



SFD Promotion Initiative

Aizawl India

Final Report

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SFD Promotion Initiative





SFD Report Aizawl, India, 2015

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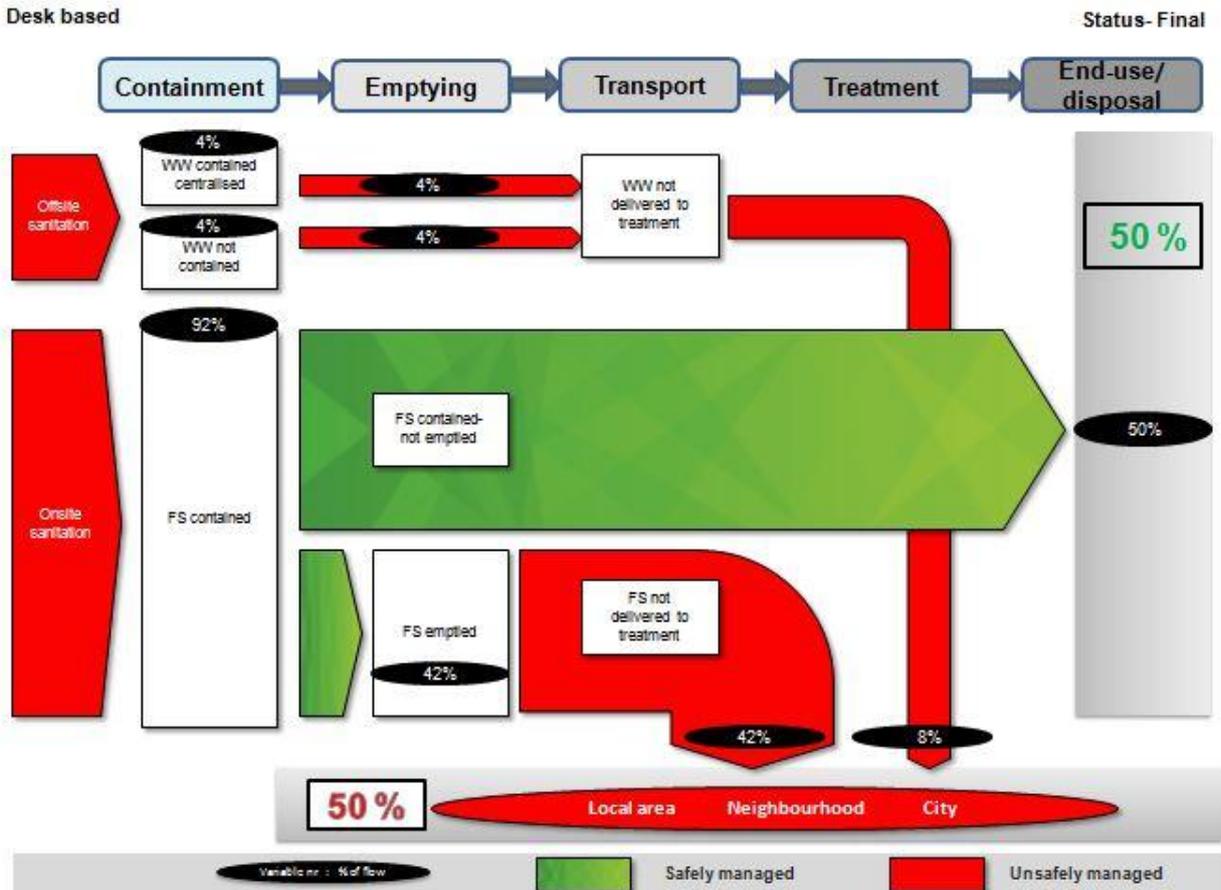
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1. The Diagram

Aizawl- 29 July 2015
Desk based



2. Diagram information

Desk or field based:

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3. General city information

Aizawl, capital of Mizoram state, lies in east Himalayan region of India. It is the largest city of the state. Area under municipal council, which is 103.93 sq.km, has been chosen for the study. Aizawl Municipal Council (AMC) is further divided into 19 Wards.

The population of city under AMC, as per 2011 Census, is 293,416 persons. The density of city is 2,823 persons per sq.km which is very high when compared to state average of 52 persons per sq.km (UD&PA, 2014). Mizoram state has low density as most of the places are found to be uninhabitable. Aizawl has no visible slum pockets.

The topography of city is very undulating and the slopes vary between 30° and 45°. The altitude of the city varies at different points between 700 m and 1188 m above MSL (UD&PA, 2014a).

4. Service delivery context

In 2008, the 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). 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 (USAID, 2010).

The objectives of NUSP are to be realized through CSPs and state sanitation strategies. As of now there are very few cities which have finalized their CSPs, and those plans are also not implemented. This remains a major drawback in implementation of NUSP.

The advisory note on septage management in urban India, issued by MoUD in 2013, recommends supplementing CSPs with Septage Management Sub-Plan (SMP). Still septage management in India is not prominent due to lack of knowledge, consideration of septage management as an interim solution, lack of sufficient funding and many other socio-political issues.

There are no specific legal provisions relating to septage management, but there are a number of provisions relating to sanitation services and environmental regulations, which majorly stems from, The Environment (Protection) Act, 1986 and the Water (Prevention and Control of Pollution) Acts. Municipal acts and regulations usually refer to management of solid and liquid wastes but may not provide detailed rules for septage management (MoUD, 2013a).

Aizawl has initiated and prepared SMP, which is under review with MoUD. Though there is no regulation private emptiers have to get themselves registered with MPCB, to get license for operating in the city. Three disposal sites, away from the city, have also been located.

5. Service outcomes

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

Containment: Presently there's no sewerage system. The city is majorly dependent on septic tanks which are generally not adhering to design

prescribed by Bureau of Indian Standards (BIS). The effluent from the septic tank flows into soak pit. Some households are also connected to pits.

