SFD Promotion Initiative

Hawassa, Ethiopia

Final Report

This SFD Report was created through desk based research by
WEDC as part of the SFD Promotion Initiative.
It is primarily based on a recent World Bank FSM diagnostic report.
See Acknowledgments.

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SFD Promotion Initiative

sustainable sanitation alliance

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On behalf of Federal Ministry for Economic Cooperation and Development

UNIVERSITY OF LEEDS

WORLD BANK GROUP Water

wsp water and sanitation program

WEDC

Loughborough University

CSE

eawag aquatic research

Sandec Sanitation, Water and Solid Waste for Development

Bill & Melinda Gates foundation

SFD Report Hawassa, Ethiopia, 2016

Produced by:

Claire Furlong

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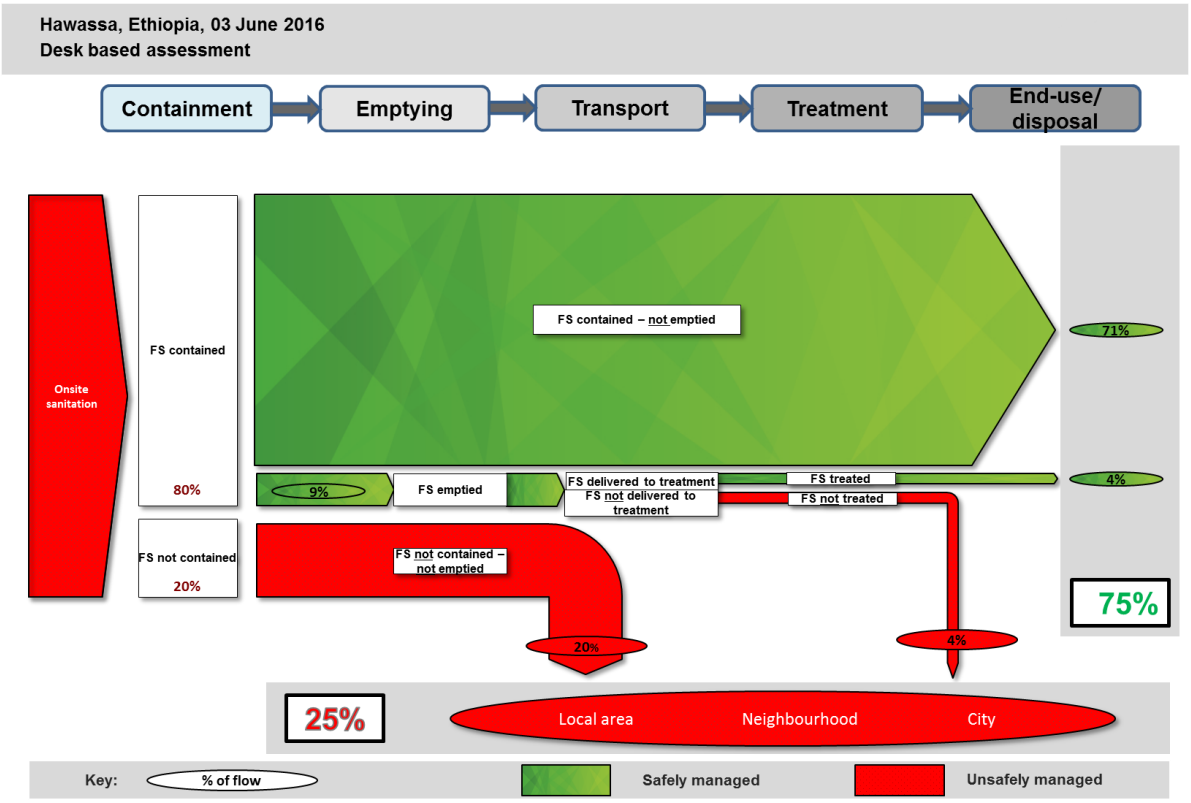
1. The Diagram



2. Diagram information

The excreta flow diagram (SFD) was created through desk based research by WEDC (Water, Engineering and Development Centre) Loughborough University.

Collaborating partners:
The World Bank Water and Sanitation Program and Oxford Policy Management Ltd.
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3. General city information

Hawassa is the capital of the Southern Nations, Nationalities and People's Region in Ethiopia. The city administration is divided into 8 sub-cities and 32 Kebeles [1] (20 urban and 12 rural). The administrative land area of Hawassa is 15,720ha, with the municipal boundary (i.e. urban kebeles) covering 65 km^2.

The Ethiopian Central Statistical Agency estimates that the population of Hawassa is 351,469 and it has an annual population growth rate of 4% (CSA, 2015). The population is relatively young, with 65% under 25 years of age and around 5.5% over 50 years of age.

