SFD Report

Bijnor
India

Final Report

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

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SFD Report Bijnor, India, 2017

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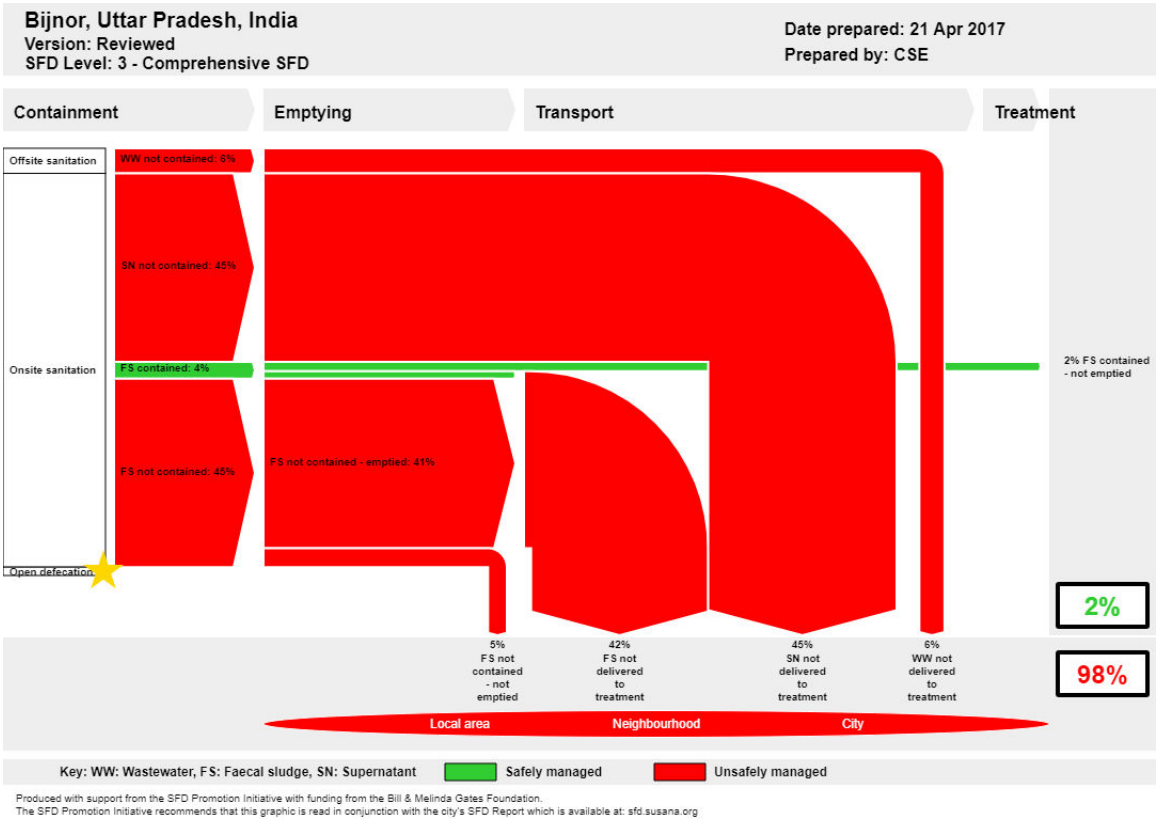
This Executive Summary and SFD Report are available from:

www.sfd.susana.org

1. The SFD Graphic



2. Diagram information

SFD Level: Comprehensive.

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3. General city information

Bijnor city is located 12 km west to the bank of River Ganga and 460 km from Lucknow, the state capital of Uttar Pradesh. Bijnor is the district headquarters of Bijnor district. As per Census 2011, Bijnor has a population of 93,297 residing in 17,715 households. The urban local body governing the town is Bijnor Nagar Palika Parishad (BNPP) or (Bijnor Municipal Council). BNPP has an administrative area of 3.6 sq.km which is divided into 25 wards (BNPP, 2015). The density of the city is 25,915 people per sq.km which is very high in comparison to state density of 828 people per sq.km. (Census, 2011).

The geographical coordinates of Bijnor are 29^0 9' 0" North and 78^0 16' 0" East. The topography of Bijnor district is majorly plain. It is elevated 225 metres above sea level (BNPP, 2015) . The average rainfall is 999.4 mm. Temperature rises to 46^0C and drops to 6^0C. The soil type is clay and sand with occasional gravel and boulder (UPJN, 2006).

Bijnor is located in northern plain, hot sub humid (dry) eco-region according to Indian Council of Agricultural Research (ICAR), upper Gangetic plain zone (V) according to NITI Ayog (National Institution for Transforming India, formerly Planning Commission) agro-climatic zone and Bhabar and Terai zone (UP-2) according to National Agricultural Research Project (NARP) agro climatic zone (District planning committee, 2007).

4. Service outcomes

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

Containment: The city has recently got the sewer network in place but it is not functional yet, as the Sewage Treatment Plant (STP) is still under construction, scheduled to be completed only by 2018.

It is estimated that 94% population is dependent on onsite sanitation systems, out of which 46% population is dependent on fully lined tanks connected to open drains, 44% population is dependent on septic tanks connected to open drains, these systems are 2-3 chambered tanks connected to open drains and 4% population is dependent on lined pits with semi-permeable walls and open bottoms without any outlets/overflow. The BNPP owns two mobile Bio Toilets which are put up in the Exhibition ground during public gatherings in addition to the existing public toilets.

Figure 1: Mobile toilets used for public events in Bijnor (Source: Bhavik/CSE, 2016)

Bijnor has been declared as an Open Defecation Free city. No open defecation was observed during the field visit. Emptying: The city is dependent on emptying by private vacuum tank

Figure 2: Methods of advertising used by private vacuum tank operators (Source: Amrita/CSE, 2016)

operators or manual emptiers for emptying faecal sludge (FS), as BNPP does not own any emptying machine. Due to narrow and congested roads, manual emptying is prevalent in a few wards of the city. There are a total of 5 operators and 5 vacuum tanks in the city, the capacity of each vehicle being 4,000 litres. Emptying vehicles are either assembled at '*Karnal'* or '*Sangla'* or then brought to Bijnor. The vacuum tanker covers a distance of 3-5 km per trip and the average time taken to empty and discharge is 1 hour. Desludging is usually carried out by 3 people (1 Driver + 2 Helpers) and the operators charge a fee of INR 1,500 – 2,000 (23 – 30 USD), depending upon the size of the containment and the level of solidification. The emptiers advertise their contact numbers using wall paintings and distribution of business cards.

Transportation: The sewer network has been laid but it is not yet operational and thus the effluent or supernatant (SN) from on-site sanitation systems, is conveyed through drains. The open drains are further connected to bigger drains which lead to four main points: Noorpur Road, Khass Bahnga Retii, Meersaman Road and Temarpur Road. Faecal sludge collected from different parts of the

Figure 3: Vacuum tanker (5,000 litres capacity) used for emptying of OSS (Source: Amrita/CSE, 2016)

city is transported by 5 privately operated vacuum tankers. These suction machines are usually tractor mounted with a capacity of 5,000 litres. Manually emptied faecal sludge from containment systems are loaded onto a cycle cart and disposed at the nearest big drain or an open low-lying area.

Figure 4: Screens, classifier and equalisation tank of STP under construction at Bijnor (Source: Amrita/CSE 2016)

Treatment and disposal: There is no treatment of sewage and faecal sludge generated in the city and the wastewater conveyed through open drains is eventually disposed of either at agricultural fields or open grounds in the outskirts of the city. All the open drains flowing in the city terminate in one of the 16 nullahs, which in turn form four big nullahs. A Sewage Treatment Plant of 24 MLD based on Upflow Anaerobic Sludge Blanket (UASB) technology, under Bijnor Sewerage Scheme, is being constructed at Khedki Village and the treated water is planned to be reused in agriculture (UPJN, 2016).

There is no clear differentiation between the volume of effluent and solid FS generated from septic tanks and fully lined tanks, hence to reduce the maximum error, it is assumed to be 50% each. Therefore, SN that goes into open drains is

assumed to be from 45% population. FS is divided into FS contained which is estimated to be 4% and FS not contained which is estimated to be 45%. It is also assumed that 90% of the population (dependent on onsite systems) gets their system emptied when full. Hence, 2% FS is contained but not emptied, 43% FS is not contained and emptied while 4% FS is not contained and not emptied.

5. Service delivery context

National Urban Sanitation Policy (NUSP) was issued in 2008, by the Ministry of Housing and Urban Affairs (MoHUA) formerly known as Ministry of Urban Development (MoUD). 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). A draft CSP for Bijnor was prepared by BNPP and U. V. D Private Ltd in the year 2016 which has not been passed by municipal resolution.

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 the central government to provide basic civic amenities including improvement of urban sanitation. Under Swachh Bharat Mission (SBM), 469 individual households' toilets have been approved but no toilet has been constructed yet. The city has proposed to National Mission for Clean Ganga (NMCG): laying of 80 km sewer line, installation of a 24 MLD Sewage Treatment Plant (STP) and interception of drains to abate pollution in the Ganga River (BNPP, 2016).

