SFD Report

Siddipet
India

Final Report

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

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SFD Report Siddipet, India, 2017

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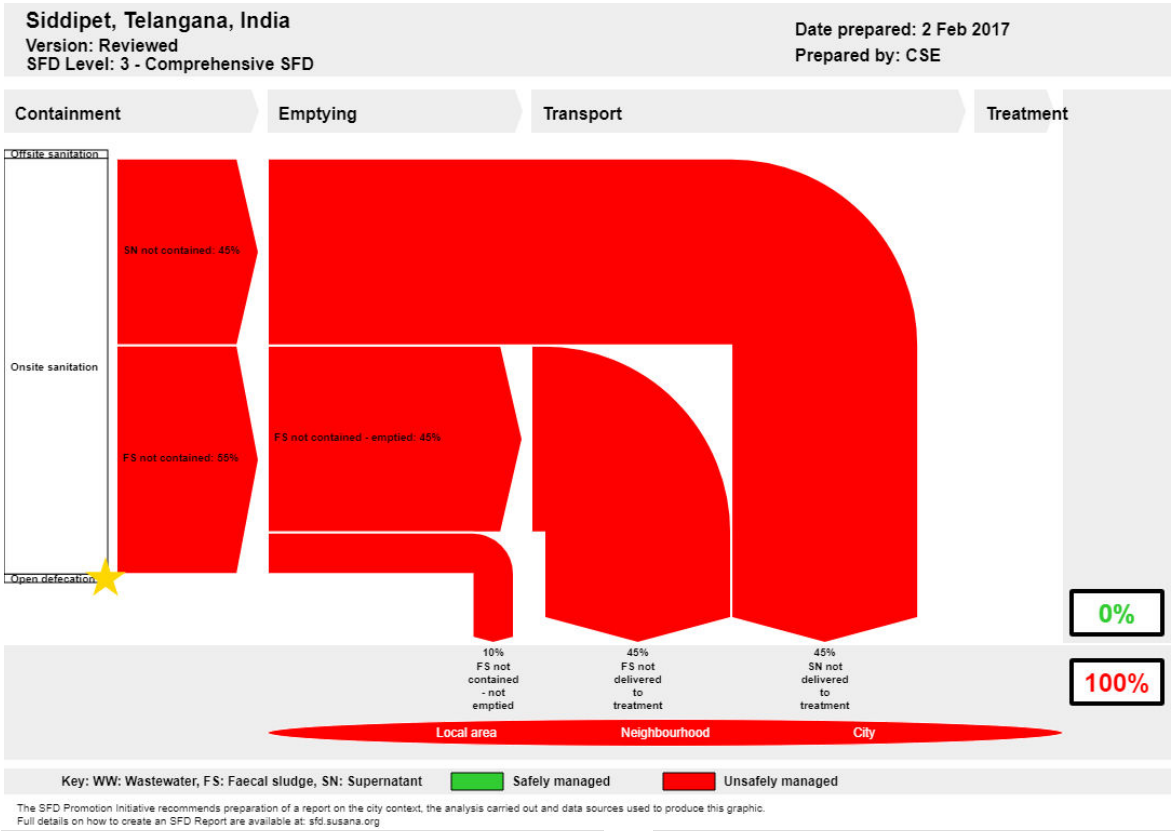
1. The SFD Graphic



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 with inputs from Siddipet Municipality.

Status:

Final SFD report.

Date of production:

11/09/2017

3. General city information

Siddipet is a city in Siddipet district of the Indian state of Telangana. It is a municipality and the headquarters of Siddipet *mandal* administrative division. The city is spread over an area of 36.03 sq.km and is divided into 34 municipal wards and 12 revenue wards. Komati Cheruvu, Narsapur Cheruvu and the Yerra Cheruvu are the major lakes of the city. The city is located at 18.1° N Latitude and 78.85° E Longitude; the city is 110 km away from Hyderabad, the capital city of Telangana state (SM, 2015).

The population of the town is 111,358 as per Census, 2011 and has increased to 138,690 as per Samagra Kutumba Survey-2014 with an increase of 24.54%, latter population has been considered for SFD graphic. No major hillocks or deep valleys are observed in the area. The Manair River is flowing from west to east on the southern side of the city (SM, 2015).

The town has hard gravel soil in locations away from the Manair River and black-cotton soil at the south-eastern part of the city nearer to the river. The groundwater table is at depth of 5m to 10m. (SM, 2015). Siddipet has tropical climatic condition throughout the year. Summer, monsoon and winter are primarily the three seasons. The temperature ranges from 40°C during summer to 10°C in winter (SM, 2016).

4. Service outcomes

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

Containment: According to the field-based research, there is no functional sewerage system available in the city. The city is entirely dependent on onsite sanitation systems (OSS) like a septic tank and pit latrines.

Generally, It was observed that higher income households (HHs) prefer to construct a well-designed septic tank having maximum size measuring 12 ft. x 7 ft. x 9 ft (3.6 m x 2.1 m x 2.7 m). The overall cost of constructing this type of septic tank is about INR 45,000 (USD 681). Whereas, the middle to lower income HHs prefers a prefabricated tank which is cylindrical in shape with a baffle in the tank. The size of this system measures 6 ft. (1.8 m) in depth with 3 ft. (0.9 m) in diameter. The materials used for construction are concrete and steel bars. These tanks cost around INR 12,000 (USD 181) for each unit. Though, latter tanks do not adhere to prescribed design of BIS standards of septic tank, relatively with better lined structure and baffle wall in it, the structure has been considered as septic tank for SFD study.

All these containment systems have an outlet pipe connected to open drains.

Pit latrines: These containment systems are only observed in urban poor settlements where the toilets are constructed under SBM. The pits are constructed using rings made of concrete. Each ring measures 3 ft. (0.9 m) in diameter and 10 inches (25.4 cm) in height. Depending upon the HH size, usually, 6 to 9 rings are installed for a pit.

Figure 1: Cylindrical shape containment system (Source: Shantanu/CSE, 2016)

Emptying: The service is provided only by private emptiers as the ULB does not have vacuum tankers to provide emptying service. This profession is practised by a particular community of the society residing in the town. In order to cater for emptying demand, there are a total of two private emptiers plying in the city who charges a fee of around INR 2,500 (USD 38) for emptying per containment (SM, 2016).

Emptying a containment involves two people to do the emptying service consisting of a driver and a labourer. The emptiers wear no personal protective equipment while emptying, thereby making the practice prone to serious health issues.

Faecal Sludge (FS) not contained-emptied is attributed to be from 45% of the population. FS not contained-not emptied is attributed to be from 10% of the population.

Transportation: Tractor-mounted tanker is used for emptying and transport. According to Key Informant Interview (KII) with a driver and labourer, the average distance travelled for each trip is 10 km. On an average, an operator completes two trips per day. Each trip consumes 2 to 3 hours of service. A 3 HP pump assembled with the vehicle is used for suction of septage from containment systems. The capacity of the vacuum tanker is 4,000 litres.

The supernatant (SN) from the septic tank is conveyed through open drains/*nullahs* to nearby water bodies.

Figure 2: Truck-mounted tanker used for emptying (Source: Anil/CSE, 2016)

Treatment and disposal/end-use: There is no treatment facility available for the wastewater and faecal waste generated in the city. Discharge of FS is an issue as there is no designated discharge site. Discharging of FS by private emptiers within 10 km of the city is prohibited by the municipality. FS is generally discharged into forest areas and also in agricultural fields outside the municipal limits. Seldom, farmers pay INR 50 to 100 (USD 0.5 to 1) to the emptiers for discharging of FS into their fields.

As per secondary data analysis, FGDs, KIIs and random surveys, the city is dependent on onsite systems only. Out of 100% OSS, 90% are dependent on septic tanks connected to open drains and 10% of the population is dependent on lined pit with impermeable walls and open bottom. According to random survey and KII conducted, public latrines are also connected to septic tanks, hence, have been incorporated in onsite systems. Septic tanks connected to open drains are considered to be FS not contained due to

supernatant flowing in open drain causing chances of pathogen transmission. The pits are considered to be not contained as groundwater table is high.

In Siddipet, the septic tank connected to open drain is used by 90% population. Since there is no clear differentiation between the volume of SN and solid FS generated from septic tank connected to open drain, to reduce maximum error it is assumed to be 50% each. Hence, the SN is 50% of the FS present, i.e. 45%.

