SFD Report

Kannur
India

Final Report

This SFD Report – Comprehensive level - was prepared by Centre for Science and Environment (CSE).

Date of production: 29/11/2016

Last update: 29/11/2016

SFD Report Kannur, India, 2017

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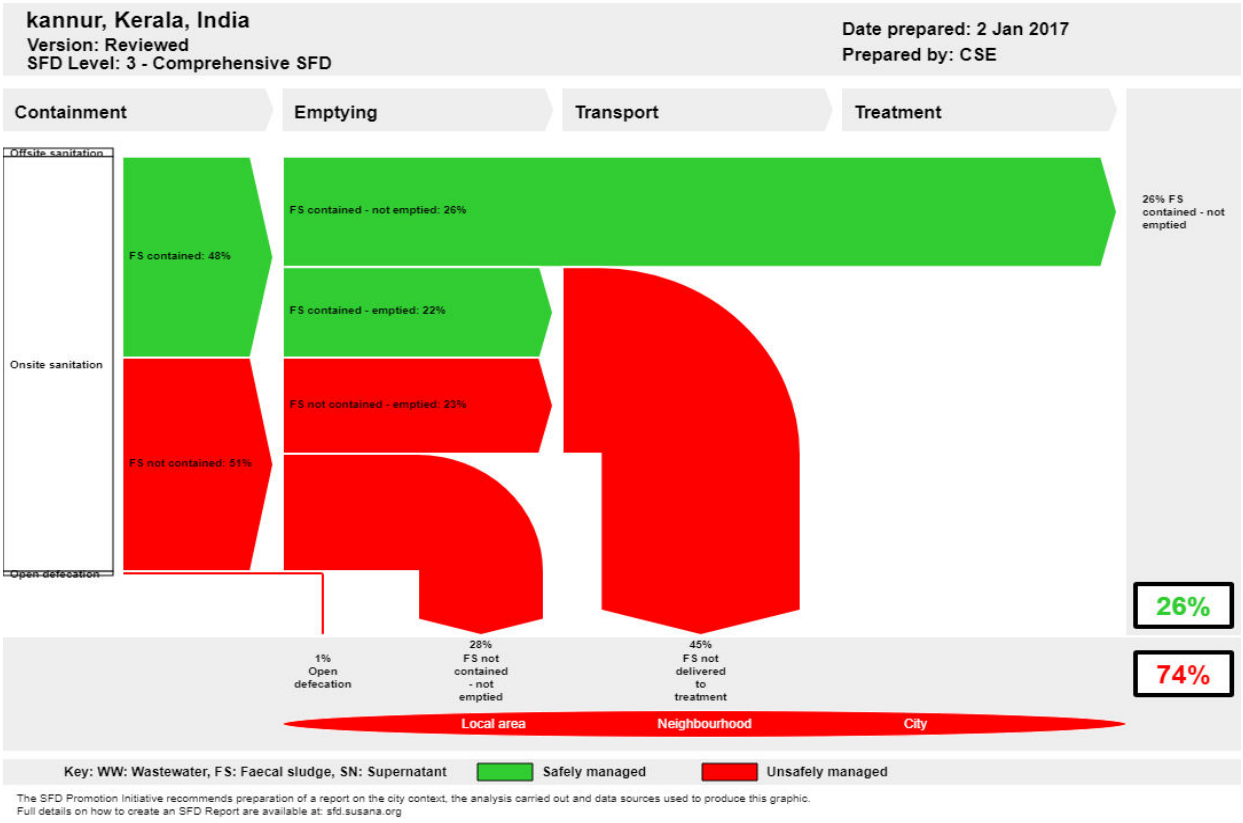
1. The SFD Graphic



The SFD Promotion Initiative recommends preparation of a report on the city context, the analysis carried out and data sources used to produce this graphic.
Full details on how to create an SFD Report are available at: sfd.susana.org

2. Diagram information

SFD Level: Comprehensive.

Produced by:

Centre for Science and Environment (CSE), New Delhi.

Status:

Final SFD report.

Date of production:

02/01/2017

3. General city information

Kannur, also known by its English name Cannanore, is a city in Kannur district, state of Kerala, India. It is the administrative headquarters of the Kannur district and situated 518 km north of the state capital Thiruvananthapuram. Kannur is famous for its pristine beaches, Theyyam (its native performing art), and its handloom industry. Kannur Municipal Corporation (KMC) is the largest urban local body of the north Malabar region.

On 1st November 2015, the 'Kannur Municipality' was combined with five adjacent gram panchayats (Pallikkunnu, Puzhathi, Elayavoor, Edakkad & Chelora) and became KMC. This increased city's area from 11.03 sq.km to 73.3 sq.km (KSPB, 2016). The population of the city, as per the survey done by KMC in 2015 is 232,486. The city is divided into 55 electoral wards. Population density of the city is 3,172 persons per sq.km, which is considerably high, when compared to that of Kerala state, i.e. 859 persons per sq.km. The slum population is 5,368, representing 2.5% of the total population (KMC, 2016). The temperature is 35°C during peak summer season and 16°C during the winter. The annual average rainfall is 3,438 mm, where more than 80% of it occurs during the period of South-West monsoon. The rainfall during July is very heavy and the district receives 68% of the annual rainfall during this season (CalicutNet, 2017).

4. Service outcomes

Overview of technologies and methods used for different sanitation systems through the sanitation service chain is as follows:

Containment: The Census of India 2011 reflects that 19% of the households are connected to pipe sewer system but during the field based study it was found that the city does not have any sewer system at present. Most of the people in the city (99%) are dependent on Onsite Sanitation System (OSS). 48% of the population is dependent on septic tanks connected to soak pits, 47% on fully-lined tanks connected to soak pits and 4% on pit latrines either constructed with concrete rings or laterite stones. Rest 1% of the population (mostly urban poor residing is the coastal areas) defecate in open. The types of containments in the city vary with the economic status of the residents. Readymade septic tanks made up of Polyvinyl Chloride (PVC) are also prevalent in the city, installed mainly in sandy areas to avoid seepage.

Figure 1: Prefabricated septic tanks made of PVC (Source: Anil/CSE, 2016)

Emptying: Since KMC does not own a vacuum tanker, residents are dependent on private emptiers for getting their OSS emptied. The private emptiers are not stationed in town, but are called from outskirts of the city like from Payyanur city (about 30km from Kannur). The emptiers advertise their contact details in local newspapers on alternate days. In order to avail the emptying service, the resident has to contact emptiers through phone call. Another way of contacting emptiers is through agents. These agents used to work as local manual emptiers in earlier days and have the contacts of motorized emptier running in other cities or rural areas. Emptying service is provided late night only, as this practice keeps the emptiers away from police and local people who may get offended and troubled by the emptying business. The capacity of the vacuum tanker is typically 5,000 litres and the emptying duration is dependent on the size and type of containment. But generally, it takes about half an hour for emptying one septic tank and the charges are INR 6,000 – 10,000 (92 – 153 USD) per trip (Private Emptiers, 2016). A pump of 2 HP is attached to the truck which is the source of power for suction process and each truck makes 4 - 5 trips per day, on average. Manual emptying of Faecal Sludge (FS) from septic tanks was also reported. Specifically, in the five newly added gram panchayats. Kerosene oil is used to get rid of odour from septic tank before starting emptying process.

Transportation: Plan for construction of a new house gets approved by the municipality only if it complies with Kerala Municipal Building Rules (KMBR) 1999, which states that each house must have a septic tank connected to a soak pit. It is a common practice in the city to construct separate soak pit within the premises of the household, for grey water disposal. Thus, no wastewater (black and grey) leaves the household premises and is managed in situ. Only a few households in the coastal areas discharge their grey water to open drains which discharges into the Arabian Sea. Storm water drains, where they exist, are clogged due to silt and dumping of waste. A number of hotels and restaurants functioning at the town centre have no proper wastewater treatment facilities and discharge their wastewater to the storm water drains which lands up in water bodies. Natural flow of water from the town carries major portion of the contaminated water to the natural drains and it causes heavy pollution of water bodies. FS collected from different parts of the city is transported by the privately operated vacuum tankers outside the city.

End-use/Disposal: There is no treatment of septage and FS generated in the city. The FS collected by the vacuum tankers is disposed at open low-lying areas outside the city. The private emptiers informed that disposal of FS is a huge issue as there is no specific place for discharging FS. They have threat from the local police for which they even have to bribe.

According to the Census, 80% of the city is dependent on OSS. But according to KII, FGDs and random sample household survey, 99% of the population is dependent on OSS. Out of this, 48% of the population is dependent on septic tanks connected to soak pit, 47% on fully-lined tanks connected to soak pit and around 4% on pit latrines. FS contained is attributed to 48% of the population that is dependent on septic tanks connected to soak pit. FS not contained is attributed to 51% of the population (47% dependent on fully-lined tanks connected to soak pit and 4% dependent on pit latrines).

In the FS contained system, 50% is considered as solid FS and 50% is considered as the liquid FS component (infiltrate). It is also assumed that 90 % of the population use their systems with emptying. Out of the 48% FS contained, 24% is considered as the liquid component (infiltrate) and 24% is the solid FS. Out of the 24% solid FS (contained), 22% is emptied (90% of 24%) leaving behind 2% FS which is not emptied. The 24% infiltrate together with the 2% FS which is left behind in the containment system constitute the 26% 'FS contained – not emptied'.