Hawassa is located on the shores of Lake Hawassa in the Great Rift Valley. The catchment of Lake Hawassa is formed of Pliocene-age volcanic rock. Significant faults and ground cracks in the rock result in a highly permeable soil and unconfined aquifers in the area. The depth to the static groundwater level varies from a few meters in the low-lying areas to up to 40m deep in elevated areas (Ayenew and Tilahun, 2008).

Hawassa has a mean annual rainfall of about 950 mm and temperature of 20°C. The main rainy season generally extends from June to October.

4. Service delivery context

The National Constitution includes the protection of public health. Several ***policies*** and guidelines have been produced to guide the implementation of national policies regarding water and sanitation (WASH), the main ones are listed below:

- Ethiopian Water Resource Management Policy (1999).

[1] A Kebele is a "neighbourhood": the smallest administrative division, similar to a ward

• Universal Access Plan for Water and Sanitation (2005).

• National Sanitation and Hygiene Strategy (2005).

• National Protocol for Hygiene and "On-Site" Sanitation (NPHOSS) (2006).

• Needs Assessment to Achieve Universal Access to Improved Hygiene and Sanitation by 2012 (2007).

• National Sanitation and Hygiene Implementation Guideline (2011).

• Urban Sanitation Universal Access Plan (2011).

• One WASH National Program (OWNP) (2013).

• National Sanitation Marketing Guidelines (2014).

NPHOSS was produced by the Ministry of Health (MoH) to "follow the national strategy for hygiene and sanitation improvement with its focus on universal access (100% hygienic and sanitised households) in primarily rural or peri-urban environments" (MoH, 2006).

A seven year program (2013-2020) under the name of One WASH National Program (OWNP) and the WASH Implementation Framework has been developed. This program is the main tool to achieve the targets for sanitation and hygiene proposed in the Universal Access Plan.

The development of towns is supported both by the federal and regional state. The Federal Government prepares policies, strategies and development plans in consultation with regional counterparts. A range of regional bureaus and offices, constituted under the Regional Government, guide the development of towns and rural areas. They support towns in implementing policies and strategies in line with development plans and programs they are committed to deliver. The support is often in the form of capacity building, procurement or technical assistance. In 2002, decentralisation of powers from federal to local government was undertaken. This was seen as a major step towards the development of WASH infrastructures (WaterAid, 2013).

5. Service outcomes

Hawassa has no sewerage system. Faecal sludge management in Hawassa is the responsibility of Hawassa Town Water Supply and Sewerage Services Enterprise (HTWSSSE). HTWSSSE has responsibility for the emptying of septic tanks and latrine pits. They operate two vacuum tankers and supervise approximately 12 vacuum tankers owned by private operators. Vacuum tankers transport collected faecal sludge to a site operated by HTWSSSE, located at Alamura on a hilltop just outside the city boundary. The route to the site is about 18km. The site has a treatment plant consisting of eight sludge drying beds.

100% of the population is reliant on onsite sanitation. The most popular sanitation technology being semi-lined pits (56%), followed by unlined pits which are never emptied, abandoned when full, but not adequately covered with soil (20%), fully lined septic tanks with no outlet that operate as a sealed tank (16%), then septic tanks with a soakpit (4%) and unlined tanks which are classified as unlined pits (4%).

Only 9% of households had their systems emptied by vacuum tankers, these were assumed to be all of the septic tanks (4%) and a 30% of sealed tanks (5%), due to the higher household investment in these systems.

All other systems which discharged to a tank or pit had never filled up or required emptying. This is thought to be due to the waste leaching into the highly permeable soil and 'fluidising' of the pit contents during the rainy season, resulting in the content being 'washed-out' into the highly porous sub-soils. This includes the remaining 11% of the sealed tanks which seems improbable, so suggests that in reality many of these tanks do not function as fully sealed units.

No manual emptying services were identified in Hawassa during the study and interviews conducted by consultants confirmed that manual emptying is virtually non-existent in the city.

Although the SFD shows that 75% of the excreta as being safely contained, it is actually being discharged into the soil.

6. Overview of stakeholders

The institution in charge of monitoring sanitation and hygiene interventions in Ethiopia is the Ministry of Health (MoH) with more than 38,000 health extension workers. They work at community

and household levels to promote the use of improved sanitation facilities and eradicate open defecation (Jones, 2005). The Ministry of Water, Irrigation and Energy (MoWIE) is responsible for water policy, coordination and monitoring. The Ministry of Finance and Economic Development (MoFED) is responsible for budgeting and managing economic resources in both Federal and Regional governments. Institutional roles for sanitation in Hawassa are clearly defined, although they are stronger in relation to containment, emptying and transportation of excreta, than its treatment and end-use. This will be eventually addressed in the upcoming Integrated Urban Sanitation and Hygiene Strategy. Private emptying service providers are uncoordinated and not strongly regulated. NGOs and other non-state providers limit their role to providing communal or public latrines in low-income areas.

7. Credibility of data

The fate of infiltrate from soakaways and pit latrines has been disregarded in the SFD. It was deemed to have little, if any, direct impact on health or the local environment (through ground water pollution). The SFD represents only the flows of wastewater and faecal sludge through the sanitation service chain.