FS not contained is attributed to be from 100% population which use the systems: septic tank connected to open drain (90%) + lined pit with impermeable walls and open bottom (10%). FS not contained implies that FS infiltrates and pollutes the high groundwater table and the SN from the septic tank connected to open drain reaches water bodies in the city.

It is also assumed that 90 % of FS is emptied during the emptying process, thereby leaving 10% of FS in the containment system itself. From 100% FS not contained, 50% is solid FS and 50% is a liquid component. Out of 50%, solid FS, 45% FS is emptied, leaving 5% in the bottom of the tank which is not emptied. The 5% liquid component which gets infiltrated (from pits) together with the 5% which is left in the bottom of the containment system constitute the 10% FS not contained-not emptied.

The 45% FS which gets emptied is transported and discharged into forest/fields without treatment, thereby leaving it untreated. Hence, no FS is safely managed and the total FS which is unsafely managed is 100%.

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 and state government to provide basic civic amenities including improvement of urban sanitation. Swachh Bharat Mission (SBM), Atal Mission for rejuvenation and urban transformation (AMRUT), Housing for All etc. These schemes provide funds for infrastructure development to improve sanitation.

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. 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 results in implementation (USAID, 2010). The following stakeholders are responsible for sanitation service delivery in Siddipet.

Key stakeholders	Institutions / organizations
Public Institutions	Municipal Administration & Urban Development Department (MAUD), Directorate of Municipal Administration (CD&MA), Telangana State Pollution Control Board (TSPCB), Directorate of Town and Country Planning (DTCP), Telangana state Housing Committee (TSHC) and Siddipet Municipality (SM)
Non-governmental Organizations	Centre for Science and Environment
Private	Local masons, Septic tank emptiers
Others	SBCLTF

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

MAUD is responsible for policy formulation, preparation of municipal laws, monitoring and evaluation of state runs programmes. CD&MA is responsible for implementation of laws, policies and programmes relating to the urban sector. TPCB is responsible for monitoring of effluent standards. DTCP provides a formulation of annual plans and five-year plans, preparation of state plan budget and socio-economic survey report. TSHC works on the formation of layouts, land development, preparation and implementation of housing schemes. SM is responsible for overall management of the civic services in the city. SBCLTF 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 Samagra Kutumba Survey-2014, a sample survey conducted in August 2016. Most of the data are then updated by KIIs and Focus Group Discussions (FGDs). Overall, 9 KIIs and 2 FGDs were conducted with different stakeholders.

There were three major challenges to develop the SFD graphic. Census and published/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.

8. Context-adapted SFD Graphic

The Census mostly differentiate between systems connected to 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 primary survey was conducted in the city to identify and cross-check the data collected from the secondary sources.

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).

Therefore, a sample survey was conducted in the city to identify and cross-check the data collected from the secondary sources.

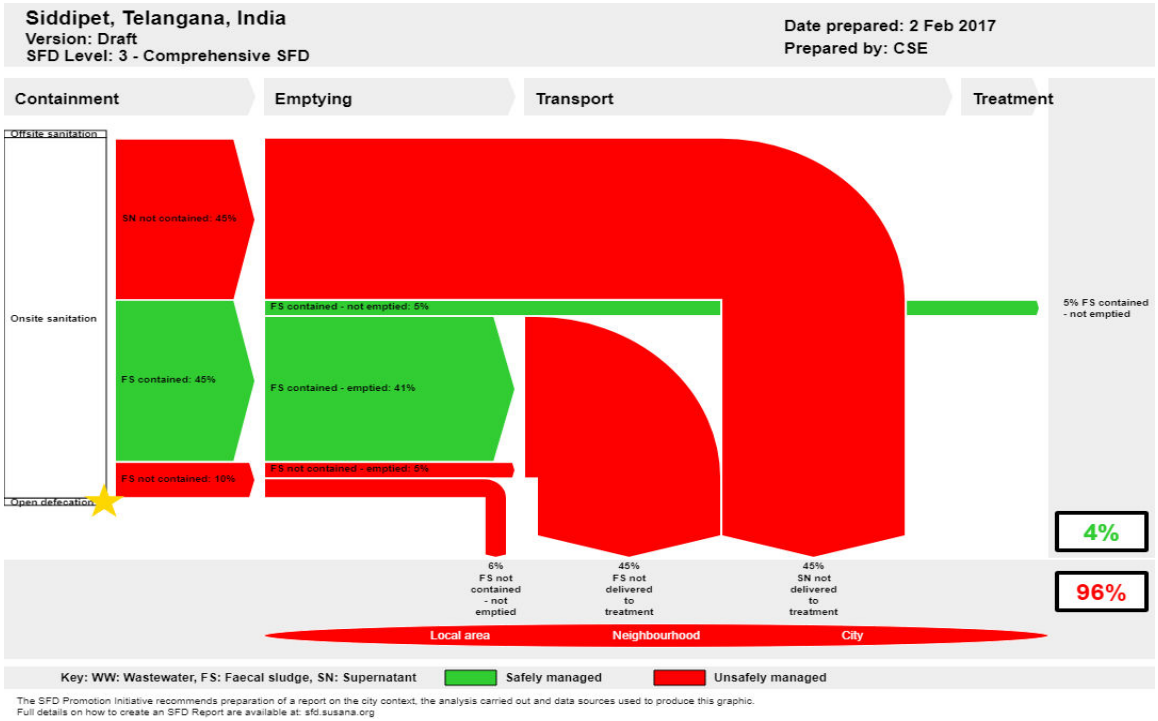
9. Process of SFD development

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

For the validation of the SFD prepared for the city, the graphic (refer section 1) was presented to municipality and GIZ India. Based on their feedback, a context-adapted SFD graphic was prepared.

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 tool to calculate the excreta flow in terms of percentage of the population.



The SFD graphic of Siddipet, developed using the graphic generator was not able to capture the correctly designed fully functional septic tanks as a contained system, as based on feedback. Hence, a context-adapted city specific SFD graphic is manually corrected to convey the substantial picture of the excreta management in the city.

Overall, 96% of excreta are unsafely managed in the city which is at high risk of polluting the environment.

10. Description of context-adapted SFD

As mentioned in section 4, 100% of the population is dependent on onsite sanitation systems. Out of 100% of the population, 90% of the population is dependent on septic tanks connected to open drain. 10% of the population, dependent on lined pit with semi-permeable walls and open bottom, is attributed to be FS not contained. The only difference suggested in the context-adapted SFD is at containment stage for correctly designed septic tanks.

With the same and earlier assumption, the proportion of solid FS generated and collected inside the septic tanks is set to 50%. Rest of the 50% of the content is supernatant, which attributes to 45% (septic tank) of the population that flows through open drains. According to the municipality and GIZ India, the solid FS collected in the septic tank should be considered contained as it is neither polluting the groundwater nor the solid excreta are overflowing in the open drain. Hence, 45% of FS is considered contained (represented green in colour). 45% FS contained is emptied and remaining 5% FS remains in the tank which is contained and never emptied. Nevertheless, the supernatant generated from septic tank connected to open drain is not contained and hence considered to be unsafely managed (represented red in colour).

Overall, excreta of 96% population are not managed safely according to the context-adapted SFD.

9. List of data sources

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

- Published reports and books:
  - Census of India 2011, Houselisting and housing data.
  - Samagra Kutumba Survey-2014.
- KIIs with representatives from
  - Government officials of SM.
  - Private emptiers.
  - Public toilet in charge.
  - Mason.
- FGDs
  - SM staff.
  - Private emptiers.