The municipality did a rapid assessment of FSM in the city to calculate the funds required for the same. It was estimated that INR 5,550 lakh (8.3 million USD) is required for implementation of effective faecal sludge and septage management including operation and maintenance for five years (MoUD, 2016).

6. Overview of stakeholders

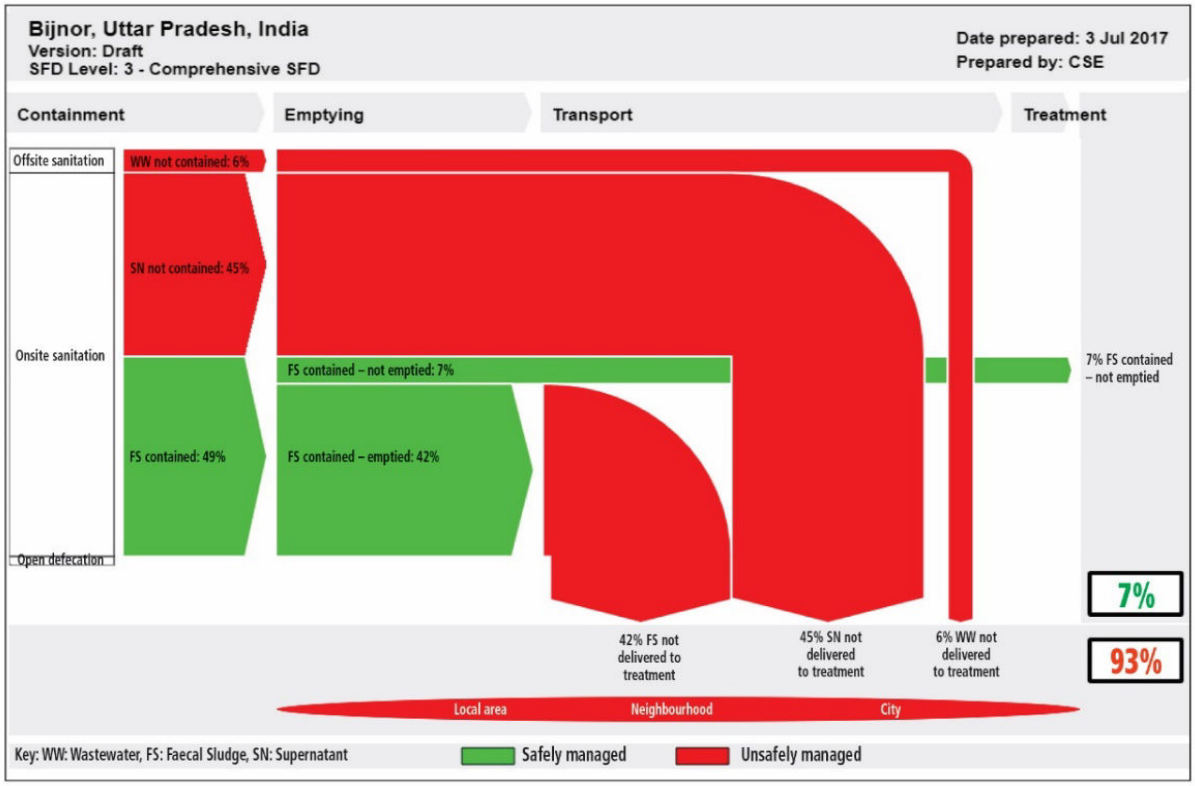
The 74th Constitutional Amendment Act of 1992 reformed the sector by transferring responsibility for domestic, industrial, and commercial water supply and sewerage (WSS) from state agencies, such as Departments of Public Health Engineering and State Water Boards, to Urban Local Bodies (ULBs). This transfer 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	Ministry of Housing and Urban Affairs (MoHUA), National Ganga Council, Ganga Pollution Control Unit, UP Jal Nigam (UPJN), Urban Development Department (UDD), Nagar Palika Parishad-Bijnor (BNPP), District Urban Development Authority (DUDA) Uttar Pradesh Pollution Control Board (UPPCB), State Programme Management Group (SPMG)
NGOs	Centre for Science and Environment (CSE)
Private sector	Private vacuum tank emptiers, manual emptiers, local masons

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

UPJN is responsible for planning, designing and construction/development of the assets in sewerage and drainage sector, while BNPP is responsible for operation and maintenance of assets (MoUD, 2013). UDD is responsible for administrative and financial management of municipalities, implementation of development programmes. UPPCB is responsible for monitoring and evaluation of STPs. DUDA is responsible for implementation of central and state government's schemes. BNPP is responsible for septage management. SPMG coordinates and oversees the implementation of projects sanctioned by Government of India under National Ganga Council (NGC). 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. Description of context-adapted SFD



As mentioned in section 4, the city is majorly dependent on OSS: 44% of the population depends on septic tanks connected to open drains. 46% population depends on fully lined tank connected to open drains. 4% population depends on lined pit with semi permeable walls and open bottom. 6% population, user interface discharging directly to open drain. The only difference suggested in this context-adapted SFD is at containment stage for correctly designed septic tanks, though connected to open drains.

With an earlier assumption of 50% of the proportion of the content of the septic tanks and fully lined tanks is solid FS, generated and collected inside the septic tanks. Rest of the 50% of the content is supernatant, which attributes to 45% of the population that flows through open drains.

8. Context-adapted SFD graphic

According to SBCLTF the solid FS collected in the septic tank should be considered contained as it is neither polluting the ground water nor the solid excreta are overflowing in the open drain.

Hence 49% of FS is considered contained (represented green in colour). 42% FS contained is emptied and remaining 7% 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).

The 'FS not contained' changes from 45% to zero as 'FS contained' becomes 49% from 4% and there is no change in SN, though FS contained and not emptied increases from 2% to 7% when compared to SFD generated through graphic generator.

Overall, excreta of 93% population (which was 98% according to GG) are not managed safely according to the context-adapted SFD.

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.

To start with, a relationship between sanitation technologies defined in Census of India and that defined in the project is established. The secondary 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 93% population are discharged in environment untreated.

10. Credibility of data

Two key sources of data are used; (i) Census of India, 2011 as base data to feed into SFD graphic generator for population (ii) random households survey based on socio economic condition of each wards, where 5-6 respondents were recorded. Most of the data are then updated by KIIs. Overall four KIIs and four FGDs have been conducted with different stakeholders.

There were three major challenges to develop the SFD. 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.

11. 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 – Bijnor
  - Groundwater Year Book, Central Groundwater Board, 2014
- KII
  - Masons
  - Executive officer- Jal Nigam
  - Project manager- STP
  - Public toilet care taker
- FGD
  - BNPP officials
  - Private mechanical emptiers
  - Manual emptiers
  - SBCLTF members

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Abbreviations

AMRUT	Atal Mission for Rejuvenation and Urban Transformation
BIS	Bureau of Indian Standard
BNPP	Nagar Palika Parishad – Bijnor
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
DUDA	District Urban Development Authority
EWS	Economically Weaker Sections
FC	Finance commission
FGD	Focus Group Discussion
FS	Faecal Sludge
FSM	Faecal Sludge Management
FSSM	Faecal Sludge and Septage Management
GoI	Government of India
GoUP	Government of Uttar Pradesh
ICAR	Indian Council of Agricultural Research
INR	Indian National Rupee
KII	Key Informant Interview
LPCD	Litres per Capita per Day
MHUPA	Ministry of Housing and Urban Poverty Alleviation
MIS	Management Information System
MLD	Million Litres per Day
MoHUA	Ministry of Housing and Urban Affairs
MoUD	Ministry of Urban Development
NARP	Agricultural Research Project
NBC	National Building Code
NFSSM	National Faecal Sludge and Septage Management Alliance
NGC	National Ganga Council
NIC	National Informatics Centre
NIUA	National Institute of Urban Affairs
NUHM	National Urban Health Mission
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	Submersible Pump
SN	Supernatant
SPS	Sewage Pumping Station
sq km	Square Kilometre
STP	Sewage Treatment Plant
SWM	Solid Waste Management
TCPO	Town and Country Planning Organisation
UDD	Urban Development Department
ULB	Urban Local Body
UPAVP	Uttar Pradesh Awas Vikas Parishad
UPJN	Uttar Pradesh Jal Nigam
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

Bijnor city is located 12 km west to bank of River Ganga in the state of Uttar Pradesh, India. The city lies in the Indo Gangetic plain. Bijnor is located 460 km from the state capital Lucknow and comes under the north-western part of Uttar Pradesh (BNPP, 2015). Bijnor is the district headquarters of Bijnor district. As per Census 2011, Bijnor has a population of 93,297 and 17,715 households.

The urban local body governing the town is Bijnor Nagar Palika Parishad (BNPP). BNPP has an administrative area of 3.6 sq.km which is divided into 25 wards (BNPP, 2015) . The density of the city is 25,915 people per sq.km which is very high in comparison to state density of 828 people per sq.km (Census, 2011). The area under BNPP administration has been chosen for the case study. Population growth of Bijnor city has been highlighted in Table 1.

