


SAN Benchmarks

Citywide assessment of sanitation service delivery

- *Including onsite sanitation*

Framework and Indicators

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pas performance assessment system

CEPT UNIVERSITY

Acknowledgements

There is a wide prevalence of onsite and mixed sanitation systems in urban India. This note provides a new framework for performance assessment of citywide sanitation by capturing the onsite sanitation systems along with the conventional sewerage systems. And indicates a more realistic picture of on-ground situation as well as facilitates in identification of improvement areas at local level.

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Background

The Ministry of Urban Development (MoUD) launched the Service Level Benchmarking (SLB) initiative covering water, sanitation, solid waste management and storm water drainage in 2009. This framework was piloted in 28 cities across 14 states. In subsequent years, it was extended to all states. There is now an extensive database covering nearly 1800 cities across 18 states in India. Urban Water and Sanitation System (UWSS) performance information is now used by the Government of India as well as state governments.

A review of the SLB framework was organised by MoUD through a national workshop on "Service Level Benchmarks (SLB): Moving from Measurement to Monitoring and Improvement" in February 2013 at Ahmedabad, with support from the CEPT University and other organisations.[1] Participants from various states and city level SLB cells deliberated on the SLB concepts and indicators. One of the key recommendations that emerged from the workshop was the need for additional SLB indicators for onsite sanitation systems. This was considered necessary a large number of Indian cities depend on onsite sanitation systems and the SLB indicators only capture conventional underground sewerage system. It was argued at the workshop that well managed onsite sanitation systems can also provide good public health and environmental outcomes. Based on the deliberations, it was proposed that CEPT will prepare a document to capture onsite sanitation systems in the SLB framework.

This note provides a framework for performance assessment of city wide sanitation by capturing onsite sanitation systems along with the conventional sewerage systems. Proposed indicators capture the full sanitation service chain from access to toilet, to containment, conveyance, treatment and reuse or disposal.

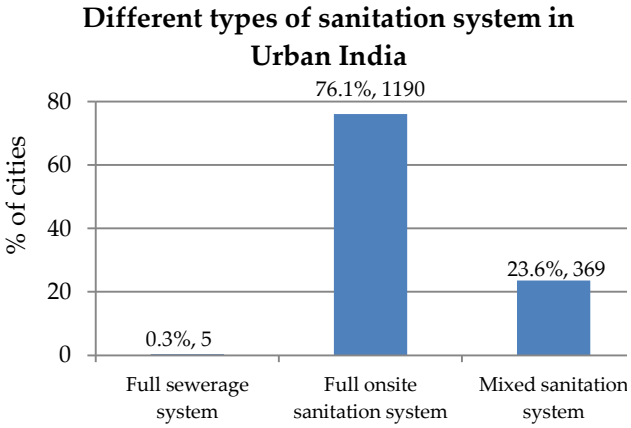
Overview of existing sanitation situation in urban India

An analysis of available information suggests that only five cities in India have 100 percent coverage of sewerage connections. On the other hand, many cities depend fully on onsite sanitation systems. In most cities with sewer network, the coverage is partial for the network and connections.

Coverage of properties connected with onsite sanitation system is higher than the sewer network connections in India as shown by the Census of India 2011 results. Compared to 40 percent of households with toilets connected to sewer network, nearly 60 percent that depend on onsite sanitation systems, mainly septic tanks.

[1] http://www.pas.org.in/Portal/document/ResourcesFiles/pdfs/National%20workshop%20report.pdf

Despite this wide prevalence of onsite sanitation systems, the SLB indicators of the Government of India are focused only on conventional underground sewerage systems. Thus, the benchmark value of SLB indicators for wastewater management, consider cities without sewer network as 'unsanitized'. This is despite the fact that, the National Urban Sanitation Policy (NUSP) [2] considers properly managed onsite sanitation as acceptable sanitation. The recently revised CPHEEO manual on sewage and sewerage treatment also considers onsite sanitation system as an acceptable level of service. It states that different types of sewerage systems can be used for wastewater collection, treatment and disposal / reuse:



Sources: Analysis based on the SLB indicator value in service levels in urban water supply and sanitation sector status report 2010-11, 2011-12 and 2012-13

"Sewage collection, treatment and disposal systems can be either the short-term (onsite system), or medium-term (decentralized system) or long-term (conventional sewerage system). To keep overall costs down, most urban systems today are planned as an optimum mix of the three types depending on various factors."

Box 1 provides a review of several sources on approach to and acceptance of onsite sanitation systems. These reviews suggest that to achieve the goal of a totally sanitized city, different types of sanitation systems including onsite sanitation system can be considered.

[2]The goal of NUSP is to transform urban India into community- driven, totally sanitized, healthy and livable cities and towns.

Box 1: Onsite sanitation system as acceptable sanitation

National Urban Sanitation Policy (NUSP) published by Ministry of Urban Development (MoUD), GoI in 2010 states that:
"Some of the activities in the sanitation plan may be possible to complete with little financial resources e.g. better utilization of existing facilities, improved management systems for septage cleaning, awareness generation; etc. whereas others e.g. reconditioning or laying new sewers, may be more resource-intensive. The CSP will need to be prepared keeping in view what the city can afford and finance."

Handbook for managing Onsite and Clustered (Decentralised) wastewater treatment system published by United States Environmental Protection Agency (USEPA) in 2005 states that:
"Adequately managed decentralized wastewater systems are a cost-effective and long-term option for meeting public health and water quality goals, particularly in less densely populated areas."

A guide to the development of Onsite sanitation system published by World Health Organisation (WHO) in 1992 states that:
"The cost of a sewerage system (which is usually more than four times that of on-site alternatives) and its requirement of a piped water supply preclude its adoption in the many communities in developing countries that lack adequate sanitation. On-site disposal, dealing with excreta where it is deposited, can provide a hygienic and satisfactory solution for such communities."

Fecal Sludge Management systems approach for implementation and operation published by the International Water Association (IWA) in 2014 states that:
"Over the last 15 years, the thinking of engineers worldwide has started to shift, and people are starting to consider onsite or decentralised technologies as not only long-term viable options, but possibly the more sustainable alternative in many ways compared to sewer-based systems which are prohibitively expensive and resource intensive. In urban areas, it has been demonstrated that, depending on local conditions, the cost of FSM technologies are five times less expensive than conventional sewer-based solutions"

Proposed framework for citywide sanitation assessment

A new set of indicators have been developed to reflect the prevailing situation in urban India, where both sewerage and onsite sanitation systems are prevalent. The basic premise is also that a well-managed onsite sanitation system can also result in a fully sanitized city as per the NUSP.

Onsite sanitation systems considered include: a) septic tanks and settled sewers/drains, b) septic tanks and soak pits, and c) double pit toilets.[3] Each of these systems is considered capable of providing adequate services towards a fully sanitized city.

To capture the service performance of different sanitation systems, a revised set of indicators have been developed covering all components of the sanitation service chain (user access, storage, conveyance, treatment, recycle and reuse) for each of the following sanitation systems:

a) Cities with citywide coverage of conventional underground sewerage system
b) Cities with citywide coverage of septic tank and settled sewer / drains
c) Cities with citywide coverage of septic tank and soak pit
d) Cities with citywide coverage of double pit toilets
e) Cities with mixed sanitation systems

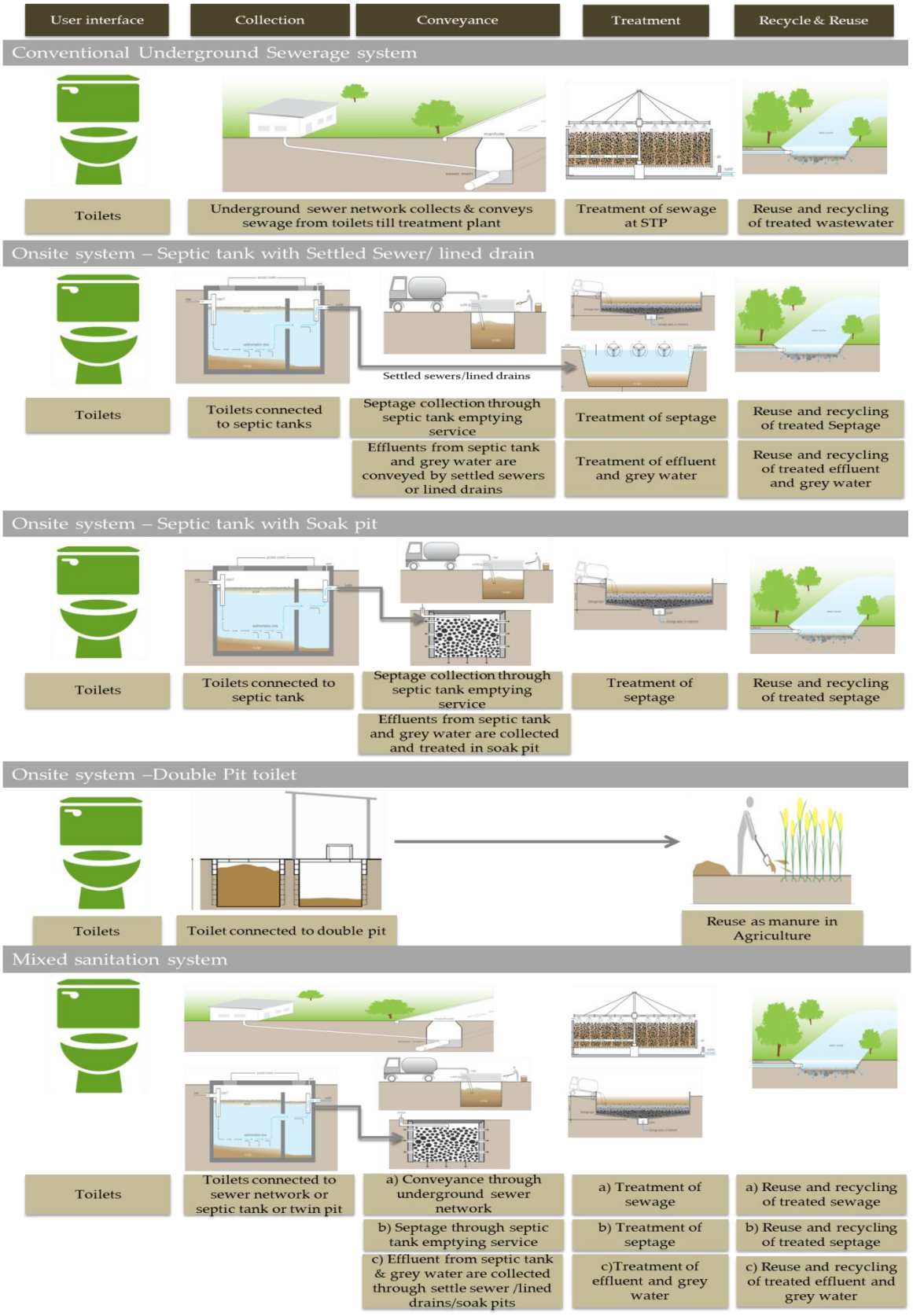
Figure 1 provides an illustrative overview of each of these systems covering the full service chain.