Emptying: There are 40 private emptiers active in city, registered under Mizoram Septic Service Association (MSSA), an association of private emptiers and 5 vacuum tankers owned by Urban Development and Poverty Alleviation (UD & PA). The private emptiers utilize blow mould tank of 2000 litres capacity to carry septage and generator motor for emptying purpose, whereas UD & PA provides quality emptying by well designed vacuum tankers of 2000 litres capacity. Private emptiers attract customers through advertisements in television and local newspapers, and their emptying fee is generally INR.4000/- (63 USD) per trip. On the other hand emptying fees charged by UD & PA is INR 3,100 (USD 48.79) per trip. Some instances of manual emptying is also reported (UD & PA, 2014, AMC, 2015).

Transport: Both private emptiers and UD & PA emptiers transport septage by mini truck (TATA 407) to disposal sites. Since private service providers carry septage in blow mould tank, many times septage spills on the road during transportation. Disposal sites are generally 10 - 15 kms away from the city.



Figure 1: AMC vacuum tanker (Source: Shantanu/CSE, 2015)



Figure 2: Private vacuum tanker (Source: SMP, 2014)

Treatment: There is no treatment facility for waste water and septage.

End-use/Disposal: Wastewater flows through drain along the road network disposed into low lying land. All the septage emptied is disposed to three recognized disposal sites. Two among them are private lands. The septage is disposed indiscriminately from the upper region to a low lying area down the hill. Emptiers pay INR 100 (USD 1.57) per trip for permission to discharge septage on private lands. There is one government owned site (commonly known as oxidation pond), used for septage discharge, located at backyard of solid waste disposal site (SMP, 2014). None of the existing sites have post-disposal monitoring system. Some instances of using septage directly on agricultural fields have been reported.

According to Census, only 8% of city is dependent on offsite systems, population connected to sewer line is 4% and user interface directly discharging in open drain is only 4%, but since there's no treatment it's shown unsafe in SFD.

Rest of the 92% of the city is dependent on onsite sanitation systems (OSS), out of which 85% is dependent on septic tanks and 7% on pits. The public latrines are connected to septic tanks and hence are incorporated in onsite systems. Faecal sludge (FS) from OSS is contained as the effluent from septic tanks infiltrates through soak pits and ground water table is very low.

There is no clear differentiation between percentage of effluent and septage produced from septic tanks, hence it's assumed to be 50% each. Therefore, 42% of FS, which is effluent, infiltrates through soak pit or pits and 42% is emptied from tanks whenever full. Some FS is always left in the tanks and pits and is assumed to be 8%.

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 allocation of roles and responsibilities between state and local agencies, which sometimes results in large gaps in implementation (USAID, 2010).

The following stakeholders are responsible for sanitation service delivery in Aizawl.

Key Stakeholders	Institutions / Organizations
Public Institutions	State Investment Program Management and Implementation Unit (SIPMIU), UD & PA, Public Health and Engineering Department (PHED), AMC, Mizoram Pollution Control Board (MPCB)
Private Sector	MSSA, private emptier, private land owners
Development Partners, Donors	Asian Development Bank (ADB)

Table 1: Key stakeholders (Source: Compiled by CSE, 2015)

SIPMIU: Single window for facilitating liaison between state government and ADB, liaison between PHED/ municipalities, DUDA, health and MPCB. UD & PA is responsible for state urban development. It delegates work to district level officers. Sanitation wing, is under this department, and runs state owned emptiers in city. PHED is responsible for water supply to city. AMC, established in November 2010, at present is responsible mainly for solid waste management, regulatory system and septage management. MPCB's role is to regulate measures for septage and solid waste disposal operation, licensing for environmental check etc.

Private individuals make money by allowing discharge of septage on their land with/without taking government approval.

7. Credibility of data

Service outcome analysis is based on secondary sources. Three key sources of data are; Census of India, 2011, draft SMP 2014, and draft CSP, 2014. Most of the data is then updated by Key Informant Interviews (KIIs). Eight KIIs have been conducted with stakeholders.

Data on containment is available in census. Data on emptying and transport is collected by KII's. However most of the data is qualitative.

Some of the issues and challenges are listed below:

- Data insufficiency & non availability: No data available on how many septic tanks are connected to open drains
- Accuracy: Discrepancy observed between Census data and actual ground situation
- Data available at different time lines

- Limited data available on reuse (formal / informal)

Assumptions followed for preparing SFDs:

- Data provided by Census, 2011 is correct
- Septic tanks and sewer connections on ground are as per septic tanks & sewer connections defined in Census
- 100 % septic tanks are connected to soak pits
- 90% of the people get their tanks emptied
- Soak pits are properly functioning
- No transportation losses have taken into account
- Volume of waste water generated is 80 % of water supplied

8. Process of SFD development

Data is collected through secondary sources, and then a visit to the city is done to conduct KIIs with relevant stakeholders, to fill in the gaps in data and to crosscheck the data collected.

To start with, a relationship between sanitation technologies defined in Census of India and the ones defined in project is established.

The data is fed into the calculation tool to calculate the excreta flow in terms of percentage of the population.

No treatment of wastewater and septage reported, which means excreta of 50% of the city is not safely managed, hence shown red in colour. Since FS of 50% of city is contained it is shown green in colour. No open defecation has been reported.

Limitations of SFD:

It's dependent on secondary data and true picture of the city may differ.

The data available is at different timelines, for example data on containment is from census 2011, and data on emptying and transportation is collected through KIIs conducted in 2015.

Whether excreta is safely managed or not is dependent on whether the system is contained

or not, and not on whether waste is safely handled.