Table 1: Population growth rate

Census year	Population	Growth rate (%)
2001	79,346	—
2011	93,297	18
2016	105,827	13

Source: (BNPP, 2015), (Census, 2011)

The city has 6 notified slums and 7 non-notified slums. The slum population of the town is 34,480 (NUHM, 2013). The geographical coordinates of Bijnor are 29^0 9' 0" North and 78^0 16' 0" East. The topography of Bijnor district is majorly plain. It is elevated 225 metres above sea level. (BNPP, 2015). The average rainfall is 999.4 mm (UPJN, 2006). Temperature rises to 46^0C and drops to 6^0C. The soil type is clay and sand with occasional gravels (UPJN, 2006).

Bijnor is located in northern plain, hot sub humid (dry) eco-region according to Indian Council of Agricultural Research (ICAR) upper Gangetic plain zone (V) according to Niti Ayog (formerly Planning Commission) agro-climatic zone and Bhabar and Terai zone (UP-2) according to National Agricultural Research Project (NARP) agro climatic zone (District planning committee, 2007).

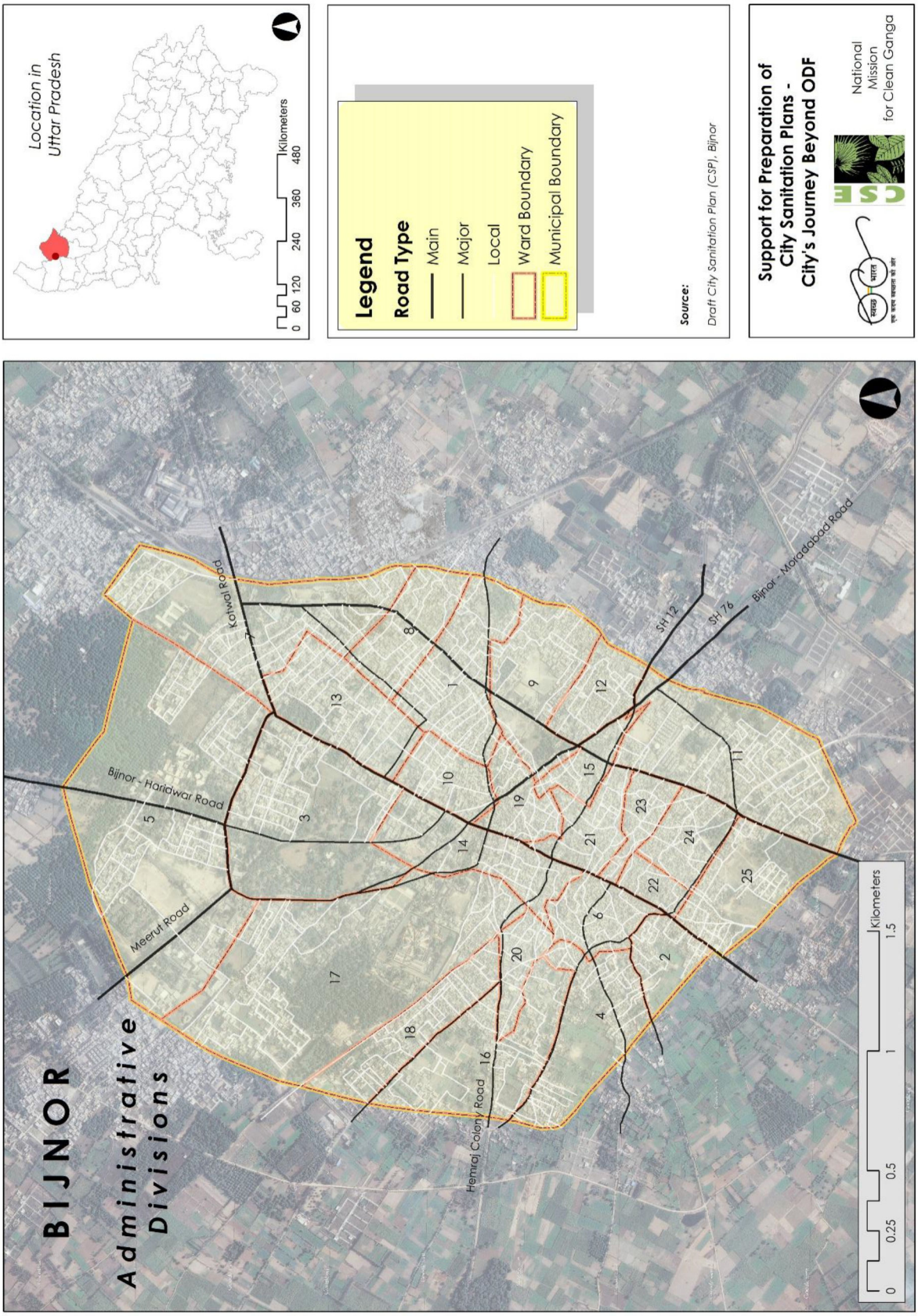

Figure 1: Administrative boundary map of Bijnor NPP (Source: CSE, 2016)

2 Service outcomes

The analysis is based on data available from Census of India, 2011, published reports of government, non-profit organizations and reconnaissance household 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). According to the SFD promotion initiative (PI) definitions of sanitation systems, the types of containments prevalent in the wards are examined through random household survey (Table 9). Data on emptying, transport, treatment and disposal of faecal sludge are 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 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	20.1
2	Septic tank	Septic tank connected to open drain or storm sewer	T1A2C6	70.5
3	Other Systems	User interface discharges directly to open ground	T1A2C8	0.5
4	Pit latrine with slab	Lined pit with semi-peable walls and open bottom, no outlet or overflow, general situation	T1A5C10	2.3
5	Pit latrine without slab	Unlined pit no outlet or overflow, general situation	T1A6C10	0.3
6	Night soil disposed into open drain	User interface discharges directly to open drain or storm drain	T1A1C6	0.6
7	Service latrine	User interface discharges directly to 'don"t know where"	T1A1C9	1.7
8	Public latrine	Septic tank connected to open drain or storm sewer	T1A2C6	2.6
9	Open defecation	Open defecation	T1B11C7 TO C9	1.4

Source: (Census of India, 2011)

2.1.1. Sanitation facilities

This section presents on existing sanitation facilities in institutions, commercial establishments, slums and facilities for tourists.

Community/public toilets: It is reported that there are ten public toilets and four community toilets in the city (BNPP, 2016). All the community/public toilets have septic tanks connected to the user interface. The septic tanks do not fulfil the requirement of the sewerage management system as stipulated in the CPHEEO (Central Public Health & Environmental Engineering Organization) manual on sewerage and sewage treatment and there are no established faecal sludge management process/service institutions in terms of infrastructure.

An average size of septic tanks for community toilets observed was 10m×3.5m×2.5m and they are emptied every year by private emptiers who charge INR 700 (10 USD) per tank and the sludge is disposed of on any low-lying open areas in the outskirts of the city.

Commercial areas: 437 commercial properties within the NPP's area of jurisdiction comprise of 18 bank branches, 10 hotels, 43 nursing homes, 6 marriage halls and a cinema hall. All the market places in the city have access to public toilets which are operated and maintained by BNPP. All the toilets have their user interfaces connected to septic tanks but none of them have ever been emptied yet, as all of them are less than 10 years old.

Industrial areas: Bijnor has no industrial area within the city boundary, but has 2 large scale sugar manufacturing units, 2 steel factories and few chemical industrial units which are 3-5 km from the limits of the municipal boundary (UPJN, 2006). Within the municipal boundary, only 0.50% area is used for industrial purpose which are small scale factories having toilets within the premises (UPJN, 2006).

Due to the lack of data on excreta generated from schools and industries are not taken into consideration for production of SFD.

2.1.2. Containment

According to Census of India 2011, Bijnor is covered with 20.1% sewerage network, but according to on field survey (random) and Key Informant Interviews (KII) conducted in 2016, the city has recently got the sewer network in place but it is not functional yet, as the Sewage Treatment Plant (STP) is still in construction phase, scheduled to be completed only by 2018. As per field survey and KIIs it was estimated that 6% of the city is dependent on offsite systems, comprising only of user interface directly discharging in open drain.

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

Figure 3: Mobile toilets used for public events in Bijnor (Source: Bhavik/CSE, 2016)

According to the Census of India 2011, 75% of the city is dependent on onsite sanitation systems (OSS), out of which 71% are dependent on septic tanks, 3% on pits and 2% on service latrines. But according to the survey and key informant interviews (KIIs) conducted in 2016, it is estimated that 94% population is dependent on onsite sanitation systems, out of which 46% population is dependent on fully lined tanks connected to open drains, 44% population is dependent on septic tanks connected to open drains, these systems are 2-3 chambered tanks connected to open drains. 4% population is dependent on lined pits with semi-permeable walls and open bottoms without any outlets/overflow. Community & public latrines connected to septic tanks hence have been incorporated in onsite systems. Septic tanks and fully lined tanks are not contained as they are connected to open drains. Due to no standardization being followed while construction of containment system, few households have constructed tanks large in capacity irrespective of household size with the general perception of emptying the septic tanks only after an interval of 10-15 years, this inadequate containment of human excreta leads to the contamination of water supply, ground water and attracts the carriers of various diseases, and hence poses severe risks to health and environment. In some wards, mobile toilets were also observed, which were used in place of community and public toilets.