A revised set of indicators have been developed for use in the National SLB system, by using weighted averages for each system, where the weights are the share of households served with each sanitation system. In onsite sanitation system, there are two outputs (septage and effluent from septic tank and grey water) which require safe conveyance, treatment and recycle and reuse. In revised indicators, effluent and grey water are also considered along with septage management because these can cause adverse impact on health and environment pollution.

Table 1 shows the existing and proposed indicators across the sanitation service chain. Table 2 provides description of these indicators. Detailed variables, formulae, data requirements and rationale for all the indicators are given in the Annex 1.

[3] As per the Census of India 2011, 7% of toilets used in urban areas are pit latrines. However, detailed assessments of their impact on ground water are not available. Even safe emptying of single pits is difficult due to undigested sludge contents. Therefore pit latrines have not been included in acceptable sanitation system in this paper.

Figure 1: Full service chain for different sanitation systems[4]



[4] Source: Graphics in figure 1 are from Elizabeth et al, 2008. "Compendium of Sanitation Systems and Technologies". Swiss Federal Institute of Aquatic Science and Technology (Eawag), Dübendorf, Switzerland.

Table 1: List of existing and proposed indicators for sanitation assessment

a. Current SLB Indicators (Sewerage)

Type of system	Capture	Collection	Conveyance	Treatment	Recycle and Reuse
Conventional underground sewerage system	1. Coverage of toilets*	2. Coverage of sewerage network service* 3. Collection efficiency of sewer network*		4. Adequacy of sewage treatment capacity* 5. Quality of sewage treatment*	6. Extent of reuse and recycling of sewage*

*Notes: All indicators are in percentage. * These indicators are from the Government of India's Service level benchmarking (SLB), MOUD (2009).*

b. Proposed onsite sanitation system indicators

Type of system	Capture	Collection	Conveyance	Treatment	Recycle and Reuse
Onsite system – Septic tank with settled sewer / drains	1. Coverage of toilets	2a. Percentage of households (or toilets) connected to septic tank	3. Percentage of septic tanks connected to settled sewer / drains for effluent 4. Collection efficiency of septage	5. Adequacy of septage treatment capacity 6. Quality of septage treatment 7. Adequacy of septic tank effluent treatment capacity 8. Quality of septic tank effluent treatment	9. Extent of reuse and recycling of treated septage 10. Extent of reuse and recycling of treated septic tank effluent
Onsite system – Septic tank with soak pit			3. Percentage of septic tanks connected to soak pit for effluent disposal 4. Collection efficiency of septage		
Onsite system – Twin pit		2b. Percentage of households with toilets connected to twin pit toilets			

Annex 2 provides comprehensive list of indicators for onsite sanitation system

c. Proposed composite SLB Indicators (weighted average of onsite and network systems)

Type of system	Capture	Collection	Conveyance	Treatment	Recycle and Reuse
Includes all types of sanitation systems	1. Coverage of toilets	2. Coverage of adequate sanitation system (sum of network and onsite system)	3. Collection efficiency of sanitation system *(weighted average of each sanitation system)*	4. Adequacy of treatment capacity of sanitation system *(weighted average of each sanitation system)* 5. Quality of treatment of sanitation system *(weighted average of each sanitation system)*	6. Extent of reuse and recycling in sanitation system *(weighted average of each sanitation system)*

Notes: All indicators are in percentage.

Table 2: Description of citywide sanitation indicators

Current SLB indicators (sewerage system)	Proposed Onsite sanitation indicators	Proposed composite indicators (Sewerage + Onsite systems)
1. Coverage of sewerage network services	**1. Coverage of septic tank and twin pit system**	**1. Coverage of adequate sanitation system**
Total number of properties with individual connections to sewerage network as a percentage of total number of properties in the city.	Percentage of households with individual or group toilets connected with septic tank and twin pit system in the city	Percentage of households with individual or group toilets connected with adequate sanitation systems (sewer network/ septic tank / double pit system) to total households in the city.
2. Collection efficiency of sewerage network	**2.1 Collection efficiency of septage** **2.2 Collection efficiency of effluent and grey water**	**2. Collection efficiency of sanitation system**
Quantum of wastewater collected at the intake of the treatment plant to the quantity of wastewater generated (as per CPHEEO, 80% of water consumed is wastewater generated).	3.1 Quantum of septage collected at the intake of the treatment plant / disposal point to the quantity of septage generated 3.2 Quantum of effluent / grey water collected at the intake of the treatment plant / disposal point and disposed by soak pit to the quantity of wastewater generated	Weighted average of collection efficiency of each sanitation system, weighted by share of households dependent on each sanitation system.
3. Adequacy of sewage treatment capacity	**3.1 Adequacy of septage treatment** **3.2 Adequacy of effluent and grey water**	**3. Adequacy of treatment capacity of Sanitation System**
Adequacy is expressed as secondary treatment capacity available as a percentage of normative wastewater generation.	4.1 Available capacity of treatment plant that can treat septage to desirable standards as a percentage of normative septage generated. 4.2 Available capacity of effluent treatment plant that can treat effluent / grey water to desirable standards as a percentage of normative wastewater generation.	Weighted average of adequacy of treatment plant capacity available for each sanitation system, weighted by share of households dependent on each sanitation system.
4. Quality of sewage treatment	**4.1 Quality of septage treatment** **4.2 Quality of effluent and grey water treatment**	**4. Quality of treatment of sanitation system**
Quality of treatment is measured as a percentage of WW samples that pass the specified secondary treatment standards, that is, treated water samples from the outlet of STPs are equal to or better than the standards lay down by the GoI agencies for secondary treatment of sewage.	5.1 Total number of septage samples that have passed the specified treatment standards to number of septage samples tested, at the outlet of the plant. 5.2 Total number of effluent samples that have passed the specified treatment standards to number of effluent samples tested, at the outlet of the plant.	Weighted average of quality of treatment of each sanitation system, weighted by share of households dependent on each sanitation system.
5. Extent of reuse and recycling of sewage	**5.1 Extent of reuse and recycling of treated septage** **5.2 Extent of reuse and recycling of treated effluent and grey water**	**5. Extent of reuse and recycling in sanitation system**
Quantity of wastewater that is recycled or reused after secondary treatment as a percentage of quantity of wastewater received at the treatment plant.	6.1 Quantity of septage that is recycled or reused after treatment as a percentage of quantity of septage received at the treatment facility. 6.2 Quantity of effluent that is recycled or reused after treatment as a percentage of quantity of effluent received at the treatment facility.	Weighted average of extent of reuse of treated wastewater and sludge after adequate treatment as a percentage of wastewater and sludge received at the treatment plant, weighted by share of household dependent on each sanitation system.

Note: All indicators are in percentages.

Illustrative applications for three cities in Maharashtra

Use of the proposed indicators has been assessed by illustrative applications for three cities in Maharashtra. These cities are at different levels of sewerage versus onsite sanitation systems.

Extent of coverage of sewerage system	Extent of coverage of onsite sanitation system	
	High	Low
High	-	Nagpur Municipal Corporation
Low/ None	Kalyan-Dombivli Municipal Corporation	Sinnar Municipal Council

The first case of mixed sanitation system with high coverage of conventional sewerage system is illustrated through the case of Nagpur Municipal Corporation (Box 2). It is interesting to note that by adding onsite sanitation details, coverage shows a slight increase. Similarly as the toilets with septic tanks are connected to soak pits which treat both the septic tank effluent and grey water, adequacy of treatment shows some increase. However, the quality of treatment goes down as the septage collected from septic tanks is no treated.

The second case of Kalyan Dombivli Municipal Corporation demonstrates a context of mixed sanitation system with high coverage of onsite sanitation system (Box 3). Given higher coverage through onsite sanitation systems, there is increase in performance in coverage, collection efficiency and adequacy of treatment as for Nagpur, though the extent of improvement is far greater. The fall in quality of treatment is significant as both septage and grey water are not treated.

The third case of Sinnar Municipal Council shows a city that is fully dependent on onsite sanitation system (Box 4). The SLB indicators consider this city as fully "unsanitatised" with zero performance on each wastewater management indicator, as service performance of onsite sanitation system is not captured in the current SLB framework. With the proposed indicators, the city sanitation performance improves considerably. It also shows that the proposed improvement measures for onsite sanitation system by the local government are not captured in the SLB framework. However the new indicators help to show the higher performance level achieved after such improvements.

These illustrative applications show that for cities with mixed sanitation systems, use of current SLB indicators only captures the performance of conventional sewerage system, and fails to include the performance of onsite sanitation system. The new set of proposed indicators, however help to capture the situation better especially for cities that have onsite sanitation systems. The impact of using the new framework is more dramatic for a city that depends fully on onsite sanitation systems.