9. List of data sources

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

- Published reports and books:
 - Census of India 2011, House listing and Housing data, Government of India
 - Rapid Base Assessment, MoUD, 2013
- Un-published documents:
 - CSP of Aizawl, UD & PA, Government of Mizoram, 2014
 - SMP of Aizawl, UD & PA, Government of Mizoram, 2014
- KIIs with representatives from
 - Government agencies: AMC, SIPMIU, UD&PA
 - Service providers: private emptiers
 - Residents

Aizawl, India, 2015

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Abbreviations

ADB	Asian Development Bank
AMC	Aizawl Municipal Council
AUA	Aizawl Urban Agglomeration
BIS	Bureau of Indian Standard
CSP	City Sanitation Plan
CPHEEO	Central Public Health & Environmental Engineering Organization
CSE	Centre for Science and Environment
CGWB	Central Ground Water Board
DUDO	District Urban Development Officer
FS	Faecal Sludge
GOM	Government of Mizoram
KII	Key Informant Interview
LAD	Local Administration Department
MSSA	Mizoram septic service association
MSPCB	Mizoram State pollution Control Board
MMA	Mizoram Municipalities Act
MoUD	Ministry of Urban Development
NIUA	National Institute of Urban Affairs
PHED	Public Health and Engineering Department
PWD	Public Works Department
SLB	Service Level Benchmarks
SIPMIU	State Investment Program Management and Implementation Unit
SMP	Septage Management Plan
SO	Sanitation Officer
SWM	Solid Waste Management
UD & PA	Urban Development and Poverty Alleviation
USAID	United States Agency for International Department
WW	Waste Water

1 City context

Aizawl, the capital of Mizoram state, lies in the eastern Himalayan region of India. It is also the centre of administration, which has all the important government offices, state assembly house and civil secretariat. The co-ordinates of Aizawl is 23°43'38"N 92°43'04"E. It is situated on a ridge 1,132 meters above mean sea level, with the Tiawng river valley to its west and the Tuirial river valley to its east. Aizawl is connected with National Highway 54 (NH 54), which connects to Silchar at a distance of 180 km in Assam (UD&PA, 2014a).

The Aizawl Urban Area was constituted in 2005. It consists of 82 Local Council and 14 Village Council areas. The total planning area equals to 152.80 sq. km out of which, 103.93 Sq. Km is under Aizawl Municipal Council (AMC) (UD&PA, 2014). Aizawl Urban Agglomeration (AUA) accounts for about 52% of the total urban population of Mizoram. The total population under AMC is 293,416, which is 93.14% of the total population of AUA. The density is 2,823 persons per sq.km which is very high when compared to state average of 52 persons per sq.km. The population growth rate is shown in Table 1. The floating population of the city is 21,128. Area under municipal council (i.e. 103.93 sq. km) has been chosen for the study. AMC is further divided into 19 Wards (UD&PA, 2014a).

Table 1: Population Growth Rate (MoUD, 2013)

Census Year	Population	Growth Rate (%)
1971	38,260	-
1981	74,493	94%
1991	155,240	108%
2001	228,280	47%
2011	293,416	29%

The topography is hilly and undulating with the slopes varying between 30° and 45°. In some places, the steepness is high and found to be uninhabitable. The altitude of the city at different points varies between 700 m and 1188 m above MSL. The hills are formed of mostly sedimentary rocks of tertiary (Surma) group. Sandstone, siltstone and shale are found in abundance. The nature of the soil is highly susceptible to erosion and rain-induced landslides, leading to severe damages to property and life every year (UD&PA, 2014).

Climate in Aizawl is cool with relatively high humidity and abundant rainfall with the average rainfall being close to 2,350 mm. The temperature varies from 4°C to 31°C and average temperature is 20.6°C. The city has no visible slum pockets along the streets. However, there are notable areas having poor drainage systems, high population density, inadequate or absence of water supply, absence of street lighting, uninhabitable environment, etc. The drainage system of Aizawl as a whole is dendrite in nature. The streams and natural drains have much straightened and deep course. People live in unpleasant conditions in the area between 700m to 1,288m altitude (UD&PA, 2014).