2.1.3. Emptying

Since the ULB does not own a vacuum tanker for the emptying purpose, households are dependent on private vacuum tank emptiers. Due to narrow and congested roads, manual emptying is prevalent in a few wards of the city. There are 5 operators having one vacuum tanker each with a capacity of 4,000 litres. These vehicles are either assembled at '*Karnal'* or '*Sangla'* then brought to Bijnor. The vacuum tanker covers a distance of 3-5 km per trip and the average time taken to empty and discharge is 1 hour. Desludging is usually carried out by 3 people (1 Driver + 2 Helpers) and the operators charge a fee of INR 1,500 – 2,000 (23 – 30 USD), depending upon the size of the containment and the level of solidification. The emptiers advertise their contact numbers using wall paintings and distribution of business cards.

Figure 4: Methods of advertising used by private vacuum tank operators (Source: Amrita/CSE, 2016)

2.1.4. Transportation

The sewer network has been laid, but it is not yet operational and thus the effluent from on-site sanitation systems, is conveyed through drains. The open drains are connected further to bigger drains which lead to four main points: Noorpur Road, Khass Bahnga Retii, Meersaman Road and Temarpur Road. Even though Bijnor has a topography advantage (with a slope towards the south-eastern part of the town which minimizes water logging) and a reasonably good storm-water drain coverage (73% as per SLB study), effectiveness is severely limited due to indiscriminate and widespread solid waste dumping and discharge of grey water into the network. Faecal sludge is collected from different parts of the city, and is transported by 5 privately operated vacuum tankers. These suction machines are usually tractor mounted with a capacity of 4,000 litres. Manually emptied faecal sludge from containment systems are loaded onto a cycle cart and discharged at the nearest big drain or open low-lying area. Illegal practice of manual scavenging of containment system not only violates the national laws but also exposes the involved population to the higher risks of degraded quality of life. Narrow lanes in the city of Bijnor restricts the access of the containment systems to the mechanical emptying trucks results into the prevailing practice of manual cleaning.

Figure 5: Vacuum tanker (4,000 litres capacity) used for emptying of OSS (Source: Amrita/CSE, 2016)

2.1.5. Treatment and disposal

There is no treatment of sewage and faecal sludge generated in the city and the wastewater conveyed through open drains is eventually disposed of either at agricultural fields or open grounds in the outskirts of the city. All the open drains flowing in the city terminate in one of the 16 nullahs, which in turn form 4 big nullahs, list of which has been provided in Table 8. Also, the private emptiers dispose the faecal waste at low-lying open grounds anywhere in and around the city. Unregulated emptying and transport of FSS exposes the immediate communities (cleaners, proponents, neighbourhood especially children) to high risk of health hazards. Emptying services are rendered only by private players, as informed during the KIIs with NPP. Amount charged by emptiers varies from INR 1,000-2,500 (USD 15-37.5) per tank, based on the size of the tank and extent of solidification. The personnel providing emptying services were found to be inadequately trained and lacked personal protective equipment (PPE).

Table 3: Location of sewage/wastewater outfall.

S. No.	Name	Location of Outfall
1	Hemraj colony road	After flowing for 3km outside NPP area, it terminates on an agricultural land.
2	Barrage road, Timarpur Gaon	After flowing for 3km outside NPP area, it terminates on an agricultural land.
3	Ambey Bihar colony, Jhalu road	Open ground
4	Meerut Chungi to Jalalpur road	Open ground

Source: (BNPP, 2015)

A Sewage Treatment Plant of 24 MLD based on Upflow Anaerobic Sludge Blanket (UASB) technology, under Bijnor Sewerage Scheme, is being constructed at Khedki Village. The area inside the municipal boundary is the command area of the project and the initial quantity of wastewater expected to reach the plant is 14 MLD with its design period being 30 years. The UASB reactor is expected to lower the BOD of the inflow by 60% & the aeration tank to further lower it by 90% and maintaining the pH value between 6 and 8. The treated water has been planned to be reused in agriculture (UPJN, 2016).

Figure 6: Screens, classifier and equalisation tank of STP under construction at Bijnor (Source: Amrita/CSE 2016)

Figure 7: FGD with UPJN staff (Source: Amrita/CSE, 2016

2.2. SFD matrix

The SFD matrix is shown in Appendix 7.7 and the final SFD for Bijnor 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 4 and 5.

Table 4: Description of variables used for defining containment systems

S. No.	SFD reference variable	SFD promotion initiative	Percentage of Population
1.	T1A2C6	Septic tank connected to open drain or storm sewer	44%
2.	T1A3C6	Fully lined tank (sealed) connected to open drain or storm sewer	46%
3.	T1A1C6	User interface discharges directly to open drain or storm drain	6%
4.	T1A5C10	Lined pit with semi-permeable walls and open bottom, no outlet or overflow, where there is a 'low risk' of groundwater pollution	4%

Source: (CSE, 2016)

Table 5: Description of variables used in SFD

System type	Variables	Description (city context)	Percentage of population
Offsite Sanitation	WW not contained	Wastewater from user interfaces connected directly to open drains	6
	WW not delivered to treatment	Wastewater from user interfaces connected directly to open drains and not delivered to treatment plant	6
Onsite	SN not contained	Supernatant (SN) from OSS (T1A2C6 and T1A3C6), i.e. the liquid portion which is let out into the open drains	45
	SN not delivered to treatment	Supernatant from OSS (T1A2C6 and T1A3C6) that does not reach a treatment plant	45
	FS contained	Faecal sludge (FS) from OSS (T1A5C10) which does not pollute ground water due to “low risk” of contamination	4
	FS contained-not emptied	Faecal sludge from OSS (T1A5C10) that remains in the tank, and does not get desludged.	2
	FS contained-emptied	Faecal sludge from OSS (T1A5C10) that gets desludged using motorized emptying or manual emptying	2
	FS not contained	Faecal sludge from OSS (T1A2C6 and T1A3C6) is not contained as these systems are connected to open drains	45
	FS not contained – emptied	Faecal sludge removed from OSS (T1A2C6 and T1A3C6) where FS is not contained and is emptied using either motorized emptying equipment.	41
	FS not delivered to treatment	Faecal Sludge discharged in the environment (open fields, nullahs etc.)	43
	FS not contained-not emptied	Faecal Sludge from OSS (T1A2C6 and T1A3C6) remains in the system and is not emptied	4

Source: (CSE, 2016)

Offsite systems

Population with user interface discharging WW directly into open drains (T1A1C6) attributes to 6%. WW which is directly discharged from this population is not treated and ultimately leads to the four discharge points as mentioned in Table 3.

Onsite Systems

94% of the city is dependent on OSS, out of which 46% population is dependent on fully lined tank (sealed) connected to open drain or storm sewer (T1A3C6), 44% population is dependent on Septic tank connected to open drain or storm sewer (T1A2C6) while 4% is

dependent on Lined pit with semi-permeable walls and open bottom, no outlet or overflow, (T1A5C10) where there is a 'low risk' of groundwater pollution.

There is no clear differentiation between the volume of effluent and solid FS generated from septic tanks and fully lined tanks, hence to reduce the maximum error, it is assumed to be 50% each. Therefore, SN that goes into open drains is assumed to be 45%, which is attributed to 23% population using fully lined tanks and 22% population using septic tanks. FS is divided into FS contained which is assumed to be 4% and FS not contained which is assumed to be 45%. FS not contained is attributed 21% population dependent on fully lined tanks, 20% population dependent on septic tanks, and 4% dependent on line tanks with semi-permeable walls with open bottom. It is also assumed that 90% of the population (dependent on onsite systems) gets their system emptied when full. Hence 2% FS is contained and emptied, and 2% FS is contained and not emptied, 41% FS is not contained and emptied while 4% FS is not contained and not emptied.

Open defecation

Bijnor has been declared as an Open Defecation Free (ODF) city. ODF city means that everyone in the city will have access to toilet, even if there is no toilet at house the people would have an approachable PT (Public Toilet) and/or CT (Community Toilet). It also means that at any given time no one would be seen defecating in the open. No open defecation was observed during the field visit.

It can be concluded that Bijnor is an open defecation free city and excreta of the 98% population are discharged in environment untreated. The Table 5 summarizes the percentage of the population using each sanitation technology and method along the service chain.

2.2.2. Risk of groundwater contamination

Uttar Pradesh is covered with rich fertile soil and underlain by a large thickness of alluvium making it one of the richest ground water repositories of the world (CGWB, 2014).

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.