The use of the revised indicators framework for sanitation will help state and city governments in monitoring sanitation improvement. It also helps in improvement planning as a city can choose various options based on local priorities and availability of finance. Importantly, it is possible to more clearly assess the improvement in service performance by making smaller investments in onsite sanitation system.

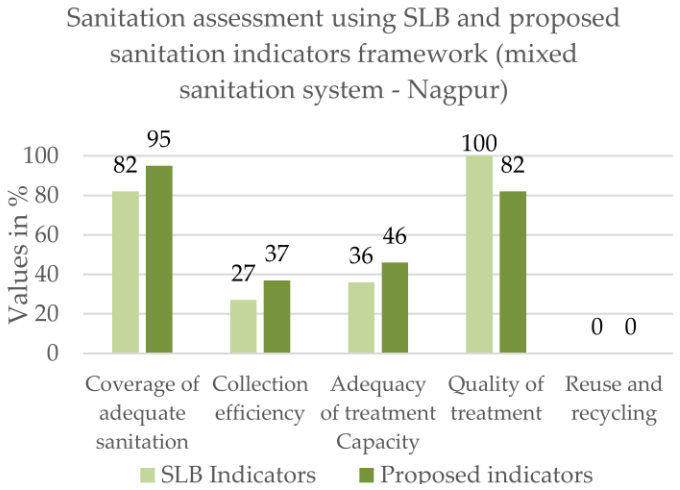
Box 2: An example of revised sanitation indicators framework for mixed system – Nagpur (High coverage of sewer connections)

Nagpur Municipal Corporation has a population of 2.6 million. Conventional underground sewer network is provided in about 85% of its inhabited area and 82% of properties are connected to this sewer network. However, 13% of properties have onsite sanitation system – with septic tanks and soak pits.

General Information	Nagpur
Total Population	25, 61, 974
Total Properties	5,33,884
Properties connected to sewer network	82%
Properties connected to onsite sanitation system	13%
Wastewater generated (MLD)	276
Sewage treatment plant capacity (MLD)	100

The treatment plant is able to treat 75 MLD (33% of sewage conveyed through network). Also 12% of septic tanks are cleaned annually and the waste is taken to sewage treatment plant. Effluent from septic tank is percolates into ground and considered as treated.

As quality tests are not carried out for sludge treatment, quality of treatment indicator shows lower value than SLB indicators. More details are available in annex 4.

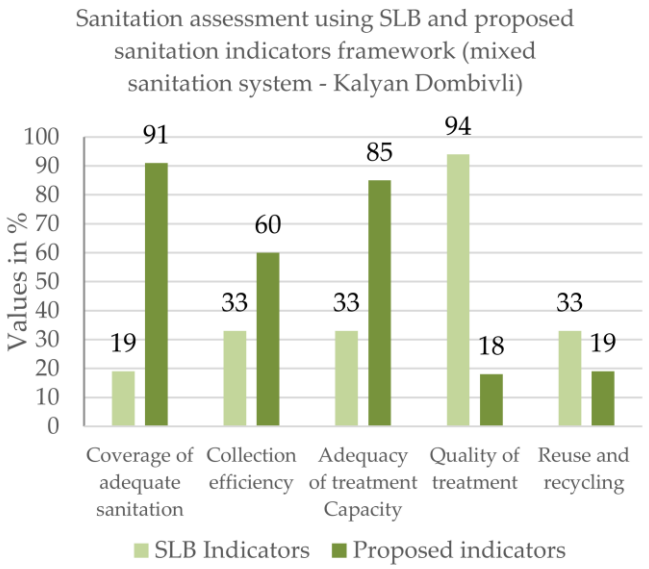


Box 3: An example of revised sanitation indicators framework for mixed system – Kalyan Dombivli (High coverage of onsite sanitation system)

Kalyan Dombivli Municipal Corporation has a population of 1.25 million. Conventional sewer network covers 37% of the inhabited area, with 19% of properties connected to the sewer network, while, 78% properties have onsite sanitation system - septic tank and soak pits. Only 30 MLD (42% of sewage generated) is treated in the treatment plant. 8% of total septic tanks are cleaned annually and sludge is treated in existing sewage treatment plant.

Proposed sanitation indicators related to coverage, collection efficiency and adequacy of treatment show higher performance than the use of SLB indicators. On the other hand, as quality tests are not carried out for sludge treatment and treated sludge is not reused, quality and reuse related indicators show lower performance (more details in annex 4).

General Information	Kalyan Dombivli
Total Population	12,51,668
Total Properties	1,23,473
Properties connected to sewer network	19%
Properties connected to onsite sanitation system	78%
Wastewater generated (MLD)	370
Sewage treatment plant capacity (MLD)	123



Box 4: An example of revised sanitation indicators framework for fully onsite sanitation system – Sinnar

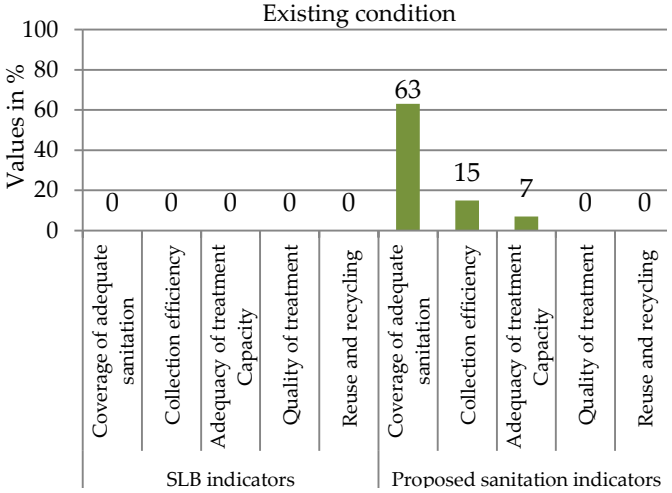
Sinnar Municipality with population of around 70,000 has no underground sewer network. All properties have onsite sanitation system. Around 49% HHs have septic tank and outflow in lined drains, 14 % HHs are connected with septic tank and soak pits and 21% HHs depend on community toilets which have septic tank connected to lined drains.

Only 6% of total septic tanks are cleaned annually through vacuum trucks and sludge is discharged on land near solid waste dump site without any treatment. Due to high desludging period, septage solidifies at bottom of septic tank and is not removed. Effluent from septic tank is discharged in lined drains without treatment.

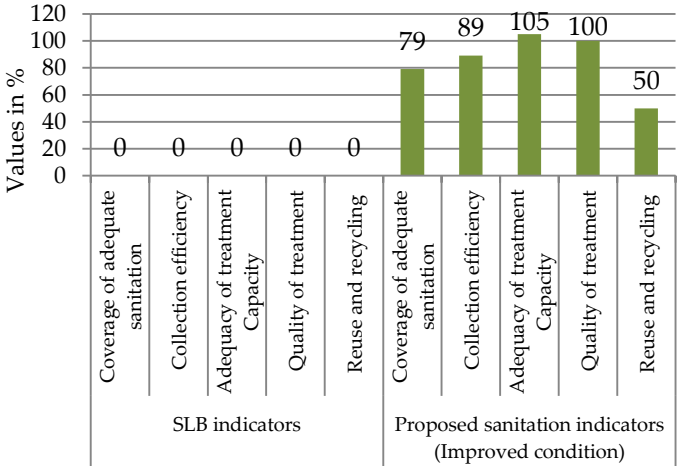
In fully onsite sanitation system, SLB indicators show zero value for all indicators. However, proposed sanitation indicators show performance of coverage of adequate sanitation system, collection efficiency and adequacy of treatment (effluent treatment through soak pits). Currently most cities in India do not have septage and effluent / grey water treatment facility. Therefore treatment and reuse & recycling columns are blank.

General Information	Sinnar
Total Population	69,670
Total Properties	14,420
Properties connected to sewer network	0%
Properties connected to onsite sanitation system	63%
Wastewater generated (MLD)	5
Sewage treatment plant capacity (MLD)	0

Sanitation assessment using SLB and proposed sanitation indicators framework:
Existing condition



Sanitation assessment after improvement



If proper integrated fecal sludge management (IFSM) plan is implemented, the sanitation service levels improved dramatically. The IFSM plan includes, regular cleaning of septic tank, treatment of septage and effluent and reuse of sludge. Treated sludge is reused in agriculture, whereas treated effluent is disposed of in water bodies.

Such improvements in the onsite sanitation system are not reflected in old SLB indicators. Whereas proposed sanitation indicators framework shows improvements in indicator values.

Background details of Sinnar Municipality are given in annex 4.

Drill-down indicators for sanitation

The proposed revised sanitation indicators for the SLB system presented above provides key performance indicators (KPIs) that are monitored by local governments themselves as well as by higher levels of governments at state and national levels. Under the PAS framework, further a set of drill down indicators have been developed. These provide further details on the service chain, or suggest key areas of action that need to be taken up to improve performance of the main KPI.[5] A full set of such drill-down indicators for each of the above KPIs in provided in Annex 3.