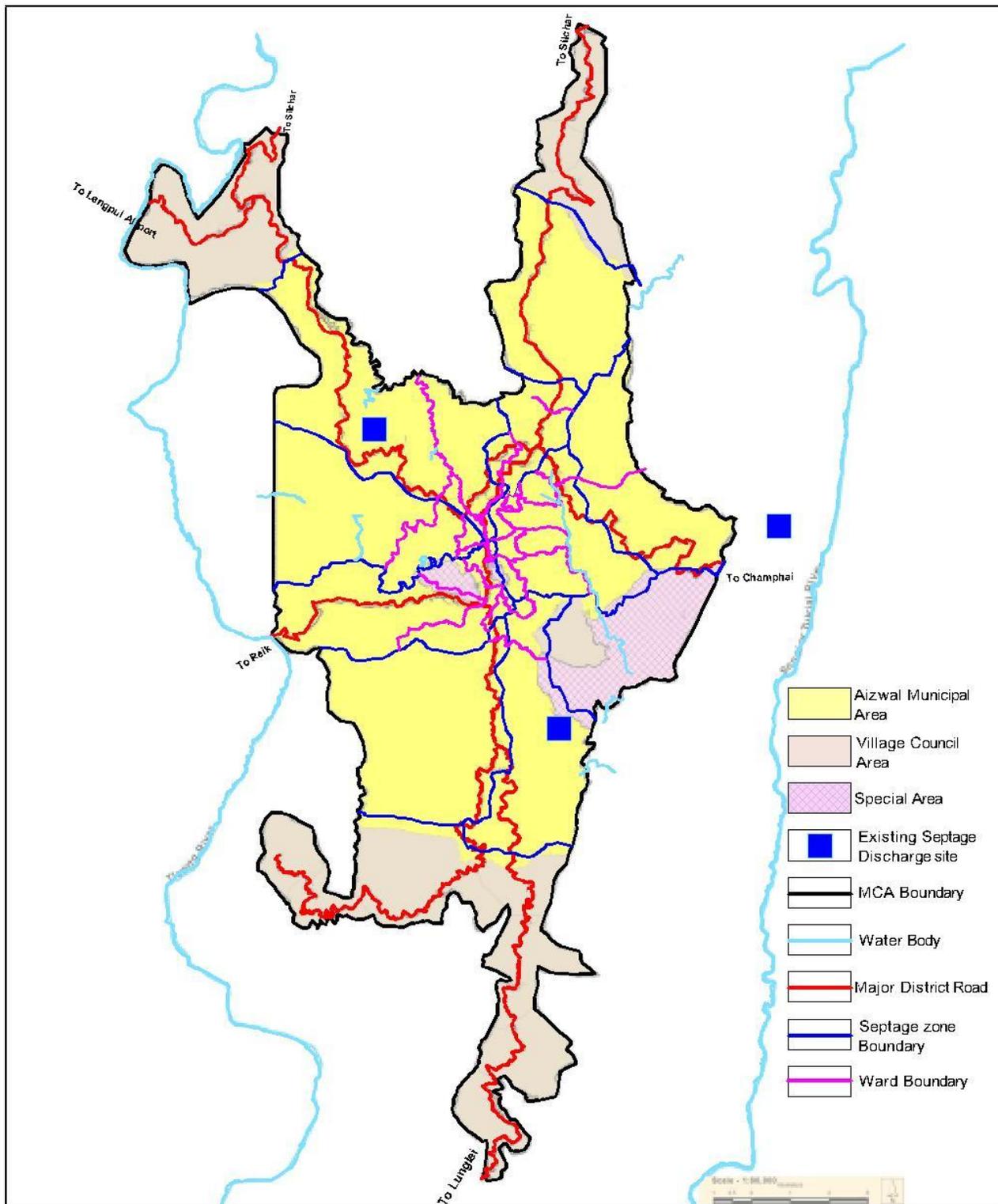


Figure1: Administrative Units of Aizawl Urban Area (UD&PA, 2014)

2 Service delivery context description/analysis

2.1 Policy, legislation and regulation

2.1.1 Policies, legislations and regulations at national level

In 2008, the 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. As of now there are very few cities, which have finalized their CSPs, and those plans are also not implemented. This remains a major drawback in implementation of NUSP.

The advisory note on septage management in urban India, issued by MoUD in 2013, recommends supplementing CSPs with Septage Management Sub-Plan (SMP) as a part of the CSP, being 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 provide references to Central Public Health & Environmental Engineering Organisation (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, 2013a). It clearly discusses techno- managerial and socio- economic aspects of septage management in India and provides guidelines for Urban Local Bodies (ULBs) to plan and implement SMP.

There are no specific legal provisions relating to septage management, but there are a number of provisions relating to sanitation services and environmental regulations, which majorly stems from, The Environment (Protection) Act, 1986 and the Water (Prevention and Control of Pollution) Act, 1974. It also applies to households and cities with regard to disposing waste in 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 for meeting all state permit requirements and regulations (CSE, 2010). Municipal acts and regulations usually refer to management of solid and liquid wastes but does not provide detailed rules for septage management (MoUD, 2013a).

The Prohibition of Employment as Manual Scavengers and their Rehabilitation Act is enacted in 2013. This act prohibits employment of manual scavengers, installation of insanitary latrines. It has laid strong emphasis on rehabilitation of manual scavengers. This act has become instrumental in eradicating manual scavenging in India.

2.1.2 Policies, legislations and regulations at state level and ULB level

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. The following are some of the laws and regulations:

a. Mizoram Municipalities Act, 2007 (amended 2009)

The act governs the structure and management of the Aizawl municipal council (AMC) of the state. Provision and maintenance of water supply, drainage and sewerage, conservancy, public places and streets, buildings etc. are the key functions defined in the act. The act provides inputs of resource mobilization by using property tax and other such tools (UD&PA, 2014).

b. Mizoram Sanitation Rules, 1980

Passed by the Government of Mizoram, the stated objective of the rules was, improving the arrangements for the promotion of public health and sanitation, comfort and convenience of the inhabitants of the towns of Mizoram. The rules deal with the collection and removal of sewage and garbage, permission for establishing factory, workshop or trade premises, storage prohibition of dangerous articles, prevention of dangerous diseases, burial grounds, disposal of dead animals, slaughter of animals, cleanliness of hotels, restaurants and tea stalls etc. The powers of sanitary officers to conduct inspections and penalties for contraventions were also framed in these rules (UD&PA, 2014).

c. Mizoram Urban and Regional Development Act, 1990 (amended 1996)

It aims to make provision for the regulation of planned growth and the development of urban and rural areas. Following observations were made after a close examination of some of the important state/ city level legislations, rules and regulations in the context of urban sanitation services including septage management (such as Mizoram Municipalities Act, Public Health & Sanitation regulations, Building Regulations, MSPCB etc.) (UD&PA, 2014).

The Mizoram Municipalities Act (MMA) of 2007 amended up to 2009 has incorporated most of the provisions of 74th Constitutional Amendment Act including 12th Schedule. The act has provided a long list of municipal functions including water supply, drainage and sewerage, conservancy, buildings, public streets etc. to be performed by the AMC. On ground AMC issues trade license, manage parking places, maps property, collect tax, maintains burial grounds and building approvals ; presently they are not discharging any other function which otherwise should be the responsibility of the AMC (UD&PA, 2014).

In case of septic tank emptying, it is reported that the private emptiers are carrying out desludging and transportation. It is estimated that more than 40 emptiers are working in the Aizawl city alone. Emptiers with equipments are organized under the Mizoram septic service association (MSSA). MSSA was established in 2000 with 25 members (now over 200 registered members but only 40 emptiers are active (UD&PA, 2014).