Similarly, out of the 51% FS not contained, 25% is considered as the liquid component (infiltrate) and 26% is the solid FS. Out of the 26% solid FS (not contained), 23% is emptied (90% of 26%) leaving

behind 3% FS which is not emptied. The 25% infiltrate together with the 3% FS which is left behind in the containment system constitute the 28% FS not contained-not emptied.

'FS contained – emptied' which is attributed to 22% of the population along with 23% FS not contained–emptied together constitutes around 45%, which does not get delivered to treatment.

It was also found that in the wards within the vicinity of the sea, only females use toilets and males & children practice open defecation. Thus, 1% of the total population has been attributed to be practising open defecation. It can be concluded that excreta of 74% of the population are discharged untreated. Whereas excreta of 26% of the population are managed safely.

5. Service delivery context

National Urban Sanitation Policy (NUSP) was issued in 2008, by the Ministry of Housing and Urban Affairs (MoHUA, GoI) formerly known as Ministry of Urban Development. The policy aims to: raise awareness, promote behaviour change; achieve open defecation free cities; develop citywide sanitation plans; and provide 100% safe confinement, transport, treatment and disposal of human excreta and liquid wastes. The NUSP mandates state to develop state urban sanitation strategies and work with cities to develop City Sanitation Plans (CSPs).

NUSP identifies the constitution of the multi-stakeholder task force, known as City Sanitation TaskForce (CSTF) as one of the principal activities to be taken up to start the city sanitation planning process. CSTF has now been renamed as Swachh Bharat City Level Task Force (SBCLTF) (MoUD, 2014).

The Environment (Protection) Act, 1986 and the Water (Prevention and Control of Pollution) Act, 1974 have provisions relating to sanitation services and environmental regulations. It applies to households and cities with regard to disposing wastes into the environment. ULBs utilities also have to comply with discharge norms for effluent released from sewage treatment plants and to pay water cess under the Water Cess Act, 1977 (MoUD, 2013).

In February 2017, MoHUA issued the National Policy on Faecal Sludge and Septage Management (FSSM). The policy aims to set the context, priorities, and direction for, and to facilitate, nationwide implementation of FSSM services in all ULBs such that safe and sustainable sanitation becomes a reality for all in each and every household, street, town and city in India (MoUD, 2017).

There are various schemes launched by central government to provide basic civic amenities including improvement of urban sanitation. A total of four projects have been proposed under Atal Mission for Rejuvenation and Urban Transformation scheme during Financial Year (FY) 2016-17. Total investment of INR 200 crores (31.3 Million USD) was proposed for the projects – "Providing sewerage system in zone 1"; "Providing septage collection and septage treatment plant at Edakkad"; "Providing sewerage system in zone 2"; and "Providing sewerage system in zone 3".

6. Overview of stakeholders

The 74th Constitutional Amendment Act of 1992 reformed the sector by transferring responsibility for domestic, industrial, and commercial water supply and sewerage (WSS) from state agencies, such as Departments of Public Health Engineering and State Water Boards, to Urban Local Bodies (ULBs). This transfer has resulted in a variety of implementation models, as well as lack of clarity in the allocation of roles and responsibilities between state and local agencies, which sometimes result in large gaps in implementation (USAID, 2010).

Key Stakeholders	Institutions / organizations
Public institutions	Town and Country Planning Department (TCPD), Kerala Water Authority (KWA), Local Self Government Department (LSGD), Kerala State Pollution Control Board (KSPCB), Urban Poverty Alleviation Department (UPAD), Ministry of Housing and Urban Affairs (MoHUA), Kannur Municipal Corporation (KMC), Kerela State Planning Board (KSPB) and Suchitwa Mission
NGOs	Centre for Science and Environment (CSE)
Private sector	manual emptiers, local masons

Table 1: Key stakeholders (Source: Compiled by CSE, 2017)

The responsibility of the Local Self Government Department is to integrate the activities of 1,200 local bodies.

KWA is responsible for planning, designing and construction/development of the assets in sewerage and drainage sector, while KMC is responsible for operation and maintenance of assets (MoUD, 2013). KSPCB is responsible for monitoring and evaluation of STPs. KSPB formulates and prepares plans for cities and towns in the state. KMC is responsible for septage management.

CSTF is a multi-stakeholder platform comprising representatives from different sectors of society, including agencies directly responsible for sanitation, agencies indirectly involved or

impacted, eminent persons, practitioners, NGOs and sanitary workers.

7. Credibility of data

Two key sources of data are used; Census of India, 2011 and published documents of relevant departments. Most of the data are then updated by KIIs. Overall three KIIs and three FGDs have been conducted with different stakeholders.

There were three major challenges to develop the SFD graphic. Census and published/unpublished reports were not able to provide (i) up-to-date data on containment (ii) detailed typology of containment and (iii) actual information about FSM services provided to households. For this reason, field based studies were conducted to validate the data provided by secondary sources.

The Census and published/unpublished reports mostly differentiate between systems connected to the user interface, if any, but does not give information about the design of actual containment systems on ground level or about the disposal of septage and wastewater generated. Therefore, a random sample household survey was conducted in each ward of the city to identify and cross-check the data collected from the secondary sources.

8. Process of SFD development

Data are collected through secondary sources. The city is visited to conduct the random household surveys, FGDs and KIIs with relevant stakeholders, to fill in the data gap and to cross-check the data collected.

To start with, a relationship between sanitation technologies defined in Census of India and that defined in the project is established. The survey data are quantified and cross-checked with FGDs and KIIs.

The data are fed into the SFD graphic generator to calculate the excreta flow in terms of percentage of the population and also produce the SFD graphic. It can be concluded that excreta of 74% population are discharged in environment untreated. Whereas excreta of 26% of the population are safely managed.

9. List of data sources

Below is the list of data sources used for the development of SFD.

- Published reports and books:
  - Census of India 2011, House listing and housing data, Government of India.
  - Census of India 2011, District Handbook – Kannur.
  - Groundwater Year Book, Central Groundwater Board, 2014.
- KII with representatives from:
  - KMC.
  - GWD - Kannur.
  - KSPB.
- FGDs:
  - KMC staff.
  - Private emptiers.
  - Local masons.
- Random household survey.

Kannur, India, 2017

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Abbreviations

AMRUT	Atal Mission for Rejuvenation and Urban Transformation
BIS	Bureau of Indian Standard
CAPEX	Capital Expenditure
CGWB	Central Ground Water Board
CPCB	Central Pollution Control Board
CPHEEO	Central Public Health & Engineering Organization
CSE	Centre for Science and Environment
CSP	City Sanitation Plan
CSTF	City Sanitation Task Force
CT	Community Toilet
EWS	Economically Weaker Sections
FGD	Focus Group Discussion
FS	Faecal Sludge
FSM	Faecal Sludge Management
FSSM	Faecal Sludge and Septage Management
GoI	Government of India
GoK	Government of Kerala
GWD	Ground Water Department
IHSDP	Integrated Housing and Slum Development Programme
ICAR	Indian Council of Agricultural Research
INR	Indian Rupee
KII	Key Informant Interview
KITCO	Kerala Industrial and Technical Consultancy Organisation
KMBR	Kerala Municipal Building Rules
KMC	Kannur Municipal Corporation
KSPB	Kerala State Planning Board
KSPCB	Kerala State Pollution Control Board
KWA	Kerala Water Authority
LPCD	Litres per Capita per Day
MBGL	Metres Below Ground Level
MoHUA	Ministry of Housing and Urban Affairs
MIS	Management Information System
MLD	Million Litres per Day
MoHUA	Ministry of Housing and Urban Affairs (Formerly known as MoUD)
MoUD	Ministry of Urban Development
MoWRRD&GR	Ministry of Water Resources, River Development and Ganga Rejuvenation
MSL	Mean Sea Level
NBC	National Building Code
NH	National Highway
NIC	National Informatics Centre
NITI	National Institution for Transforming India (Formerly Known as Planning Commission)
NIUA	National Institute of Urban Affairs

NUSP	National Urban Sanitation Policy
OD	Open Defecation
ODF	Open Defecation Free
OPEX	Operation Expenditure
OSS	Onsite Sanitation System
PMAY	Pradhan Mantri Awas Yojna
PPE	Personal Protective Equipment
PT	Public Toilet
SBCLTF	Swachh Bharat City Level Task Force
SBM	Swachh Bharat Mission
SFD	Shit Flow Diagram
SLB	Service Level Benchmarks
SMP	Septage Management Sub-Plan
SN	Supernatant
sq km	Square Kilometre
STP	Sewage Treatment Plant
SWM	Solid Waste Management
UIDSSMT	Urban Infrastructure Development for Small and Medium Towns
ULB	Urban Local Body
USAID	United States Agency for International Development
USD	United States Dollar (1 USD = 66.5 INR)
WSS	Water Supply and Sewerage
WW	Wastewater

1 City context

Kannur, also known by its English name Cannanore, is a coastal city and a Municipal Corporation in the south Indian state of Kerala. It is the administrative headquarters of the Kannur district situated 518 km north of the state capital Thiruvananthapuram (Figure 1). On 1st November 2015, the 'Kannur Municipality' was combined with five adjacent gram panchayats (Pallikkunnu, Puzhathi, Elayavoor, Edakkad & Chelora) and became 'Kannur Municipal Corporation' (KMC). This increased city's area from 11.03 sq.km to 73.3 sq.km (KSPB, 2016).