Table 3 provides an illustrative list of such drill down indicators for onsite sanitation system

Table 3: Indicators for Local Action: Onsite sanitation

Key Performance Indicators (KPIs)	Local Action Indicators (LAIs)	Areas for actions
1. Collection efficiency of septage (%)	1. % of septic tanks cleaned annually (%)	1. Increase number of trips for septage collection using existing vehicles
	2. Number of septage sucking machines/1000 septic tanks (Ratio)	2. Procure new suction emptier
	3. PSP in septic tank cleaning services (Y/ N)	3. Regularize cleaning of septic tank (Pre-scheduling and planning)
	4. User charges levied per emptying	
2. Collection efficiency of effluent and grey water (%)	5. Percentage of septic tanks connected to settled sewer / drains for effluent disposal (%)	4. Lay new settled sewers in uncovered areas
		5. Increase settled sewer connection for effluent disposal
	6. Percentage of septic tanks connected to soak pit for effluent disposal (%)	6. New soak pits to be built
	7. Coverage of sullage network (%)	7. Improvement & regular cleaning of existing drains
3. Adequacy of septage treatment facility (%)	8. PSP in O & M operations for treatment plant (Y/N)	8. Construct /Augment septage treatment plant capacity
		9. Refurbish non-functional septage treatment plant
		10. Involve private sector for operation and maintenance function of treatment plant
4. Adequacy of effluent (from septic tank and grey water) treatment capacity (%)		11. Construct /Augment treatment plant for effluent and grey water
		12. Refurbish non-functional treatment plant for effluent and grey water

[5] http://pas.org.in/Portal/document/ResourcesFiles/pdfs/Performance%20Measurement%20Framework%20Report_Vol%20I%20&%20II.pdf

Addressing the data challenges

A major challenge in assessing performance using the proposed onsite sanitation indicators is availability of adequate information. For example, most cities do not readily have data for onsite systems, i.e. properties with septic tanks, disposal of effluent from septic tanks through soak pits or drains, and frequency of cleaning of septic tanks. Quality tests are carried out only for treated wastewater and not for sludge.

Based on assessment of data of onsite sanitation systems in a few cities in Maharashtra, a number of measures have been identified to improve information of onsite sanitation systems. For example, it would be useful to add appropriate questions for onsite sanitation in property tax assessment form. Property tax assessment is done regularly and this will help to maintain updated information. For this, an initial baseline survey will have to be carried out with appropriate links to the property tax system. For regular updates, appropriate links will also need to be established with the process of granting building permissions. This will provide information about new properties and make it possible to have updated database.

Involvement of private septic tank emptiers to assess the extent of septic tank emptying. This can be easily done through records maintained by service providers.

The way forward…

Many cities aspire to provide sewer networks in their cities but this is beyond the capacity of most cities and is not financially sustainable. A well-managed onsite sanitation system is likely to play an important role in providing safe sanitation. However, the current performance measurement framework using SLB of the Government of India does not capture service level of onsite sanitation system. Onsite sanitation systems need to become an integral part of the performance assessment systems.

The proposed measurement framework provides a more realistic picture of on-ground situation as well as facilitates identification of improvement areas at local level. The case studies illustrate the manner in which onsite sanitation system can be captured in sanitation assessment through the proposed sanitation indicators. Together these will help provide an improved performance assessment of truly sanitized cities across India.

Annex I: Data requirements and rationale for the sanitation indicators

Proposed Sanitation Indicators

1. Coverage of toilets

Performance Indicators		
Indicator	**Unit**	**Definition**
Coverage of toilets	%	This indicator denotes the extent to which households have access to a toilet (whether individual or community) in a service area. The service area implies a specific jurisdiction in which the service is required to be provided.
Data Requirements		
Data required for calculating the indictor	**Unit**	**Remarks**
a. Total number of households with access to individual or community toilets within walking distance in the service area	Number	The total number of toilets (as against households) should be assessed. A property may have multiple households. Municipal records should be up-to-date, and preferably backed up by a cadastral map.
b. Total number of households without individual or community toilets within walking distance	Number	Only the total number of households without access to individual or community toilets should be assessed.
Coverage of toilets	**%**	**Coverage of toilets = [a/a+b]*100**

Rationale for the Indicator
"Last mile access to toilets is a key to improvement in service levels of sanitation facilities. In many Indian cities, there is inadequate access to toilet facilities. The Government of India has set an impressive target of universal access to improved sanitation by 2019. Swachh Bharat Mission has specific goals of creating open defecation free cities and integrated city-wide sanitation. Therefore, it is important to measure this parameter. The benchmark value for this indicator is 100 percent."

2. Coverage of households with adequate sanitation System

Performance Indicators		
Indicator	**Unit**	**Definition**
Coverage of households with adequate sanitation system *(toilets connected to sewerage, septic tank ortwin pit system)*	%	Percentage of households with individual or group toilet connected with adequate sanitation systems (either septic tank or underground sewer network or twin pit system) to total households in the ULB. HHs depending on community toilet is not considered in this indicator.
Data Requirements		
Data required for calculating the indictor	**Unit**	**Remarks**
Sewerage system		
a. Households with sewerage connections	Number	Households with connection to the underground sewage network should be included. Households that connect their toilet outlet to storm water drains or open drainage systems directly should not be considered.
Onsite Sanitation system		

b. Households connected to septic tank	Number	Households with access connection to the individual or community septic tanks should be included. Households that directly connect their outlet to open drainage system should not be considered.
c. Households connected to twin pit system	Number	Households with access connection to the twin pit system should be included. Households that are connected to only single pit should not be considered.
d. Total Number of households in the City	Number	The total number of households should be estimated.
Coverage of adequate sanitation system	**%**	**Coverage of adequate sanitation system = [(a+b+c)/d]*100**

Rationale for the Indicator
As per census 2011, most of the Households have sewer network or septic tank for wastewater discharge. Very few HHs are depending on pit latrines and other type of sanitation system. Swachh Bharat Mission draft guidelines talks about on-site sanitation which includes toilets connected to sewerage network, septic tank or double pit. And hence coverage of adequate sanitation indicator should capture both the households connected to sewerage system and those connected to on-site system i.e. septic tank or double pit. This indicator excludes the households depending on community or public toilets.

3. Collection efficiency of Sanitation system

Performance Indicators		
Indicator	**Unit**	**Definition**
Collection efficiency of sanitation system	%	Total quantum of sewage collected through underground sewer network, effluent from septic tank flowing through settled sewer network or drains, septage collected through vacuum tank emptying vehicles and wastewater collected and treated through twin pit system as percentage of normative wastewater generated in city. This indicator is calculated based on weighted average of households dependent on sewerage and onsite sanitation system.
Data Requirements		
Data required for calculating the indictor	**Unit**	**Remarks**
Sewerage system		
a. Total sewage received at the inlet of sewage treatment Plant and other decentralized wastewater treatment plant or at disposal point	MLD	The quantum of sewage measured at the inlet of treatment plants or at disposal point. It includes the sewage collected from households with sewerage network.
f. No. of HHs connected to underground sewerage network	Number	Households with connection to the underground sewerage network should be included. Households dependent on community toilets that are connected to sewer network should also be included here. Households that connect their sewerage outlet to storm water drains or open drainage systems should not be considered.
Onsite sanitation system		
b. Total septage collected from septic tank	Cum/year	The total quantum of septage collected through vacuum tank emptying vehicles. The quantum of untreated septage disposed on land, into rivers, lakes or other

		water bodies should be included in the quantum of septage collected.
c. Total effluent of septic tank collected through settle sewer / drain	MLD	The quantum of effluent from septic tank collected /flowing through settled sewer / drains. It should be measured either at inlet of treatment plant or in case of no treatment facility at outlet/disposal points. The quantum of untreated effluent at outfalls, leading into rivers, lakes or other water bodies should be included in the quantum of effluent collected.
d. Total wastewater generated	MLD	It includes total quantum of wastewater generated in the city. Wastewater generation is linked to the quantum of water supplied through piped systems, and other sources such as bore wells, when they are very extensively used.
e. Total septage generated	Cum/year	It includes quantum of septage generated from population depending on onsite sanitation system. A normative standard of 230 liter per capita per year, given by septage management advisory is used.
g. No. of HHs having septic tank connected to drains/settled sewers	Number	Households whose septic tanks are connected to drain or settled sewers for septic tank effluent should be recorded
h. No. of HHs having septic tank connected to soak pit	Number	Households whose septic tanks are connected to soak pit for septic tank effluent should be recorded
i. No of HHs connected to twin pit system	Number	Households with connection to the double pit system should be included. Single pit system should not be included.
j. Septage collected through twin pit system	Cum/year	It includes quantum of septage generated from population depending on twin pit system. A normative standard of 230 liter per capita per year, given by septage management advisory is used.
k. Number of HHs	Number	The total number of households should be assessed.
Collection efficiency of sanitation system	**%**	**Collection efficiency of sanitation system = {[(a*100/(d*{f/k}))*f]+ [0.5*{((b+j)*100/e)*(k-f)}]+ [0.5*(({c+((h+i)*(d/k))*100}/{(k-f)*(d/k)})*(k-f))]}/k**

Rationale for the Indicator
As per NUSP (2008), any combination of systems that does not lead to the output of 100% safe collection, conveyance and treatment, will not serve the purpose of achieving 100% sanitation for the city. Hence it is essential that there is proper collection of septage and effluent from septic tank and sewage from sewerage system and its proper conveyance. Hence it is important to measure this indicator. For cities with mixed sanitation system, proper collection of sewage by sewerage system and collection of septage and effluent from septic tank and settled sewers/drain is required. Collection efficiency of wastewater can be measured at the inlet of STP or at outlet point with the help of bulk meters. Collection efficiency of septage can be measured by volume and number of trucks collecting septage whereas if septic tank is connected to settled sewers/drains collection efficiency of effluent from septic tank can be measured either at the inlet of wastewater treatment facilities or by measuring flow at the outlet/disposal points in case of non-availability of treatment facility. It is assumed that quantity of effluent from septic tank discharge in soak pit is treated since it safely percolates into ground.