Based on the random survey with households and KIIs in Bijnor, it was decided to characterize all existing sanitation containment systems as having “low risk" of groundwater pollution, as groundwater table is more than 10mbgl. According to the Census of India, 86% of the population is dependent on piped water supply from municipal borewell, 3% on well/tube well/bore well, 9% on hand pumps and 2% on tank/pond/lake. Random survey revealed 94% of the respondents are dependent on piped water supply, which also includes public tap water and households dependent on community based piped water connections. Rest of the respondents are either depended on municipal hand pumps or submersible pumps.

2.2.3. Discussion of certainty/uncertainty levels of associated data

There were three major challenges to develop the SFD. 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 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 WW generated. Therefore, a random household survey was conducted in few wards of the city to identify and cross-check the data collected from the Census, 2011. No other agency was hired for the random survey, CSE's representative conducted the KIIs, FGDs and random surveys. The census data is solely derived from the responses of head of the household that they provide to the enumerators. Since there is no mechanism to cross verify the responses, there could be misreporting of the information due to various reasons including inadequate knowledge of the respondents or enumerators.

Although the number of households considered per ward was less to represent the whole city, the households surveyed were from the different typology of settlements and different socio-economic backgrounds

The assumption regarding the amount of FS emptied as compared to FS generated has high impact on the overall SFD. 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. The amount of FS emptied is not clear because the private emptiers empty sewage from sewer-holes, septage from government & private institutions and commercial establishment. However, based on random 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 get their containment systems emptied when full.

The objective of the random 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 was prepared based on the analysis done and was presented to SBCLTF's members for their feedback.

2.3. Context-adapted SFD

According to the SBCLTF, SFD generated by the graphic generator is not sufficiently visualizing the actual situation at containment stage of sanitation chain. According to the stakeholders the properly designed 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 true 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 graphic. The only difference suggested in this context is at containment stage, i.e. for correctly designed septic tanks and fully lined tank. Out of 94% of the population, dependent on onsite sanitation systems, 90% of the population is dependent on septic tanks connected to open drain or storm sewer and fully lined tank. 4% of the population, dependent

on lined pit with semi-permeable walls and open bottom, is also attributed to be FS contained as the ground water level is more than 10m which is considered “low risk”.

With an earlier assumption of 50% of the proportion of the content of the septic tank and fully lined 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 SBCLTF the solid FS collected in the septic tank (attributed to 22% population) and fully lined tank (attributed to 23% population) should be considered contained as it is neither polluting the ground water nor the solid excreta are overflowing in the open drain. Hence 45% of FS is considered contained (represented green in colour). 42% FS contained is emptied and rest 3% 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).

The ‘FS not contained’ changes from 45% to zero as ‘FS contained’ becomes 49% from 4% and there is no change in SN, though FS contained and not emptied increases from 2% to 7% when compared to SFD generated through graphic generator.

Overall, excreta of 93% population are not managed safely according to the context adapted SFD, which was 98% according to SFD developed by graphic generator. The graphic is well received by the stakeholder's group and city’s authority has agreed that the context adapted SFD graphic is representing much closer picture to the ground conditions.

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 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 to improve sanitation facilities (MoUD, 2014). A draft CSP for Bijnor was prepared by BNPP and U. V. D Private Ltd in the year 2016 which has not been passed by municipal resolution.

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 a reference to 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 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 Uttar Pradesh Water Supply and Sewerage Act, 1975:
An act to facilitate the establishment of corporation, authorities and organizations for the development and regulation of water supply and sewerage services, related matters. According to this act, the corporation has powers to fine the owner of the improper/damaged septic tank.

The Uttar Pradesh Urban Sanitation Policy, 2010:
In 2010, the Director of Local Authorities, Uttar Pradesh issued the Uttar Pradesh Urban Sanitation Policy (UPUSP). The policy is inspired from the NUSP. The UPUSP mandates the cities to establish City Sanitation Task Force (CSTF) and to elevate the consciousness about sanitation in municipal agencies, government agencies and most importantly, amongst the people of the city. UPUSP 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. As of

now there are very few cities that have finalized their CSPs, and it remains a major drawback in the implementation of the UPUSP.

Draft Faecal Sludge and Septage Management Guidelines 2016:
The draft guidelines provide step by step approach for the preparation of plan for septage management and financial resource mobilization, along with a focus on existing situation across sanitation service chain and sources of revenue. The guidelines stress upon Uttar Pradesh Municipal Corporation Act, 1959, Chapter IX: Corporation taxation, Section 173(d), *where conservancy tax can be levied on all the properties by the corporation where city undertakes the collection, removal and disposal of excreta and polluted matter from privies, urinals and cesspools.*

Uttar Pradesh Municipal Building Bye-Laws, 2008: Issued by Housing Department, Government of Uttar Pradesh, the codes specify standards and design consideration for installation of toilets and septic tank.

Uttar Pradesh Finance Commission: It is a committee pertaining to the state of Uttar Pradesh, established with a purpose of reviewing the financial implementations of the state. The main purpose of this committee is to formulate implementation of financial policies pertaining to the state of Uttar Pradesh. The Finance Commission is set up under the Article 243 Sec I of the Indian Constitution, which orders that the Governor of the state would, at the end of every fifth year establish a Finance Commission for the purpose of reviewing, within the introduction of the 73rd Amendment of the Constitution Act, 1992 (BMoI, 2016).

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 Central Public Health and Environmental Engineering Organisation (CPHEEO), created in 1953, is the technical wing of the MoHUA, 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 Commision, 2002).

National Council for Rejuvenation, Protection and Management of River Ganga (referred as National Ganga Council) formerly known as National Ganga River Basin Authority (NGRBA), which was constituted under the provisions of the Environment (Protection) Act (EPA),1986. The Council aims at ensuring effective abatement of pollution and rejuvenation of the River Ganga by adopting a river basin approach to promote inter-sectoral co-ordination for comprehensive planning and management, maintenance of minimum ecological flows in the river Ganga with the aim of ensuring water quality and environmentally sustainable development (NMCG, 2011a).

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 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 Bijnor is governed by various institutions. The following are the institutions responsible for policy making, service provision and regulation of urban services:

Table 6: Roles and responsibilities

Institutions	Roles and responsibilities
Urban Development Department (UDD)	Policy formulation, preparation of municipal bye-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, administrative and financial management of municipalities, implementation of development programmes.
Nagar Palika Parishad–Bijnor (BNPP)	Water supply and sewerage, public health, sanitation, conservancy and solid waste management, urban poverty alleviation by providing infrastructure, provision and maintenance of urban amenities and facilities such as parks, gardens, playgrounds, provision and maintenance of the lighting in the public streets, corporation markets, public buildings. Registration of births and deaths, O&M of burial grounds, cremation grounds, etc. The ULB has a vital role in design, develop, plan and implement ULB level FSSM strategy, set up and ensure operation of systems for 100% safe and sustainable collection, transport, treatment and disposal of faecal sludge &septage, monitor and evaluate FSSM strategy and implementation plan and Implement Municipal Bye-laws.
Uttar Pradesh Jal Nigam (UPJN)	Carry out the functions of – • Preparation, execution, and promotion of ULB and state level plans of water supply and sewerage schemes • Establishment of standards for water supply and sewerage in the state
Uttar Pradesh Awas Vikas Parishad (UPAVP)	Its functions are to: • Plan and develop affordable housing to the economically weaker section of the society • To ensure prudent financial results with appropriate accounting principles • To plan and develop centres of excellence at strategic locations across the state. • To maintain an effective public grievance redressal mechanism and set standards by adhering to timeframe and schedules.
State Urban Development Authority (SUDA) / District Urban Development Authority (DUDA)	Its functions are to– • Execute various government schemes for urban development and employment generation • Create urban infrastructure, including water supply • Undertake tasks related to urban infrastructure to generate local employment • Construct community toilets and link it to sewer lines etc. • Lay sewerage network according to plan made by Jal Nigam • Regulate and help ULBs set up systems to ensure financial sustainability in provision of sanitation services
State Programme Management Group (SPMG)	It is implementing arm of NMCG in the state. Coordinate and oversee the implementation of projects sanctioned by Government of India under National Ganga Council (NGC). Take all such action and to enter all such actions as may appear necessary or incidental for the achievements of the objectives of the NGC.
Uttar Pradesh Pollution Control Board (UPPCB)	Regulation, licensing for environmental check etc. Monitor the compliance of the standards regarding ground water, ambient air, leachate quality and the compost quality including incineration standards as specified in Schedule II, III & IV of 'The Water (Prevention and Control of Pollution) Act 1974'.

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 (Urban Local Bodies) is in charge of operation and maintenance (NIUA, 2005). Some of the largest cities have created municipal water and sanitation utilities that are legally

and financially separate 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 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 Bijnor, public health, sanitation, conservancy, and solid waste management services are delivered by Health and Sanitation Department of BNPP. Septage management is also the responsibility of the same department, headed by the Sanitary Officer. There is only 1 sanitary inspector, while 62 sanitary workers on a permanent basis and 52 sanitary workers on a temporary basis. (BNPP, 2016).