The population of the city, as per the Kudumshree survey done by KMC is 232,486. The city is divided into 55 electoral wards. Population density of the city is 3,172 persons per sq.km, which is considerably high when compared to that of Kerala state, i.e. 859 persons per sq.km. The slum population is 5,368, representing 2.3% of the total population (KMC, 2016). The population growth rate of the city is given in Table 1.

Table 1: Population growth rate

Census year	Population	Growth rate (%)
1991	200,725	—
2001	211,694	5.46
2011	215,478	1.79
2015	232,486	7.89

Source: (Census, 2011), (KMC, 2016)

Kannur is famous for its pristine beaches, Theyyam (it is a native performing art), and its handloom industry. It is the sixth largest Urban Local Body (ULB) in Kerala after Thiruvananthapuram, Kochi, Kozhikode, Kollam and Thrissur. KMC is the largest ULB (local government) of the North Malabar region.

Kannur has a humid climate with an oppressive hot season from March to May, followed by the South-West monsoon which continues till September, October and November form the post-monsoon or retreating monsoon season, followed by the North East monsoon which extends till February, although the rain generally ceases after December. The annual average rainfall is 3,438 mm and more than 80% of it occurs during the period of South-West monsoon. The rainfall during July is very heavy and the district receives 68% of the annual rainfall during this season (CalicutNet, 2017).

During the months of April and May, the mean daily maximum temperature is about 35°C. Temperature is low in December and January – about 20°C. On certain days the night temperature may go down to 16°C.

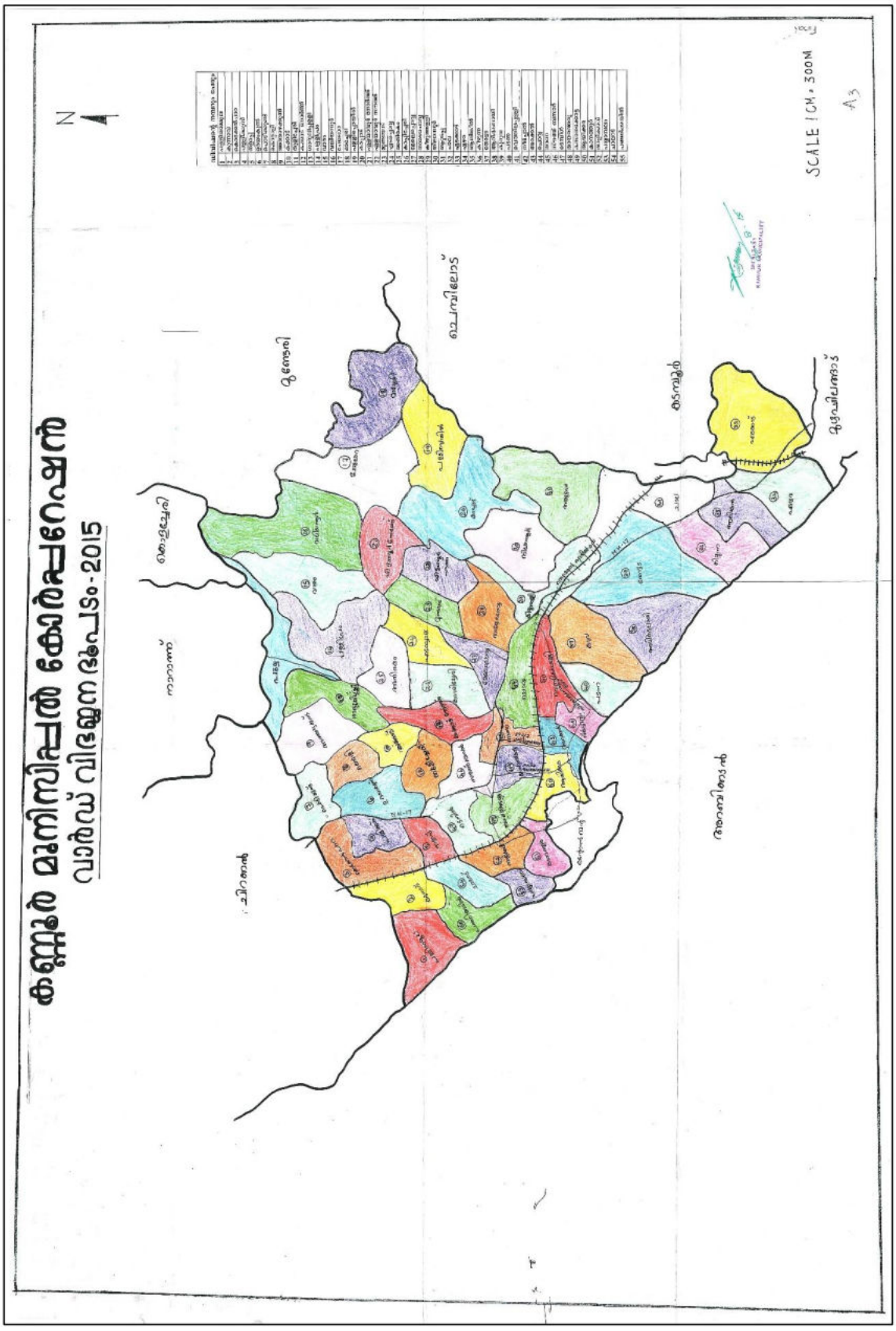

Figure 1: Ward map of Kannur Municipal Corporation area (KMC, 2016)

2 Service outcomes

The analysis is based on data available from Census of India, 2011 and sample household survey. Data collected from secondary sources is triangulated in field-based study. Data on containment are available in Census, 2011. Data have been cross-checked and updated by Key Informant Interviews (KIIs) and Focus Group Discussions (FGDs). According to the SFD promotion initiative (PI) definitions of sanitation systems, the types of containments prevalent in the wards are examined through sample household survey (for details refer Table 3). Data on emptying, transport, treatment and disposal of FS are collected through KIIs with ULB (It is the local governing body of a city responsible for providing basic infrastructures like water supply and sanitation along with health facilities as per standards and norms, to all the citizens. In Kannur, the ULB is called KMC), private emptiers and parastatal body. However, most of the data are qualitative.

2.1. Overview

To start with, a relationship between sanitation technologies defined in Census of India and the variables defined in the project is established. Then the population dependent on those systems is represented in terms of percentage of population, as shown in Table 2.

Table 2: Sanitation technologies and corresponding percentages of population

S. No.	Sanitation technologies and systems as defined by:		SFD reference variable	Percentage of Population
	Census of India	SFD Promotion Initiative		
1	Piped sewer system	User interface discharges directly to a centralized foul/separate sewer.	T1A1C2	18.63
2	Septic tank	Septic tank connected to open drain or storm sewer	T1A2C6	69.62
3	Other Systems	User interface discharges directly to open ground	T1A2C8	1.08
4	Pit latrine with slab	Lined pit with semi-permeable walls and open bottom, no outlet or overflow, general situation	T1A5C10	8.87
5	Pit latrine without slab	Unlined pit no outlet or overflow, general situation	T1A6C10	0.08
6	Night soil disposed into open drain	User interface discharges directly to open drain or storm drain	T1A1C6	0.01
7	Service latrine	User interface discharges directly to ‘don"t know where"	T1A1C9	0.00
8	Public latrine	Septic tank connected to open drain or storm sewer	T1A2C6	0.99
9	Open defecation	Open defecation	T1B11C7 TO C9	0.72

Source: (Census of India, 2011)

2.1.1. Sanitation facilities

This section presents on existing sanitation facilities in institutions, commercial establishments, slums and public places.

Community/public toilets: There are nine public toilets available in the city. However, there are no designated community toilets for urban poor, those who do not have individual household toilet. Public toilets are used by urban poor as well. Eight out of the nine public toilets are connected to septic tanks and the latest one has on the spot treatment. The size and design of septic tanks of the public toilets meet the design standards as prescribed in the Central Public Health & Environmental Engineering Organisation (CPHEEO) manual on sewerage and sewage treatment systems. The septage is emptied from the public toilets by the private emptiers and the collected septage is indiscriminately disposed at any low-lying areas outside the city. But, sometimes, the septage is even sold to a manure producing plant at Payyanur.

School sanitation: There are a total of 20 schools in the municipal area, out of which 14 are privately owned and the rest are government aided. Some of the schools lack the basic facilities such as drinking water and sanitation (MoUD, 2015).

Due to lack of data on excreta generated from institutions and commercial areas, it has not been taken into consideration for production of the SFD graphic.

2.1.2. Containment

The Census of India, 2011, reflects 19% of households are connected to piped sewer system but during the field-based study including KII with ULB, it was found that the city does not have any sewer system at present.