4. Adequacy of treatment capacity of sanitation system

Performance Indicators		
Indicator	**Unit**	**Definition**
Adequacy of treatment capacity of sanitation system	%	Adequacy is expressed as sewage treatment; septage treatment and effluent treatment capacity available in case of disposal by settled sewers/ drains as a percentage of normative septage & sewage generation, for the same time period. This indicator is calculated based on weighted average of households dependent on sewerage and onsite system.
Data Requirements		
Data required for calculating the indictor	**Unit**	**Remarks**
Sewerage system		
a. Total sewage treatment capacity	MLD	Total functional capacity of all sewage treatment plants that can meet desired treatment standards as per Pollution control boards or Environmental disposal standards.
f. No. of HHs connected to underground sewerage network	Number	Households with connection to the underground sewerage network should be included. Households that connect their toilet outlet to storm water drains or open drainage systems should not be considered.
Onsite sanitation system		
b. Total Septage treatment capacity	Cum/year	Total functional capacity of all septage treatment facilities available within the city.
c. Total treatment capacity for effluent from septic tank	MLD	Total functional capacity of all treatment plants treating effluent received from septic tank. It includes treatment of effluent from household connected by septic tank and settled sewer / drains.
d. Total wastewater generated	MLD	It includes total quantum of wastewater generated in the city. Wastewater generation is linked to the quantum of water supplied through piped systems, and other sources such as bore wells, when they are extensively used.
e. Total septage generated	Cum/year	It includes quantum of septage generated from population depending on onsite sanitation system. Normative standards given in advisory note of septage management i.e. 230 litres per capita per year is used.
g. No. of HHs having septic tank connected to drains/settled sewers	Number	Households whose septic tanks are connected to drain or settled sewers for septic tank effluent should be recorded
h. No. of HHs having septic tank connected to soak pit	Number	Households whose septic tanks are connected to soak pit for septic tank effluent should be recorded
i. No of HHs connected to twin pit system	Number	Households with connection to the double pit system should be included. Single pit system should not be included.
j. Number of HHs	Number	The total number of households should be assessed.
k. Septage collected through twin pit system	Cum/year	It includes quantum of septage generated from population depending on twin pit system. A normative standard of 230 liter per capita per year, given by septage management advisory is used.
Adequacy of sewage, septage and effluent treatment	**%**	**Adequacy of sewage, septage and effluent treatment = {[(a*100/ (d*{f/j}))*f] + [0.5*{((b+k)*100/e)*(j-f)}]+**

		[0.5*(({c+((h+i)*(d/j))*100}/{(j-f)*(d/j)})*(j-f))]}/j

Rationale for the Indicator
Treatment of both septage and wastewater (sewage and effluent from septic tank) is essential before its final disposal in the environment. Hence the treatment capacity should be adequate in proportion to total wastewater and septage generated. This indicator will measure adequacy of treatment capacity for sewage treatment, septage treatment and treatment of effluent from septic tank as well. Septage from septic tank can either be treated along with sewage in STP or in independent septage treatment facilities. Effluent from septic tank can be treated either by soak pit or by wastewater treatment facilities for the septic tank connected by settled sewer / drains.

5. Quality of treatment of sanitation system

Performance Indicators		
Indicator	**Unit**	**Definition**
Quality of treatment of sanitation system	%	Percentages of sewage and septage samples, including effluent from septic tank treatment sample in case of disposal by settled sewers/ drain meeting Pollution Control Board standards at treatment plant outlets and CPHEEO recommended standards for sludge treatment. This indicator is calculated based on weighted average of households dependent on sewerage and onsite system.
Data Requirements		
Data required for calculating the indictor	**Unit**	**Remarks**
Sewerage system		
a. Total number of sewage samples tested in a month	Number per year	Sampling of treated sewage (quantity, periodicity, point of sample collection, etc.) should be taken as per good industry practices and laid down norms by environmental agencies, such as pollution control boards of respective States or as detailed in relevant Beaureau of Indian Standards.
b.Number of sewage samples that pass the specified treatment standards	Number per year	Within the total valid samples of sewage, the number of samples that pass the specified treatment standards given by pollution control board, along all key parameters.
g. No. of HHs connected to underground sewerage network	Number	Households with connection to the underground sewerage network should be included. Households that connect their toilet outlet to stormwater drains or open drainage systems should not be considered.
Onsite sanitation system		
c. Total number of septage samples tested in a year	Number per year	Sampling of septage (quantity, periodicity, point of sample collection, etc.) should be taken as per good industry practices and laid down norms by MSW 2000 rule and CPHEEO manual.
d.Number of treated septage samples passed in a year	Number per year	Within the total valid samples of septage, the number of samples that pass the specified septage treatment standards, of all key parameters as per MSW 2000 rules and CPHEEO manual.
e. Number of treated effluent samples tested in a year	Number per year	Sampling (quantity, periodicity, point of sample collection, etc.) should be taken as per good industry practices and laid down norms by environmental agencies, such as pollution control boards of respective States.

f. Number of treated effluent samples Passed in a year	Number per year	Within the total valid samples, the number of samples that pass the specified treatment standards, of all key parameters.
h. No of HHs connected to septic tank	Number	Households with connection to the septic tank should be included. Septic tank should be connected to either settled sewer / drains or soak pit
i. Total households	Number	The total number of households should be assessed.
Quality of sewage , septage and effluent treatment	**%**	**Quality of sewage, septage and effluent treatment = [{(b*100/a)*g}+0.5*{(d*100/c)*h}+0.5*{(f*100/e)*h}]/(g+h)**

Rationale for the Indicator
For the sustainable management, it is essential that the treated sewage, septage and effluent from septic tank meet the required quality standard for safe discharge into environment or for its reuse. Hence it is essential to measure this parameter. Presently at the Sewage Treatment Plant (STP), quality check of only treated liquid portion of sewage is carried out & there is no check on sludge or septage. But it is necessary to check the quality of septage for its reuse as compost in agriculture fields. At present there is no defined quality standard as prescribed by pollution control board for septage. However, MSW 2000 rules have recommended the quality standard for the compost. As per advisory on septage management, GoI it is recommended that these MSW standards be adopted in absence of standards notified by the Central Pollution Control Board. Recently revised CPHEEO manual on sewerage and sewage treatment suggest standards for dewatered septage/sludge agriculture application, it should satisfy the following criteria of Class A Biosolids of US EPA either by lime stabilization, solar drying and or composting. • A faecal coliform density of less than 1,000 MPN/g total dry solids • Salmonella sp. density of less than 3 MPN per 4 g of total dry solids (3 MPN/4 g TS)

6. Extent of reuse and recycling in sanitation system

Performance Indicators		
Indicator	**Unit**	**Definition**
Extent of reuse and recycling in sanitation system	%	Quantum of wastewater and septage that is recycled or reused after treatment, including treated effluent in case of disposal by settled sewer / drains as percentage of normative wastewater and septage generated in city. This indicator is calculated based on weighted average of households dependent on sewerage and onsite system.
Data Requirements		
Data required for calculating the indictor	**Unit**	**Remarks**
Sewerage system		
a. Total sewage received at the inlet of treatment plant and other decentralized WWTP	MLD	The quantum of sewage measured at the inlet of treatment plants. It includes the sewage collected from properties with sewerage network.
b. Wastewater recycled or reused after appropriate treatment	ML per day (or) month	This should be based on the actual flow measurement by functional flow meters, the quantum for which should be measured daily.
g. No. of HHs connected to underground sewer network	Number	Households connected to the underground sewerage network should be included. Households that connect their toilet outlet to storm water drains or open drainage systems should not be considered.
Onsite sanitation system		

c. Total septage received at the inlet of treatment facilities	Cum/year	The quantum of septage measured at the inlet of septage treatment plants.
d. Quantum of treated septage reused after treatment	Cum/year	This should be based on the volume of compost produced, bio-gas generated or any other form in which septage is reused after proper treatment.
e. Total effluent collected through settled sewer / drain	MLD	The quantum of effluent from septic tank received at the inlet of treatment plant through settled sewer / drains.
f. Wastewater recycled or reused after appropriate treatment	MLD	This should be based on the actual flow measurement by functional flow meters, the quantum for which should be measured daily.
h. No of HHs connected to septic tank	Number	Households with connection to the septic tank should be included. Septic tank should be connected to either settle sewer / drains or soak pit
Extent of reuse and recycling in sanitation system	**%**	**Extent of reuse and recycling in sanitation system = [{(b*100/a))*g}+{(0.5*(d*100/c))+(0.5*(f*100/e))*h}]/(g+h)**

Rationale for the Indicator

For safe environmental management, recycle and reuse of both treated wastewater and septage should be encouraged. NUSP recommends promoting recycle and reuse of treated wastewater for non-potable applications wherever possible and technologies that promote recycle and reuse of treated wastewater should be encouraged. The high concentrations of nitrogen, phosphorous, and organic compounds in sewage sludge make it a beneficial fertilizer for plants. This can be a good substitute of chemical fertiliser, most of phosphorous used in fertilizers in India is imported.

As per recently revised CPHEEO manual on sewerage and sewage treatment, properly treated sludge can be reused to reclaim parched land by application as soil conditioner, and 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 sludge. Agricultural use of sludge matches best with priorities in waste management.

