

SFD Promotion Initiative

Axum Ethiopia

Final Report

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SFD Promotion Initiative

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SFD Report Axum, Ethiopia, 2016

Produced by:

Oscar Veses

Barbara Evans

Andy Peal

Haile Dinku

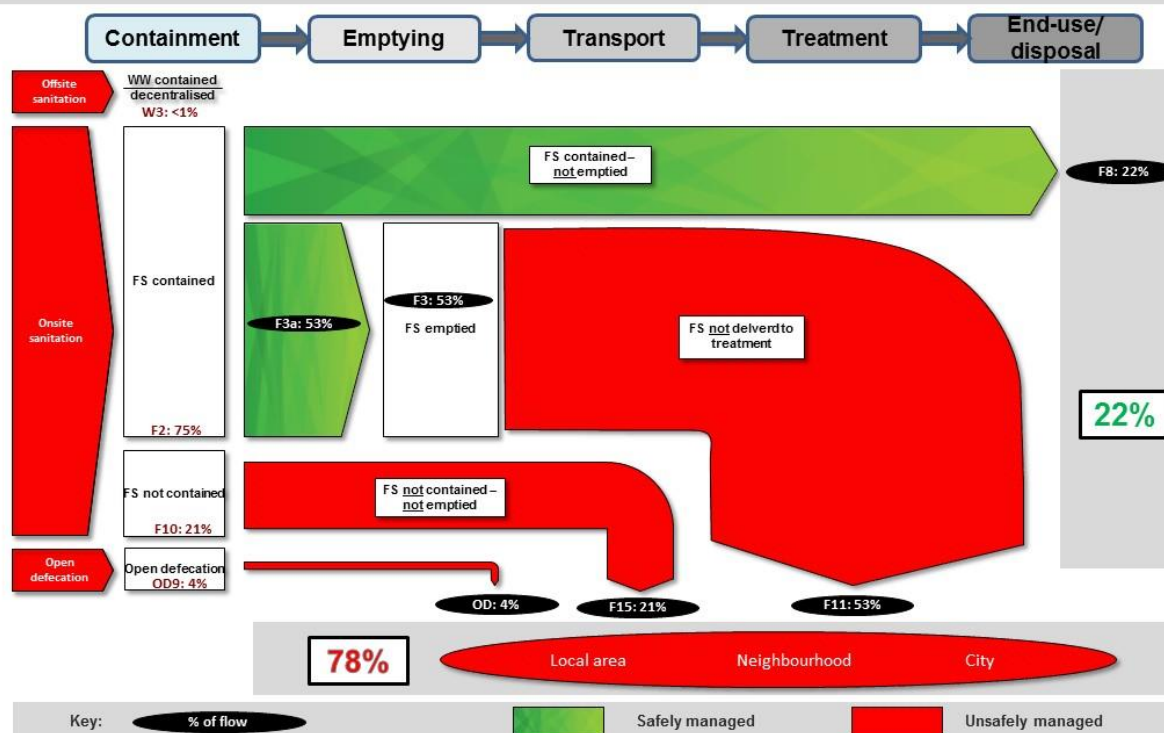
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1. The Diagram

Axum, Ethiopia, 18 March 2016
Field-based assessment



2. Diagram information

Desk or field based:

The SFD was generated from field-based work.

Produced by:

University of Leeds (UoL) with support from Mr. Haile Dinku, WaSH capacity building consultant from WaterAid Ethiopia.

Collaborating partners:

WaterAid Ethiopia,

Municipality of Axum,

Axum Town Water Supply and Sewerage Service Enterprise

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3. General city information

Axum is in Tigray region in the northern tip of the Ethiopian Plateau at an altitude of 2,100 m above the sea level. The town is 1,041 km

away from the capital, Addis Ababa. The town is structured into four kebeles or wards with a total population of 46,887 out of which 21,778 are males and 25,108 are females, living in a total of 13,790 households. The annual growth rate of the population is set at 2.5%.

Annual temperatures range between 9.3°C and 29.8°C with a mean annual rainfall range between 85.9 ml and 428.1 ml (AXM, 2016g).

The main economic activities are agriculture, tourism and trade.

The town has no sewerage system with the whole population using onsite sanitation technologies, mainly pit latrines. Faecal sludge emptying is done by vacuum trucks and discharged to an open dump.

4. Service delivery context

The Federal Democratic Republic of Ethiopia included the protection of public health in the 1995 National Constitution. The 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”.