Most of the people in the city (99%) are dependent on Onsite Sanitation System (OSS). 48% of the population is dependent on septic tanks connected to soak pits, 47% on fully-lined tanks connected to soak pits and 4% on pit latrines either constructed with concrete rings or laterite stones. Rest 1% of the population (mostly residing is the coastal areas) practices open defecation.

The types of containments in the city vary with the economic status of the residents. People belonging to high income groups mainly rely on three chambered septic tanks or fully-lined tanks connected to soak pits. Whereas, people belonging to middle income groups prefer constructing either fully-lined tanks connected to soak pit or lined-pits constructed with granite stones. The people from lower economic section prefer unlined-pit constructed with granite stones.

Readymade septic tanks made up of Polyvinyl Chloride (PVC) are also prevalent in the city, installed mainly in sandy areas. These are manufactured in Coimbatore and are available for INR 10,000 – INR 40,000 (155 – 625 USD), depending upon their sizes.

Sizes of all pits depend on space availability and affordability of households. Layout plan for construction of a new house only gets approved by the municipality if it complies with Kerala Municipal Building Rules (KMBR) 1999, which states that each house must have a septic tank connected to a soak pit.

Figure 2: Outlet of OSS (source: Amrita/CSE, 2016)

Figure 3: A circular pit with open bottom (Source: Anil/CSE, 2016)

A separate soak pit is constructed within the premises of all households, for grey water disposal. Open defecation is mostly practised in the wards occupied by urban poor and the wards in proximity to the Arabian Sea.

2.1.3. Emptying

Households are dependent on private emptiers for emptying service. According to the KII with ULB, the private emptiers are not stationed in town, but are called from outskirts of the city such as Payyanur city (about 30 km from Kannur). The emptiers advertise their contact details in local newspapers on alternate days. In order to avail the emptying service, a resident has to contact emptiers through a phone call. Another way of contacting emptiers is through agents. These agents, were local manual emptiers in earlier days and have the contacts of motorized emptier running in other cities or rural areas. The agents then contact the private emptier and earn a commission from an emptier to crack a deal.

Emptying service is provided late night only, as this practice keeps the emptiers away from police and local people who may get offended and troubled by the emptying operation.

The capacity of the vacuum tanker is typically 5,000 litres and the emptying duration is dependent on the size and type of containment. But generally, it takes about half an hour to empty one septic tank and the fees charged is INR 6,000 – 10,000 (92 USD – 153 USD) per trip (Private Emptiers, 2016). A pump of 2 HP is attached to the truck which is the source of power to create vacuum for suction. On an average, each vacuum truck completes 4 - 5 trips per day.

2.1.4. Transportation

Among the houses dependent on OSS, the houses which ones septic tanks/fully-lined tanks installed are all connected to soak pits while others are dependent on pit latrines. Also, there is a general practice in the city to construct a separate pit for the seepage of grey water (that is, relatively clean wastewater from bath, sinks, washing, etc.) within the premises of a household. Thus, no wastewater, black or grey, leaves the household premises and is managed on the site, except for a few households in coastal areas that discharge grey water in drains ending into Arabian Sea.

A number of hotels and restaurants operating in the town centre have no proper wastewater treatment facilities and discharge their wastewater to the storm water drains which leads to water bodies. Natural flow of water from the town caries major portion of the contaminated water to the natural drains and it causes heavy pollution of water bodies. Faecal sludge (FS) collected from different parts of the city is transported by the privately operated vacuum tankers.

Figure 4: Grey water connected to a separately constructed soak pit (Source: Bhavik/CSE, 2016)

Figure 5: Grey water flowing into the open drain (Source: Anil/CSE, 2016)

2.1.5. Treatment and disposal

There is no treatment of septage and FS generated in the city. The FS collected by the vacuum tankers is discharged untreated at open low-lying areas outside of the city. As per FGD with private emptiers, disposal of FS is a huge issue as there is no specific site for discharging FS. There is also threat from the local police for which they often bribe.

Figure 6: Storm water drains terminating in the Arabian Sea (Anil/CSE, 2016)

2.2. SFD matrix

The SFD matrix is shown in Appendix 7.6 and the final SFD for Bansberia is presented in Appendix 7.3.

2.2.1. SFD matrix explanation

Definition and estimation of different variables (used to make SFD) are explained in Table 3 and 4.

Table 3: Description of variables used for defining containment systems

S. No.	SFD reference variable	SFD promotion initiative	Percentage of Population
1.	T1A2C5	User interface discharging to septic tank connected to soak pit	48%
2.	T2A3C5	User interface discharging to fully lined tank (sealed) connected to a soak pit,where there is 'significant risk' of groundwater pollution	47
3.	T2A5C10	User interface discharging to lined pit with semi-permeable walls and open bottom,no outlet or overflow, where there is 'significant risk' of groundwater pollution	4%
4.	T1B11C7	Open defecation	1%

Source: (CSE, 2016)

Table 4: Description of variables used in the SFD graphic

System type	Variables	Description (city context)	Percentage of population
Onsite	SN contained	FS from the onsite sanitation technology (T1A2C5) where there is low risk of groundwater pollution	48
	FS contained- not emptied	FS contained that remains in the system and is not emptied. This includes the infiltrate as well	26
	FS contained-emptied	FS contained, that is emptied, using either motorized or manual emptying equipment	22
	FS not contained	FS from the OSS (T2A3C5 and T2A5C10) is not contained due to significant risk of groundwater contamination	51
	FS not contained-emptied	FS not contained, that is emptied, using either motorized or manual emptying equipment	23

	FS not delivered to treatment	FS that is taken outside the city and is either discharged into a water body or sold to a manure producing plant in Payyanur	45
	FS not contained-not emptied	FS not contained, that remains in the system and cannot be emptied. This includes the infiltrate as well	28
Open defecation	Open defecation	With no user interface, users defecate in water bodies or on open ground, consequently the excreta are not contained	1

Source: (CSE, 2016)

Offsite systems

According to the Census, 19% of the city is dependent on offsite systems, all of which are connected to piped sewer system. But according to the survey, KII and FGDs conducted, it was found that there is no household connected to functional underground drainage system.

Onsite sanitation systems

According to the Census, 80% of the city is dependent on OSS. But according to the sample household survey and FGDs, 99% of the population is dependent on OSS, out of which 48% is dependent on septic tanks connected to soak pit, 47% on fully-lined tanks connected to soak pit and around 4% on pit latrines. The public latrines in the city have been taken to be connected to septic tanks and hence have been incorporated in onsite systems.

Since the septic tanks connected to soak pit are constructed as per the norms stated in KMBR, they have been considered 'contained'; even though people consume the groundwater from the open wells in their respective premises. But, pits constructed with concrete rings / laterite stones have been considered 'not contained' as they present a 'significant risk' of groundwater contamination due to high groundwater table.

There is no clear differentiation between the volume of effluent and solid FS generated from septic tanks and pits, hence to reduce the maximum error; it is assumed to be 50% each.

FS contained is attributed to 48% of the population that is dependent on septic tanks connected to soak pit and FS not contained is attributed to 51% of the population (47% dependent on fully-lined tanks connected to soak pit and 4% dependent on pit latrines).

In the FS contained system, 50% is considered as solid FS and 50% is considered as the liquid FS component (infiltrate). It is also assumed that 90 % of FS is emptied during the emptying process thereby leaving 10% of FS in the containment system itself. Out of the 48% FS contained, 24% is considered as the liquid component (infiltrate) and 24% is the solid FS. Out of the 24% solid FS (contained), 22% is emptied (90% of 24%) leaving behind 2% FS which is not emptied. The 24% infiltrate together with the 2% FS which is left behind in the containment system constitute the 26% 'FS contained – not emptied'.

Similarly, out of the 51% FS not contained, 25% is considered as the liquid component (infiltrate) and 26% is the solid FS. Out of the 26% solid FS (not contained), 23% is emptied (90% of 26%) leaving behind 3% FS which is not emptied. The 25% infiltrate together with the 3% FS which is left behind in the containment system constitute the 28% FS not contained-not emptied.

'FS contained – emptied' which is attributed to 22% of the population along with 23% FS not contained – emptied together constitutes around 45%, which does not get delivered to treatment.

Open defecation

Although the city has been declared open defecation free (ODF), according to the survey and FGDs conducted, it was revealed that in the wards in vicinity of the sea, only females use toilets while males and children practise open defecation. Thus 1% of the total population has been attributed to be practising open defecation.

It can be concluded that excreta of 74% of the population are discharged in environment untreated and hence are not safely managed. Whereas the excreta of 26% of the population are safely managed. The appendix 7.4 summarizes the percentage of the population using each sanitation technology and method along the service chain.

2.2.2. Risk of groundwater contamination

The SFD assessment includes the risk of groundwater pollution as an important factor in determining whether excreta are contained or not contained. If the risk of contamination to groundwater is low, then FS is considered “contained”. The type of onsite sanitation technology in use also has an influence on infiltration of liquid into the groundwater and therefore on the potential risk of groundwater pollution.

According to the Census, 77% of the population is dependent on covered/uncovered wells, 22% on piped water supply and the rest 1% on other sources like hand-pumps, tube well, etc. Sample survey revealed 85% of the respondents are dependent on covered/uncovered wells and 15% use the piped water supply, which also includes public tap water and households dependent on community-based piped water connections. But since the sample size for the survey was very small, the census data are more reliable.