Siddipet, India, 2017

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This Executive Summary and the SFD Report are available from: www.sfd.susana.org

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Abbreviations

AMRUT	Atal Mission for Rejuvenation and Urban Transformation
APL	Above Poverty Line
BIS	Bureau of Indian Standard
BPL	Below Poverty Line
CAPEX	Capital Expenditure
CDP	City Development Plan
CD&MA	Commissioner & Director of Municipal Administration
CGWB	Central Ground Water Board
CPCB	Central Pollution Control Board
CPHEEO	Central Public Health & Environmental Engineering Organization
CSP	City Sanitation Plan
DTCP	Directorate of Town and Country Planning
EWS	Economically Weaker Sections
FGD	Focus Group Discussion
FS	Faecal Sludge
FSM	Faecal Sludge Management
FSSM	Faecal Sludge and Septage Management
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
GoI	Government of India
GoWB	Government of West Bengal
HFA	Housing For All
HHs	Households
INR	Indian National Rupee (INR = 66.5 USD)
KII	Key Informant Interview
Km	Kilometre
LPCD	Litres per Capita per Day
MAUD	Municipal Administration & Urban Development
Mbgl	Meters below ground level
MHUPA	Ministry of Housing and Urban Poverty Alleviation
MIS	Management Information System
MLD	Million Litres per Day
MoHUA	Ministry of Housing and Urban Affairs (formerly known as Ministry of Urban Development)
MoUD	Ministry of Urban Development
MoWRRD & GR	Ministry of Water Resources, River Development and Ganga Rejuvenati
NFSSM	National Faecal Sludge and Septage management
NGOs	Non-Government Organizations
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
MoHUD	Ministry of Housing and Urban Development

MoUD	Ministry of Urban Development
O & M	Operation and Maintenance
ODF	Open Defecation Free
OPEX	Operating Expenditure
OSS	Onsite Sanitation System
PMAY	Pradhan Mantri Awas Yojna
SAAP	State Annual Action Plan
SBCLTF	Swachh Bharat City Level Task Force
SBM	Swacch Bharath Mission
SFD	Shit Flow Diagram
SLB	Service Level Benchmarks
SLIP	State Level Improvement Plan
SM	Siddipet Municipality
SMP	Septage Management Plan
SN	Supernatant
SPS	Sewage Pumping Station
Sq.km	Square Kilometre
STP	Sewage Treatment Plant
SWM	Solid Waste Management
TL-SSS	Telangana State Sanitation Stategy
TSPCB	Telangana State Pollution Control Board
ULB	Urban Local Body
USAID	United States Agency for International Department
USD	United States Dollar
WSS	Water Supply and Sewerage
WW	Waste Water

1 City context

Siddipet is a city in Siddipet district of the Indian state of Telangana. It is a municipality and the headquarters of Siddipet administrative division. The city is spread over an area of 36.03 sq.km and is divided into 34 municipal wards and 12 revenue wards (Figure 1). Komati Cheruvu, Narsapur Cheruvu and the Yerra Cheruvu are the major lakes in the Siddipet city. Siddipet town is located at 18.1° N Latitude and 78.85° E Longitude. The city is at a distance of 110 km from the state capital, Hyderabad. The nearest railway station for Siddipet is Jangaon which is at a distance of 55 km (SM, 2015). The population of the town is 111,358 as per Census, 2011 and has increased to 138,690 as per Samagra Kutumba Survey-2014 with an increase of 24.54%. Refer table below for growth rate pattern (SM, 2015; SM, 2016).

Table 1: Population growth rate

Year	Population	Growth rate
1981	42,755	-
1991	54,091	26.51%
2001	92,664	71.31%
2011	111,358	20.17%
2014 (SKS)	138,690	24.54%

Source: (Census of India, 2011) (Samagra Kutumba Survey-2014)

No major hillocks or deep valleys are observed in the area. The maximum difference in the levels is around 45 m with levels varying from 300 m to 251 m with respect to mean sea level. Manair River is flowing from west to east on the southern side of the city. The river water is the main source of drinking water to the households (SM, 2016).

The town has hard gravel soil in locations away from the Manair River and black-cotton soil at the south-eastern part of the city nearer to the river. The ground water table is at depth of 5 m to 10 m. The average depth of the household bore well is 70 m. At some place, it is found that the groundwater table is even at a depth of 3 mbgl, due to the influence of Manair reservoir (CGWB, 2013).

Siddipet has tropical climatic condition throughout the year. Summer; monsoon and winter are primarily the three seasons. Summer sets in from March and stretches till June with the temperature hovering around 38°C and falls up to 10°C in winters (SM, 2016).

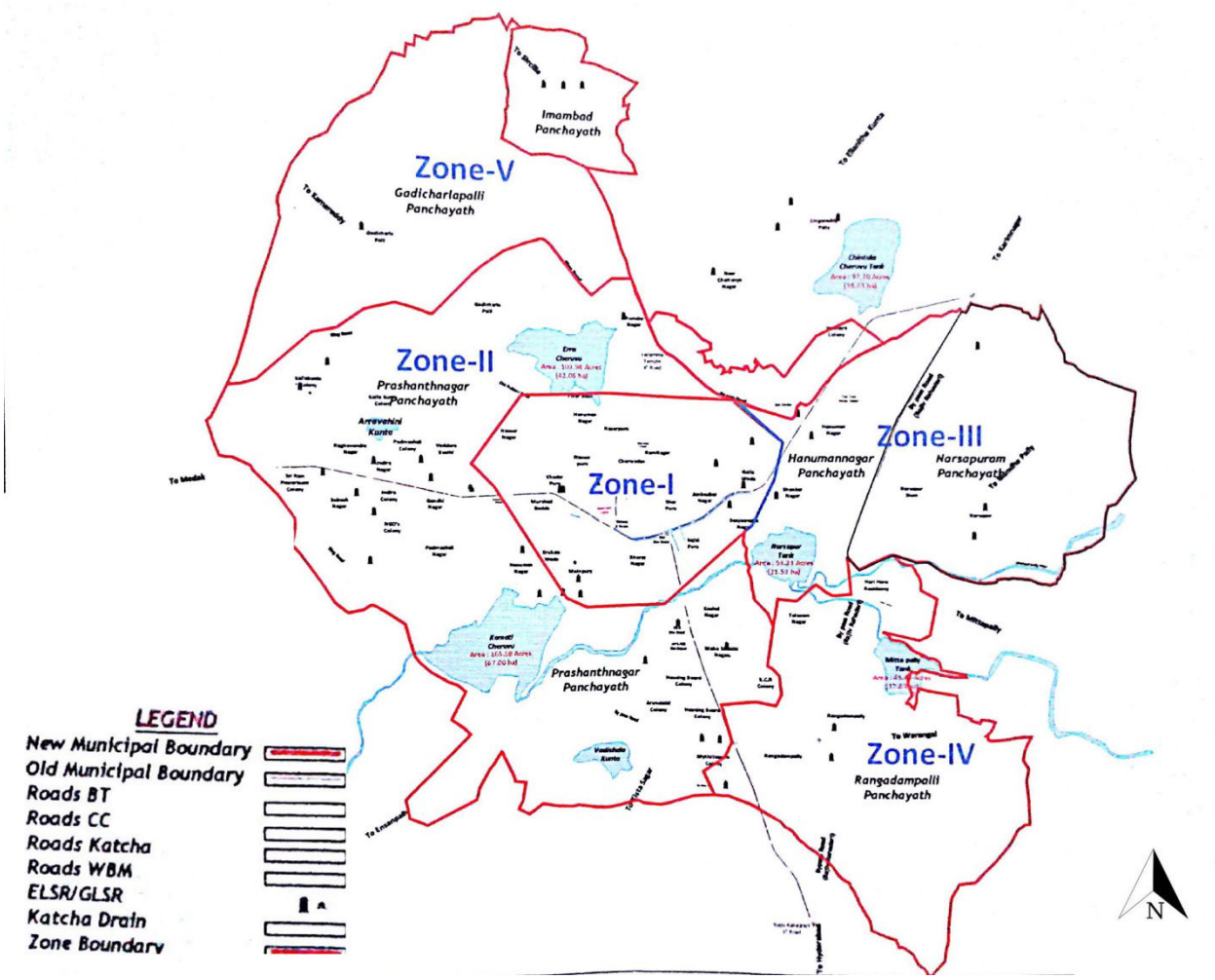

Figure 1: Administrative zone map of Siddipet (Source: SM, 2016)

2 Service outcomes

The analysis is based on data available from Census 2011, published reports of government, non-profit organizations and sample HH survey. Data collected from secondary sources are triangulated in field-based study. Data on the containment are available in Census 2011. Data have been cross-checked and updated by Key Informant Interviews (KIIs) and Focus Group Discussions (FGDs) and Samagra Kuthumb Survey 2104. According to the SFD promotion initiative, definitions of sanitation systems, the types of containments prevalent in the wards are examined through sample household survey (Table 2). Data on emptying, transport, treatment and disposal of FS is collected through KIIs with ULB, 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 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 percentage of population

S. No.	Sanitation technologies and systems as defined by:		SFD reference variable	Percentage of population
	Census of India	Sanitation systems defined by SFD Promotion initiative		
1.	Piped sewer system	User interface discharges directly to centralized separate sewer	T1A1C6	11.6
2.	Septic tank	Septic tank connected to open drain or storm sewer	T1A2C6	52.3
3.	Other systems	User interface discharges directly to open ground	T1A1C8	3.2
4.	Pit latrine with slab	Lined pit with semi-permeable walls and open bottom, no outlet or overflow, general situation	T1A5C10	9.1
5.	Pit latrine without slab	Unlined pit no outlet or overflow, general situation	T1A6C10	0.7
6.	Night soil disposed into open drain	User interface discharges directly to open drain or storm drain	T1A1C6	10.4
7.	Service latrine	User interface discharges to “don’t know where”	T1A1C9	1.8
8.	Public latrine	Septic tank connected to open drain or storm sewer	T1A2C6	0.7
9.	Open defecation	Open defecation	T1B11C7 to C9	10.3

Source: (Census of India, 2011)

2.1.1 Sanitation facilities

This section presents on existing sanitation facilities in Community toilets (CT)/Public toilets (PT), institutions, commercial establishments and slums.