MMA under its Section 158 to 164 of chapter XIII pertaining to public conservancy and private conservancy has made the provision for maintenance of public and private latrines/urinals. The act says that, it shall be the civic duty of every person to maintain cleanliness and live decent and respectable way of living with respect to proper collection, removal and disposal of sewage and keeping in view proper cleanliness of latrines and urinals. In chapter XII on buildings under Section 146 (2), the act has laid down power of state government to make building rules in relation to provision of septic tanks. However, there is no reference or direction in the MMA or even in the draft public health and sanitation regulations prepared by the AMC in 2012 with regard to design of septic tanks, operational procedures, institutional frame work or such other matters focusing septage management (UD&PA, 2014).

d. Public Health and Sanitation Regulation, 2012

AMC has prepared public health and sanitation regulations for efficient delivery of the service. It aims to give powers to the chairman and the executive council of AMC to inspect, issue notices and impose fine under Section 386 of the MMA, 2007. The offender can be punished after serving the notice/order to him under sub-regulation (5) to improve the public health and sanitation functions in the urban areas of Aizawl (UD&PA, 2014).

e. The Aizawl Municipal Council Building Regulations, 2012

This has been prepared for regulating development in Aizawl urban area. The regulation mentions about the design / specifications of water closet as a requirement of parts of building approval process. There is no reference either on the septic tanks or its management system (UD&PA, 2014).

2.1.3 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. The Central Public Health and Environmental Engineering Organisation (CPHEEO), created in 1953, is the technical wing of the MoUD, which advises the Ministry in all technical matters and collaborates with the state agencies about water supply and sanitation activities. CPHEEO plays a critical role in externally funded and special programmes. CPHEEO also plays a central role in setting design standards and norms 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 Urban Local Bodies (ULBs). This transfer has resulted in a variety of implementation models, as well as lack of clarity in allocation of roles and responsibilities between state and local agencies, which sometimes leave large gaps in implementation (USAID, 2010).

Management and delivery of basic urban services in Mizoram is governed by various institutions. At the state level, besides the urban development and poverty alleviation (UD&PA), department of government of Mizoram is responsible for the overall urban development related policy matters; the other key departments are:

1. State Investment Program Management and Implementation Unit (SIPMIU)
2. Public Health and Engineering Department (PHED)
3. Public Works Department (PWD)
4. Mizoram State Pollution Control Board (MSPCB)
5. Aizawl Municipal Council (AMC)

The following table provides roles and responsibilities of institutions:

Table 2: Institutional roles and responsibilities (UD&PA, 2014)

Institution	Roles and Responsibilities
UD&PA	It is responsible for policy formulation, preparation of municipal laws, monitoring and evaluation of programmes, supervision of municipal administration, coordination with related state government departments, liaisoning with the central government and external funding agencies, etc.
SIPMIU	Single window for facilitating liaison between state Government and Asian Development Bank (ADB), facilitator for plan implementation and liaising between PHED, AMC and District Urban Development Officer (DUDO).
PHED	Responsible for water supply, sewerage and drainage. Include septage management plan and execution. Should provide training to municipal staff and other related matters.
MSPCB	Advises state on pollution related standards and policies. Monitoring of treatment plants. Key regulator for pollution related issues.
Aizawl Municipal Council	Under the Mizoram Municipal Act, 2007, Aizawl municipal council (AMC) was constituted. Before this, Local Administration Department (LAD) was managing sanitation services in the entire state including Aizawl. Mizoram Municipal Act and AMC Public Health & Sanitation Regulation has provided provisions to impose penalties on non-compliance of municipal rules and regulations including on urban sanitation matters. In Aizawl, sanitation is managed by the AMC now, though main works are related to municipal solid waste management, and provision and maintenance of septic tanks has not given any attention or importance.

2.1.4 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 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, 2002a).

In the absence of a separate utility, there is no separation 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).

2.1.5 *Service standards*

1. Service Level Benchmarks (SLB), 2008: Issued by the Ministry of Urban Development 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 and (iii) set out guidelines on how to operationalize this framework in a phased manner. 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 Part-A: Effluents-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.
3. Manual on Sewerage & Sewage Treatment, Second Edition, 2013: This manual has been developed by Central Public Health and Environmental Engineering Organization (CPHEEO).It provides detailed design and guidelines for various technologies of wastewater management.
4. Code of Practice for Installation of Septic Tanks, 1985: Issued by Bureau of Indian standards. It is a national standards setting body of India. The code specifies standards and design consideration for installation of septic tanks.
5. Building Regulations of AMC, 2012: The Regulation of AMC has mentioned the design/specifications of water closets as requirement of the parts of building approval process (Chapter/Section II-IV of the Aizawl Municipal Council Building Regulations, 2012).The public health and sanitation regulations (draft) prepared by the AMC with regard to design of septic tanks, operational procedures, institutional framework or other such matters focusing septage management (UD&PA, 2014) are yet to be notified.

3 Service Outcomes

Service outcome analysis is based on secondary sources. Three key sources of data are; Census of India, 2011, draft SMP 2014, and draft CSP, 2014. The data is crosschecked and updated by Key Informant Interviews (KIIs). Eight KIIs have been conducted with stakeholders. Data on containment is available in the Census. Data on emptying, transport and treatment is collected by KIIs. However, most of the data is qualitative. Draft report of SIPMIU helped to understand the current situation of service delivery chain. No/negligible sewerage system exists; hence majority of the population of Aizawl is dependent on-site sanitation system.