Based on the survey with households and KIIs in Kannur, it was decided to characterize all existing sanitation containment systems as having significant risk of groundwater pollution, as groundwater table varies from 0.37 (pre-monsoon) to 20.48 (post-monsoon) mbgl (CGWB, 2013). But since the septic tanks connected to soak pits are designed and constructed as per norms stated in KMBR, they have been taken as presenting “low risk” of groundwater contamination.

2.2.3. Discussion of certainty/uncertainty levels of associated data

There were three major challenges to develop the SFD graphic. Published and unpublished reports were not able to provide completely (i) up-to-date data on containment (ii) detailed typology of containment and (iii) actual information about FSM services provided to households. For this reason, field-based studies were conducted to validate the data and triangulation of data provided by secondary sources.

The Census mostly differentiates between systems connected to the user interface, if any, but does not give information about the design of actual containment systems on ground level or about the disposal of septage and WW generated. Therefore, a sample household survey was conducted in each ward of the city to identify and cross-check the data collected from secondary sources.

CSE’s representatives have conducted the KIIs, FGDs and sample surveys.

The assumption regarding the volume of FS emptied as compared to FS generated has a high impact on the overall SFD. A reliable method for estimating quantities of FS generated on a citywide scale does not yet exist, and it is complicated because the containment size

and emptying period greatly vary. Since there is no clear differentiation between the volume of effluent/supernatant and septage generated from septic tanks and lined tanks, hence it is assumed to be 50% each. Based on the survey, it is assumed that respondents getting their OSS emptied within 10 years are using their systems with emptying and respondents getting their OSS emptied after 10 years are using their system without emptying. In the matrix, it is assumed that 90% of the population gets their containment systems emptied when full.

The objective of the survey conducted was to obtain a more accurate measure of how excreta are managed through stages of sanitation service chain (from containment to end-use or disposal). To reduce the uncertainty around the data collected, the draft SFD graphic was prepared and presented to the KMC.

3 Service delivery context description

3.1. Policy, legislation and regulation

3.1.1. Policies, legislations and regulations at national level

In 2008, the Ministry of Housing and Urban Affairs (MoHUA), formerly known as Ministry of Urban Development (MoUD) issued the National Urban Sanitation Policy (NUSP). The policy aims to: raise awareness; promote behaviour change; achieve open defecation free cities; develop citywide sanitation plans; and provide 100% safe confinement, transport, treatment and disposal of human excreta and liquid wastes. The NUSP mandates states to develop state urban sanitation strategies and work with cities to develop City Sanitation Plans (CSPs). NUSP specifically highlights the importance of safe and hygienic facilities with proper disposal and treatment of sludge from on-site installations (septic tanks, pit latrines, etc.) and proper operation and maintenance (O&M) of all sanitary facilities. Furthermore, it explicitly states that cities and states must issue policies and technical solutions that address onsite sanitation, including the safe confinement of Faecal Sludge (FS) (USAID, 2010). The objectives of NUSP are to be realized through CSPs and state sanitation strategies. NUSP identifies the constitution of multi-stakeholder task force as one of the principal activities to be taken up to start the city sanitation planning process. As per the requirement of CSP, major role is to be played by the members of institutions, organizations, individuals, NGOs, academics, media representatives, local councilors, industry owners, consultants, representatives of private sector, etc. Constitution of Swachh Bharat City Level Task Force (SBCLTF) formerly known as City Sanitation Task Force (CSTF) is facilitated by drawing members from these groups in consensus with citizens who will be constantly supporting the CSP preparation by analysing the strengths and competencies required to overcome the current situation and to improve sanitation facilities (MoUD, 2014).

The advisory note on septage management in urban India, issued by MoHUA in 2013, recommends supplementing CSPs with a Septage Management Sub-Plan (SMP), prepared and implemented by cities. Septage here broadly refers to not only FS removed from septic tanks but also that removed from pit latrines and similar on-site systems. This advisory provides reference to Central Public Health & Environmental Engineering Organisation (CPHEEO) guidelines, Bureau of Indian Standard (BIS), and other resources that users of this advisory may refer, for details while preparing their SMP (MoUD, 2013). The advisory clearly discusses the techno-managerial and socio-economic aspects of septage management in India and provides guidelines for Urban Local Bodies (ULBs) to plan and implement SMP.

The Environment (Protection) Act, 1986 and the Water (Prevention and Control of Pollution) Act, 1974 have provisions relating to sanitation services and environmental regulations. It applies to households and cities with regard to disposing wastes into the environment. ULBs/ utilities also have to comply with discharge norms for effluent released from sewage treatment plants and to pay water cess under the Water Cess Act, 1977. The ULB is responsible for ensuring the safe handling and disposal of septage generated within its boundaries, for complying with the Water Act and for meeting all state permit requirements and regulations (CSE, 2010). Municipal acts and regulations usually refer to management of solid and liquid wastes but may not provide detailed rules for septage management (MoUD, 2013).

The Prohibition of Employment as Manual Scavengers and their Rehabilitation Act is enacted in 2013. This act prohibits employment of manual scavengers and insanitary latrines - Laying strong emphasis on rehabilitation of manual scavengers. The broad objectives of the act are to eliminate insanitary latrines, prohibit the employment of manual scavengers and the hazardous manual cleaning of sewer and septic tanks, and to maintain a survey of manual scavengers and their rehabilitation (MoSJE, 2014).

In February 2017, MoHUA issued the National Policy on faecal sludge and Septage Management (FSSM). The policy aims to set the context, priorities, and direction for, and to facilitate, nationwide implementation of FSSM services in all ULBs such that safe and sustainable sanitation becomes a reality for all in each and every household, street, town and city in India (MoUD, 2017).

The Fourteenth Finance Commission (FC-XIV) was constituted by the President of India under Article 280 of the Constitution on 2 January 2013 to make recommendations for the period 2015-20. Its assignments include distribution of revenue between union and state; devising formula for grant; suggesting method to augment resources for local bodies; and taking care of any matter referred to it (NIUA, 2015).

Model Municipal Building Bye-laws 2016 are prepared by Town and Country Planning Organization (TCPO). Building Byelaws 2016 is used to regulate coverage, height, building bulk, and architectural design and construction aspects of buildings so as to achieve orderly development of an area. They are mandatory in nature and serve to protect buildings against fire, earthquake, noise, structural failures and other hazards. It includes chapters on green buildings and sustainability provisions, rainwater harvesting, wastewater (WW) reuse and recycle, installation of solar roof top photo voltaic norms, revised norms for adequate toilet facilities for women and public conveniences in public buildings and mandatory provisions for segregated toilet facilities for visitors in public buildings (TCPO, 2016).

3.1.2. Policies, legislations and regulations at state level and ULB level

According to the Constitution of India, water and sanitation are state subjects. Statutory powers are conferred to the state for making laws on water and sanitation. Some of the policies, laws and regulations are listed below:

The Kerala Water Supply and sewerage Act, 1986

An Act to provide for the establishment of an autonomous authority for the development and regulation of water supply and wastewater collection and disposal in the state of Kerala and for matters connected there with.

Draft Health Policy of Kerala, 2013

Its objective is to position good health as the product of development agenda including water supply, nutrition, sanitation, prevention of ecological degradation, respect for citizen's rights and gender sensitivity.

Kerala State Sanitation Strategy, 2011

The objectives of the strategy, passed by Government of Kerala (GoK), includes; comprehensive information about the full cycle of sanitation, ensuring the accessibility to sanitation and also to build capacities within ULBs and other line agencies for participatory citywide sanitation. KSSS is a major fillip to guide the municipal authorities to prepare and

operationalize CSP. Strategy emphasizes on promoting proper disposal and treatment of sludge from on-site installations (septic tanks, pit latrines, etc.); It also indicates that ULBs should ensure that all the human wastes are collected safely, confined and disposed of after treatment so as not to cause any hazard to public health or the environment (GoK, 2011).

Draft Kerala State Housing Policy, 2011

Its objectives include following an integrated habitat approach to housing, taking into account issues of spatial planning, including water supply, sanitation and waste disposal. It aims to facilitate all dwelling units with easy accessibility to basic services of sanitation, drinking water, power, waste disposal and social infrastructural facilities and transportation. Its objectives also include slum reconstruction programmes for creating a better environment, which would be based on the basis of audit of slum areas covering health status, education, sanitation, environment, employment status and income.

Kerala Municipality Act, 1994

The act governs the structure and management of the notified area councils and municipalities. Provisions for sanitation are listed below.

- A Municipality shall provide and maintain in proper and convenient places a sufficient number of public latrines and shall cause the same to be daily cleansed and kept in proper order.
- The Secretary may, by notice, require the owner or occupier of any building, within the time specified in such notice, to provide a latrine or alter or remove from an unsuitable to a more suitable place any existing latrine in accordance with the directions contained in such notice for the use of the persons employed in or about or occupying such building and to keep it clean and in proper order.
- The Secretary may, by notice require the owner or manager of a market, car stand, cattle shed, poultry, theatre, railway station, dock, wharf or other place of public resort to provide and maintain within the time specified in such notice for the separate use of persons of each sex latrines of such description and number and in such position as may be specified in such notice.

