functional.
- In year 2005, due to shortage of equipment, labour and time ULB discontinued the wastewater emptying service.
- Private organizations provide emptying and cleaning services mechanically and manually for these onsite sanitation systems.





#### Value chain of Sanitation







#### Value chain of Sanitation: Collection



Septic tank located outside the plot in the street ROW



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- Septic tanks are watertight and are built of bricks or concrete. The general specifications of septic tanks are 8' (L)X 3'(B) X 5'(D). The size is typically larger than what CPHEEO recommends. The building use permission process requires the location as well as specifications of septic tanks to be marked on the site plan. However there is almost no monitoring on site.
- Toilets in slum households (many constructed under NGSY) dispose wastewater using single pits. Several residential colonies in the outskirts of the cities also use single pits for wastewater disposal. These pits are generally 20' deep with a diameter of 5'.
- Most septic tanks and pits are ventilated and accessible.
- In dense colonies, several septic tanks are located outside the plot in the street ROW.
- Most on-site systems do not have open-able covers. The systems are sealed with permanent concrete lids and stone slabs which are heavy and require lifting tools and some digging.



#### Value chain of Sanitation: Collection



Septic tank located outside the plot in the street ROW

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Newer higher-end residential developments in the outskirts using single pit s for OSS disposal

Laying of underground drainage lines in some parts of the city.



#### Value chain of Sanitation: Conveyance

The municipality does not provide OSS cleaning & emptying services. Demand for these services is met by the private market.

There are 8-10 agencies providing septic tank/ pit cleaning services. Out of these 6 agencies are licensed with the Municipality for carrying out construction works for UGD. There is no separate empanelment/ licensing procedure for private emptiers.

Households get their on-site systems cleaned only when they over flow or when the toilets back flow (once in 5-10 years). single pits and soak pits takes 15 years to clean for the first time. While in case of the septic tank its 5 years.

The municipality has not carried out awareness campaigns to inform & educate households regarding proper O&M of OSS

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Privately owned Vacuum emptier



Manual emptying of single pit



Tractor used to transport sludge

Insights from Mahakali Gutter Construction (Private cleaning & emptying service providers)

Receive 8-10 calls in a day for cleaning of septic tank, soak pit/ single pit.

Charge Rs. 2500 for cleaning and emptying septic tanks and Rs. 3500 for cleaning pits and soak pits. Procedure includes emptying waste water and desludging.

Use a variety of emptying and conveyance vehicles including suction emptier and open trucks. All of these are tractor mounted. The tanker has a capacity of 4000 L

Waste water is emptied using suction emptiers, and sludge is removed manually and transported in open trucks.



#### Value chain of Sanitation: Treatment

- Oxidation pond is the treatment system, with an area of 9.24 ha.
- Wastewater collected through underground drains and sludge collected from onsite systems is disposed in the oxidation pond near Kantwada road.
- Oxidation pond is overloaded than the designed area.
   ULB plays a minimum role in maintenance of oxidation pond.
- Oxidation pond does not have any outlet and hence the area has been expanding.
- Currently STP is under construction which is located next oxidation pond.



Emptying of Vacuum tug at oxidation pond





- Most of the households dispose the effluent from septic tank into the soak pit.
- Soak pit is generally 20' deep with a diameter of the 5'.
- Generally, soak pits are constructed below 4'-5' from the road level, in front or rear side margin. In order to be away from heavy loads and traffic. Most of the pits are ventilated.
- Soak pits are lined with white stones along the circumference and cement plastered in the bottom.
- Due to large size and high percolation of soil, soak pits takes 15 years to clean for the first time.
- Wastewater collected through underground drains and sludge is disposed in the oxidation pond near Kantwada road.