8. Process of development

A majority of the data in this report unless stated otherwise is taken from:

The World Bank Water and Sanitation Program 2016 Report: Fecal Sludge Management: Diagnostics for Service Delivery in Urban Areas, Case study report – Fecal sludge management in Hawassa, Ethiopia.

The World Bank study was based on a household survey, transect walks, observations, key informant interviews and focus group discussions. It also incorporates a review of the enabling environment for FSM in Hawassa.

It should be noted that no other stakeholders were involved in the production of this report.

9. References

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SFD Hawassa, Ethiopia, 2016

Produced by:
WEDC, Dr Claire Furlong in collaboration with the World Bank Water and Sanitation Program and Oxford Policy Management Ltd.

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Abbreviations

CSA	Central Statistical Agency
FSM	Faecal Sludge Management
GoE	Government of Ethiopia
HCA	Hawassa City Administration
HTWSSSE	Hawassa Town Water Supply and Sewerage Services Enterprise
MoFED	Ministry of Finance and Economic Development
MoH	Ministry of Health
MoWIE	Ministry of Water, Irrigation and Energy
NGO	Non-Governmental Organisation
NPHOSS	National Protocol for Hygiene and "On-Site" Sanitation
OWNP	One WASH National Program
SFD	Excreta Flow Diagram
SNNPR	Southern Nations, Nationalities and People's Region
UNICEF	United Nations International Children's Emergency Fund
US$	US dollars
WASH	Water, Sanitation and Hygiene
WEDC	Water, Engineering and Development Centre
WSP	Water and Sanitation Program

1 City context

Hawassa, a newly emerging city in Ethiopia, is the capital of the Southern Nations, Nationalities and People's Region (SNNPR). The city administration is divided into 8 sub-cities and 32 Kebeles[2] (20 urban and 12 rural). The administrative land area of Hawassa is 15,720ha, with the municipal boundary (i.e. urban kebeles) covering 65 km^2.

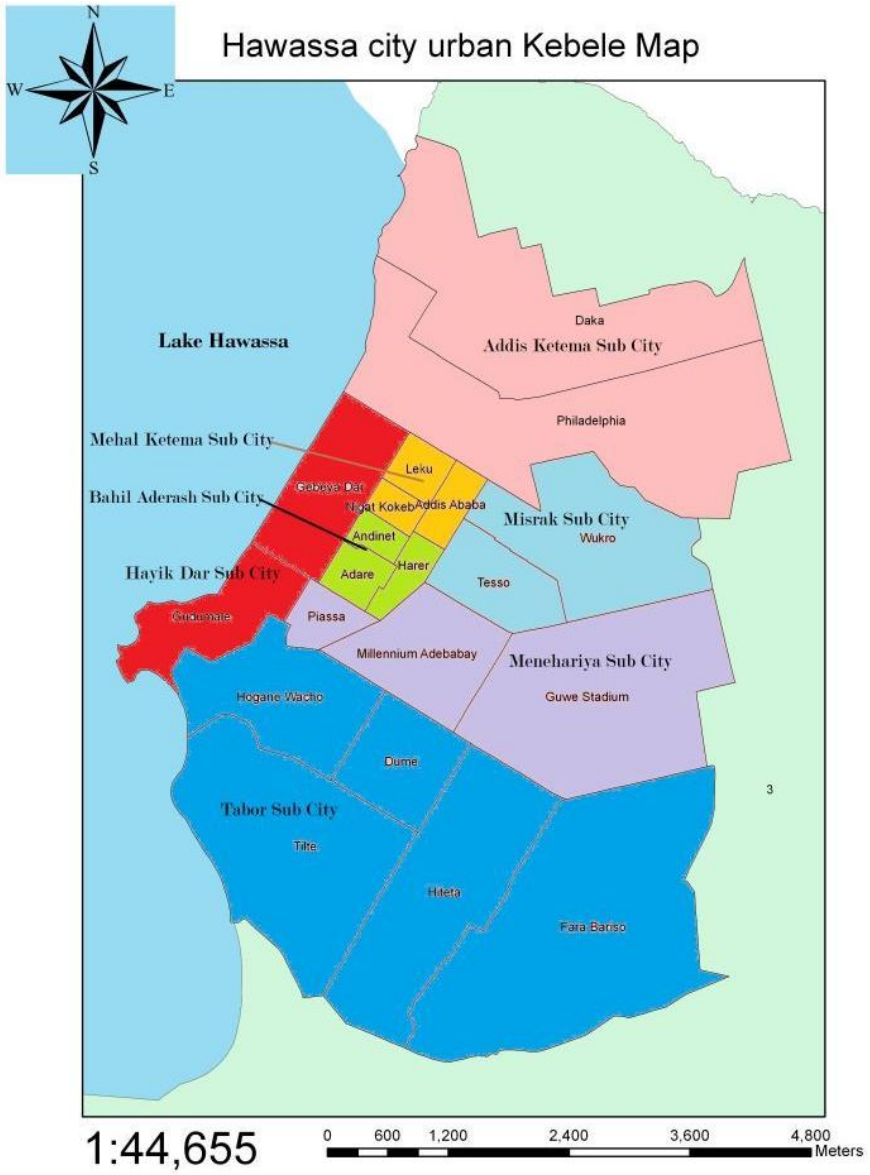

Figure 1: Map of Hawassa City

[2] A Kebele is a "neighbourhood": the smallest administrative division, similar to a ward