Annex II: List of indicators for Onsite sanitation system

1. Percentage of households connected to septic tank (%)
2. Percentage of households connected to septic tank as per design standards (%)
3. Percentage of households connected to twin pit system (%)
4. Collection efficiency of septage (%)
5. % of septic tanks cleaned annually (%)
6. Number of septage sucking machines/1000 septic tanks (Ratio)
7. PSP in septic tank cleaning services (Y/ N)
8. User charges levied per emptying
9. Percentage of septic tanks connected to settled sewer / drains for effluent disposal (%)
10. Percentage of septic tanks connected to soak pit for effluent disposal (%)
11. Collection efficiency of effluent (from septic tank) and grey water (%)
12. Coverage of sullage network (open + covered) (%)
13. Adequacy of septage treatment facility (%)
14. Adequacy of effluent (from septic tank and grey water) treatment capacity (%)
15. PSP in O & M operations for treatment plant (Y/N)
16. Quality of septage treatment (%)
17. Quality of effluent (from septic tank) treatment (%)
18. Extent of reuse and recycling of treated septage (%)
19. Extent of reuse and recycling of treated effluent (from septic tank and grey water) (%)

Annex III: Additional indicators for improvement at local level

List of additional indicators

Key Performance Indicators	Local Action Indicators	Action Area
1. Coverage of (Individual and community) toilets (%)	1. Coverage of households with own toilets (%)	1. New Individual toilets to be built in a year
		2. New group toilets to be built in a year
	2. Percentage of functional community toilet seats (%)	3. Refurbishment of non-functional community toilet seats
		4. New community toilets to be built in a year
2. Coverage of households with adequate sanitation system (toilets connected to sewer network or septic tank or twin pit) (%)	3. Percentage of households connected to septic tank (%)	5. Refurbishment of existing septic tank
	4. Percentage of households connected to septic tank as per design standards (%)	
	5. Percentage of households connected to twin pit system (%)	6. Households with unsafe sanitation disposal system to be upgraded to safe system
	6. Percentage of illegal sewer network connections (%)	7. Regularize unauthorized sewer connections
	7. Percentage of identified illegal sewer network connections that are regularized (%)	
	8. Percentage of households connected to sewer network (%)	8. Increase sewer connections using existing sewerage network
	9. Percentage of area covered with sewer network (%)	9. Laid down new sewer network in uncovered area
3. Collection efficiency of sanitation system (%)	10. Collection efficiency of sewer network (%)	
	11. Frequency of sewer overflows (number)	10.Improve and regular cleaning of sewer network
	12. Collection efficiency of septage (%)	11. Increase septage collection using existing suction emptier truck
	13. % of septic tanks cleaned annually (%)	12. Increase number of trips for septage collection
	14. Number of septage sucking machines/1000 septic tanks (Ratio)	13. Procure new suction emptier
	15. PSP in septic tank cleaning services (Y/ N)	14. Regularize cleaning of septic tank (Pre-scheduling and planning)
	16. User charges levied per emptying	
	17. Percentage of septic tanks connected to settled sewer / drains for effluent disposal (%)	15. Lay new settled sewers in uncovered areas
	18. Percentage of septic tanks connected to soak pit for effluent disposal (%)	16. New soak pits to be built
	19. Collection efficiency of effluent (from septic tank) and grey water (%)	17. Increase settled sewer connection for effluent disposal
	20. Coverage of sullage network (open + covered) (%)	18. Improvement & regular cleaning of existing drains
4. Adequacy of treatment capacity of	21. Adequacy of sewage treatment facility (underground sewerage system) (%)	19. Construct /Augment sewage treatment plant capacity
		20. Refurbish non-functional sewage treatment plant

Key Performance Indicators	Local Action Indicators	Action Area
sanitation system (%)	22. Adequacy of septage treatment facility (%)	21. Construct /Augment septage treatment plant capacity
		22. Refurbish non-functional septage treatment plant
	23. Adequacy of effluent (from septic tank and grey water) treatment capacity (%)	23. Construct /Augment treatment plant for effluent and grey water
		24. Refurbish non-functional treatment plant for effluent and grey water
	24. PSP in O & M operations for treatment plant (Y/N)	25. Involve private sector for operation and maintenance function of treatment plant
5. Quality of treatment of sanitation system (%)	25. Quality of septage treatment (%)	26. Improve quality surveillance by conducting regular sewage, septage and effluent quality tests at laboratory, if not carried out now
	26. Quality of effluent (from septic tank) treatment (%)	
	27. Quality of treated sewage disposed (BOD & COD) (%)	
6. Extent of reuse and recycling in sanitation system (%)	28. Extent of reuse and recycling of treated sewage (%)	27. Identify potential buyer /market in nearby areas for reuse (Industries, farmers, etc)
	29. Extent of reuse and recycling of treated septage received at treatment plant (%)	28. Increase Reuse of treated sewage, septage and effluent
	30. Extent of reuse and recycling of treated effluent (from septic tank and grey water) (%)	

Description of additional indicators

Wastewater	Unit	Description of Local Action Indicators
Access and Coverage		
1. Coverage of households with own toilets	%	Percentage of households with access to either individual or group toilets to total households in the city
2. Percentage of functional community toilet seats	%	Percentage of functional community toilet seats to total community toilet seats in the city
3. Percentage of households connected to septic tanks	%	Percentage of households with connections to septic tank to total number of households in the city
4. Percentage of households connected to septic tank constructed as per design standards	%	Percentage of households with connections to septic tank constructed as per design standards guidelines of CPHEEO / NBC / IS 2470 to total number of households with septic tank in the city
5. Percentage of households connected to twin pit system	%	Percentage of households with connections to twin pit system to total number of households in the city
6. Percentage of illegal sewer network connections	%	Percentage of illegal connections to total number of sewer network connections
7. Percentage of identified illegal sewer network connections that are regularized (%)	%	Percentage of illegal connections that have been identified and regularized to total number of sewer network connections
8. Percentage of households connected to sewer network	%	Percentage of households with connections to sewer network to total number of households in the city.
9. Percentage of area covered with sewer network	%	Percentage of municipal area covered by sewer network to total area of the city.

Wastewater	Unit	Description of Local Action Indicators
10. Collection efficiency of sewer network	%	Quantum of sewage collected at the intake of the treatment plant / disposal point to the quantity of sewage generated (as per CPHEEO, 80% of water consumed is wastewater generated by households connected to sewer network)
11. Frequency of sewer overflows	No	Number of incidents reporting sewer overflows in a year
12. Collection efficiency of septage	%	Quantum of septage collected at the intake of the treatment plant / disposal point to the quantity of septage generated (as per septage management advisory note, a normative standard of 230 liter per capita per year is used)
13. % of septic tanks cleaned annually	%	Percentage of septic tanks cleaned annually to total number of septic tanks in the ULB
14. Number of septage sucking machines/1000 septic tanks	ratio	Number of septage sucking machines (owned by ULB and private) per 1000 septic tanks
15. PSP in septic tank cleaning services	Y/ N	Presence of private sector participation in cleaning of septic tank services.
16. User charges levied per empting	Rs/ trip	Average user charges for septic tank empting levied by city / authorized private sector
17. Percentage of septic tanks connected to settled sewer / drains for effluent disposal	%	Percentage of households with septic tank connected to settled sewer / drains for effluent disposal to the total households with septic tank.
18. Percentage of septic tanks connected to soak pit for effluent disposal	%	Percentage of households with septic tank connected to soak pit for effluent disposal to the total households with septic tank.
19. Collection efficiency of effluent (from septic tank) and grey water	%	Quantum of effluent / grey water collected at the intake of the treatment plant / disposal point and disposed by soak pit to the quantity of wastewater generated (as per CPHEEO, 80% of water consumed is wastewater generated by households connected to septic tank)
20. Coverage of sullage network (open + covered)	%	Percentage of municipal area covered by sullage network (open and covered drains), to the total area of the city.
21. Adequacy of sewage treatment facility (underground sewerage system)	%	Available capacity of treatment plant that can treat sewage to secondary treatment standards (removal of BOD and COD) as a percentage of normative sewage generated by households connected to sewer network.
22. Adequacy of septage treatment facility	%	Available capacity of treatment plant that can treat septage to desirable standards as a percentage of normative septage generated.
23. Adequacy of effluent (from septic tank and grey water) treatment capacity	%	Available capacity of effluent treatment plant that can treat effluent / grey water to desirable standards as a percentage of normative wastewater generation.
24. PSP in O & M operations for treatment plant	Y/N	Presence of private sector participation in construction, operation and maintenance of STP
25. Quality of septage treatment	%	Total number of septage samples that have passed the specified treatment standards to number of septage samples tested , at the outlet of the plant.
26. Quality of effluent (from septic tank) treatment	%	Total number of effluent samples that have passed the specified treatment standards to number of effluent samples tested , at the outlet of the plant.
27. Quality of treated sewage disposed (BOD & COD)	%	Total number of sewage samples that have passed the specified treatment standards to number of sewage samples tested , at the outlet of the plant.
28. Extent of reuse and recycling of treated sewage	%	Quantity of sewage that is recycled or reused after treatment as a percentage of quantity of sewage received at the treatment facility.

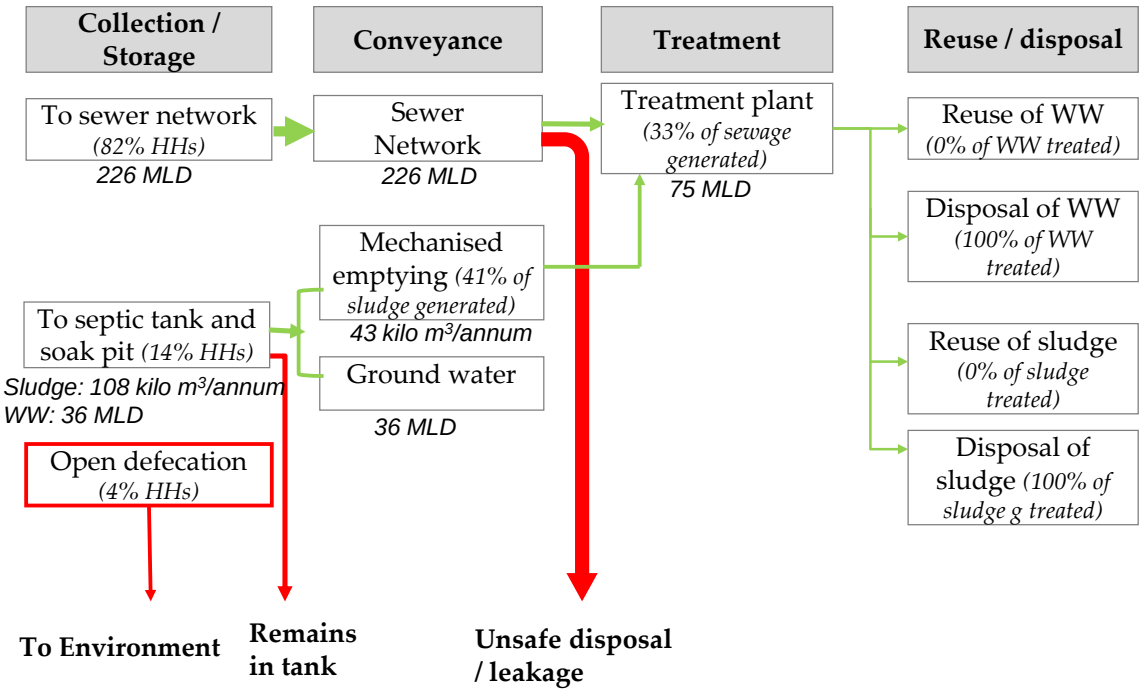
Wastewater	Unit	Description of Local Action Indicators
29. Extent of reuse and recycling of treated septage	%	Quantity of septage that is recycled or reused after treatment as a percentage of quantity of septage received at the treatment facility.
30. Extent of reuse and recycling of treated effluent (from septic tank and grey water)	%	Quantity of effluent that is recycled or reused after treatment as a percentage of quantity of effluent received at the treatment facility.