CT/PT: There are no community toilets in slums. The municipality has 9 PTs but it has not covered all areas of the town. All these toilets are functional under public-private partnership. During field survey, it was closely noted that the PTs were clean and maintained. These were equipped with facilities for both male and female. The PTs have septic tank whose supernatant discharges into open drain (SM, 2016; SM, 2016a).

Figure 2: Community toilet in Purani Gudri area of ward 40 (Source: Anil/CSE, 2016)

Institutional and commercial establishments: The municipality has 2,884 commercial and institutional establishments and 3 markets in the town. Institutional buildings have toilet facility within the premises. These toilets are connected to septic tank with effluent discharging into open drain. Whereas, in market places, the visitors are dependent on public toilets. The shops within mixed land use (residential and commercial) have toilet facility within the plot area (SM, 2016a).

In general, the market areas and some public places are devoid of the toilet facilities. The central part of the city has mixed land use (residential and commercial). These have toilets within the plot area.

2.1.2 Containment

According to the field-based research, it is noted that no functional sewer network is present in the city. All HHs dependent on on-site sanitation systems (OSS) like a septic tank and pit latrines.

Generally, the pattern observed during the random survey was that the existing septic tanks in HHs of middle and lower income groups do not adhere to prescribed design of BIS

standards of septic tank. Hence, the containment does not function as a septic tank due to rudimentary design. These are constructed inside the HH premise as it is not permissible to construct a tank outside the plot area (SM, 2016a).

According to KII with a well-experienced mason, the higher income households (HHs) prefer to construct a well-designed rectangular septic tank. Each tank has maximum size measuring 12 ft. x 7 ft. x 9 ft (3.6 m x 2.1 m x 2.7 m) with two baffle walls, each baffle wall has an opening of 1 ft (0.3 m) from the top and 2 ft (0.6 m) from bottom.

The overall cost of this type of septic tanks is about INR 45,000 (USD 681). On the other hand, HHs with middle to lower income groups prefer a tank which is cylindrical in shape with only 1 baffle wall. The size of these system measures 6 ft. (1.8 m) height and 3 ft. (0.9 m) diameter. The material used for construction is concrete and steel bars. These tanks cost around INR 12,000 (USD 181) per unit. All these containment systems have an effluent pipe which discharges into open drain.

This type of tank is constructed on the site using a casing. Bottom of the tank is covered by concrete.

Figure 3: Septic tank under construction (Source: Shantanu/CSE, 2016)

Pit latrines: These containment systems are only observed in urban poor settlements where the toilets are constructed under SBM. The pits are constructed using prefabricated rings made of concrete. Each ring measures 3 ft. (0.9 m) in diameter and 10 inches (25.4 cm) in height. Usually, 6-9 rings are laid depending on HH size to prepare a pit tank.

2.1.3 Emptying

The service is provided only by private emptiers as the ULB does not have vacuum tankers to provide emptying service. This profession is practised by a particular community of the society residing in the town. In order to cater for emptying demand, there are a total of two private emptiers plying in the city who charges a fee of around INR 2,500 (USD 38) for emptying per containment (SM, 2016).

Emptying process involves two people to complete the emptying service consisting of a driver and a labourer. The emptiers wear no personal protective equipment while emptying, thereby making the practice prone to serious health issues (SM, 2016a).

2.1.4 Transportation

Tractor-mounted tanker is used for emptying. According to Key Informant Interview (KII) with a driver and labourer, the average distance travelled for each trip is 10 km. On an average, 2 trips are completed per day and each trip consumes 2 to 3 hours of service. A 3 HP pump is attached to the vehicle which is used for suction of FS from containment. The capacity of a vacuum tanker is 4,000 litres. The supernatant (SN) from the septic tank is conveyed through open drains/*nullahs* to nearby water bodies.

Figure 4: Tractor-mounted tanker used for emptying service (Source: Anil/CSE, 2016)

Figure 5: SN from septic tanks conveyed through drains/*nullah* (Source: Anil/CSE, 2016)

2.1.5 Treatment and disposal

There is no treatment facility available for the wastewater and faecal waste generated in the city. Discharge of FS is an issue as there is no designated dumping site. Discharging FS by private emptiers within 10 km of the city is prohibited by the municipality. FS is generally discharged in forest areas and also in agricultural fields outside the municipal boundary. Seldom, agriculture landowners pay INR 50 to 100 (USD 0.5 to 1) to the emptiers for discharging of FS into their fields. The WW generated from HHs is indiscriminately discharged into open fields and water bodies.

Figure 6: Discharge of supernatant in lakes (Source: Anil/CSE, 2016)

2.2 SFD matrix

The SFD matrix is shown in Appendix 7.7 and the final SFD graphic for Siddipet is presented in Appendix 7.3.

2.2.1 SFD matrix explanation

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

Table 3: Description of variables used for defining containment systems

S.no.	Variables	Description (city context)	Percentage of population
1	T1A2C6	Septic connected to open drain or storm water drain	90
2	T2A5C10	Lined pit with semi-permeable walls and open bottom, no outlet or overflow, where there is 'significant risk' of groundwater pollution	10

(Source: CSE, 2017)

Table 4: Description of variables used in SFD graphic

System type	Variables	Description	Percentage of population
Onsite	SN not contained	SN from the onsite sanitation technology (T1A2C6) discharges into open drains hence is not contained.	45
	SN not delivered to treatment	SN from the onsite sanitation technology (T1A2C6) that is conveyed through open drains and ends up in ponds.	45
	FS not contained	FS from the onsite sanitation technologies (T1A2C6) and (T2A5C10), where FS is not contained either due to infiltration in ground and or due to effluent discharging into open drain.	55
	FS not contained – emptied	Where FS is not contained, which is emptied, using motorized emptying equipment.	45
	FS not delivered to treatment	FS that is discharged at non-confirming places such as storm water drains, open fields and *nullah*..	45
	FS not contained – not emptied	FS that remains in the tanks and pits. It also includes the infiltrate.	10

(Source: CSE, 2017)

Offsite sanitation system

According to census 2011, 11.6% of the city is dependent on piped sewer systems. But from the field survey conducted, it was observed that there is no existing underground drainage system in the city.

Onsite Sanitation System

According to Census 2011, 62.8% population is dependent on OSS of which, 53.3% use septic tanks and 9.8% use pits, and 0.7% use public latrines.

The OSS is divided into two categories. A containment system in which FS is contained and one in which FS is not contained. FS is considered not contained in Siddipet when the FS infiltrate into the ground and pollutes the high groundwater table or if the supernatant from the septic tank flows through open drain. In Siddipet, 90% population is dependent on onsite systems connected to open drain. There is no clear differentiation between the volume of SN and solid FS generated from septic tank connected to open drain, hence to reduce maximum error it is assumed to be 50% each, therefore, the SN is 45%. The SN is not delivered to any treatment facility and ends up landing in the nearby ponds.

FS not contained is attributed to 55% be from the population who use the systems: septic tank connected to open drain (90%) and lined pit with semi-permeable walls and open bottom (10%).

It is also assumed that 90% of FS is emptied during the emptying process, thereby leaving 10% in the OSS. Out of the 55% solid FS (not contained), 45% is emptied (41% from septic tank connected to open drain + 4% from lined tank with semi-impermeable walls and open bottom. This 45% attributed FS is discharged untreated at non confirming places. FS not contained-not emptied (10%) includes FS that is left in the tanks (5%) and infiltrate (5%).