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 provided by different ULBs throughout the country.
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 of effluent to inland surface water/public sewers/land for irrigation/ marine coastal areas.
3. Manual on Sewerage & Sewage Treatment, Second Edition, 2013: This manual was developed by Central Public Health and Environmental Engineering Organization (CPHEEO). It provides detailed designs and guidelines for various technologies of wastewater management.
4. Code of Practice for Installation of Septic Tanks, 1985: Issued by, Bureau of Indian Standards. The code specifies standards and design consideration for installation of septic tanks.

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 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).

The Swachh Bharat Mission (SBM), one of the flagship programmes of the government of India, launched on October 2nd 2014 by MoHUA. SBM-Urban aims to eliminate open defecation, eradicate manual scavenging, capacity augmentation of ULBs 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) all households with single-pit latrines (MoUD, 2014) . Table 8 provides an overview of service delivery progress in accordance with SBM.

Table 7: 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 8: Service delivery progress in accordance with SBM

SBM Head	Online Application Status		
	Received	Verified	Approved
Individual Household Toilets (IHHT)	800	700	469
Community Toilets (CT)	0	0	0
Public toilets (PT)	0	0	0

Source: (BNPP, 2016)

According to rapid assessment of FSM in the city done by NPP, they would need three additional emptying trucks, which will improve the emptying service. Each vehicle is expected to complete 2 trips per day with an average distance of round trip being 20 km. Along with the emptying trucks, the NPP would also need to install one or more FSTPs in the municipal area, which are expected to treat 83 m^3/day of septage initially and 92 m^3/day after a period

of 5 years (MoUD, 2016). Sewerage network has already been laid by UP Jal Nigam and a plant of 24 MLD is under construction in *Khedki* village.

3.2.2. Investments

An investment of INR 128.43 crore (19 million USD) has been done for the project "Bijnor Sewerage Scheme" (UPJN, 2006) . The project includes laying of 80 km sewer line and construction of 24 MLD Sewage Treatment Plant (STP). Gross cost estimates of the project have been given in Table 9.

Table 9: Cost estimates of sewerage scheme for Bijnor

Cost Estimates			
Stage/Cost	**Initial stage**	**Mid stage**	**Final stage**
Annual Income (INR Lakh)	100.969	229.966	343.22
Per capita cost	13,491	6,790	4,533
Per capita maintenance and expenditure	172	114	94
Annual O&M (INR Lakh)	163.339	216.559	266.318
Profit and loss (INR Lakh)	₹-62.37	₹13.407	₹76.902

Source: (UPJN, 2006)

As per the rapid assessment of FSM in city done by BNPP, the budgetary provision required for capital expenditure for FSM is around INR 5,550 lakh (8.3 million USD). Whereas, the operation and maintenance (O&M) cost associated with the emptying services and treatment operations is estimated to be INR 1,146.80 lakh (1.7 million USD) for 5 years (MoUD, 2016). Further details of CAPEX and OPEX have been provided in Table 10.

Table 10: Estimation of CAPEX & OPEX for FSSM.

S. No.	Component	CAPEX (INR Lakhs)	OPEX (INR Lakhs)	Total (INR Lakhs)
1	Faecal sludge management	1,545.98	812.88	2,358.86
2	Liquid waste management	4,004.77	333.92	4,338.69
3	FSSM Total	₹5,550.75	₹1,146.80	₹6,697.56

Source: (MoUD, 2016)

3.3. Reducing inequity

3.3.1. Current choice of services for the urban poor

There are 6 notified and 7 non notified slum settlements within the BNPP limits (NUHM, 2013). According to Census of India, 2011, the slum population is in Bijnor is 34,480. Bijnore has been declared as an Open Defecation Free (ODF) city. ODF city means that everyone in the city will have access to toilet, even if there is no toilet at house the people would have an approachable PT and CT. It also means that at any given time no one would be seen defecating in the open. No open defecation was observed during the field visit (BNPP, 2016). The practice of manual emptying is still prevalent in the city. The manual emptying is usually carried out by 2-4 people. Sometimes, manual emptiers enter into the containment system to empty FS. No safety measure is taken while emptying and thus diseases are common among sanitary workers. Bucket and spade is used to empty the containment systems (Manual Emptiers, 2016). BNPP does not endorse the practice of manual emptying.

Figure 8: FGD with slum dwellers (Source: Bhavik/CSE)

3.3.2. Plans and measures to reduce inequity

Aasra housing scheme was launched in 2013 to build houses for the urban poor, in which preference was given to the minorities. The scheme was an initiative of Uttar Pradesh and executed by SUDA. The scheme was launched with a provision of INR 100 crore (USD 15 million) (The Indian Express, 2013). In Bijnor a total of 188 houses have been built. Houses built under this scheme have a provision of toilet along with construction of septic tank for containment purpose.

Kanshiram housing scheme was launched in 2007 to build houses for economically weaker class with 50% reservation for scheduled caste and scheduled tribes. In Bijnor, a total of 1,416 households were constructed in the city. Standard layout plan for this scheme provisions for a toilet with dimensions 1.3m×1m (UPAVP, 2011).

3.4. Outputs

3.4.1. Capacity to meet service needs, demands and targets

NPP has insufficient fund to meet the demand of providing basic sanitation services and amenities through the revenue it is generating. NPP is majorly dependent on state and central schemes for funding. It is learnt during the focus group discussion with the NPP that there is often delay in the disbursement of fund through state finance department (BNPP, 2016).

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 Bijnor, 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. NPP also received funds for sanitation infrastructure development which came through SBM.

Shortage of human resource can be witnessed in the NPP. It largely relies on staff hired on a contractual basis to provide the daily service needs to the public. Also, the staff lacks the basic know-how and technical skills.

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.

Progress on 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 no toilets have been constructed yet in the city, but BNPP has received 850 applications of which 700 have been verified and 469 have been approved.

The officials of BNPP occasionally carry out site inspections to check the quality of emptying services. 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 time (BNPP, 2016).

3.5. Expansion

In 2016, MoHUA initiated a 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 Open Defecation Free (ODF) - mainstreaming effective faecal sludge and septage management by key decision makers and NFSSM alliance members.Bijnor is one of the flagship city and has undergone the assessment but since it is not covered under the AMRUT programme, the NPP has to look for other sources of funding like NMCG/ FC/ donor agencies etc.

National Mission for Clean Ganga, develop such infrastructure or make such infrastructure functional, as the case may be, for collection, storage, transportation and disposal of sewage in the territorial area of the local authority through its *Namami Gange* programme- an integrated Ganga conservation programme (NMCG, 2011). Under this mission, 118 towns have been identified as priority towns for the interventions near main stem of Ganga. Bijnor city is one of the cities listed in 118 urban habitations.

Nirmal Dhara is proposed under *Namami Gange* Programme – an initiative ensuring sustainable municipal sewage management which plans for (NMCG, 2014b):

- Project prioritization in coordination with MoHUA
- The incentive for states to take up projects on Ganga Main-stem by providing an additional share of central grants for sewerage infrastructure.
- Uniform standards for both MoHUA scheme and 10 years mandatory O&M by the same service provider at par with NGRBA programme and Public- Private Partnership (PPP), Mandatory reuse of treated water.
- Expanding coverage of sewerage infrastructure in 118 urban habitations on banks of Ganga- estimated cost by MoHUA is INR 51,000 crores (7.6 Billion USD).

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 faecal sludge 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 centralized) 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

Funding is estimated for septage management initiatives under rapid assessment for FSSM supported by the MoHUA, GoI through National Alliance for Faecal Sludge and Septage Management (NFSSM). These funds can be used to buy vacuum tankers, building treatment facility, etc. BNPP has to make use of these funds to strengthen the services. At present, there are no detailed plans for strengthening service delivery.

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 NMCG. 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. Overall, four KIIs were conducted with different stakeholders like government functionaries, emptiers, masons and community representatives (see appendix 7.2). Apart from KIIs, the survey was 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 CDP, CSP etc. Interview with the private emptiers, masons 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 onsite sanitation system random surveys were conducted. The sample was carefully chosen to get good spatial representation from each ward of OSS dependence based on Census, 2011 (refer Table 7). At-least 5-10 households were surveyed in each of the selected wards of Bijnor. It was made sure that respondents from slums are surveyed as well. The researcher also recorded the field observations related to sanitation. Such surveys, observations and KIIs helped to produce a more credible and accurate SFD, 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. Most of the houses have toilets and a few that don't have any, use community toilets and people do not practice open defecation. The containment system varies according to the economic section of the society. Due to such variation of containment system in the city, it was decided on the field to conduct random survey with OSS dependent wards of the municipal area. A visit was done to observe the various disposal points of sewage and septage in the city. Observation in the city also helped in sample selection as it gave a better understanding of the city context.

4.3. Focused Group Discussion

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

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

Stakeholders were identified and task force was formulated and notified under the mandate by NUSP (refer appendix 7.8 for more details). An FGD was conducted with the SBCLTF's members and the draft SFD was presented and analysed. SBCLTF's members shared their feedback on the SFD graphic (SBCLTF, 2017).