1.1 *Geography*

Hawassa city is located on the shores of Lake Hawassa in the Great Rift Valley. The catchment of Lake Hawassa is formed of Pliocene-age volcanic rock. Significant faults and ground cracks in the rock result in a highly permeable soil and unconfined aquifers in the area. The depth to the static groundwater level varies from a few meters in the low-lying areas to up to 40m deep in elevated areas (Ayenew and Tilahun, 2008).

1.2 *Climate*

Hawassa has a mean annual rainfall of about 950 mm and temperature of 20°C. The main rainy season generally extends from June to October.

1.3 *Population*

The Ethiopian Central Statistical Agency estimates that the population of Hawassa is 351,469 and it has an annual population growth rate of 4% (CSA, 2015). The population is relatively young, with 65% under 25 years of age and around 5.5% over 50 years of age.

2 Service delivery context description

2.1 *Policy and Laws*

The National Constitution of the Federal Democratic Republic of Ethiopia includes the protection of public health. Article 90.1 states that "to the extent the country's resources permit, policies shall aim to provide all Ethiopians access to public health and education, clean water, housing, food and social security" (GoE, 1995). several policies and guidelines have been produced to guide the implementation of national policies regarding water and sanitation (WASH), the main ones are listed below:

- Ethiopian Water Resource Management Policy (1999).
- Universal Access Plan for Water and Sanitation (2005).
- National Sanitation and Hygiene Strategy (2005).
- National Protocol for Hygiene and "On-Site" Sanitation (NPHOSS) (2006).
- Needs Assessment to Achieve Universal Access to Improved Hygiene and Sanitation by 2012 (2007).
- National Sanitation and Hygiene Implementation Guideline (2011).
- Urban Sanitation Universal Access Plan (2011).

• One WASH National Program (OWNP) (2013).

• National Sanitation Marketing Guidelines (2014).

The Ethiopian Water Resource Management Policy was developed in 1999 by the Ministry of Water Resources, now the Ministry of Water, Irrigation and Energy (MoWIE). Its aim was to promote the development of adequate management of water resources in Ethiopia to contribute to the accelerated economic growth of the country. The National Protocol for Hygiene and "On-Site" Sanitation (NPHOSS) was produced by the Ministry of Health (MoH) to "follow the national strategy for hygiene and sanitation improvement with its focus on universal access (100% hygienic and sanitised households) in primarily rural or peri-urban environments" (MoH, 2006).

The draft Growth and Transformation Plan, developed by the Ministry of Finance and Economic Development (MoFED), set goals and targets which relate to the Millennium Development Goals, including those related to WASH. Although water and sanitation are seen as priority areas, the only goal set is to have "better and closer access to safe water and sanitation facilities", with no other specification included (MoFED, 2010).

A seven year program (2013-2020) under the name of One WASH National Program (OWNP) has a total budget of more than USD $2 billion, the largest in the WASH sector in Ethiopia (Goyol and Girma, 2015). This program is the main tool to achieve the targets for sanitation and hygiene proposed in the Universal Access Plan, delivered through the WASH Implementation Framework.

The development of towns is supported both by the Federal and Regional State governments. The Federal Government prepares policies, strategies and development plans in consultation with Regional counterparts. A range of Regional Bureaus and offices, constituted under the Regional Government, guide the development of towns and rural areas. They support towns in implementing policies and strategies in line with development plans and programs they are committed to deliver. The support is often in the form of capacity building, procurement or technical assistance. In 2002, decentralisation of powers from Federal to local government was undertaken. This was seen as a major step towards the development of WASH infrastructures (WaterAid, 2013).

2.2 *Institutional roles*

The institution in charge of monitoring sanitation and hygiene interventions in Ethiopia is the MoH with more than 38,000 health extension workers. They work at community and household levels to promote the use of improved sanitation facilities and eradicate open defecation (Jones, 2005). The MoWIE is responsible for water policy, coordination and monitoring. The Ministry of Finance and Economic Development (MoFED) is responsible for budgeting and managing economic resources in both federal and regional governments. The MoWIE and MoFED collaborate on monitoring and reporting the status of WASH in the country (Jones, 2005).