3.1 Overview

This section presents the range of sanitation technologies/infrastructure, methods and services designed to support the management of FS and/or Waste Water (WW) through sanitation service chain in Aizawl. The details on quantitative estimations are presented in table below and following sections:

Table 3: Sanitation Technologies and contribution of excreta in terms of percentage 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 centralized separate sewer	T1A1C2	4%
2	Septic tank	Septic tank connected to soak pit, general situation	T1A2C5	84.54%
3	Other systems	User interface discharges directly to open ground	T1A1C8	2.56 %
4	Pit latrine with slab	Lined pit with semi-permeable walls and open bottom, no outlet or overflow, general situation	T1A5C10	4.1%
5	Pit latrine without slab	Unlined pit no outlet or overflow, general situation	T1A6C10	3.45%
6	Night soil disposed into open drain	User interface discharges directly to open drain or storm drain	T1A1C6	0.78 %
7	Service latrine	User interface discharges directly to 'don't know where'	T1A1C9	0%
8	Public latrine	Septic tank connected to soak pit, general situation	T1A2C5	0.2 %
9	Open defecation	Open Defecation	T1B11C7 to C9	0.3 %

3.1.1 Sanitation facilities:

This section presents existing sanitation facilities apart from household toilets.

Public and community toilets:

In Aizawl, 7% of the households do not have access to toilets. The percentage of these gaps are little high in ward no. 1, 6, 13 & 19. Open defecation is not in practice in and around the city. There are no community toilets available in city, but around 20 Public toilets are available in the market area (UD&PA, 2014a).

Institutional sanitation:

Aizawl, being a capital city, has all levels of education facilities- a university, 11 colleges, higher secondary and primary schools. Also, there is a veterinary college, polytechnic institute, industrial training institute and 2 law colleges. It was observed in many schools either there is no toilet or they are dysfunctional. Among 1,607 schools in Aizawl, only 732 have toilet facility (UD&PA, 2014a).

Commercial and industrial areas:

Almost all the commercial hubs are on State Highway & National Highway 54. The most important market places are Bara bazaar, New market, Ritz market and Zarkawt. The town supports handicraft industries. At present there are 3157 small scale industries in Aizawl (UD&PA, 2014a). AMC has a record of 9 hotels, 10 restaurants and community halls of occupancy of 1800 (UD&PA, 2014a).

Due to lack of data on excreta generated from institutions, industrial areas, restaurants and hotels, these establishments have not been taken into consideration for production of SFD. Whereas excreta from public toilets, residential as well as commercial areas is considered for this study.

Containment prevalent in the city is majorly of two types; septic tanks followed by soak pits and ventilated improved pit. It is observed that size, location, and design of on-site system is majorly dependent on space available and is prerogative of local masons. There is no monitoring of whether the septic tank adheres to the design prescribed by the Bureau of Indian Standards (UD&PA, 2014a).

Emptying of FS/septage from On-site Sanitation Systems (OSS) is done mechanically (motorized emptying); no instance of manual scavenging is reported. Private emptiers are majorly responsible for emptying, however, in 2013, UD & PA procured vacuum tankers for providing quality desludging and transport services. There are 40 private emptiers active in the city, registered under Mizoram Septic Service Association (MSSA), an association of private emptiers and 5 vacuum tankers operated by UD& PA (UD&PA, 2014a).

Mizoram Septic Service Association (MSSA) was established in the year 2000 with 25 members but now has over 200 members. The MSSA has not yet developed any rules and regulations either for process, operation or charges neither does it have any code of conduct, nor training programmes to upgrade technology or services. No documents (Log book/MIS) are maintained by

emptiers. Hence it is difficult to assess number of houses attended per day/month/year (UD&PA, 2014a).

3.1.2 Containment

Sanitation in Aizawl is becoming a serious issue due to improper collection, transport & disposal of waste. There is no/negligible dedicated sewerage system at present. In Aizawl most of the residents use toilet, most of these are either bucket or cistern flush which are connected to septic tanks. Majority of septic tanks are connected to soak pits. Sullage (i.e. kitchen and bathroom waste) is discharged into open drains along the road network. This sullage finally drains downstream into the natural valley. Some septic tanks are built under the houses and do not have an access for desludging. A few do not have individual septic tank, where they share in public/community toilet. No septic tank is connected to sewerage network. Other on-site sanitation system like ventilated improved pit latrines and pit latrine without slab/ open pit are also reported to be present, but small in number when compared to septic tanks (UD&PA, 2014a, AMC, 2015).

3.1.3 Emptying

Emptying of septic tank is done in an ad-hoc manner, there is no regulation at present, but as per KII the frequency of emptying of the household septic tank is once in 3 years. Few septic tanks haven't been emptied over past 10 years. The practice of manual scavenging is not reported according to the primary survey. In some of the commercial buildings, however, the septic tanks are being emptied manually. Private emptiers use innovative marketing strategies to attract customers like advertisement on television and local newspaper. Residents contact emptiers/desludgers when tanks are full (UD&PA, 2014a).

The emptiers operate freely throughout the city. Charges levied for service provision on an average are INR.4000/-(63 USD). Majority of them work with one set of equipment and some also hire trucks and generators. Generally there are 6 persons; one driver and one pump operator. The labour is unskilled and learn on the job. There is no provision/usage of gloves, boots or masks or any other safety gears. It was also reported that no medical check-ups are conducted for the labor. The emptiers claimed that till date no medical issues or challenges have been faced by anyone (UD&PA, 2014a).

Sanitation officer, from the UD&PA department has an additional responsibility to oversee the sanitation wing of the municipality which otherwise should be a full time function. Sanitation wing doesn't advertise like private emptiers. A resident has to register to sanitation wing in advance to avail the service. The sustainable mechanism to provide emptying service is yet to be worked out. Charges levied for service provision are– INR 3,100 (USD 48.79) (AMC, 2015).

It is observed that the private emptiers are using following equipment; kerosene pump set (Honda HP 110 cc), PVC pipe, PVC tanks (Blow Mould) 2000 liters and mini truck (TATA 407) to carry out emptying process and septage transportation. State owned emptying technologies are different from the ones with private operators. UD&PA sanitation wing runs modern vacuum tanker which has tank of 2000 liters capacity, made with tested MS plate, side cover with 8mm MS plate

complete diameter with 18 inches manhole leader, sludge trap, 12 inches diameter black port, vacuum pump, 200 ft. long hose pipe, 75 mm diameter aluminum PVC hose section. The vacuum tanker is mounted on the chassis of medium commercial vehicle TATA 407. The state run service is still under trial and sustainable mechanism is under development therefore percentage contribution of excreta from emptying services could not be determined (UD&PA, 2014a).