#### **Basic Profile**

Class B Municipality Population: 117967 Area: 13.42 sq km Number of Wards: 12

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Source of Water: Soil Type: Shallow, medium, black calcareous soils Groundwater table: 5 to 20 M Water bodies/ lakes: Dhebi River

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#### Access to Sanitation Facilities (Census, 2011)

Total Number of Households	22,878	100.0%
Households with Individual Toilets	19896	86.9%
Toilets connected to UGD	4211	18.4%
Toilets connected to OSS	14,982	65.5%
Toilets disposing wastewater in open drains	72	0.3%
Pit latrines and other insanitary toilets	631	2.76%
Households dependent on public facilities	504	2.2%
Households defecating in the open	2478	10.8%



## 4.2 Amerli

- More than 65% households in the city use septic tank systems for collection and treatment of waste-water. Few toilets are connected to single pits. The effluent from the septic tanks is disposed off using soak pits or is discharged into SW drains. Grey water from kitchens and bathrooms is directly disposed off in the septic pits if there is no provision of open drainage system.
- Most of the on-site sanitation systems gets cleaned manually and disposed at dumping yard without any treatment.
- Underground drainage is yet to be laid, about 50% of the city is covered with open drains which collect grey water and the effluent from septic tank.
- Amreli municipality has one vacuum emptier for emptying services for septic tanks and pits with a charge of Rs. 700 per cleaning.
- Private organizations provide emptying and cleaning services for these onsite sanitation systems manually.





### Value chain of Sanitation, Amreli











Septic tank located within the plot



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- Septic tanks are watertight and are built of bricks or concrete. The general specifications of septic tanks are 8' (L)X 3'(B) X 5'(D). The size is typically larger than what CPHEEO recommends. The building use permission process requires the location of septic tanks to be marked on the site plan. However there is almost no monitoring on site.
- Several households of the cities also use single pits for wastewater disposal which are 5 to 10' deep with a diameter of 5' and need to be cleaned/ emptied often, mostly every 2-3 years because of less percolation capacity.
- Most septic tanks and pits are ventilated and accessible.
- In many colonies, several septic tanks are located within the plot.
- Most on-site systems do not have open-able covers. The systems are sealed with permanent concrete lids and stone slabs which are heavy and require lifting tools and some digging.



#### Value chain of Sanitation: Collection



from septic tank





#### Value chain of Sanitation: Conveyance

The municipality provide OSS cleaning & emptying services but currently not functional. Demand for these services is met by the private market which is completely manual emptying.

ULB receives 8-10 calls in a day for cleaning of septic tank, soak pit/ single pit and charges Rs.700 per trip and it varies with the distance. Rs. 300 is charged by the driver and cleaner for service provision. If possible soak pits are also cleaned using vacuum machine.

Households get their on-site systems cleaned only when they over flow or when the toilets back flow (once in 5-15 years). single pits and soak pit takes 2 to 3 years to clean for the first time because to less percolation capacity.

The municipality has not carried out awareness campaigns to inform & educate households regarding proper O&M of OSS.

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Sludge contained drums mounted on auto rickshaw



**ULB** owned Vacuum emptier

Insights from private cleaners (Private cleaning & emptying service providers)

Septic tank/soak pit manhole is opened few hours prior to the cleaning in order to release the gases.

Charge of Rs. 3000- 5000 for cleaning and emptying septic tanks, pits and soak pits. Procedure includes emptying waste water and desludging.

All the private cleaners empty waste water and sludge manually using buckets /drums and transported in jugadd vehicle to dumping site. Drums mounted on auto rickshaws as shown in the picture.

It generally takes 3 to 4hrs to clean and 4 to 5 trips to transport the sludge to dumping site.



Amreli does not have sewage/ sludge treatment facility.

Effluent is disposed using soak pits. The soak pits are generally 5 to 6' deep 3 to 5' wide. Soak pits are covered with plastic sheets in order block the entry of rain water.

Most soak pits do not have open-able covers. The systems are sealed with permanent concrete lids/stone slabs which are heavy and require lifting tools and some digging. They are filled with huge stones.

Due to poor percolation capacity of the soil, the soak pits also need to be cleaned/ emptied often, mostly every 2-3 years.