There are five divisions in terms of governance and administration of the WASH sector in Ethiopia (Girma and Suominen, 2013):

1. Federal government, with its capital in Addis Ababa.
2. Nine Regions and two city administrations (each with a Water Bureau).
3. Over 70 Zones (Some of the Zones are important for ethnic reasons, and have autonomous status. These are called “Special Zones”.)
4. 805 Woredas (Districts). Each Woreda has a Water Office.
5. Around 16,000 administrative Kebeles (comprising several villages or “peasant associations”).

Under the constitution of the Southern Nations, Nationalities and People’s Regional State, Hawassa City Council is the highest government body, holding city-wide leadership responsibilities in relation to political, economic, judicial, administrative and security matters. Hawassa City Administration (HCA) is the highest executive body mandated to oversee the delivery of all municipal services. The Head of the HCA is the Mayor, under whom sit three main structures: the HCA Executive Body, Municipality Services and eight sub-city Administrations. The HCA Executive Body directly oversees activities of the different sectorial departments, authorities and offices established to deliver services. The Municipality Services Manager and Deputy Manager have executive roles to deliver services including Sanitation, Beautification & Park Development Services, Plan Preparation & Monitoring Services, each led by a coordinator. The Hawassa Town Water Supply and Sewerage Services Enterprise (HTWSSSE) is the department responsible for faecal sludge management (FSM) services in Hawassa.

Table 1 summarises the stakeholders and their roles in this sector.

Table 1: Stakeholers and their assigned roles

Categories	Stakeholder	Assigned roles
Federal government	Ministries of Health; Education; Water, Irrigation & Electricity; and Finance & Economic Cooperation	**WASH Policy** - Joint WASH MOU
	Ethiopian Environmental Protection Agency	**Environmental regulation and monitoring** - Develops environmental strategic plans - Formulates environmental laws and standards - Provides support for environmental regulatory bodies and implementers - Undertakes monitoring and effectiveness evaluation of environmental systems
SNNPR Regional Government Bureaus	Water, Irrigation and Electricity	**Deliver potable water supply and sewerage services** - Responsible for liquid waste management - Town water utilities are charged to deliver sewerage services.
	Health	**Health promotion and regulation on food, health care and medicine control** - Oversees urban health extension packages, of which seven relate to hygiene promotion and waste management
	Urban Development and Housing	**Support improvement of solid waste management** - Strengthens capacity of the municipal agencies to implement solid waste management
	Environmental Protection and Climate Change	**Protection of the environment and nature** - Develops standards, regulations and guidelines on elements adversely affecting the environment
	Justice	**Ensuring implementation of all regulations** - Advises or takes legal action against those releasing or dumping waste from their compound
Local government	Hawassa City Council	**Ensure sanitation provision** - Sets laws and regulations on socio-economic matters - Monitors appropriate enforcement
	Hawassa City Administration	**Water supply, sanitation and solid waste services** - Delivers municipal services to city inhabitants
	Hawassa Town Water Supply and Sewerage Services Enterprise	**Sanitation Services** - Oversees and coordinates activities undertaken in sub-city Municipalities
	Hawassa City Natural Resources and Environmental Protection Agency	**Ensuring well-managed natural resources and environment** - Uses Liquid and Solid Waste Proclamations as basis of ensuring proper disposal for industry, hotels and businesses
	Hawassa City Design and Construction Supervision Department	**Approves building plans** - Supervises construction of houses, including standards of sanitation infrastructure
	Hawassa City Health Department	**Education and behaviour change affecting sanitation and hygiene** - Motivates households and supports institutions to improve access to improved latrine - Urban Health Extension Workers – officially assigned staff in charge of organising the Health Development Army (see below) - Health Development Army – voluntary teams of 6 workers covering up to 30 households in a neighbourhood (5 households per worker)
	Hawassa City Finance and Economic Development Department	**Developing services** - Engages the private sector

Categories	Stakeholder	Assigned roles
	Enterprise Development Office	**Engaging private sector providers** - Enables business ventures by private sector providers, especially young graduates, with sanitation seen as a key area for development
Private sector & NGOs	Private vacuum truck operators	**Emptying services** - Runs private collection services to empty septic tanks and latrine pits – on invitation from households or institutions
	Jerusalem Children and Community Development Organisation	**Support to communities** - Provision of communal toilets in low-income kebeles

Institutional roles for sanitation are clearly defined in Hawassa, although they are recognised as being stronger in relation to containment, emptying and transportation of excreta, than its treatment and end-use. This is due to be addressed in the upcoming Integrated Urban Sanitation and Hygiene Strategy. The Municipal Enterprise Development Office is tasked to support the development of small and micro enterprises, but this has not been strongly developed for FSM services. Private emptying service providers operate in a somewhat uncoordinated manner and at present are not strongly regulated by the city administration. NGOs and other non-state providers limit their role to providing communal or public latrines in low-income areas. They do not offer support for the operation, maintenance and servicing of these facilities. A proclamation addressing private sector roles for liquid waste management is under preparation at national level, this will eventually be adapted by Regional government and Hawassa City Administration.