3.1.4 Transportation

Exact location of sewerage network is not known. Wastewater (grey water) flows through drain along the road network. The roads in the area are narrow and it is impossible to drive heavy vehicles. Both private emptiers and UD&PA emptiers transport septage by mini truck (TATA 407) to disposal sites. The private service providers carry septage in blow mould-tanks and travel 10 - 15 km outskirts of city for disposal, septage spills onto road during transportation causing unhygienic, unsafe and hazardous condition to the local environment. Transportation by state owned vacuum tankers is safe (UD&PA, 2014a).



Figure 2: Private vacuum tanker (UD&PA, 2014)



Figure 3: AMC vacuum tanker (Source: Shantanu/CSE, 2015)

3.1.5 Treatment and Disposal

At present there is no treatment facility for septage; mostly collected septage is transported to the disposal ground. There are three designated disposal sites for septage. From visit to the city and conducting KIIs. It was reported that the dumping or discharge of septage is not done in organized manner. Emptiers pay INR 100 (USD 1.57) per trip for permission to discharge septage on private lands.

Table 4: Existing Septage Disposal Sites at Aizawl (UD&PA, 2014a)

Site	Location	Remarks
Site -1	Tuirial near solid waste disposal site under UD & PA (commonly known as oxidation pond)	Land belongs to government
Site -2	Phunchawng - Bethany stone quarry	Land belongs to private owner; Mr. Kapzela of Zarkawt
Site -3	F. Lalnienga of Republic Veng, location- Mualpui, Aizawl	Land belongs to private owner.

Disposal site at Tuirial: It is basically a solid waste disposal site. There is a pond (4mx14m approx.) at the site, known as oxidation pond, where the septage is discharged. The site is about 15km from the city (UD&PA, 2014a).

Disposal site at Bethany: The site is on the way to the airport, about 10 km from the city as a private land. Private emptiers dispose septage occasionally. The pinpointed disposal location within the site is also not well identified. According to the accessibility point of view, emptiers dispose septage to the place which suits them. Sometimes the sludge is used for agriculture purpose right at the site (UD&PA, 2014a).



Figure 4: Disposal site at Tuirial (UD&PA, 2014a)

Disposal site at Mualpui: The site F. Lalnienga of Republic Veng, at Mualpui is owned by private owner. The septage is disposed indiscriminately from the upper region to the valley down the hill. The sludge is supposed to be used as manure for plantation without any formal treatment (UD&PA, 2014a, AMC 2015). None of the existing sites have post-disposal monitoring system.



Figure 5: Disposal site at Mualpui (Source: Shantanu/CSE, 2015)

3.2 SFD matrix

The final SFD for Aizawl is presented in appendix 7.1

3.2.1 SFD matrix explanation

According to Census 2011, only 8% of the city is dependent on offsite systems. Population connected to sewer line is 4% and user interface discharging directly into open drains is only 4%, but there's no treatment system available in city, hence 8% excreta generated from offsite sanitation systems is carried through drains and gets discharged on low lying lands, hence it's shown unsafe (red) in SFD.

According to Census of India, 2011, 92% of the city is dependent on onsite sanitation systems, in which 85% are dependent on septic tanks and 7% on pits. The public latrines are connected to septic tanks and hence are incorporated in onsite systems. FS in given case, is contained as the septic tanks are coupled with soak pits and the effluent infiltrates into the soil and ground water table is very low. It is difficult to determine the percentage of effluent and septage produced from septic tanks, hence it's assumed to be 50% each to reduce error in estimation. Therefore, 42% of faecal sludge which is effluent infiltrates through soak pit or pits and 42% is emptied from tanks, whenever full. Some FS (approximately 8%) is left in the tanks and pits.

Table 5: Description of variables used in SFD

Variable	Description
W2	WW contained centralized (offsite)
W15	WW not contained (offsite)
W11	WW not delivered to treatment
W11a	WW not delivered to centralized treatment plant
W11c	WW not contained, not delivered to centralized treatment plant
F2	FS contained (onsite)
F3	FS emptied
F3a	FS contained- emptied
F8	FS contained- not emptied
F11	FS not delivered to treatment

Assuming Census figures are correct; W2 was estimated to be around 4%, though the WW is discharged in the environment untreated. W15 is calculated as 4%, which constitutes of WW discharged in open drain i.e. 1% and WW discharged to open ground (defined as other systems in Census) i.e. 3%. Since WW is not delivered to treatment plant W11a and W11c become 4% each, hence W11 comes out to be 8%.

F2 is estimated to be around 92% which constitutes of 85 % population dependent on septic tanks, 4% dependent on lined pit with semi-permeable walls and 3% on unlined pits. Since there is no clear demarcation in quantity of solid FS generated and effluent/infiltration generated from an onsite system, it is assumed to be 50% each. It is also assumed that 90% of population (dependent on onsite systems) gets their system emptied when full. Therefore out of 85% septic tank dependent population, FS of 38% population gets emptied.

Similarly for lined pits and unlined pits FS emptied comes out to be 2% each, making total FS emptied, i.e. F3a equal to 42%. Since all onsite systems are contained F3a is equal to F3 in case of Aizawl. Whereas FS contained but not emptied, i.e. F8 comes out to be 50%, which constitutes of FS of 47% septic tank dependent population, 2% lined pit and 1% unlined pit. The emptied FS is discharged untreated in environment therefore F11 comes out to be 42%.