At national level, a seven year program (2013-2020) under the name of One WASH National Program (OWNP) was launched in September 2013 by the Government of Ethiopia with additional support of UNICEF with a total budget of more than USD \$2 billion (Goyol and Girma, 2015).

In 2013, in order to meet national and global commitments, the GoE developed the Sanitation and Hygiene Strategy, Sanitation Protocol, Strategic Sanitation Action Plan. The plan was created to facilitate changes in the sanitation and hygiene situation in Ethiopia and promote improved sanitation (MoH, 2013).

There are no guidelines, by-laws or directives regarding faecal sludge management. That means that there is no regulation of faecal sludge management in the town. The lack of awareness of people and governmental and local institutions also influences in this inadequacy of regulation (AXM, 2016a; AXM, 2016g).

However, the Health Extension Program (HEP) is an essential service providing advice to families and improving sanitation and waste management practices at household level (AXM, 2016e; AXM, 2016f).

Axum Town Water Supply and Sewerage Service Enterprise (ATWSSSE) manages the town’s water supply network, while the municipality has overall responsibility for faecal sludge management.

Emptying services are provided by private companies who operate under a service agreement with the municipality, using an agreed emptying tariff structure. The municipality also provides with this service but the standard of service is considered to be low and is poorly monitored with no penalties issued for illegal dumping (AXM, 2016a; AXM, 2016g).

5. Service outcomes

The majority of the population use pit latrines (93%), around 3% use flush toilets connected to septic or fully lined (sealed) tanks (with no outlet or overflow) which are mainly found in high-income households and hotels. Approximately 4% of the population practice open defecation (AXM, 2016a).

All solid wastes, including faecal sludge, are unsafely discharged in an open field in the outskirts of the town with no treatment at all (Figure 1). The absence of capacity building in solid and liquid waste management also increases this problem (AXM, 2016a; AXM, 2016c; AXM, 2016d; AXM, 2016g).



Figure 1 Open field used as a dumpsite for all wastes (photo credit: Oscar Veses)

Water supply comes from ground water and surface water sources. There are 6 deep wells and 2 surface water sites for water supply with a total production of 8,905.5 m³/month and water coverage of 63% (AXM, 2016g). Mean water table is greater than 15m and groundwater wells are surrounded by a fence but agriculture and cattle rising are common in the proximities of the wells (AXM, 2016a, AXM, 2016f).

The situation described above is reflected in the SFD which shows that 76% of the excreta generated is considered to be ‘unsafely managed’. Although no data is available on the percentage of pit latrines that are covered when full, that number is estimated to be 24% of the total faecal sludge; this percentage is considered to be safely disposed, as shown on the SFD.

Currently, no budget is available to improve excreta management arrangements and little capacity to implement or operate its components, such as an appropriate treatment plant (AXM, 2016a; AXM, 2016d; AXM, 2016g).

6. Overview of stakeholders

The main stakeholders are outlined in Table 1. The municipality of Axum is responsible for faecal sludge management in the town.

The ATWSSSE has the mandate to deliver water supply and sewerage in the town. However, as there is currently no sewerage system, it only manages the water supply service.

Health Extension Workers (HEWs) are the main actors in advising people at household level to carry out good WaSH practices.

The municipality and one private company are responsible to provide emptying services and the government at regional level provide with funding to the WaSH sector.

Key Stakeholders	Institutions / Organizations /
Public Institutions	Municipality of Axum Water Utility (ATWSSSE) HEWs Axum Health Office
Private Sector	One private emptying service provider
Development Partners, Donors	Several international institutions and NGOs

Table 1 Key stakeholders

7. Credibility of data

The main data sources include published national level WaSH policy and implementation documents – these are available online with public access. However, a literature search revealed that no local or town level documents are available with public access. The visit was therefore essential to collect data on WaSH services and, in particular, to gain access to unpublished reports on service outcomes and details of future plans for the sanitation sector in the town.

The main uncertainties of the data are the percentage of people using onsite technologies and the percentage of the population that use pit latrines that are covered and safely abandoned when full.

8. Process of SFD development

All data were collected by unstructured Key Informant Interviews (KIIs). The unstructured interviews were useful in gaining access to unpublished reports, including first-hand information on the drinking water monitoring procedure and the project on a new wastewater treatment plant under construction in the University of Axum. Some of the interviews were conducted jointly with a group of stakeholders. This allowed for an open discussion and cross-checking of data.

KIIs were conducted with senior representatives of the public institutions. In addition, five KII were conducted with representatives from several institutions at national level, including the Ministry of Water, Irrigation and Energy (MoWIE) and the Ethiopian Institute of Architecture in order to provide a general view on the WaSH situation at country level.