2.3 *Service provision*

National targets, investment plans and budgets have been developed as part of the OWNP. OWNP is seen as a key mechanism through which WASH services will be enhanced throughout Ethiopia. This in turn places substantial responsibility on Hawassa Municipality to identify city-level targets, investment plans and associated budgets for the full range of sanitation and FSM services. Currently, budgets are focused on the provision of public toilet facilities and their operation and maintenance (cleaning, emptying, repairs, etc.) but not on aspects of treatment and disposal of faecal sludge. A new Hawassa City master plan is in preparation. This gives greater attention to sanitation than in previous plans, including both developing a sewerage network for the new industrial zone and possibly central areas of the city, and developing the capacity for FSM service delivery within Hawassa.

2.4 *Service Standards*

Following the Ethiopian Constitution, The Food, Medicine and Health Care Administration and Control issued the *Proclamation No*. 661/2009 to address waste handling and disposal and the availability of toilet facilities in articles 30 and 31, respectively (Table 2).There are national standards regarding the maximum concentration of several chemicals that can be discharged into the receiving waters from several industries (EEPA, 2011), but there are no quality standards set for wastewater or sludge disposal. However, the draft "Guidelines for Social, Environmental and Ecological Impact Assessment and Environmental Hygiene Impact Assessment and Environmental Hygiene in Settlement Areas", states that "latrines should be connected to digesters to produce both biogas and slurry as organic fertiliser. As a minimum, they should be connected to a compost pit and the human waste should be used to produce compost", (GoE, 2004).

Table 2 Articles related to WASH in Proclamation No. 661/2009 (EEPA, 2011)

Waste handling and disposal (art. 30)	Availability of toilet facilities (art. 31)
30/1. "No person shall collect or dispose solid, liquid or other wastes in a manner contaminating the environment and harmful to health"	31/1. "Any institution providing public service shall have the obligation to organise clean and adequate toilet facilities and keep it open to its customers"
30/2. "Any wastes generated from health or research institutions shall be handled with special care and their disposal procedures shall meet the standards set by the executive organ"	31/2. "Any city or rural administration shall be responsible to provide public toilet and ensure its cleanliness"
30/3. "It is prohibited to discharge untreated waste generated from septic tanks, seepage pits, and industries into the environment, water bodies or water convergences"	----

3 Service Outcomes

Hawassa has no sewerage system. Faecal sludge management in Hawassa is the responsibility of the HTWSSSE. HTWSSSE has responsibility for the emptying of septic tanks and latrine pits. They operate two vacuum tankers and supervise approximately 12 vacuum tankers owned by private operators. Vacuum tankers transport collected fecal sludge to a site operated by HTWSSSE located outside the city boundary (Section 3.5).

3.1 *Onsite systems*

Effluent from septic tanks is being managed through the use of on-site soakpits, or steady leaching from the tank into the soil where tanks are not fully lined. The World Bank study noted that many tanks and pits never (or very infrequently) fill up in Hawassa. From focus groups reported on in the study, it was found that certain pits fill from below with groundwater during the rainy season, then the level drops during the dry season. The filling of pits from groundwater rising above the base of the pit is thought to result in the pit contents 'fluidising' on a regular basis, with the content being 'washed-out' into the highly porous sub-soils.

3.2 *Usage*

Sanitation access data specifically for Hawassa city is not available in the public domain. The data in Table 3 was obtained from the survey undertaken in the World Bank study, based on a relatively small data set. The data from Table 3 has been transposed into categories used to construct the SFD (Table 5).

Table 3: Usage of household onsite sanitation systems in Hawassa

Sanitation type	% (*n=359*)
Lined pit	41
Septic tank: fully lined with no outlet to on-site infiltration (i.e. a sealed tank)	16
Septic tank: partially lined with no outlet to on-site infiltration (i.e. semi- lined pit)	15
Septic tank: unlined with no outlet to on-site infiltration (i.e. unlined pit)	4
Septic tank: with an outlet to on-site infiltration such as a soakpit (i.e. septic tank)	4
Unlined pit	20

3.3 *Categories of origin*

This report and the SFD are based on an *in-depth* World Bank study that focussed on household-level faecal sludge management. It does not consider non-household generated faecal sludge, such as from schools. Schools were identified in the other city studies[3] as a potential significant contributor to faecal sludge flow across the city. To include the flow of excreta from schools, a better knowledge of

[3] See reports for Kumasi, Nakuru, Niamey and Kisumu http://sfd.susana.org/

the use of school and home sanitation facilities is required, so usage could be split between locations and technology types.

3.3.1 Shared or communal toilets

Shared sanitation is defined by the Joint Monitoring Programme as a sanitation facility shared by two or more households. The World Bank study found that 62% of households reported using a shared facility, 49% share an improved facility and 13% share an unimproved facility. This makes use of shared facilities a significant element of sanitation provision in the city.