It can be concluded that excreta of 50% population is managed safely in the Aizawl city as F8 is 50% and excreta of rest of the 50% population is discharged untreated in the environment as F11 is 42% and W11 is 8%.The following table summarizes the percentages of the population using each sanitation technology and method along the service chain.

3.2.2 Risk of groundwater contamination

Ground water stored in the hill slopes, emanates in the form of springs, which are being used as a source of water supply. From quality point of view, most of the chemical constituents in ground water are within the permissible limit. In general, the quality of ground water in the district is fresh and potable and is suitable for domestic and industrial purposes. No ground water abstraction structures have been noticed in the valley. The shallow ground water abstraction structures may be attempted in the suitable locations in the valley. The valley formation shows low permeability and infiltration rate. Ground water potential is low (CGWB, 2009).

Table 6: Percentage of the Population Using Each System Technology and Method

System type	Containment	Emptying	Transport	Treatment	End-use/ disposal
Offsite	<p>T1A1C2 (Reference L1): 4% of the population is connected to centralised sewer, hence W2 is 4%.</p> <p>T1A1C6 (Reference L4): 1 % of the population is discharging their excreta directly to open drain.</p> <p>T1A1C8 (Reference L5): 3 % of the population is discharging their excreta directly to open ground.</p> <p>Total waste water not contained (offsite), i.e.W15,adds up to 4%.</p>	No data available.	<p>0% of the population served by centralised sewers has their wastewater reaching treatment facilities, hence W11a is 4%.</p> <p>Waste water not contained, delivered to centralised treatment plant, i.e. W4c is 0%.</p> <p>Therefore waste water not contained not delivered to centralised treatment plants, i.e. W11c, is 4%.</p> <p>Total waste water not delivered to treatment plant, i.e. W11, is 8%.</p>	No treatment facility available hence 0% of the population has their wastewater treated, therefore W5a is 0%.	<p>4% of the population has their wastewater disposed in local area without treatment.</p> <p>Total waste water disposed untreated in local area comes out to be 8%</p>
Onsite	<p>92% of population is dependent on onsite sanitation systems, hence F2, FS contained (onsite) is 92%</p> <p>T1A5C10 (Reference L11):4% of population is dependent on lined pit with semi permeable walls and open bottom</p> <p>T1A6C10 (Reference L11):3% of population is dependent on unlined pit</p>	<p>Since most of the population is getting their systems emptied, it is assumed 90% of population has their onsite technology emptied.</p> <p>Since there is no clear differentiation between % of septage and effluent, it is assumed to be 50% each. But since 90% are getting it emptied, FS emptied, i.e. F3a, comes out to be 42%. FS contained not emptied, i.e. F8, becomes 50 %, which includes effluent that infiltrates through soak pits.</p>	<p>No FS is transported to treatment plant therefore FS not delivered to treatment plant, i.e.F11, is 42%.</p>	No treatment facility exists hence no FS is treated, therefore FS treated, i.e. F5, is 0%.	All the FS emptied ends up in local area without any treatment.
Open Defecation	No/negligible open defecation is practiced in city, hence OD9 is 0%.				

4 Stakeholder Engagement

4.1 Key informant interviews

The relevant departments were contacted through e-mail, letter, call and fax prior to visit to the city. The purpose of the SFD study and depth of data required was conveyed through introductory letter to respective departments. Overall, 8 KIIs were conducted with different stakeholders like government functionaries, private emptiers, NGOs (see appendix 7.2). The GoM operates through its PHED/UD&PA department. The department is supported by the single window of ADB – the SIPMIU.

Limited documents were available on web hence the visit to city also helped in collecting data, including unpublished reports. The KIIs and data collected helped in understanding the existing situation and upcoming development plans in the sanitation sector. Due to limitation of desk-based study all the key stakeholders engaged in sanitation services could not be interviewed in person.



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7.2 Stakeholder identification (Tab 2: Stakeholder tracking tool)

Table 7: Stakeholder identification

No.	Stakeholder group	In Aizawl context
1	City council / Municipal authority / Utility	Aizawl Municipal Corporation
2	Ministry in charge of urban sanitation and sewerage	Urban Development and Poverty Alleviation Department, GoM
3	Ministry in charge of urban solid waste	Urban Development and Poverty Alleviation Department, GoM
4	Ministries in charge of urban planning finance and economic development.	Urban Development and Poverty Alleviation Department, GoM
	Ministries in charge of environmental protection/	Department of Environment & Forests, GoM
	Ministries in charge of health	Health & Family Welfare Department GoM
5	Service provider for construction of onsite sanitation technologies	Local masons
6	Service provider for emptying and transport of faecal sludge	Private emptiers
7	Service provider for operation and maintenance of treatment infrastructure	Aizawl Municipal Corporation
8	Market participants practising end-use of faecal sludge end products	Farmers
9	Service provider for disposal of faecal sludge (sanitary landfill management)	Private land owners
10	External agencies associated with FSM services: e.g. NGOs, academic institutions, donors,	Private emptiers

7.3 Tracking of Engagement (Tab 3: Stakeholder Tracking Tool)

Table 8: Key informants interviewed during field visit to Aizawl city

Name	Office	Designation	Date of engagement	Purpose of engagement
Mr M.Zohmingthangi	Aizawl Municipal Council	Chief Executive Officer	10.6.2015	KII
Er R.Lalfanliana	PHED	Engineer-in-Chief	10.6.2015	KII
Mr Vanlalsawma (Somtea)	Aizawl Municipal Council	Executive Officer	12.6.2015	KII
Er. Valbuanga	SIPMIU	Project Director	12.6.2015	KII
Mr Lalhmuaka	SIPMIU	Asst. Engineer(SWM)	12.6.2015	KII
Mr P.C. Lalmalsawma	UD & PA	Sanitary Inspector	13.6.2015	KII
unknown	AMC	Sanitary worker	13.6.2015	KII
Mr Robert	Resident	Upper Republic Hmarveng Section Aizawl	13.6.2015	KII