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7 Appendix

7.1. Stakeholder identification

Table 11: Stakeholder identification

S. No.	Stakeholder group	In Bijnor context
1	City council / Municipal authority / Utility	Nagar Palika Parishad, Bijnor
2	Ministry in charge of urban sanitation and sewerage	Urban Development Department, GoUP
3	Ministry in charge of urban solid waste	Urban Development Department, GoUP
4	Ministries in charge of urban planning finance and economic development	Urban Development Department, GoUP
	Ministries in charge of environmental protection	Environment Department, GoUP
	Ministries in charge of health	Department of Medical Health and Family Welfare, GoUP
5	Service provider for construction of onsite sanitation technologies	Local masons
6	Service provider for emptying and transport of faecal sludge	Private emptiers, Manual 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 and agricultural landowners
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 12: Tracking of engagement

S. No.	Name of Organisation	Designation	Date of engagement	Purpose of engagement
1	BNPP	Chairman	7/11/2016	Introduction of SFD and permission to conduct FGDs in the offices and municipal wards. FGD with administrative staff of BNPP
2	BNPP	Executive Officer	7/11/2016	FGD
3	BNPP	Junior Engineer- Water Works		
4	BNPP	Sanitary Inspector		
5	UPJN- Bijnor branch	Assistant Engineer-	8/11/2016	KII
6	G.S.J. Invo Ltd.	Project Manager - STP		
7	Private	Mason	8/11/2016	KII
8	Private	Private vacuum tank emptiers	9/11/2016	FGD
9	Private	Emptiers/Manual Scavengers	9/11/2016	FGD
10	Public toilets	Caretaker	10/11/2016	KII
11	UPJN- Bijnor	Executive Officer	10/11/2016	KII
12	SBCLTF	16 members of SBCLTF	8/03/2017	FGD

Source: (CSE, 2016)

7.3. SFD graphic

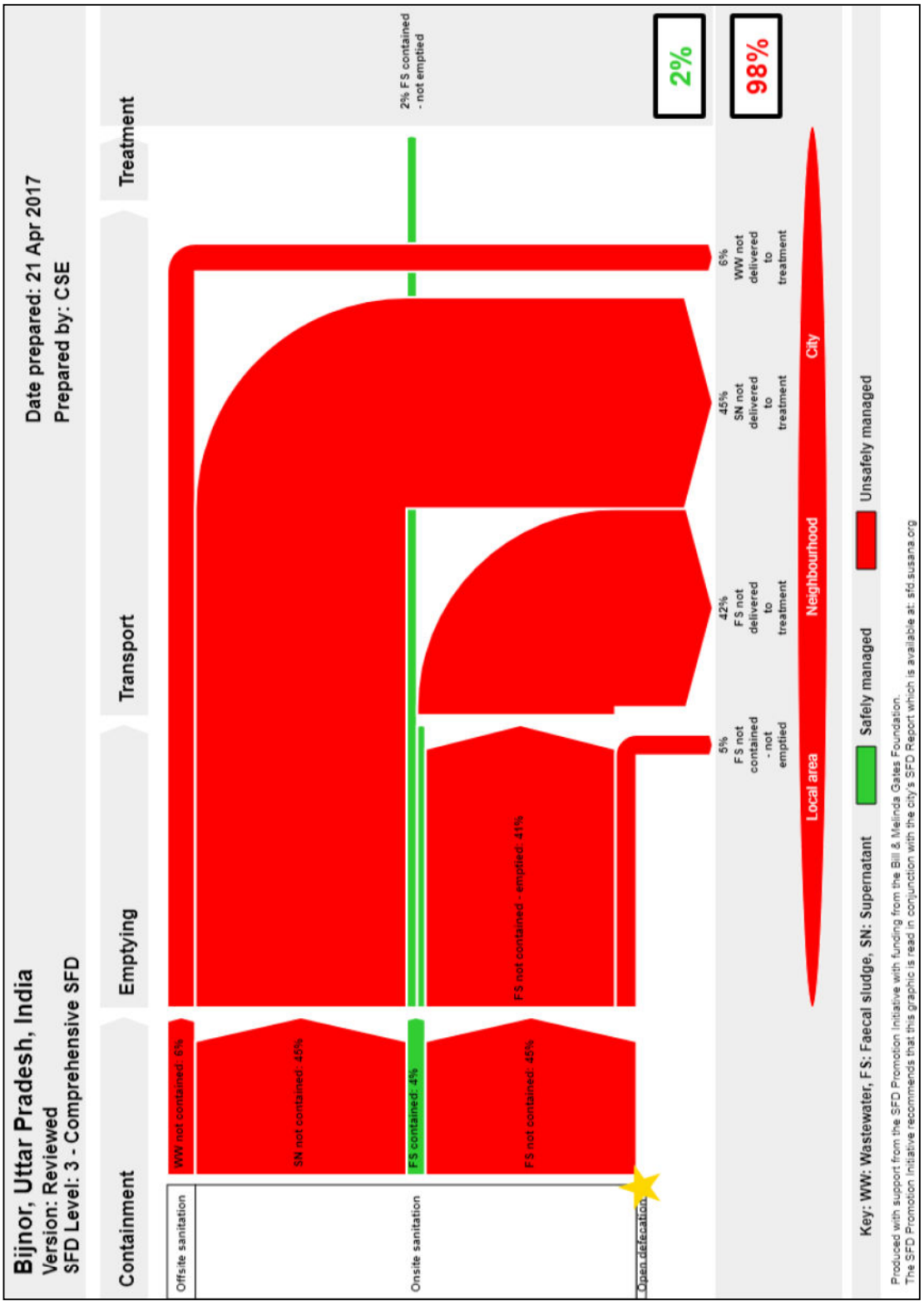

Figure 9: SFD graphic (Source: SFD graphic generator)

7.4. SFD brief explanation

Table 13: Percentage of the population using each system technology and method.

System Type	Containment	Emptying	Transport	Treatment and End-use/ disposal
Offsite	T1A1C6: 6% of the population is discharging their excreta directly to open drain.	Not applicable.	WW not delivered to treatment plant is 6%.	There's no treatment of waste water in the city. All WW is discharged in nullahs untreated.
Onsite	T1A2C6: 44% of population is dependent on septic tank connected to open drain. T1A3C6: 46% of population is dependent on fully lined tank connected to open drain. T1A5C10: 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 system emptied. • Since there is no clear differentiation between percentage of septage and effluent, it is assumed to be 50% each. FS not contained - emptied comes out to be 41%, FS not contained-not emptied is estimated to be 4% and FS contained is 4%. • Of the 45% FS not contained, 23% is attributed to population using fully lined tank, and 22% is attributed to population using septic tanks.	No treatment facility exists hence no FS is transported to treatment plant therefore FS not delivered to treatment plant is 42%. Since there is low risk of groundwater contamination, the infiltration from the pits is taken as safe and is equal to 2%	No treatment facility exists hence no FS is treated; therefore, FS treated is 0%. All the FS emptied ends up in local area without any treatment.
Open Defecation	Not Applicable			

Source: (CSE, 2016)