3.4 *Emptying technologies for onsite sanitation*

The World Bank study found that 92% households reported they had toilets which discharged to a tank or pit that had never filled up or required emptying. This is thought to be due to the waste leaching into the highly permeable soil and due to 'fluidising' of the pit contents during the rainy season, resulting in the content being 'washed-out' into the highly porous sub-soils. Conversely 9% of their respondents stated that their pit or tank had ever filled. The frequency of reported filling ranged from below 1 year to above 10 years, and households who reported having their systems emptied indicated that this was done by motorised means.

FSM services are provided either by the municipality (via HTWSSSE) or private service providers.

- The municipality owns two vacuum tankers that carry out up to six trips per day. At the time of the study one of the municipal vacuum tankers had broken down.
- There are five privately owned vacuum tankers registered with the HTWSSSE. An additional four or five privately owned vacuum tankers provide emptying services exclusively for hotels, resorts and restaurants in the city.

Householders predominately use private providers for emptying services as they are able to respond faster, although they are reported to charge a higher tariff compared to the municipal services. The approved charge rates (applicable only to the HTWSSSE services) given by the General Manager of Hawassa and HTWSSSE are shown in Table 4, together with various official and unofficial charges for services provided by private operators and those provided by the municipality. Over 90% of respondents to the World Bank household survey reported paying a flat rate for emptying services, regardless of the volume of pit, tank or tanker capacity. The specific tanker capacities are not known, but in general are known to vary between those used by the private and municipal operators. It is

likely that the capacity in the range of private tankers is larger (between 10-15m³), while those of the municipality are in the order of 5-8m³.

Table 4: Ranges of identified emptying charges: formal private and municipal services

Source of data	Charge (USD) Private provider	Charge (USD) Municipality
Household survey (average cost)	$86 (*n=14*)	$70 (*n=6*)
FGD: residents in central Hawassa, using emptying services (mostly in the rainy season)	$77	$30
WSE: approved tariff for private institutions	n/a	$36
WSE: proposed new tariff (to be approved)	n/a	$77
Private provider: more typical charge	$72	n/a

It was found that, on average, tanker drivers undertook four trips per day in the dry season and double this number during the rainy season. This is due to pits and tanks being unlined and filling more quickly, either by filling from below as the groundwater table rises, or the inflow of surface run-off.

No manual emptying services were identified in Hawassa during the World Bank study and interviews conducted by the consultants confirmed that manual emptying is virtually non-existent in the city.

To produce the SFD for this report, it was assumed that 9% of onsite sanitation systems were emptied (Table 5 & Appendix 1). This was broken down into 95% of septic tanks with an outlet to a soakpit and 30% of sealed tanks being emptied, due to the higher household investment in these systems. The World Bank study concluded that 10% of onsite sanitation systems have ever been emptied. It was assumed that the other systems had never filled up due to the reasons stated above. This includes the remainder of the sealed tanks which seems improbable, suggesting that in reality many of these tanks do not function as fully sealed units.

3.5 *Treatment, end-use or disposal*

The HTWSSS operates a faecal sludge treatment plant located approximately 18km from the city centre, on top of a hill in a location known as Alamura. The treatment system is made up of eight drying beds, each with a surface area of approximately 300m². The treatment process consists of

dewatering the faecal sludge by percolation of liquid through the sand beds and evaporation. A maximum of 12 tankers (10 private and 2 municipal) operate throughout the year. The World Bank study found the current capacity of the treatment plant to be just adequate. However, this is only true if the treatment plant is operating as it is designed to, with effective monitoring, management and planned maintenance. The study also found during visits that faecal sludge was observed to be bypassing a number of the beds and accumulating in a "pool" of faecal sludge further down the hillside. The condition of the beds was also found to be poor, with damage to retaining walls around the drying beds and excessive plant growth on the sludge. This indicates that the treatment plant is not being effectively managed and its condition is deteriorating.

As a lack of data was available from the faecal sludge plant it was assumed that the sludge is only partially treated and a default figure of 50% effective treatment was used for the World Bank study and to generate the SFD in this report (Table 5).

Once dried, faecal sludge is manually removed from the beds and the sand layer levelled to take further discharges of faecal sludge. The means of disposal of the dried faecal sludge is neither clear nor documented. Faecal sludge is currently thought to be disposed of in open spaces around the plant. It may be further utilised by local farmers on an informal basis, but there was no evidence of this established.

3.6 *Drinking water supplies in the city*

Available data for Hawassa city indicates that improved water supply access in 2014 was 85%. The household survey conducted for the World Bank study identified that 97% of households have access to an improved water point. The current water supply is from groundwater sources outside of the city, although additional surface water sources are under construction.