The emptying of soak pits is largely carried out by private contractors manually without using any machinery or safety gear with a charge between Rs 3000-5000 per cleaning.

Septage is dumped in open ground/dump yard without any primary treatment or used in farms. Site allocated for dumping of sludge and effluent is not properly designed.

The open drains empty into the Dhebi River. The river has turned into waste water collection point.



Dhebi River( wastewater collection point)



Dumping yard





The usage of septage and wastewater in farms is observed, but it is used without treatment/ proper drying.

Septage and wastewater from septic tanks as fertilizer about two times a year.

Septage and wastewater from septic tanks is mixed with murram and then utilized.

The private operators do not charge any money, but dump the septage in the farms which is much closer than the dumping site.



Murram



Farms where the septage is utilized







#### **Basic Profile**

Class D Municipality Population: 21173 Area: 6 sq km Number of Wards: 7

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Source of Water: Soil Type: Shallow, medium, black calcareous soils Groundwater table: 5 to 20 M Water bodies/ lakes:

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#### Access to Sanitation Facilities (Census, 2011)

Total Number of Households	3980	100.0%
Households with Individual Toilets	2690	67.6%
Toilets connected to UGD	79	2%
Toilets connected to OSS	2570	64.6%
Toilets disposing wastewater in open drains	35	0.9%
Pit latrines and other insanitary toilets	6	0.2%
Households dependent on public facilities	232	5.8%
Households defecating in the open	1058	26.6%



- 65% households in the city use septic tank systems for collection and treatment of waste-water. Few household toilets are connected to single pits. The effluent from the septic tanks is disposed off using soak pits or is discharged in the SW drains. Grey water from kitchens and bathrooms is also disposed into septic tank if there is no provision of open drain systems.
- Sludge from the on-site sanitation systems is removed mechanically and some cases manually and disposed at vermi- compost site/open plots.
- Underground drainage is yet to be laid in the of the city.
- Lathi municipality has one vacuum emptier for emptying services for septic tanks and pits with a charge of Rs. 500 per cleaning.
- Private organizations provide manual emptying and cleaning services for these onsite sanitation systems.



### Value chain of Sanitation, Lathi







#### Value chain of Sanitation: Collection



Septic tank located at bus station



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- Septic tanks are watertight and are built of bricks or concrete. The general specifications are 8'(L)X 3'(B), 5'(D) and covered with Rajula stone and pre-cast RCC.
- The size is typically larger than what CPHEEO recommends. The building approval process requires the location of septic tanks and soak pits to be marked on the site plan. However there is almost no monitoring on site.
- Several households of the cities also use single pits for wastewater disposal which are 20' deep with a diameter of 5'.
- Most septic tanks and pits are ventilated and accessible.
- Most on-site systems do not have open-able covers. The systems are sealed with permanent concrete lids and stone slabs which are heavy and require lifting tools and some digging.



#### Value chain of Sanitation: Conveyance

The municipality provide OSS cleaning & emptying services mechanically. Demand of these services is also met by the private market which is completely carried out manually.

ULB has one vacuum emptier machine with a capacity of 3500 lit.

ULB receives 2-3 calls in a month for cleaning of septic tank, soak pit/ single pit and charges Rs.500 per trip and it varies with the distance. The service is also provided beyond the city limits.

Households do not get their on-site systems cleaned regularly, it is carried out only when they over flow or when the toilets back flow (once in 5-10 years).

The municipality has not carried out awareness campaigns to inform & educate households regarding proper O&M of OSS



Open drains



Insights from private cleaners (Private cleaning & emptying service providers)

Manual cleaning is prevalent, generally it takes place after 5 pm.







Lathi does not have sewage/ sludge treatment facility.

Effluent is disposed using soak pits. The soak pits are generally 5-6' deep with diameter of 2-3'. Soak pits are brick made, with a pre-cast RCC / Rajula stone cover on the top.