Kerala State Finance Commissions

These are constituted by GoK under clause 1 of Article 243 (I) and (Y) of the Constitution of India read with sections 186 of the Kerala Panchayat Raj Act 1994 and Section 205 of the Kerala Municipalities Act 1994. It aims at studying the financial position of the panchayats and the ULBs and to making recommendations to the Governor accordingly.

3.1.3. Institutional roles

The MoHUA is the nodal ministry for policy formulation and guidance for the urban water supply and sewerage sector. The ministry's responsibilities include broad policy formulation, institutional and legal frameworks, setting standards and norms, monitoring, promotion of new strategies, coordination and support to state programmes through institutional expertise and finance. The ministry is also responsible for managing international sources of finance. The CPHEEO, created in 1953, is the technical wing of the MoHUA, which advises the ministry in all technical matters and collaborates with the State Agencies about water supply and sanitation activities. CPHEEO plays a critical role in externally funded and special

programmes. CPHEEO also plays a central role in setting design standards and norm setting for urban water supply and sanitation (Planning Commision, 2002).

The 74th Constitutional Amendment Act of 1992 reformed the sector by transferring responsibility for domestic, industrial, and commercial water supply and sewerage (WSS) from state agencies, such as Departments of Public Health Engineering and State Water Boards, to ULBs. This transfer has resulted in a variety of implementation models, as well as a lack of clarity in roles and responsibilities of state and local agencies, resulting in large gaps in implementation (USAID, 2010).

Management and delivery of urban basic services in Kannur is governed by various institutions. Table 5 presents the institutions responsible for policy making, service provision and regulation of urban services:

Table 5: Roles and responsibilities

Institutions	Roles and responsibilities
Town and Country Planning Department (TCPD)	TCPD is the prime agency for providing technical inputs for the planned development of urban settlements. The TCPD: • Prepares Master Plans for the State's cities and towns. • Prepares detailed development plans. • Provides guidance to local bodies and Development Authorities on plan implementation. • Prepares area development plans for controlled areas. • Advises various State level agencies on planning, site selection, and preparation of development schemes.
Kerala Water Authority (KWA)	KWA was constituted in 1984, it is a State level agency, which owns and operates water supply and sewerage services for the ULB.
Local Self Government Department (LSGD), GoK	Overall coordination, management, and administration of the various components, such as urban infrastructure improvement, urban management and implementation assistance.
Suchitwa Mission	• Providing policy, strategy, planning, implementation and monitoring, IEC campaigns and capacity building support for Solid and Liquid Waste Management. • Technical Support group in Waste Management sector.
Kerala State Pollution Control Board (KSPCB)	Controlling of water and air pollution caused by various sources across the state. It is responsible for monitoring and oversight to ensure compliance with various state and central legislation on pollution.
Urban Poverty Alleviation Department (UPAD), Ministry of Housing and Urban Poverty Alleviation (MoHUPA), GoI	The Kudumbasree Project of the UPAD channels funds of centrally sponsored schemes the ULBs and monitors fund utilization through its District Mission Coordinator (DMC). Based on the funds available through centrally sponsored schemes and projects approved by the ULB, Kudumbasree transfers the requisite amount to the ULB for utilization in Below Poverty Line (BPL) settlements.
Kannur Municipal Corporation (KMC)	Overall management of the civic services in the city including public sanitation, solid waste management, public health and education.

Source: (CSE, 2016)

3.1.4. Service provision

Institutional arrangements for water supply and sanitation in Indian cities vary greatly. Typically, a state-level agency is in charge of planning and investment, while the local government (ULBs) is in charge of O&M (NIUA, 2005). Some of the larger cities have developed municipal water and sanitation utilities that are legally and financially separated from the local government. However, these utilities remain weak in terms of financial capacity. In spite of decentralization, ULBs remain dependent on capital subsidies from state governments. Tariffs are also set by state governments, which often even subsidize operating costs (Planning commission, 2002).

Furthermore, when no separate utility exists, there is no separate allocation of accounts for different activities within a municipality. Some states and cities have non-typical institutional arrangements. For example, in Rajasthan, the sector is more centralized and the state government is also in charge of operation and maintenance while in Mumbai the sector is more decentralized and local government is also in charge of planning and investment (NIUA, 2005).

In Kannur, public health, sanitation, conservancy, and solid waste management services are delivered by Health and Sanitation Department of KMC. Septage management is also the responsibility of the same department, headed by the Sanitary Officer.

3.1.5. Service standards

1. Service Level Benchmarks (SLB), 2008: Issued by the Ministry of Urban Development in 2008, the SLB seek to (i) identify a minimum set of standard performance parameters for the water and sanitation sector that are commonly understood and used by all stakeholders across the country; (ii) define a common minimum framework for monitoring and reporting on these indicators and (iii) set out guidelines on how to operationalize this framework in a phased manner. The SLB refers to improving service through better provision and delivery. It evaluates the performance of urban services.
2. General Standards for Discharge of Environmental Pollutants – The Environment (Protection) Rules, 1986 (Schedule VI): Issued by Central Pollution Control Board (CPCB), a statutory organisation constituted in September, 1974 under the Water (Prevention and Control of Pollution) Act, 1974. It specifies the effluent standards from different pathways.
3. Kerala Municipal Building Rules (KMBR), 1999: Issued by Local Self Government Department, Government of Kerala. The codes specifies standards and design consideration for installation of toilets and septic tanks.
4. Manual on Sewerage & Sewage Treatment, Second Edition, 2013: This manual was developed by CPHEEO. It provides detailed designs and guidelines for various technologies of WW management.

3.2. Planning

3.2.1. Service targets

State governments must put in place targets for delivery of essential services provided by the local bodies for four services viz., water supply, sewerage, solid waste management and storm water drains on lines of handbook for SLB by MoHUA. State government must notify or cause all ULBs to notify by the end of a fiscal year the service standards and targets (PAS, 2009-16). Table 6 and Table 7 provide an overview of service delivery progress and targets in Kannur, in accordance with SLBs, respectively.

Table 6: Service delivery progress in accordance with SLBs

S. No.	Parameter	Existing Service Level
1	Coverage of latrines (individual or community)	98%
2	Coverage of sewerage network services	0%
3	Efficiency of collection of sewerage	N/A
4	Efficiency in Treatment: Adequacy of sewerage treatment capacity	N/A

Source: (KWA, 2016)

Table 7: Service delivery targets in accordance with SLBs

Sanitation service chain	Parameter	National benchmark	Time frame to achieve benchmark
Containment	Coverage of toilets	100%	2019
Transport	Coverage of sewer network services	100%	2031
	Collection efficiency of the sewerage network	100%	2031
Treatment	Adequacy of sewage treatment capacity	100%	2031
	Quality of sewage treatment	100%	2031
End-use/disposal	Reuse and recycling	20%	2031
Other	Cost recovery	100%	2031
	Efficiency of collection of charges	100%	2031
	Redressal of customer complaints	80%	2031

Source: Adapted from (MoUD, 2008), (MoUD, 2010)

The Swachh Bharat Mission (SBM), one of the flagship programmes of the government of India was launched on October 2nd 2014 by the Ministry of Urban Development. SBM-Urban aims to eliminate open defecation, eradicate manual scavenging, capacity augmentation of ULBs and generate awareness and generate awareness about sanitation and its linkage with public health during the mission period till 2019. The SBM (urban) aims to ensure that no new insanitary toilets are constructed during the mission period and that pit latrines should be converted into sanitary latrines. The target group for construction of household units of toilets thus is (i) 80% of urban households engaging in open defecation, remaining 20% of households practising open defecation are assumed to be catered by community toilets due to constraints of space (ii) all households with insanitary latrines (iii) insanitary latrines (iii) all households with single-pit latrines (MoUD, 2014).

Table 8 provides an overview of service delivery progress in Kannur, in accordance with SBM.

Table 8: Service delivery progress in accordance with SBM

SBM Head	Mission target (till 02.10.2019)		Achievement		Balance	
	No of Units	Amount in INR (USD)	No of Units	Amount in INR (USD)	No of Units	Amount in INR (USD)
Individual Household Toilets (IHHT)	135	2,079,000 (31,263)	117	1,891,800 (28,448)	18	1,87,200 (2,815)
Community Toilets (CT)	0	0	0	0	0	0
Public toilets (PT)	1	2,250,000 (33,384)	1	2,250,000 (33,384)	0	0

Source: (KMC, 2016)

3.2.2. Investments

A total of four projects have been proposed under AMRUT during financial year (FY) 2016-17. Total investment of INR 200 crores (31.3 Million USD) was proposed for the projects – "Providing sewerage system in zone 1"; "Providing septage collection and septage treatment plant at Edakkad"; "Providing sewerage system in zone 2"; and "Providing sewerage system in zone 3". Details of the physical components, service levels and estimated costs of the projects have been provided in Table 9.