Open defecation

According to Census, 2011, 10.3% population practices open defecation. But the municipality officials informed that the town has been declared ODF and there is no practice of OD.

Overall, human wastes are not being safely managed which results in 100% unsafely management of human excreta.

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.

The prime source of drinking water for the city is River Manair. 73% of the town receives pipe water supply coming from Manair dam which is 54 km away from town. The demand for water supply is 29.53 MLD but the residents receive only 14.54 MLD to the consumer ends. To fill in the huge gap in water supply, the municipality has also facilitated to residents 68 power bore wells, 125 single phase submersible pump set bore wells and 187 hand pumps. The town is having 13,519 house service connections and 52 public stand posts (SM, 2016).

The city has hard gravel soil in locations away from the Manair River and black-cotton soil at the south-eastern part of the city nearer to the Manair River. The groundwater table is at a depth of 5 m to 10 m. The average depth of the household bore well is varying between 60 to 75 m. At some place, it is found that the groundwater table is even at a depth of 3 m, due to the influence of Manair reservoir (SM, 2016).

The groundwater in the district is in general suitable for both domestic and irrigation purposes. High fluoride concentration in groundwater is detected in Siddipet district (CGWB, 2013). The containment systems T2A5C10 are considered not contained because of possible infiltration of FS into groundwater.

2.2.3 Discussion of certainty/uncertainty levels of associated data used for the SFD matrix

There were three major challenges to develop the SFD graphic. Census 2011, and SKS, 2014 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, 2011 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. The recent door to door socio-economic survey where data collection in each and every HH was conducted by state government called as *Samagra Kuthumba*. The survey has up to date database subject to containment systems which is considered as one of the most reliable data sources for

production of SFD graphic. CSE's representative also conducted the KIIs, FGDs and site visits.

The assumption regarding the volume of FS emptied as compared to FS generated has a high impact on the overall SFD graphic. A reliable method for estimating quantities of FS generated on a citywide scale do 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 site visits 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).

2.3 Context-adapted SFD

According to the GIZ India (involved in CSP of the city in collaboration with municipality and CSE), SFD graphic generated by the graphic generator (appendix 7.3) was not sufficiently visualizing the actual situation at containment stage of sanitation chain. The stakeholders interviewed and associated with the study raised a concerned that septic tanks, which are regularly emptied, should be considered contained even if the supernatant is discharged into open drains. Hence, a context-adapted city specific SFD graphic is manually corrected to convey the substantial picture of the excreta management in the city.

Please refer Appendix 7.5 for the context-adapted SFD graphic. There is no major change done in the SFD graphic. The only difference suggested in this context is at containment stage, i.e. for correctly designed septic tanks. Out of 100% of the population, dependent on onsite sanitation system, 90% of the population is dependent on septic tanks connected to open drain or storm sewer. 10% of the population, dependent on lined pit with semi-permeable walls and open bottom with open bottom.

With an earlier assumption of 50% of the proportion of the content of the septic tank is solid FS, rest of the 50% is assumed to be supernatant, which attributes to 45% of the population, that flows through open drains. According to GIZ India, the solid FS collected in the septic tank (attributed to 90% population) should be considered contained as it is neither polluting the groundwater nor the solid excreta are overflowing in the open drain. Hence, 45% of FS is considered contained (represented green in colour). 45% of FS contained is emptied and rest 5% FS remains in the tank, which is contained and never emptied. Nevertheless, the supernatant generated from septic tanks connected to open drain is not contained and hence, considered to be unsafely managed (represented red in colour).

Overall, excreta of 96% population are not managed safely according to the context-adapted SFD graphic. The graphic is well received by the stakeholder's group and city's authority has agreed that the context-adapted SFD graphic is representing a much closer picture to the ground conditions.

3 Service delivery context description/analysis

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, 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 on-site 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 the 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, a major role is to be played by the members of institutions, organizations, individuals, NGOs, academics, media representatives, local councillors, 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 for better 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) to be prepared and implemented by cities. Septage refers here broadly to not only faecal sludge removed from septic tanks but also that removed from pit latrines and similar on-site toilets. This advisory provides references to the Central Public Health and Environmental Engineering Organization (CPHEEO) guidelines, Bureau of Indian Standard (BIS) standards, and other resources that users of this advisory may refer for details while preparing their SMP (MoUD, 2013). It clearly discusses on techno-managerial and socio-economic aspects of Septage management in India and provides guidelines for Urban local bodies to (ULBs) to plan and implement SMPs.

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 the 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, MoUD 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 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 and ULB level

Telangana state, as a geographical and political entity, was born on June 2, 2014, as the 29th and the youngest state in the Union of India. The state government started the statehood process in July 2013 and concluded the process by passing the statehood bill in houses of Parliament in February 2014. Andhra Pradesh Reorganisation Act, 2014 is an Act of Indian Parliament that bifurcated the state of Andhra Pradesh into Telangana and the residuary Andhra Pradesh state. However, the state is still dependent on some of acts and policies of Andhra Pradesh.

Telangana State Sanitation Strategy- Urban, 2017

The state has prepared a Draft Urban Sanitation strategy which construes upon the overall framework of the NUSP. Sanitation for the purpose of Telangana State Sanitation Strategy (TL-SSS) is defined as the safe management of human excreta, including its safe confinement, treatment, disposal and associated hygiene-related practices. The TL-SSS helps in selecting integral solutions for the sector of solid waste, wastewater (including septage), stormwater drainage and drinking water. The aspect of sustainability is at the core of the strategy by looking at the dimensions of capacity enhancement, finance, technology, inclusiveness, climate change responsiveness, institutional and governance strengthening. The strategic vision is that all cities and towns in Telangana to become totally clean,

sanitized, healthy, liveable, ensuring and sustaining good public health and environmental outcomes for all citizens, with a special focus on hygienic and affordable sanitation for the urban poor and women. The strategy's regard to water management promotes to ensure 100% of human excreta and liquid wastes from all sanitation facilities including toilets must be safely treated and disposed of.

According to Constitution of India, water and sanitation is a state subject. Statutory powers are conferred to the state for making laws on water and sanitation.

There is no specific state sanitation policy for Telangana, but the state follows the approaches advocated in the NUSP. State sanitation strategy is being developed. There are no specific laws and regulations on septage management at the state level. However municipal laws have partly addressed aspects of septage management. Some of them are listed below:

Andhra Pradesh Municipalities Act, 1965

The act governs the structure and management of municipalities in Andhra Pradesh. Provisions for sanitation have been listed here.

Part V, Chapter 1 of Andhra Pradesh Municipalities Act, 1965 states the following: "All house drains whether within or outside the premises to which they belong and all private latrines and cesspools within the municipality shall be under the control of the council but shall be altered, repaired, cleaned and kept in proper order at the expense of the owner of the premises to which the same belong or for the use of which those were constructed and in conformity with by-laws and regulations framed by the council in this behalf " (GoAP,1965).

The act clearly recommends constructing septic tanks and cesspools in accordance with the bylaws and regulations.

Andhra Pradesh Building Rules, 2012

Andhra Pradesh government has issued comprehensive building rules and other related rules which are applicable to Municipal Corporations, Municipalities, Nagar Panchayats and areas covered by urban development authorities in the state. These building rules are regulating the building activities in above areas.

The by-law states that the work of other building services like sanitation, plumbing, lifts, electrical installations, and other utility services shall be as per National Building Code standards and shall be executed under the planning, design and supervision of qualified and competent technical personnel.

3.1.3 Institutional roles

The MoUD 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. CPHEEO, created in 1953, is the technical wing of the MoUD, which advises the ministry on 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 commission, 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 Siddipet is governed by various institutions. Table 5 outlines the institutions responsible for policy making, service provision and regulation of urban services:

Table 5: Roles and responsibilities

Institution	Roles and responsibilities
Municipal Administration and Urban Development Department (MAUD)	Policy formulation, preparation of municipal laws, monitoring and evaluation of programmes, supervision of municipal administration, coordination with related state government departments, liaison with the central government and external funding agencies, etc.
Directorate of Municipal Administration (CD&MA)	Executive arm of MAUD and is Implementation of laws, policies and programmes relating to the urban sector, administrative and financial management of development schemes. Acts as a conduit between the municipalities and the government and provide guidance, help and assistance to all local bodies.
Telangana State Urban Finance and Infrastructure Development Corporation (TSUFIDC)	Technical assistance to the local bodies in the preparation and implementation of development schemes
Telangana State Pollution Control Board (TSPCB)	Advises states on pollution related standards and policies. Monitoring of treatment plants. Key regulator for pollution related issues.
Directorate of Town and Country Planning (DTCP)	Formulation of annual plans and five-year plans, preparation of state plan budget and socio-economic survey report, reviewing and monitoring of plan schemes, evaluation of important schemes/ programmes.
Telangana state Housing Corporation (TSHC)	Formation of layouts, land development, preparation and implementation of housing schemes particularly for the weaker sections.
Siddipet Municipality (SM)	Overall management of the civic services in the city. 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 operation and maintenance (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).