Annex IV: Information of Cities

Mixed type of sanitation system –Nagpur Municipal Corporation

SLB indicators		Proposed sanitation indicators	
Coverage of sewerage network service	82%	Coverage of adequate sanitation system	95%
Collection efficiency of sewage network	27%	Collection efficiency of sanitation system	37%
Adequacy of sewage treatment capacity	36%	Adequacy of Sanitation system	46%
Quality of sewage treatment	100%	Quality of treatment of sanitation system	82%
Extent of reuse and recycling of sewage	0%	Extent of reuse and recycling in sanitation system	0%

Wastewater flow diagram



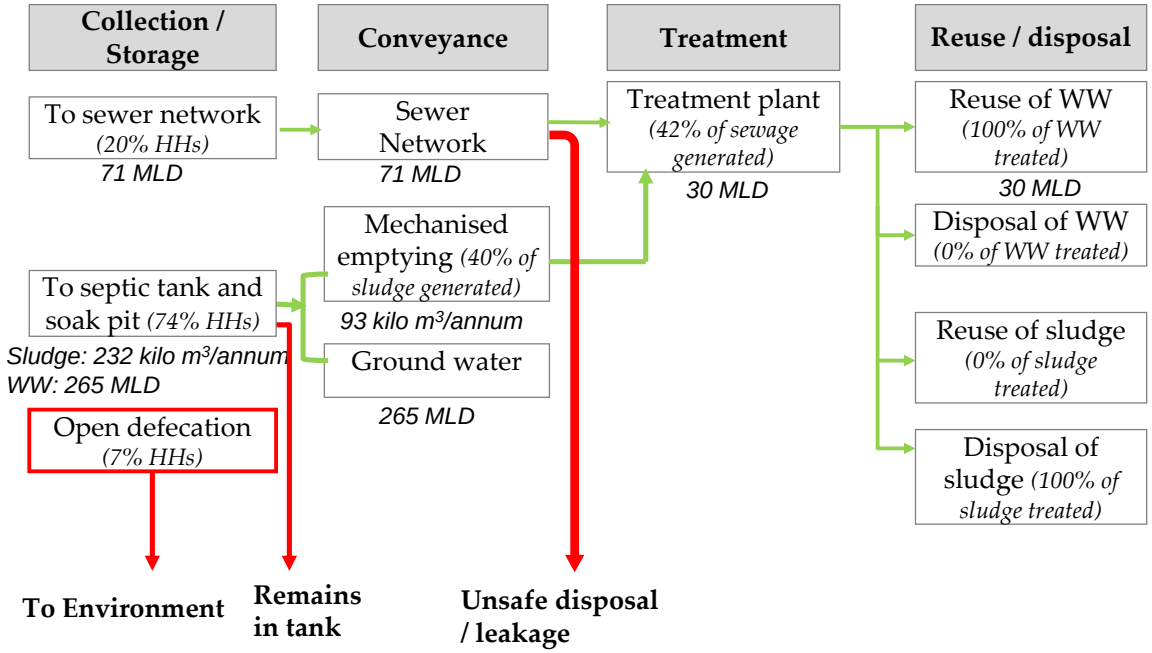
Details	Unit	Values
Total properties in the city	Number	5,33,884
Properties with toilets	Number	5,04,882
Properties with sewer connections	Number	4,35,971
Properties with septic tank	Number	68,911
No of septic tank connected to settle sewer / drains	Number	0
No of septic tank connected to soak pit	Number	68,911
Total Households in the City	Number	5,42,791
Family Size (Present Year)	persons	4.72
HHs with toilets	Number	5,13,305

Details	Unit	Values
Households dependent on functional community toilets	Number	7,537
Households with sewer connections	Number	4,43,244
Households with onsite sanitary disposal	Number	70,061
Households connected to septic tank and settle sewer / drains	Number	0
Households connected to septic tank and soak pit	Number	70,061
Total Waste Water Generated	MLD	276.3
Volume of sewage actually treated at Secondary Treatment Plant	MLD	75
Capacity of STP	MLD	100
Septic tank cleaned annually	Number	8,758
Quantity of septage received at inlet of treatment plant	Cu.m /year	43,790
Capacity of septage treatment plant	Cu.m /year	43,790
Quantity of effluent received at treatment plant	MLD	0
Capacity of effluent treatment plant	MLD	0
Number of Treated sewage Samples Tested in a year	Number	287
Number of Treated sewage Samples Passed in a year	Number	287
Number of Treated septage Samples Tested in a year	Number	0
Number of Treated septage Samples Passed in a year	Number	0
Number of Treated Effluent Samples Tested in a year	Number	0
Number of Treated Effluent Samples Passed in a year	Number	0
Volume of treated sewage reused after Secondary Treatment	MLD	0
Volume of treated sludge reused after Treatment	Kg / year	0
Volume of treated effluent reused after Treatment	MLD	0

Mixed type of sanitation system –Kalyan Dombivli Municipal Corporation

SLB indicators		Proposed sanitation indicators	
Coverage of sewerage network service	19%	Coverage of adequate sanitation system	91%
Collection efficiency of sewage network	33%	Collection efficiency of sanitation system	60%
Adequacy of sewage treatment capacity	33%	Adequacy of Sanitation system	85%
Quality of sewage treatment	94%	Quality of treatment of sanitation system	18%
Extent of reuse and recycling of sewage	33%	Extent of reuse and recycling in sanitation system	19%

Wastewater flow diagram



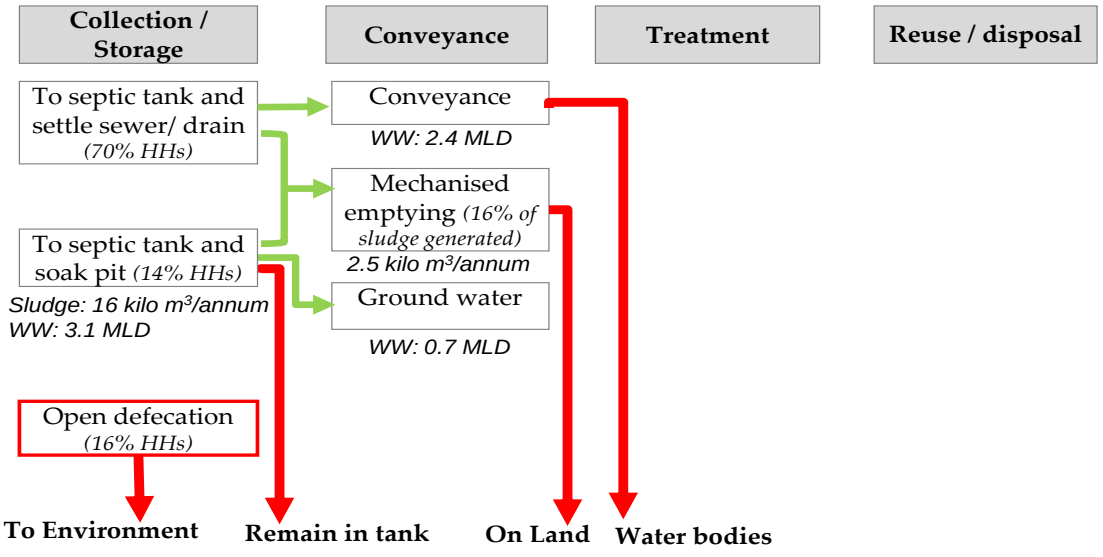
Details	Unit	Values
Total properties in the city	Number	1,23,473
Properties with toilets	Number	1,12,065
Properties with sewer connections	Number	23,713
Properties with septic tank	Number	88,352
No of septic tank connected to settle sewer / drains	Number	0
No of septic tank connected to soak pit	Number	88,352
Total Households in the City	Number	2,95,193
Family Size (Present Year)	persons	4.24
HHs with toilets	Number	2,67,919
Households dependent on functional community toilets	Number	7,700
Households with sewer connections	Number	56,692
Households with onsite sanitary disposal	Number	2,11,227
Households connected to septic tank and settle sewer / drains	Number	0
Households connected to septic tank and soak pit	Number	2,11,227
Total Waste Water Generated	MLD	370
Volume of sewage actually treated at Secondary Treatment Plant	MLD	30
Capacity of STP	MLD	123
Septic tank cleaned annually	Number	18,520
Quantity of septage received at inlet of treatment plant	Cu.m /year	92,600
Capacity of septage treatment plant	Cu.m /year	92,600