Most soak pits do not have open-able covers. The systems are sealed with permanent concrete lids/stone slabs which are heavy and require lifting tools and some digging.

Due to poor percolation capacity of the soil, the soak pits also need to be cleaned/ emptied often.

The sludge and effluent collected from tanks/pits within the city's limit is disposed on the open land near the vermi compost plant.

If sludge and effluent collected from the outskirts of the city then it is dumped at the nearest open lands.



Dumping site near Vermi-compost plant







#### Advisory on Septage Management – MoUD (2013)

#### SAFE COLLECTION

- 1. Safety gear for sanitary workers
- 2. Tools for monitoring septic tanks. Eg: tools for measuring BOD, COD levels from samples, sticks to assess effluent turbidity
- 3. SOPs for pumping and de-sludging septic tanks
- 4. PUMPING: pumping programs that focus on routine inspection and pumping when required, rather than mandated periodic pumping, are most efficient

#### MANUAL OF PRACTICE

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- 1. Scheduling and routing for trucks
- 2. Customer service protocols
- 3. Locating tanks and cleanouts
- 4. Proper pumping equipment operation and worker safety
- 5. Site control, including post-pumping clean-up
- 6. Transportation requirements, including rules of the road
- 7. Disposal procedures at the treatment facility
- 8. Routine service of equipment greasing and oiling, minor repairs
- 9. Recordkeeping for all tanks pumped and wastes discharged at the disposal facility

#### **RECORDKEEPING AND MANIFESTS**

- 1. The location or address of the pumped septic tank
- 2. Septage characteristics (residential or commercial)
- 3. The name and address of the property owner or occupier
- 4. The volume of septage pumped
- 5. Any notes regarding tank deficiencies, missing pipes or fittings, improper manholes or access ports, any other cracks or damage observed

#### **REGULATION & MONITORING BY ULB**

It is recommended that ULBs formulate their own bye-laws and rules for management of septage in the city – this could be taken up as a State-level activity in consonance with the Municipal Act in place.

#### TREATMENT METHODS OF SEPTAGE

a. Sewage treatment plant

b. Land treatment: appropriate buffers and setbacks should be provided between application areas and water resources. Other considerations include vegetation type and density, slopes, soils, sensitivity of water resources, climate and application rates.
c. Composting

#### **MOTORISED EMPTYING & TRANSPORT**

Motorized Emptying and Transport refers to a vacuum truck or another vehicle equipped with a motorized pump and a storage tank for emptying and transporting faecal sludge, septage and urine. Humans are required to operate the pump and manoeuvre the hose, but they do not lift or transport the sludge.

Once completed, a copy of the manifest is given to the owner as a receipt. When the load is delivered to the disposal site, the disposal site operator:

- 1. Accepts the load
- 2. Verifies the volume
- 3. Takes a sample if needed
- 4. Signs the manifest proving receipt of the volume of septage disposed of



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### Summary and way forward

The studies revealed that there is less attention on onsite sanitation systems. Onsite sanitation systems plays an integral role of sanitation systems in the city even if the city is covered with underground drainage system. It is important to manage these systems and establish regulations and guidance for the residents of the cities

The following can be carried out for the better management

- 1. Conduct an audit for onsite sanitation systems
- 2. Establish regulations for location and design of twin pits and septic tank system.
- 2. Provide guidance to property owners on routine O&M of these systems
- 3. Prepare septic tank/ twin pit emptying service plan for schedule cleaning
- 4. Invest in capital infrastructure (cleaning equipment and construction of sludge drying beds)
- 5. Establish customer service protocols
- 6. Follow the operating procedure for cleaning septic tank/single pit/soak pit
- 7. Safely transport septage to treatment site
- 8. Treatment and disposal of septage
- 9. Recording and reporting systems
- 10. Ensure safe practices



Standard Operating Procedure (SOP) for Septage Management for Small Cities in Gujarat (Draft)



Prepared by Urban Management Centre

PAS program







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