The SM is solely responsible for public health, sanitation, conservancy, solid waste management, construction of individual, community toilet and public toilet (in PPP mode) and faecal sludge management (FSM). However, emptying service is provided by private emptiers only.

3.1.5 Service standards

1. Service Level Benchmarks (SLB), 2008: Issued by the MoUD in 2008, which seeks 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.

   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 ULBs in providing 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. General standards are notified with respect to parameters for safe discharge to inland surface water/public sewers/land for irrigation/ marine coastal areas.

3. Code of Practice for Installation of Septic Tanks, 1985: Issued by BIS. It is a national standard setting body of India. The code specifies standards and design consideration for installation of septic tanks.

4. Manual on Sewerage and Sewage Treatment, Second Edition, 2013: This manual has been developed by CPHEEO. It provides detailed design 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 MoUD. 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).

The Swachh Bharat Mission (SBM), one of the flagship programmes of the government of India, launched on October 2nd 2014 by the MoUD. SBM-Urban aims to eliminate open defecation (OD) by the year 2019, eradicate manual scavenging, capacity augmentation of ULBs and generate awareness about sanitation and its linkage with public health. 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 OD, remaining 20% of households practising OD are assumed to be catered by community toilets due to constraints of space (ii) all households with insanitary latrines (iii) all households with single-pit latrines (MoUD, 2014). The city had a target to complete 2,601 individual household toilets (IHHT) which are already completed and the city is declared as Open Defecation Free (ODF) (SBM, 2017).

Table 6: Service delivery targets in accordance with SLBs

Sanitation service chain	Parameter	National benchmark	Timeframe 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)

Table 7: Targets under AMRUT funded project

S.No	Project name	Year in which to be implemented	Year in which to be completed
1	Laying of sewer network	2017-18	2018-19
2	Installation of sewage treatment plant	2016-17	2017-18
3	Installation of pumping station		
4	Laying of pumping main		
5	Sewer links for house service connection	2017-18	2018-19
6	Infrastructure works	2017-18	2018-19

Source: (SM, 2017)

3.2.2 Investments

Siddipet city falls under the central scheme Atal Mission for Rejuvenation and Urban Transformation (AMRUT). The municipality has received a share of funds from central and state government for construction of underground drainage network and Sewerage

Treatment Plant (STP). A total of 91.16 km of sewer line is proposed to be laid along with an STP of capacity 7.25 MLD. The following table shows the investments under the project:

Table 8: Investment for sanitation services

S.No	Project Name	Share			Total
		GOI	State	ULB	
1	Installation of sewerage treatment plant	917	366.8	864.2	2,148
2	Installation of pumping station				
3	Laying of pumping main				
4	Laying of main sewer network	2,000	800	2119	4,919
5	Sewer links for house service connection				
6	Infrastructure works				
Total		2,917	1,166.8	2,983.2	7,067

Source: (SM, 2017)

The municipality is also receiving funds under central scheme like Pradhan Mantri Awas Yojna (PMAY)/Housing for All (HFA). The scheme aims to provide shelter to urban poor. The ULB targeted to construct 1,960 dwelling units at a cost of INR 103.88 Crores (15.73 million USD).

3.3 Reducing inequity

3.3.1 Current choice of services for the urban poor

There are 41 urban poor settlements with a population of 48,299 constituting 43.37% of total population of the city as per Census, 2011. Of the 41 urban poor settlements, 12 are notified and 29 non-notified slums. The structure of houses constructed in slums was observed to be in good and stable condition. All households (HHs) have access to toilet and there is no practice of OD. The slum HHs are equipped with toilet connected to single pit containment systems constructed using concrete rings measuring 3 ft. (0.9 m) in diameter and 10 inches (25.4 cm) in height. These settlements are dependent on private emptiers for emptying containment systems. Until these settlements are covered by sewer networks, the upcoming STP will cater the wastewater generated from the settlements by taping the *nullahs* (SM, 2016a).

Figure 7: Slum HHs and toilets constructed under SBM (Source: Anil/CSE, 2016)

Most of the toilets are constructed under the central scheme of SBM. The slum dwellers are dependent on stand posts and wells for drinking water. WW is conveyed through storm water open drains to nearby water bodies. The slum communities were observed to be in hygienic condition.

3.3.2 Plans and measures to reduce inequity

Schemes of the central and state government like SBM, PMAY/HFA also provide basic services to the urban poor. SBM urban aims to eradicate OD before 2019, provides grant of 12,000 INR (181.81 USD) per HH for construction of individual toilet with containment system. It also aims to construct community toilets primarily in low-income and/or informal settlement where land is a constraint for construction of IHHT (SM, 2016a).

PMAY/HFA (Urban) scheme is aimed at 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.

PMAY/ HFA aims to construct 1,960 HHs for the in-situ upgrade of slums. The houses will be equipped with the facility of an individual toilet with containment system (SM, 2016a).

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

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 MMC, 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.

Though there is the handsome amount of funding available from Central and State government under schemes like SBM and AMRUT. The municipality suffers the problem of quality and quantity of manpower.

3.4.2 Monitoring and reporting access to services

Data on service levels should be collected, documented and reported to MoUD according to the format prescribed by SLB framework.

The progress of toilet coverage gets reflected in SBM-Urban dashboard on the website. Of 4,041+ municipalities in 650+ districts, 3,802 ULBs are active. 75 million plus cities are being monitored separately.

There is a decent database related to containment systems of all the HHs is available. The door to door socio-economic HH survey, conducted under the Samagra Kuthumba Survey in August 2014, has all the required sanitation related database in detail. These data can be

used for future planning on the identified interventions. Updated and detailed GIS database is developed for spatial planning and management of services such as schedule emptying.

Before construction of the house, people are supposed to get their house plan approved by SM, and the plan should include a well-designed septic tank connected to soak pit. However, the municipality does not adhere to regulations pertaining to sanitation and the ULB gives negligible importance to containment system while approving the house plan.

3.5 Expansion

AMRUT is a mission to provide basic services (e.g. water supply, sewerage, urban transport) to households and build amenities in cities to improve the quality of life for all. The cities are required to submit Service Level Improvement Plan (SLIP) documents (includes details on funding of specified projects by ULB) to the state. The state will then prepare State Annual Action Plan (SAAP) document compiling all the details given in SLIPs. SAAP will then be forwarded to the MoUD for sanction of funds. It has been decided to divide the projects into two phases. The Mission also has a capacity building and reforms component that are designed to bring in improvements in service delivery, mobilization of resources.

Swachh Bharat - Swachh Telangana, Government of has launched the Swachh Telangana Mission with a goal of achieving “open defecation free cities” by 2019 in line with the above vision.

3.5.1 Stimulating demand for services

The following activities can stimulate demand for services:

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

3.5.2 Strengthening service provider roles

Funding could be estimated for septage management initiatives under rapid assessment for FSSM supported by the MoUD and GoI through NFSSM. These funds can be used to buy vacuum tankers, building treatment facility, etc. SM has to make use of these funds to strengthen the services.

Emptying services are provided by private players. There are 2 private operators plying in the city. These emptiers can be given license to make emptying a legal service. The private emptiers can be used as a helping hand to cater demand. It was witnessed that the workers were worried about discharge site of faecal sludge (FS). Strategically, treatment facilities should be provided by the municipality which would be profitable for both the emptiers and the ULB.

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 national flagship programmes – SBM and AMRUT. Faecal Sludge management is not in the primacy of ULB to provide as service to the household. Provision of sewerage is in the construction phase. Until the city is completely covered with sewerage system, 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, call and fax prior to a visit to the concerned departments. The purpose of the SFD study and depth of data required was conveyed through an introductory letter to respective departments. A total of 9 KIIs were conducted with members of SM, septic tank emptiers, local masons & public toilet owners. 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 and data collected in Samagra Kuthumba survey. Interview with the private emptiers and other stakeholders provided additional insight into the service delivery context.