7.5. Context-adapted SFD graphic

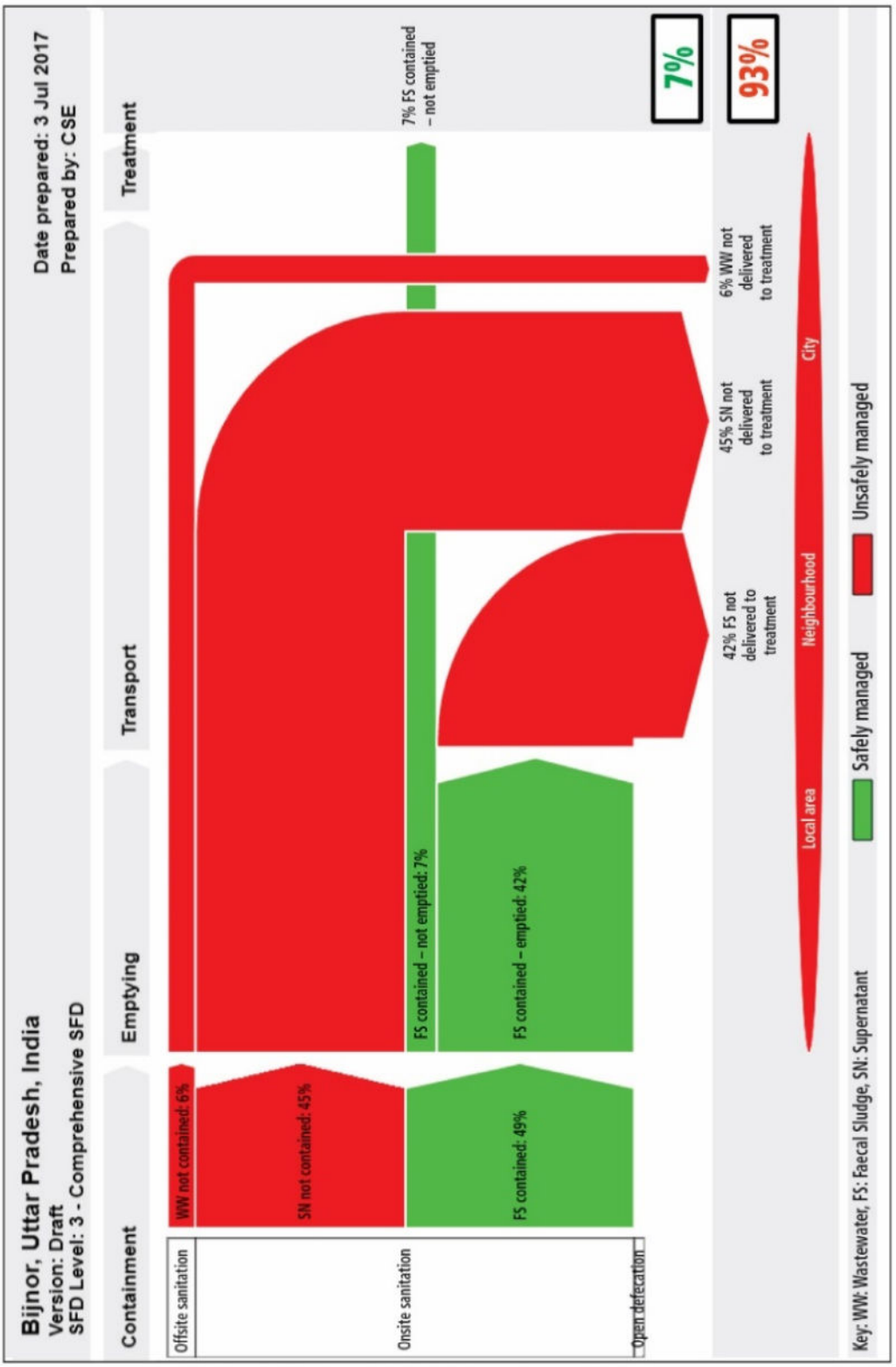

Figure 10: Context-adapted SFD graphic (Source: SFD graphic generator, 2017)

7.6. 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	T1A1C6				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	T1A3C6				
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									Significant risk of GW pollution T1A5C10
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									Not Applicable

Figure 11: SFD selection grid (Source: SFD graphic generator, 2016)

7.7. SFD Matrix

Table 14: SFD matrix

Bijnor, Uttar Pradesh, India, 21 Apr 2017. SFD Level: 3 - Comprehensive SFD
Population: 93297
Proportion of tanks: septic tanks: 50%, fully lined tanks: 50%, lined, open bottom tanks: 50%

System label	Pop	W4c	W5c	F3	F4	F5	S4e	S5e
System description	Proportion of population using this type of system	Proportion of wastewater in open sewer or storm drain system, which is delivered to treatment plants	Proportion of wastewater delivered to treatment plants, which is treated	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
T1A1C6 Toilet discharges directly to open drain or storm sewer	6.0	0.0	0.0					
T1A2C6 Septic tank connected to open drain or storm sewer	44.0			90.0	0.0	0.0	0.0	0.0
T1A3C6 Fully lined tank (sealed) connected to an open drain or storm sewer	46.0			90.0	0.0	0.0	0.0	0.0
T1A5C10 Lined pit with semi-permeable walls and open bottom, no outlet or overflow	4.0			90.0	0.0	0.0		

Source: (SFD graphic generator)

7.8. Community/public toilets

Table 15: Details of public toilets

S. No.	Location of the Toilet	No. of functional toilet seats		Urinals	Bathroom	User interface connected to	Septic tank size in metres (L×B×H)
		Women	Men				
1	Numaish Chowk	2	2	1	1	Septic Tank	26×1.5×1.8
2	Roadways Bus Stand	2	2	1		Septic Tank	26×1.5×1.8
3	Near GGIC	3	6	-	1	Septic Tank	8×3.5×2.8
4	Numaish Ground	3	6	-	1	Septic Tank	8×3.5×2.8
5	Indra Bal Bhawan	2	2	2	-	Septic Tank	3×1.5×1.8
6	Stadium	2	2	2	-	Septic Tank	3×1.5×1.8
7	Collectorate Bijnor	2	2	2	-	Septic Tank	2.2×1.65×1.75
8	Jani Chowk	1	1	1	-		
9	Numaish Ground Tubewell	-	1	1	-	Septic Tank	1×1.5×1.2
10	Mahila Thana	2	-	-	2	Septic Tank	1.7×1.3×1.75

Source: (BNPP, 2015)

Table 16: Details of community toilets.

S. No.	Location of the Toilet	No. of functional toilet seats		Urinals	Bathroom	User interface connected to	Septic tank size in metres (L×B×H)
		Women	Men				
1	Moh Qassaben Reti	10	10	-	-	Septic Tank	10×3.5×2.5
2	Ravidas Nagar	10	10	-	-	Septic Tank	10×3.5×2.5
3	Moh – Jatan Balmiki Basti	10	10	-	-	Septic Tank	10×3.5×2.5
4	Moh – Jatan Harijan Basti	10	10	-	-	Septic Tank	10×3.5×2.5

Source: (BNPP, 2015)

7.9. Swachh Bharat City Level Task Force – Bijnor

Table 17: List of SBCLTF member, Bijnor NPP

Designation	Organisation
Chairman	Bijnor NPP
Executive Officer	Bijnor NPP
Executive Engineer	Public works department, Bijnor
Executive Engineer	Uttar Pradesh Jal Nigam, Bijnor
Health Inspector	Bijnor NPP
Junior Engineer	Bijnor NPP
Junior Engineer	Bijnor NPP
Principal	RJP Intercollege, Bijnor
Reporter	Chingari, Bijnor Times
Digital Media	Representative
Executive Engineer	Construction & Design Services, Bijnor
Assistant	Public works Department, Bijnor

Figure 12: SBCLTF members of Bijnor NPP (Source: CSE, 2016)

7.10. Questionnaires for random household survey

CENTRE FOR SCIENCE AND ENVIRONMENT, NEW DELHI
Focus Group Discussion (FGD)
QUESTIONNAIRE

Date: ___/ ___ / ___, Area Name: _____, Ward:_____,

Co-ordinates:_____, No. of Participants (4-10) _____

Group Profile
No. of Male: No. of Female:

Respondents	1	2	3	4	5	6	7	8	9	10
Gender										
Age										
Marital Status ((U/M)										
Household size										
Social category (G, OBC, SC, ST										
House Structure (P,K, SP)										
Latrine facility (IT, ST, CT, PT, ODF)										
IT: Individual Toilet, ST: Shared toilet, CT: Community Toilet, PT: Public Toilet, ODF: Open Defecation										
Who constructed toilet (SF, Govt.,Pvt.,NGO)										

1

Respondents	1	2	3	4	5	6	7	8	9	10
Single/Double chamber (S/D)										
Effluent connected to :Sewer/Covered Drain/Open drain/Soak pit (S/CD/OD/SP)										
Lining of tank: side wall and bottom ;Mortar/cement (M/C)										
Connected with bathroom (Y/N)										
Connected with kitchen (Y/N)										
Connected with room floor wash water and laundry (Y/N)										
Who desludges the tank (Govt./Pvt.)										
Frequency of desludging										
Cost of desludging										
Willing to pay										

For emptiers

CENTRE FOR SCIENCE AND ENVIRONMENT, NEW DELHI
Septic tank Cleaner Survey

Date: ...../Nov/2016 Time: ..... Place: .....

1. Owner name & Mob. No. .....
2. De-sludging process (Manual/Mechanical/Semi M.M) .....
3. Reasons for adopting the process.....
4. Type of vehicle used for transportation (Tractor/Truck/trolley/others)

   .....
5. Price of vehicle.....
6. Type of ownership (Own vehicle /hire from others) .....
7. Number of vehicles (total in your area). . .....
8. Capacity of vehicles .....
9. Typical age of Vehicles .....
10. Vehicle Assembling point.....
11. Vehicle Details.

New or second hand	
Mileage	
Durability of vehicle (Max.)	
Capacity of pump (in HP)	
Location of pump on vehicle	
Tank maintenance details (if any rupture etc.)	
Tank durability (max.)	

12. Typical No of trips per day .....
13. Average distance per trip.....
14. Area of responsibility.....
15. Fees charge/trip.....
16. Time taken for desludging activity.....
17. Where is sludge dumped .....
18. Where should be disposal site to be located? .....
19. Official dumping site for city.....
20. Reuse for sludge .....
21. Total Quantity of faecal sludge received per day per trip (Approx.).....
22. Septic tank location (top place used for any activity or unused).....
23. Septic Tanks details (Capacity, dimension, materials used for construction, Inlet and outlet baffle etc.....
24. Areas having highest demand for sludge clearing .....
25. Frequency of desludging per household.....
26. Fees Charges /Trip (Competitors) .....
27. NO. Of private Operators in your area .....
28. Are you maintaining any register/produce any bill for payment? .....
29. Is the current practice suitable for the you (Suggest any changes)

    .....
30. Major issue running in the business

    .....
31. Safety Measures if any during desludging process .....
32. Marketing Strategy.....
33. Why you are doing this work?

    .....