Table 9: Details of prioritized projects proposed under AMRUT during FY 2016-17

S.No.	Project name	Physical components	Change in service levels			Project cost share (in percentage)			
			Indicator	Existing	After	GoI	State	ULB	Total
1	Providing sewerage system in zone 1	Sewerage network, pumping stations and STP	Coverage of network	0%	60%	50	30	20	100
2	Providing septage collection and septage treatment plant at Edakkad	Septage collection and treatment	-			17.5	10.5	7	35
3	Providing sewerage system in zone 2	Sewerage network and pumping stations	-			17.5	10.5	7	35
4	Providing sewerage system in zone 3	Sewerage network and pumping stations	-			15	9	6	30

Source: (KWA, 2016)

3.3. Reducing inequity

3.3.1. Current choice of services for the urban poor

There are 18 slum settlements within the KMC limits, housing a population of 5,368 residents in 1,301 households (KMC, 2016). Most of the households have toilets (1,249) and the rest (52 households) rely on the eight community toilets built in the settlements. The practice of manual emptying by slum dwellers is still prevalent in the city which is usually carried out by 2-4 people. Sometimes, manual emptiers enter into the containment to empty FS. No safety measure is taken while emptying and thus diseases are common among manual emptiers. Bucket and spade is used to empty the containment (Private Emptiers, 2016).

3.3.2. Plans and measures to reduce inequity

Pradhan Mantri Aawas Yojna (PMAY), Housing for All (Urban) project is aimed for urban areas with following components: (i) Slum rehabilitation of slum dwellers with participation of private developers using land as a resource; (ii) Promotion of affordable housing for weaker section through credit linked subsidy; (iii) Affordable housing in partnership with public and private sectors; and (iv) Subsidy for beneficiary-led individual house construction or enhancement.

All houses built or expanded under the mission should essentially have toilet facility. The mission has provision of civic infrastructure as per applicable state norms/CPHEEO norms/Indian Standard (IS) Code/National Building Code (NBC) for sewer connection, if existing or has to be made through convergence of other national or state schemes (MoHUPA, 2016).

Under PMAY, a survey of 5,329 beneficiaries has been completed and the state has approved a fund of INR 79.95 crores (12.5 Million USD), details of each component have been provided in Table 10. Each house has a toilet and containment (septic tank connected to a soak pit) (KMC, 2016).

Table 10: Details of the number of beneficiaries under PMAY

Component	New construction	Enhancement of old construction	Total number of beneficiaries
Credit Linked Subsidy Scheme (CLSS)	638	191	829
Affordable Housing in Partnership (AHP)	1,150	0	1,150
Beneficiary Led Construction (BLC)	2,651	699	3,350

Integrated Housing & Slum Development Programme (IHSDP) was envisaged and brought into effect in 1993-94. It aims at combining the existing schemes of Valmiki Ambedkar Malin Basti Awas Yojana (VAMBAY) and National Slum Development Programme (NSDP) under the IHSDP scheme for having an integrated approach in improving the conditions of the urban slum dwellers that do not possess adequate shelter and reside in dilapidated

conditions. The scheme is applicable to all cities and towns as per 2001 Census except cities/towns covered under Jawaharlal Nehru National Urban Renewal Mission (JnNURM) and administered by MoHUPA. The scheme seeks to enhance public and private investments in housing and infrastructural development in urban areas (MoHUPA, 2007).

Under IHSDP, a project of INR 1.96 crores (0.3 Million USD) was sanctioned to construct 172 new houses, renovate 127 existing houses and 21 other infrastructural projects. Table 11 provides an overview of the projects under IHSDP in Kannur.

Table 11: Status of the projects under IHSDP in Kannur

Project heads	Target		Achieved	
	No of Units	Amount in INR (USD)	No of Units	Amount in INR (USD)
House repair	127	2,524,500 (37,962)	127	2,524,500 (37,962)
Individual houses	172	14,320,000 (2,15,338)	70	10,900,000 (1,63,909)
Infrastructural works	21	2,787,950 (41,924)	7	885,667 (13,318)

3.4. Outputs

3.4.1. Capacity to meet service needs, demands and targets

Municipal expenditures in India account for 1.1% of the country's GDP, compared to 6.9% in South Africa and 9.7% in Switzerland. ULBs therefore rely mainly on national or state grants (AFD, 2014). In the context of Kannur, the major source of income (both revenue and capital) is through grants from Finance Commission and the remaining is generated through taxes and user charges. Municipality also received funds for sanitation infrastructure development which came through schemes like SBM, etc.

Shortage of human resource can be witnessed in the ULB. It is largely relied on staff hired on contractual basis to provide the daily service needs to the public. Also, the staff lacks the basic know-how and technical skills (KMC, 2016).

3.4.2. Monitoring and reporting access to services

Data on service levels should be collected, documented and reported to MoHUA according to the format prescribed by SLB framework. Service level improvement plans (SLIPs) are prepared with yearly targets. It has to be reviewed each year and progress has to be monitored. The planning documents like CDP and CSP have to be reviewed once in 5 years. This gives an opportunity to monitor the progress on service level improvement.

The progress of SBM gets reflected on mission progress dashboard in the SBM-Urban website. Of 4,041+ Municipalities in 650+ districts, 3,802 ULBs are active. 75 million plus cities are being monitored separately. Under SBM, four community toilets have already been constructed, and other 18 are under construction.

The sanitary inspector is supposed to inspect the design of septic tanks and their adherence to standards at the time of construction but this is not done most of the times.

3.5. Expansion

In 2016, MoHUA initiated rapid assessment of 131 flagship cities to estimate the budgetary requirement for implementing Faecal Sludge and Septage Management (FSSM) in selected cities across the country, supported by the National Alliance for Faecal Sludge and Septage Management (NFSSM). The flagship cities include 100 smart cities, 12 cities in Ganga basin and others across India. A declaration was signed – for cities journey beyond ODF - mainstreaming effective FS and septage management by key decision makers and NFSSM alliance members.

Kannur is one of the flagship cities and plans to undergo the assessment but since it is not covered under the AMRUT programme, the municipality has to look for other sources of funding like FC / UIDSSMT / PMAY / other donor agencies etc.

Integrated Low Cost Sanitation (ILCS)

The centrally sponsored scheme of low cost sanitation for liberation of scavengers started from 1980-81 initially through the Ministry of Home Affairs (MoHA) and later on through the Ministry of Welfare. From 1989-90, it came to be operated through the MoUD and later on through Ministry of Urban Employment and Poverty Alleviation (MoUEPA) now titled Ministry of Housing & Urban Poverty Alleviation (MoHUPA). The programme envisages construction of new sanitary latrines in households not having latrines by adopting the low cost leach pit system, with an objective to eliminate dry latrines and manual scavenging. The scheme is being implemented with 63% Housing and Urban Development Corporation Ltd (HUDCO) loan, 32% Government of India subsidy and 5% of contribution of beneficiary (MoHUPA, 2008).

3.5.1. Stimulating demand for services

The following activities may stimulate demand for services:

- Awareness generation on septic tank construction, regular emptying of septic tanks through awareness campaigns.
- Awareness campaigns on ill effects of environmental degradation because of disposal of untreated septage into local environment.
- Capacity building of ULB staff on septage management.
- Skill development for local masons and plumbers.
- Monitoring and regulation of private emptiers.

It is recognized that the end objectives and corresponding benefits of SBM cannot be achieved without proper management of FS and septage across the sanitation service chain. Further, it is well understood that sewerage coverage will not meet the complete sanitation needs in all areas, and a strategy which is a combination of OSS and off-site (decentralised and centralised) must co-exist in all cities and must be given equal attention. However, the current policies are not explicit enough and also do not provide an outcome-focused direction on this issue (MoUD, 2017).

3.5.2. Strengthening service provider roles

SBM majorly provides funds for access to toilets but thereafter lacks funds for treatment and disposal of sewage and FS throughout the service chain. The service delivery of sewage and FS treatment and disposal can be met through converging the two national flagship programmes – SBM and AMRUT. The ULB can take the benefit of the programmes and strengthen the services along the value chain and achieve the goals of both programmes.

4 Stakeholder Engagement

4.1. Key Informant Interviews

The KIIs were conducted with the stakeholders having a role or interest in sanitation and FSM services within the city. The relevant departments were contacted through e-mail, letter, and call to visit the concerned departments. The purpose of the SFD study and depth of data required was conveyed through an introductory letter to respective departments. Overall, three KIIs were conducted with different stakeholders like government functionaries from KMC, GWD, KSPB (see appendix 7.2). Apart from KIIs, random household surveys were also conducted, which included interviews with representatives from NGOs, institutions and other commercial establishments. Indeterminate information was available prior to the field based research about the type of containment, emptying service, transportation and disposal of sewage generated by the city. The visit enabled in enhancing data collection through gathering progress details of SBM, published and unpublished reports like draft CSP, etc. Interview with the private emptiers and other stakeholders provided additional insight into the service delivery context.

4.2. Field observations

In order to get a better picture of variety/typology of OSS, primary surveys were conducted. Sample was carefully chosen to get good spatial representation from each ward of OSS dependence based on Census, 2011 and KII with ULB officials. At-least 5-6 households were surveyed randomly in each of the selected wards of Kannur. It was made sure that respondents from slums are surveyed as well. The surveyor also recorded the field observations related to sanitation. Such surveys, observations and KIIs helped to produce a more credible and accurate SFD graphic, provides qualitative data and perhaps more precise quantitative data relating to the service delivery. Some of the observations are listed below.