After collecting all necessary data, the SFD was produced using the SFD calculation tool and shared with the stakeholders who collaborated in the data collection (WaterAid Ethiopia).

9. List of data sources

AXM, 2016a. Interview with Mesfin Biru, Axum water supply office manager.

AXM, 2016c. Interview with Kinife Brhane, chemical engineer from Axum beautification and sanitation.

AXM, 2016d. Interview with Asmehash Ameviya, environmentalist expert from Axum beautification and sanitation.

AXM, 2016g. Interview with Kibrem Leare, head of water development and distribution department from Axum water supply office.

Goyol, K., Girma, A. 2015. One WaSH national program (OWNP) Ethiopia: A SWAp with a comprehensive management structure. 38th WEDC International Conference, Loughborough, England.



MoH (Ministry of Health), 2013. National Sanitation Marketing Guideline. June 2013, Addis Ababa, Ethiopia.

SFD Axum, Ethiopia, 2016

Produced by:

UoL, Oscar Veses

UoL, Barbara Evans

UoL, Andy Peal

WaterAid Ethiopia, Haile Dinku

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Abbreviations

ATWSSSE	Axum Town Water Supply and Sewerage Service Enterprise
CSA	Central Statistical Agency
CSO	Civil Society Organization
EEPA	Ethiopian Environmental Protection Authority
ETB	Ethiopian Birr
EWRMP	Ethiopian Water Resource Management Policy
FMHCAC	Food, Medicine and Health Care Administration and Control
GTP	General Growth and Transformation Plan
GTP II	General Growth and Transformation Plan II
GoE	Government of Ethiopia
HEP	Health Extension Program
HEWs	Health Extension Workers
KII	Key Informant Interview
JMP	Joint Monitoring Program
MDG	Millennium Development Goal
MWA	Millennium Water Alliance
MoE	Ministry of Education
MoFED	Ministry of Finance and Economic Development
MoH	Ministry of Health
MoWIE	Ministry of Water, Irrigation and Energy
SNV	Netherlands Development Organization
NPHOSS	National Protocol for Hygiene and “On-Site” Sanitation
NWI	National WaSH Inventory
OWNP	One WaSH National Program
UAP	Universal Access Plan
UNICEF	United Nations Children's Fund
WASH	Water Sanitation and Hygiene
WC	Water Closet
WIF	WaSH Implementation Framework
WRDF	Water Resources Development Fund
WASH	Water Sanitation and Hygiene
WHO	World Health Organization

1 Town context

Axum is a town situated in Tigray region in the northern tip of the Ethiopian Plateau at an altitude of 2,100 m above the sea level. The town is 1,041 km away from the capital, Addis Ababa (Figure 1). The town is structured into 4 kebeles or wards with a total population of 46,887 out of which 21,778 are males and 25,108 are females, living in a total of 13,790 households. The annual growth rate of the population is set at 2.5%.