Details	Unit	Values
Quantity of effluent received at treatment plant	MLD	0
Capacity of effluent treatment plant	MLD	0
Number of Treated sewage Samples Tested in a year	Number	48
Number of Treated sewage Samples Passed in a year	Number	45
Number of Treated septage Samples Tested in a year	Number	0
Number of Treated septage Samples Passed in a year	Number	0
Number of Treated Effluent Samples Tested in a year	Number	0
Number of Treated Effluent Samples Passed in a year	Number	0
Volume of treated sewage reused after Secondary Treatment	MLD	30
Volume of treated sludge reused after Treatment	Kg / year	0
Volume of treated effluent reused after Treatment	MLD	0

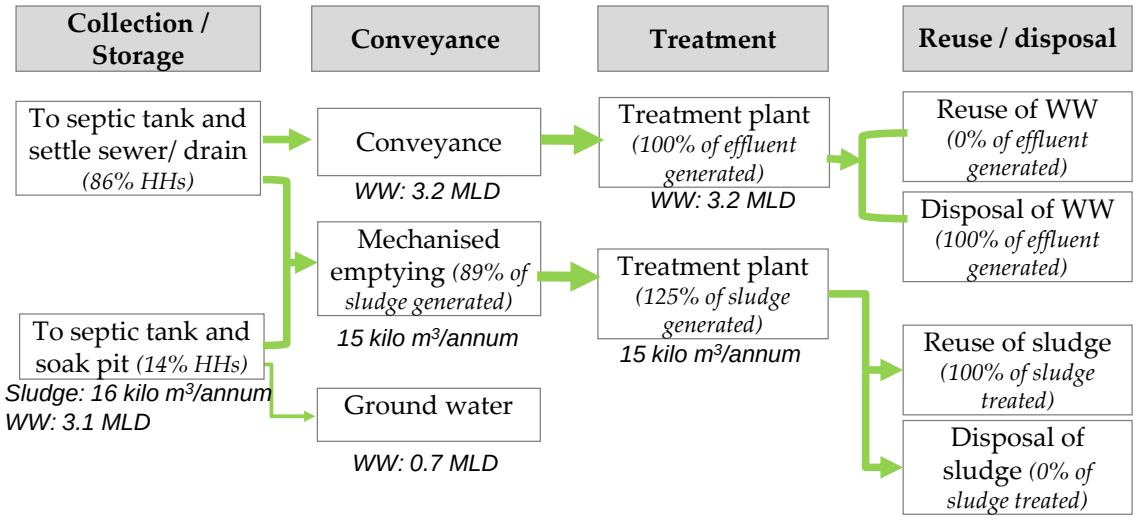
Fully onsite sanitation system –Sinnar Municipality

SLB indicators		Proposed sanitation indicators		
Indicators	Value	Indicators	Existing situation	Improved situation
Coverage of sewerage network service	0%	Coverage of adequate sanitation system	63%	79%
Collection efficiency of sewage network	0%	Collection efficiency of sanitation system	15%	89%
Adequacy of sewage treatment capacity	0%	Adequacy of Sanitation system	7%	105%
Quality of sewage treatment	0%	Quality of treatment of sanitation system	0%	100%
Extent of reuse and recycling of sewage	0%	Extent of reuse and recycling in sanitation system	0%	50%

Wastewater flow diagram - Current situation



Wastewater flow diagram – Improved situation



Details	Unit	Existing situation	Improved situation
Total properties in the city	Number	14,420	14420
Properties with toilets	Number	9,021	11360
Properties with sewer connections	Number	0	0
Properties with septic tank	Number	9,021	11360
No of septic tank connected to settle sewer / drains	Number	7,021	9360
No of septic tank connected to soak pit	Number	2,000	2000
Total Households in the City	Number	13,990	13990
Family Size (Present Year)	persons	4.98	4.98
HHs with toilets	Number	8,752	11021
Households dependent on functional community toilets	Number	3,000	3000
Households with sewer connections	Number	0	0
Households with onsite sanitary disposal	Number	8,752	11021
Households connected to septic tank and settle sewer / drains	Number	6,812	9050
Households connected to Septic tank and soak pit	Number	1,940	1940
Total Waste Water Generated	MLD	4.9	4.9
Volume of sewage actually treated at Secondary Treatment Plant	MLD	0	0
Capacity of STP	MLD	0	0
Septic tank cleaned annually	Number	500	3787
Quantity of septage received at inlet of treatment plant	Cu.m /year	2,500	15904
Capacity of septage treatment plant	Cu.m /year	0	20075
Quantity of effluent received at treatment plant	MLD	0	3.2
Capacity of effluent treatment plant	MLD	0	3.5

Details	Unit	Existing situation	Improved situation
Number of Treated sewage Samples Tested in a year	Number	0	0
Number of Treated sewage Samples Passed in a year	Number	0	0
Number of Treated septage Samples Tested in a year	Number	0	10
Number of Treated septage Samples Passed in a year	Number	0	10
Number of Treated Effluent Samples Tested in a year	Number	0	365
Number of Treated Effluent Samples Passed in a year	Number	0	365
Volume of treated effluent reused after Treatment	MLD	0	2
Volume of treated sludge reused after Treatment	Kg / year	0	19084800
Volume of treated sewage reused after Secondary Treatment	MLD	0	0

Annex V: Draft questionnaire for proposed sanitation indicators

Sr. No	*Data Elements*	*Unit*
Coverage of toilets		
1	Total Households in the City	Number
2	Family Size (Present Year)	persons
3	Households with individual / group toilets	Number
4	Households dependent on functional community toilets	Number
Coverage of toilets with adequate sanitation systems		
5	Households connected with sewer network	Number
6	Households connected with onsite sanitary disposal system	Number
7	Households connected to septic tank and settled sewer / drains	Number
8	Households connected to septic tank and soak pit	Number
9	Households connected to twin pit system	Number
10	Number of functional community toilet seats connected to sewer network	Number
Collection efficiency of sanitation system		
11	Total wastewater generated	MLD
12	Volume of sewage actually treated at secondary treatment plant	MLD
13	Number of septic tanks cleanned annually	Number
14	Quantity of septage received at inlet of treatment plant / dump site	Cu.m /year
15	Quantity of effluent / grey water received at inlet of treatment plant / disposal point	MLD
Adequacy of sanitation system		
16	Capacity of STP	MLD
17	Capacity of septage treatment plant	Cu.m /year
18	Capacity of effluent treatment plant	MLD
Quality of treatment of sanitation system		
19	Number of treated sewage samples tested in a year	Number
20	Number of treated sewage samples passed in a year	Number
21	Number of treated septage samples tested in a year	Number
22	Number of treated septage samples passed in a year	Number
23	Number of treated effluent samples tested in a year	Number
24	Number of treated effluent samples passed in a year	Number
Quality of treatment of sanitation system		
25	Volume of treated sewage reused after secondary treatment	MLD
26	Volume of treated sludge reused after treatment	Kg / year
27	Volume of treated effluent reused after treatment	MLD
Additional information		
28	Total no. of community toilet seats in city	Number
29	Total no. of functional community toilet seats in city	Number
30	Households connected to septic tank as per design standards	Number

Sr. No	*Data Elements*	*Unit*
31	Estimated number of illegal connections	Number
32	% of illegal connections regularised	%
33	Total area of city	sq. km
34	Area covered under sewer network in city	sq. km
35	Area covered with sullage network in city	sq. km
36	Frequency of sewer overflow	Number
37	No of septage sucking machines (own + private)	Number
38	PSP in septic tank cleaning services	Y/N
39	PSP in O & M operations for treatment plant	Y/N

Glossary

Effluent: The wastewater that flows out of a treatment system (in this case septic tank) or supernatant liquid discharged from the septic tank.

Fecal sludge: Fecal sludge is the solid or settled contents of pit latrines and septic tanks. It differs from sludge produced in municipal wastewater treatment plants. Fecal sludge characteristics can differ widely from household to household, from city to city, and from country to country. The physical, chemical and biological qualities of fecal sludge are influenced by the duration of storage, temperature, soil condition, intrusion of groundwater or surface water in septic tanks or pits, performance of septic tanks, and tank emptying technology and pattern.

Septage: 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.

Septic tank: An underground tank that treats wastewater by a combination of solids settling and anaerobic digestion. The effluents may be discharged into soak pits or small-bore sewers, and the solids have to be pumped out periodically.

Sewage: Sewage indicates the liquid waste from the community. It is extremely foul in nature.

Sewer: It is an under-ground conduit or drain through which sewage is carried to a point of discharge or disposal.

Sewerage: The term sewerage means the structures, device, equipment and appurtenances intended for the collection, transportation and pumping of sewage and liquid wastes but excluding works for treatment of sewage.

Soak Pit: A porous-covered chamber that allows wastewater to soak into the ground. It is also known as a soak-away or leach pit.

Sullage: Domestic dirty water not containing excreta. Sullage is also called grey water.

Twin Pit latrine: Twin-pits for pour-flush toilets are two underground leaching pits linked to one single pour-flush toilet by a Y-junction. The two pits are used alternately. The pits are lined either with a porous material or holes in the walls allowing the liquid to infiltrate into the surrounding soil.

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The Performance Assessment System – (PAS) is an action research programme, initiated by the CEPT University, Ahmedabad, with funding from the Bill and Melinda Gates Foundation. Since 2009, PAS has supported development of tools, methods and processes for performance assessment and improvement in delivery of urban water and sanitation services. It works with all levels of government: national, state and local. Since 2009, the PAS online performance assessment system has been implemented in the states of Gujarat and Maharashtra covering more than 400 cities. Other states in India have also begun to implement this system. The PAS programme has developed performance improvement tools to assist urban local governments in planning, target setting and tariff determination.

In recent years PAS programme has focused its work on urban sanitation. It has developed indicators for measuring on-site sanitation, developed framework for citywide sanitation planning considering the full value chain, and supported cities in implementing city sanitation plans that focus on making cities open defecation free (ODF). In support of these efforts, PAS team is working with various agencies on developing innovative sanitation financing mechanisms.

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