It was observed that few economically weaker section (EWS) households have poorly constructed toilets. Houses constructed under the ‘Particularly Vulnerable Tribal Groups’ scheme for the tribal people were deprived of toilet facility. Such households usually share toilets with others or opt for open defecation, especially those residing near the sea. The containment system varies according to the economic status of the society and the physiography of the area. Due to such variations, it was decided on the field to conduct survey in wards with different physiography and economic variation.

4.3. Focused Group Discussion

The FGDs were conducted to complement, validate and challenge data collected during literature review and interviews. In total, three FGD sessions were conducted. FGDs were held with KMC officials, private emptiers, community representatives and local masons. The questionnaires for FGDs were prepared in English, but the interviewer asked the questions, translating into the Malayalam language.

The findings from the FGD sessions revealed information that increased the understanding of the sanitation and septage management in Kannur. FGDs were useful in data triangulation. Primary survey helped in validating secondary data and data provided by different stakeholders. It resulted in actual and true SFD graphic of the city.

5 Acknowledgements

This report was compiled as part of the SFD promotion initiative project funded by the Bill and Melinda Gates foundation (BMGF). We would like to thank Mr K. P. Vineyan, Secretary, Kannur Municipal Corporation and Mr. K. M. Girishan, Health Supervisor, Kannur Municipal Corporation for providing information for this assessment. A special thanks to Dr. Suresh Kumar Rohilla, Senior Director, CSE, for his supervision and guidance at every step of the assessment and report writing.

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7 Appendix

7.1. Stakeholder identification

Table 12: Stakeholder identification

S. No.	Stakeholder group	In Kannur context
1	City council / Municipal authority / Utility	Kannur Municipal Corporation
2	Ministry in charge of urban sanitation and sewerage	Kerala Water Authority
3	Ministry in charge of urban solid waste	Kannur Municipal Corporation
4	Ministries in charge of urban planning finance and economic development	Local Self Government Department, GoK
	Ministries in charge of environmental protection	Directorate of Environment and Climate Change, GoK
	Ministries in charge of health	Directorate of Health Services, GoK
5	Service provider for construction of onsite sanitation technologies	Local masons
6	Service provider for emptying and transport of faecal sludge	Private emptiers
7	Service provider for operation and maintenance of treatment infrastructure	N/A
8	Market participants practising end-use of faecal sludge end products	N/A
9	Service provider for disposal of faecal sludge (sanitary landfill management)	Private Emptiers
10	External agencies associated with FSM services: e.g. NGOs, academic institutions, donors.	Centre for Science and Environment, New Delhi

Source: (CSE, 2016)

7.2. Tracking of engagement

Table 13: Tracking of engagement

S. No.	Name of Organisation	Designation	Date of engagement	Purpose of engagement
1	KMC	Secretary	15/11/2016	Introduction of SFD and permission to conduct FGDs in the offices and municipal wards
2	KMC	Health Supervisor	15/11/2016	FGD
3	KMC	Health Inspector		
4	KMC	Junior Health Inspector		
5	Private	Private emptiers	16/11/2016	FGD
6	Private	Local masons	16/11/2016	FGD
7	KMC	Confidential Assistant to Secretary	17/11/2016	KII
8	Groundwater Department, Kannur	Assistant Engineer	17/11/2016	KII
9	Kerala State Planning Board	District Town Planner	17/11/2016	KII

Source: (CSE, 2016)

7.3. SFD graphic

Figure 7: SFD graphic (Source: SFD graphic generator, 2016)

7.4. SFD brief explanation

Table 14: Percentage of the population using each system technology and method

System Type	Containment	Emptying	Transport	Treatment and End-use/ disposal
Onsite	T1A2C5: 48% of population is dependent on septic tank connected to soak pit. T2A3C5: 47% of population is dependent on fully lined tank connected to soak pit. T2A5C10: 4% of population is dependent on lined pit with semi-permeable walls and open bottom.	Since most of the population is getting their systems emptied, it is assumed 90% of population has their onsite technology emptied. FS contained - emptied comes out to be 22% and FS contained-not emptied becomes 26%. FS not contained - emptied comes out to be 23% and FS not contained-not emptied becomes 28%. Since there is no clear differentiation between % of septage and effluent, it is assumed to be 50% each. FS contained comes out to be 48% and FS not contained is 51%.	No treatment facility exists hence no FS is transported to treatment plant. Therefore, FS not delivered to treatment plant is 45%. But 26% of FS contained – not emptied has been shown as safely managed because of 'low risk' of groundwater pollution.	No treatment facility exists hence no FS is treated; therefore, FS treated is 0%. But 26% of FS contained – not emptied has been shown as safely managed because of 'low risk' of groundwater pollution.
Open Defecation	Not Applicable			

Source: (CSE, 2016)

7.5. SFD Selection Grid

List A: Where does the toilet discharge to? (i.e. what type of containment technology, if any?)	List B: What is the containment technology connected to? (i.e. where does the outlet or overflow discharge to, if anything?)									
	to centralised combined sewer	to centralised foul/separate sewer	to decentralised combined sewer	to decentralised foul/separate sewer	to soakpit	to open drain or storm sewer	to water body	to open ground	to 'don't know where'	no outlet or overflow
No onsite container. Toilet discharges directly to destination given in List B					Significant risk of GW pollution Low risk of GW pollution					Not Applicable
Septic tank					Significant risk of GW pollution T1A2C5					
Fully lined tank (sealed)					T2A3C5 Low risk of GW pollution					
Lined tank with impermeable walls and open bottom	Significant risk of GW pollution Low risk of GW pollution	Significant risk of GW pollution Low risk of GW pollution	Significant risk of GW pollution Low risk of GW pollution	Significant risk of GW pollution Low risk of GW pollution	Significant risk of GW pollution Low risk of GW pollution					Significant risk of GW pollution Low risk of GW pollution
Lined pit with semi-permeable walls and open bottom	Not Applicable									T2A5C10 Low risk of GW pollution
Unlined pit										Significant risk of GW pollution Low risk of GW pollution
Pit (all types), never emptied but abandoned when full and covered with soil										Significant risk of GW pollution Low risk of GW pollution
Pit (all types), never emptied, abandoned when full but NOT adequately covered with soil										
Toilet failed, damaged, collapsed or flooded										
Containment (septic tank or tank or pit latrine) failed, damaged, collapsed or flooded										
No toilet. Open defecation	Not Applicable						T1B11 C7 TO C9			Not Applicable

Figure 8: SFD selection grid (Source: SFD graphic generator, 2016)

7.6. SFD Matrix

Table 15: SFD matrix

kannur, Kerala, India, 2 Jan 2017. SFD Level: 3 - Comprehensive SFD
Population: 56823
Proportion of tanks: septic tanks: 50%, fully lined tanks: 50%, lined, open bottom tanks: 50

System label	Pop	F3	F4	F5
System description	Proportion of population using this type of system	Proportion of this type of system from which faecal sludge is emptied	Proportion of faecal sludge emptied, which is delivered to treatment plants	Proportion of faecal sludge delivered to treatment plants, which is treated
T1A2C5 Septic tank connected to soak pit	48.0	90.0	0.0	0.0
T1B11 C7 TO C9 Open defecation	1.0			
T2A3C5 Fully lined tank (sealed) connected to a soak pit, where there is a 'significant risk' of groundwater pollution	47.0	90.0	0.0	0.0
T2A5C10 Lined pit with semi-permeable walls and open bottom, no outlet or overflow, where there is a 'significant risk' of groundwater pollution	4.0	90.0	0.0	0.0

Source: (SFD graphic generator)

7.7. Community/public toilets

Table 16: Details of public toilets

S. No.	Location of the toilet (ward number)	No. of users per day	Pay & use or not	No. of functional toilet seats				Operation & maintenance by:	Toilet connected to (septic tank/ pit/ open drain)	Septic tank size in feet (L×B×H)
				Men		Women				
				Urinals	Seats	Urinals	Seats			
1	Varam fish market (15)	45	—	—	1	—	—	ULB	Septic tank	6×4×5
2	Chelora Mathukoth (17)	55	—	—	2	—	—	ULB	Septic tank	6×4×5
3	Mukkadav beach road (27)	20	—	—	—	—	—	—	—	15×5×5
4	Elayavoor zone Thazhe chovva (28)	50	Yes	—	1	—	—	ULB	Septic tank	—
5	Thayyil Neerchal (42)	10	No	—	—	—	2	ULB	Septic tank	6×4×5
6	Old Municipal bus stand (47)	150	Yes	13	—	—	—	ULB	Septic tank	15×5×5
7	Corporation office compound (48)	50	No	—	—	—	1	ULB	Septic tank	6×4×5
8	Peethambar a park fort road (51)	30	E-Toilet	—	—	—	1	—	Septic tank	—
9	New bus stand Thavakkara (50)	500	2 units	22	13	—	10	PPP	On the spot treatment	—

(Source: KMC. 2016)

7.8. Photographs captured during field visit

Figure 9: KII with sanitary workers/agents (Source: Bhavik/CSE, 2016)

Figure 10: Storm water drains terminating in the Arabian Sea (Source: Bhavik/CSE, 2016)