3.7 *Risk to ground water*

In terms of identifying the risk to groundwater from sanitation sources, for generating the SFD it is assumed that an equivalent to sandstone and limestone fractured rocks is the main rock type in the unsaturated zone. There is no option for permeable volcanic rock (Section 1.1), so this option is thought to be the best proxy based on soil permeability. The depth to the stabilised water table has been assumed to be between 5-10 meters (Section 1.1). It is also assumed that less than 25% of sanitation facilities are within 10 metres of a groundwater source, or uphill of groundwater sources.

Ground water is the major drinking water source for the city. As people's current source of drinking water is from the ground water supplied from a protected source outside of the city, there is a low risk of pollution to people's current source of drinking water purposes has been generated by the SFD matrix.

4 SFD Matrix

The data from Section 3 has been collated in Table 5 as the basis for generating the accompanying SFD. As no data was available on the difference between an unlined pit and an unlined tank, or a lined pit and a partially lined tank (Table 3), these tanks were defined as pits within the context of the SFD.

Due to the margins of error associated with the data collected, only streams which represent 1% of the population or more are shown in the SFD. The tool has the ability to take into account the flow of infiltrate from soakaways and pit latrines, but as this stream was deemed to be safely managed (Section 3.7), it has been disregarded. This was done to reflect the sanitation service chain more accurately in terms of faecal sludge movement. The assumptions on emptying can be found in Section 3.4, while the assumptions about the treatment efficiency are found in Section 3.5. Although the SFD (Appendix 1) shows 75% of the excreta as being safely contained, it is actually being discharged into the soil.

The SFD produced differs from the one in the World Bank study due to the way the technologies are classified. Their original classification starts with how or if the systems are flushed with water, these categories are then merged and divided by whether the containment that they flush to (if any) can be emptied. From Table 5 it can be seen that the categories used in this report are significantly different. The pits latrines without slab in the World Bank study were treated as emptiable unlined pit latrines which were abandoned when full.

In terms of the SFD in this report these sanitation systems were categorised in the same way, but were classified as abandoned when full, but not covered adequately with soil (Table 5). This fits with the earlier assumption that very few systems are ever emptied, but contradicts the findings that these systems never fill up. It is felt that this situation more accurately reflects what actually happens to these systems in this city.

5 Stakeholder Engagement

The primary stakeholder in this process was the World Bank Water and Sanitation Program (WSP) who is the collaborating partner in this study. A majority of the data in this report unless stated otherwise comes from:

The World Bank WSP 2016 Report: Fecal Sludge Management: Diagnostics for Service Delivery in Urban Areas, Case study report – Fecal sludge management in Hawassa, Ethiopia.

The World Bank study was based on a household survey, transect walks, observations, key informant interviews and focus group discussions. It also incorporated a review of the enabling environment for FSM. It should be noted that no other stakeholders were involved in the production of this report, as the World Bank had consulted with major stakeholder during their research.

Additional information was provided by Dr Oscar Veses Roda from the University of Leeds who undertook extensive field work in Ethiopia.

6 Prospects for uptake and use of this study

The detailed World Bank WSP 2016 Report, *Fecal Sludge Management: Diagnostics for Service Delivery in Urban Areas, Case study report – Fecal sludge management in Hawassa, Ethiopia*, is being used with city-level stakeholders, to inform plans for improving urban sanitation in Hawassa. This report will be available externally on http://sfd.susana.org/ and enable external organisations to gain an overview of the current situation in Hawassa.

Table 5: Data used to draw the SFD

SFD terminology level 1		%	SFD terminology level 2	%	Emptied	% emptied	% delivered to treatment	% Treated
Onsite sanitation	Unlined pit	20	Pit never emptied, abandoned when full but not adequately covered with soil, no outlet or overflow	20	N/A	N/A	N/A	N/A
	Septic tank: unlined with no outlet to on-site infiltration (i.e. unlined pit)	4	Unlined pit no outlet or overflow	4	N/A	N/A	N/A	N/A
	Lined pit	41	Lined pit with semi-permeable walls and open bottom, no outlet or overflow	56	N/A	N/A	N/A	N/A
	Septic tank: partially lined with no outlet to on-site infiltration (i.e. lined pit)	15						
	Septic tank: fully lined with no outlet to on-site infiltration (i.e. a sealed tank)	16	Fully lined tank (sealed), no outlet or overflow	16	Motorised emptying	30	95	50
	Septic tank: with an outlet to on-site infiltration such as a soakpit	4	Septic tank discharging to a soak pit	4	Motorised emptying	95	95	50

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A majority of the data in this report unless stated otherwise is from the World Bank WSP report *Fecal sludge management: Diagnostics for service delivery in urban areas, case study report – Fecal sludge management in Hawassa, Ethiopia*. That report was prepared by WEDC and Oxford Policy Management Ltd for the World Bank. Thanks to Dr Oscar Veses Roda from the University of Leeds for sharing the data he collected during his field work in Ethiopia. This report is compiled as a part of the SFD Promotion Initiative project funded by the Bill and Melinda Gates Foundation.

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Appendix 1: SFD