4.2 Field observation

Siddipet municipality is a small city having the well-functioning infrastructure. The city is declared ODF in June 2016. A major share of households has good containment systems in terms of design. Whereas, on the other hand, very few households have containment systems as pit latrines. These are prevalent in slum areas and in the suburban.

Despite the fact that there are good containment systems in the city, they are still polluting water bodies as the SN is discharged into the open drains eventually meeting urban water bodies.

The urban poor settlements were found to be clean as compared to any other cities in India. Under national and state scheme, the urban poor households have built an individual toilet facility in their houses.

Laying of sewerage network in the city is not under progress, whereas the construction of sewerage treatment plant of 24 MLD has started. The city carries its wastewater through two major *nullahs*. Wastewater from both drains is eventually disposed of in the downstream of River Manair.

4.3 Focus group discussions

The FGDs were conducted to complement, validate and challenge data collected during literature review and interviews. A total of 2 FGDs were conducted with the municipality's staff. The questionnaires for FGDs were prepared in English, but the interviewer asked the questions translating in the Hindi language.

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

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7 Appendix

7.1 Stakeholder identification

Table 9: Stakeholder identification

S.L No.	Stakeholder group	In context of Siddipet
1	City Council/ Municipal authority/Utility	Siddipet Municipality
2	Ministry in charge of urban sanitation and sewerage	Municipal Administration and Urban Development
3	Ministry in charge of urban solid waste	
4.	Ministries in charge of urban planning finance and economic development	
5	Ministries in charge of environment protection	Department of Environment and Forest
6	Ministries in charge of health	Department of Public Health and Family Welfare
7	Service provider for construction of onsite sanitation technologies	Private players
8	Service provider for emptying and transport of faecal sludge	
9	Service provider for operation and maintenance of treatment infrastructure	N/A
10	Market participants practising end-use of faecal sludge end products	N/A
11	Service provider for disposal of faecal sludge (sanitary landfill management)	Private players
12	External agencies associated with FSM services: eg: NGOs, academic institutions, donors	CSE

(Source: CSE, 2017)

7.2 Tracking of engagement

Table 10: Tracking of engagement

S.no	Name of Organization	Designation	Date of Engagement	Purpose of engagement
1	Siddipet Municipality	Municipal Commissioner	08-10-16	FGD
2		Technical Officer		
3		Building Inspector		
4		IT Manager		
5		Municipal Manager		
6		Assistant Engineer		
7	SISSO	Public toilet in charge		KII
8		Public toilet in charge		
9	N/A	Private emptier		FGD
10		Private emptier		
11		Private emptier		
12	Mason	Local Mason	09-10-16	KII
13	Siddipet Municipality	SBM Nodal officer		
14		Sanitary Inspector		
15		Septic tank emptier (driver)		
16		Septic tank emptier (labour)		
17		Public toilet in charge		
24	Private service provider	Septic tank emptier		

(Source: CSE, 2017)

7.3 SFD graphic

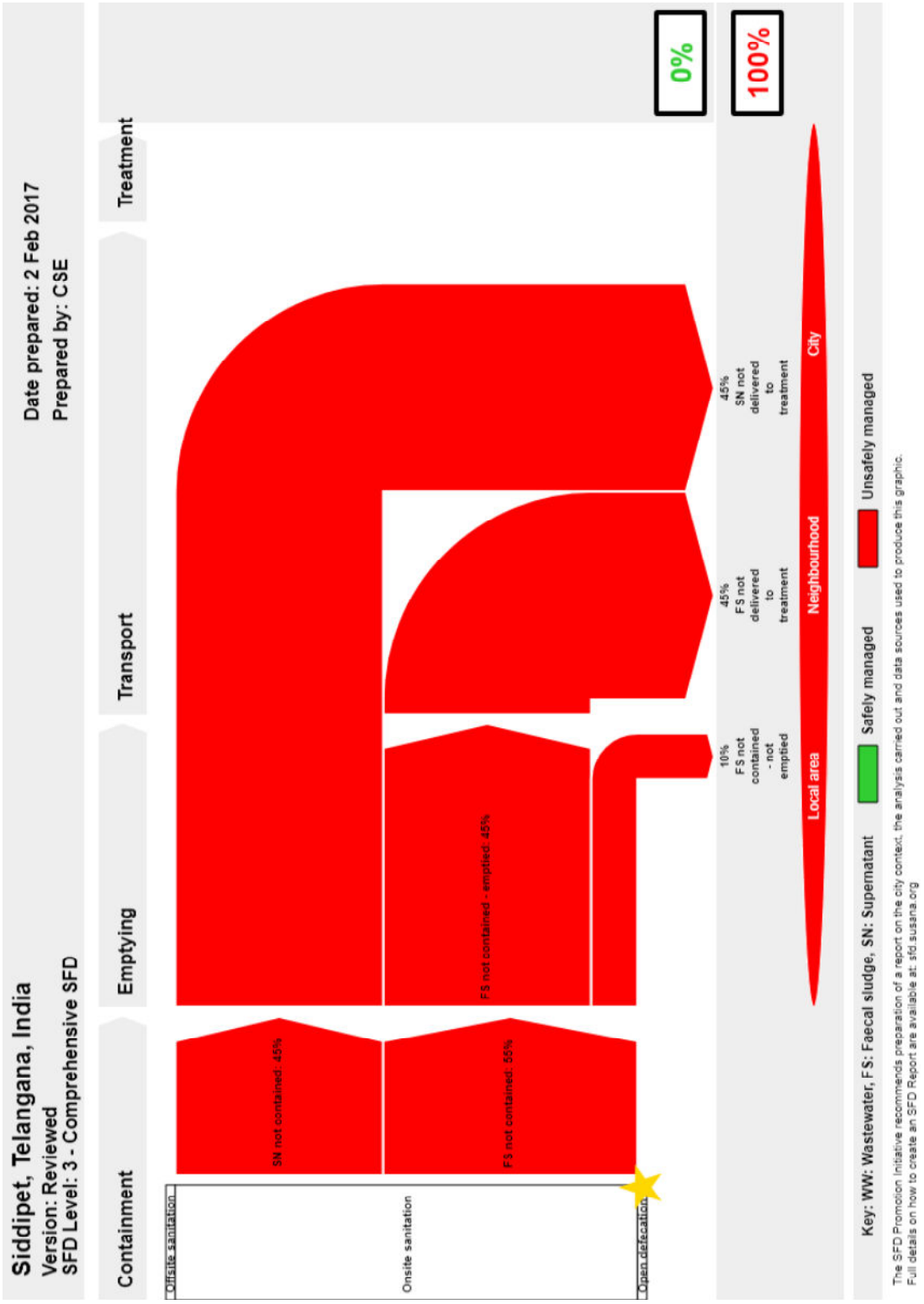


Figure 8: SFD graphic (Source: SFD graphic generator)

7.4 SFD brief explanation

Table 11: Percentage of the population using each system technology and method

System Type	Containment	Emptying	Transport	Treatment	End-use/ disposal
Offsite	The city does not have offsite system				
Onsite	T12A2C6: 90% of population is dependent on septic tank connected to open drain. T2A5C10: 10% 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. Mechanical emptying is done. Since there is no clear differentiation between % of septage and supernatant, it is assumed to be 50% each. SN is assumed to be 45%, FS not contained - emptied comes out to be 45% and FS not contained-not emptied becomes 10%.	The FS collected by private emptiers is transported 10 km away from the city to discharge.	No treatment facility exists. 90% of FS is discharged unsafely at non-confirming places.	All the FS emptied ends up in low lying areas outside the city limits.
OD	Siddipet city is declared as ODF				

Source: (CSE, 2016)

7.5 Context-adapted SFD

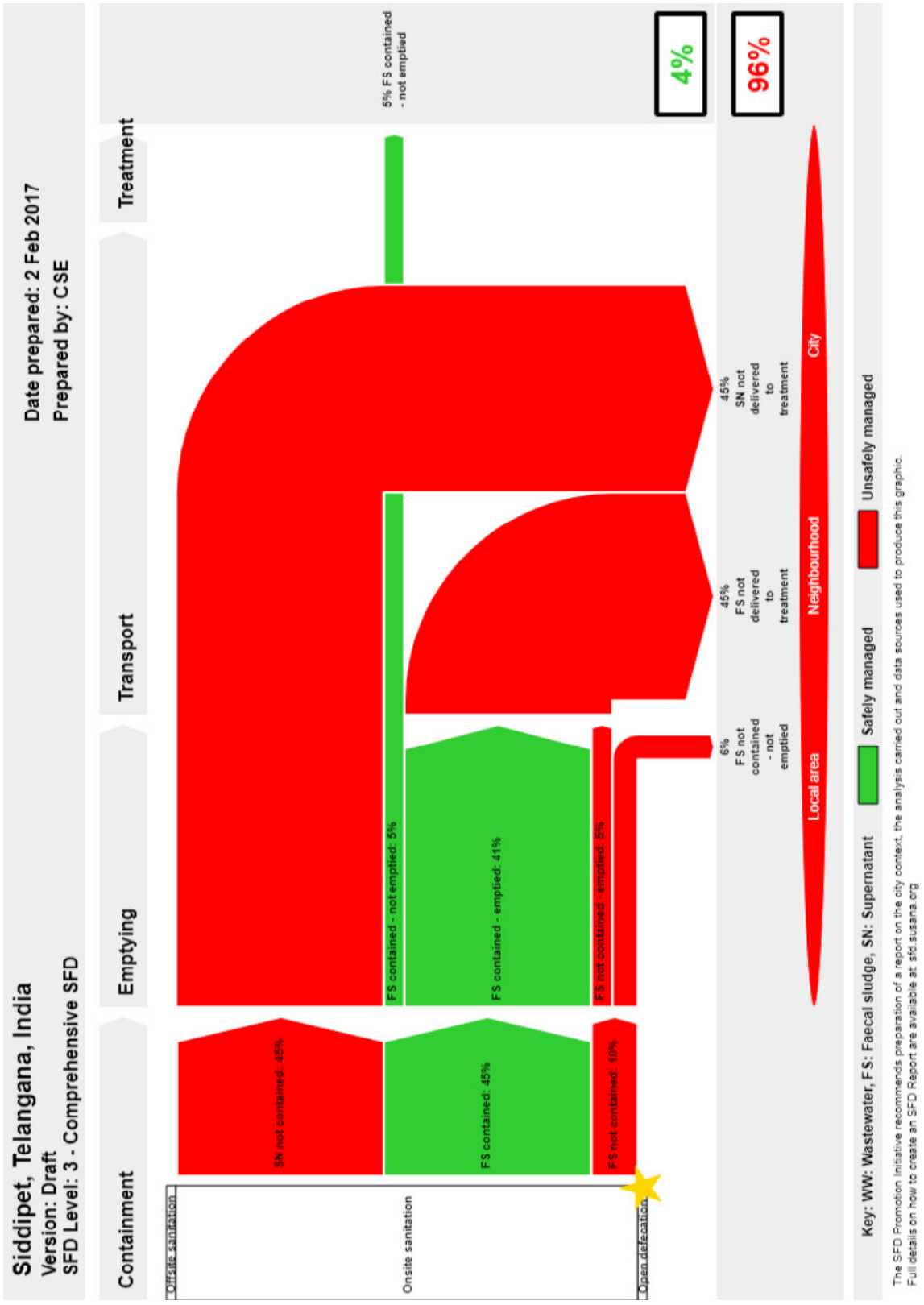


Figure 9: Context-adapted SFD graphic (Source: CSE)

7.6 SFD selection grid

Table 12: Containment system 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 / Low risk of GW pollution	T1A2C6				
Fully lined tank (sealed)					Significant risk of GW pollution / 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										
User interface failed, damaged, collapsed or flooded										
Containment (septic tank or tank or pit latrine) failed, damaged, collapsed or flooded										
No toilet. Open defecation	Not Applicable									Not Applicable

(Source: SFD graphic generator, 2016)

7.7 SFD matrix

Table 13: SFD matrix

Siddipet, Telangana, India, 2 Feb 2017. SFD Level: 3 - Comprehensive SFD
Population: 138690
Proportion of tanks: septic tanks: 50%, fully lined tanks: 50%, lined, open bottom tanks: 50%

System label	Pop	F3	F4	F5	S4e	S5e
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	Proportion of supernatant in open drain or storm sewer system, which is delivered to treatment plants	Proportion of supernatant in open drain or storm sewer system that is delivered to treatment plants, which is treated
T1A2C6 Septic tank connected to open drain or storm sewer	90.0	90.0	0.0	0.0	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	10.0	90.0	0.0	0.0		

Source: (SFD graphic generator, 2016)

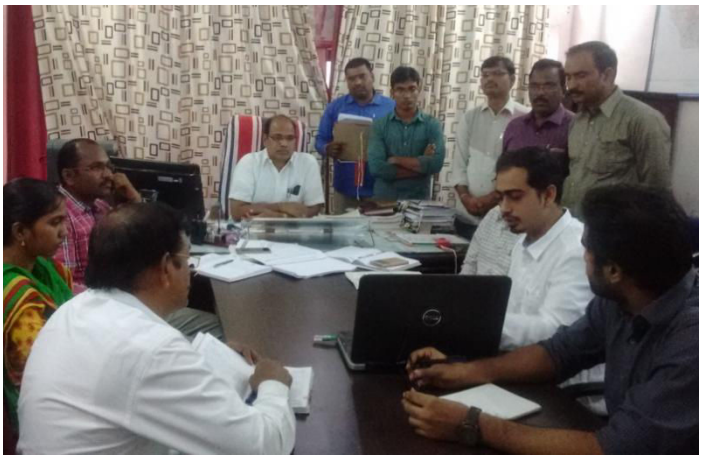
7.8 CSTF/SBCLTF

Table 14: List of CSTF memebers

Sl.No	Name	Designation	
1	Sri. A. Muthyam Reddy	RDO Siddipet	Chairman
2	Sri. K.V. Ramanachary	Commissioner	Convener
3	Sri. R. Laxman	Dy EE	Member
4	Sri. Y. Subhash	TPO	Member
5	Sri. N.Krishna Reddy	Sanitary Inspector -1	Member
6	Sri. B. Satyanarayana	Sanitary Inspector -1	Member
7	Sri. G. VenkatNarayana	Revenue Officer	Member
8	Smt. G. Vaidhehi	TPRO	Member
9	Sri Dr. Kashinath	Doctor	Member
10	Sri. Malla Reddy	Educational Institutions	Member
11	Sri. Kesharaju	Depot Manager	Member
12	Smt. Rajamani	TLF President	Member
13	Sri. Surender Reddy	Circle Inspector –I	Member
14	Sri. Sudhakar	ASWO	Member
15	Sri. Joju	NGO	Member
16	President	Vasavi Club Siddipet	Member
17	Sri .Venkata Lingan	Bar Association Member & MSC	Member
18	Sri Rajagoud	Hotel Association President	Member
19	Sri. Chiranjeevi	Function hall association president	Member
20	Sri. Prabhakar	Rythu Bazar Estate officer	Member
21	Sri Venkatesham	Thaibazar contractor	Member
22	Sri. Balaji	Slaughterhouse contractor	Member
23	Sri. Papalal	Safai Karmacharies president	Member

Source: (SM, 2016)

7.9 Photographs during field visit



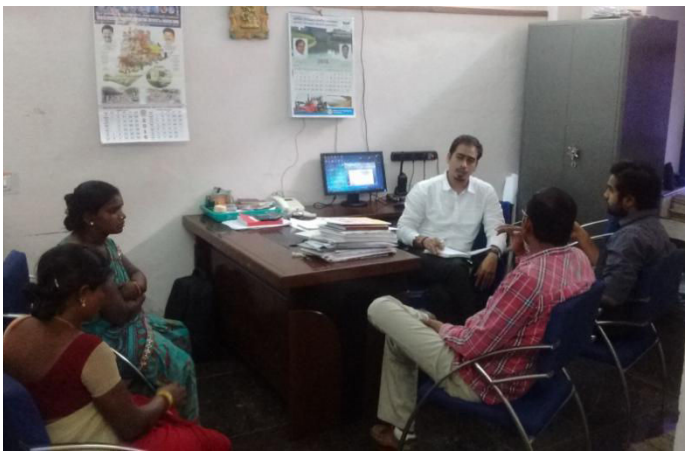


Figure 10: FGD with SM officials and private emptiers (Source: SM, 2016)

Figure 11: KII with private emptier (Source: Anil/CSE, 2016)

Figure 12: KII with public toilet in charge (Source: CSE, 2016)

Figure 13: Proposed 24 MLD STP under construction (Source: Anil/CSE, 2016)