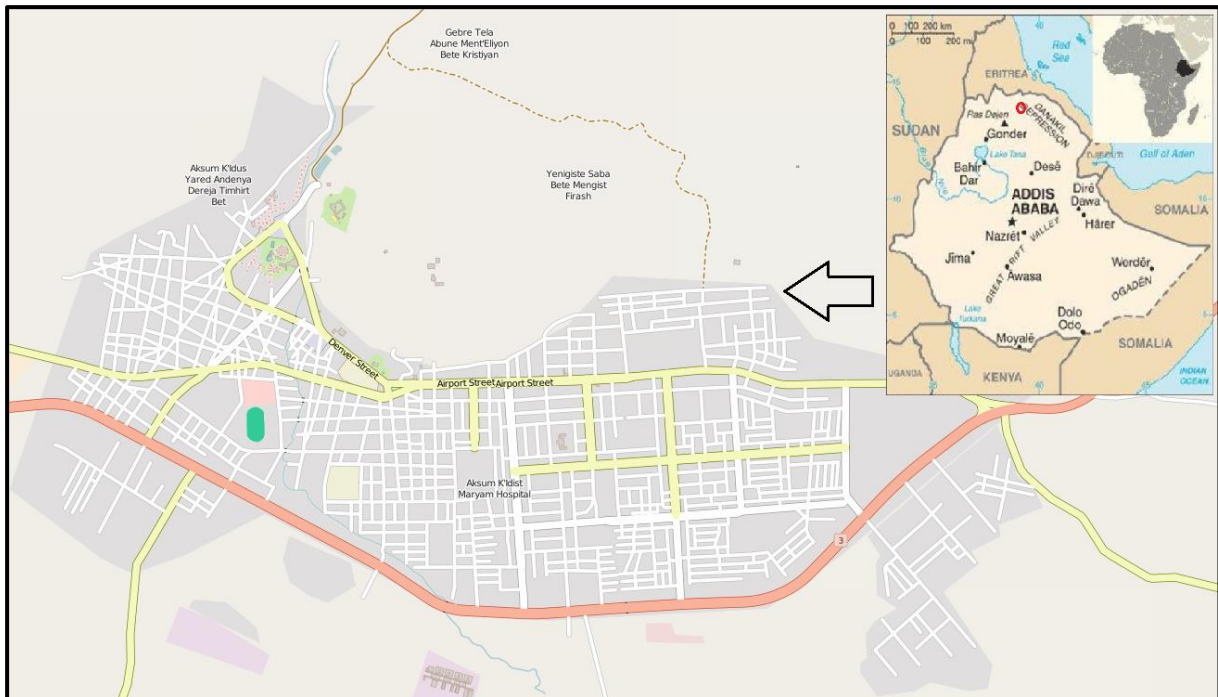


Figure 1: Location of Axum. Adapted from (Lindfors, 2010) and (OPS, 2016).

Axum annual temperatures range between 9.3°C and 29.8°C. The driest month is December, with 1 mm of rainfall while the greatest amount of precipitation occurs in July, with an average of 221 mm (AXM, 2016g; CD, 2016). The main economic activities are agriculture, tourism and trade.

2 Service delivery context analysis

2.1 Policy, legislation and regulation

2.1.1 Policy

The Federal Democratic Republic of Ethiopia included the protection of public health in the 1995 National Constitution. The 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”.

Since that time, several documents have been redacted to guide the implementation of national policies regarding water and sanitation (WaSH) developed by the government. The main ones are listed as follows:

- 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 (EWRMP) developed in 1999 by the Ministry of Water Resources, currently the Ministry of Water, Irrigation and Energy (MoWIE), aimed to promote the development of adequate management of water resources in Ethiopia to contribute to the accelerated economic growth of the country.

In 2002, decentralization of powers and functional responsibilities from federal to local government was a major step toward the development of WaSH infrastructures (WaterAid, 2013). In 2006, 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 sanitized households) in primarily rural or peri-urban environments” (MoH, 2006).

In 2010, the General Growth and Transformation Plan (GTP), developed by the Ministry of Finance and Economic Development (MoFED), is the first phase to attain the goals and targets set in the Millennium Development Goals (MDGs) at a minimum, 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 whatsoever (MoFED, 2010).

A seven year program (2013-2020) under the name of One WASH National Program (OWNP) and the related WaSH Implementation Framework (WIF), was launched in September 2013 by the Government of Ethiopia (GoE) with additional support of UNICEF with a total budget of more than USD \$2 billion, the largest ever developed in the WaSH sector in Ethiopia (Goyol and Girma, 2015). The Program will be carried out in seven years and accomplished in two phases; Phase I from July 2013 to June 2015 and Phase II from July 2015 to June 2020. This program is the main tool of the GoE to achieve the targets for sanitation and hygiene proposed in the Universal Access Plan (UAP), outlined in section 2.2.1.

In Axum, there are no guidelines, by-laws or directives regarding faecal sludge management. That means that there is no regulation of faecal sludge management in the town. Nowadays, the plan is to collect the faecal sludge at household level and discharge it in an open field with no treatment at all. The lack of awareness of people and governmental and local institutions also influences in this inadequacy of regulation (AXM, 2016a; AXM, 2016g).

However, the Health Extension Program (HEP) is an essential service providing advice to families and improving sanitation and waste management practices at household level (AXM, 2016e; AXM, 2016f). Thus, there needs to be more coordination among the institutions and a clear strategy to address urban sanitation.

2.1.2 Institutional roles

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 (HEWs). 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 whereas the Ministry of Education (MoE) tries to build an education and training system which assures quality and equity education. The Ministry of Finance and Economic Development (MoFED) is responsible for budgeting and managing economic resources in both federal and regional governments.

In recent years, profound dialogue and collaboration between the MoWIE, MoE and MoFED has been carried out to monitor and report the status of WaSH in the country including the launch of the OWNPN, among others (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”).

The organizational arrangements of the OWNPN are depicted in Figure 2.

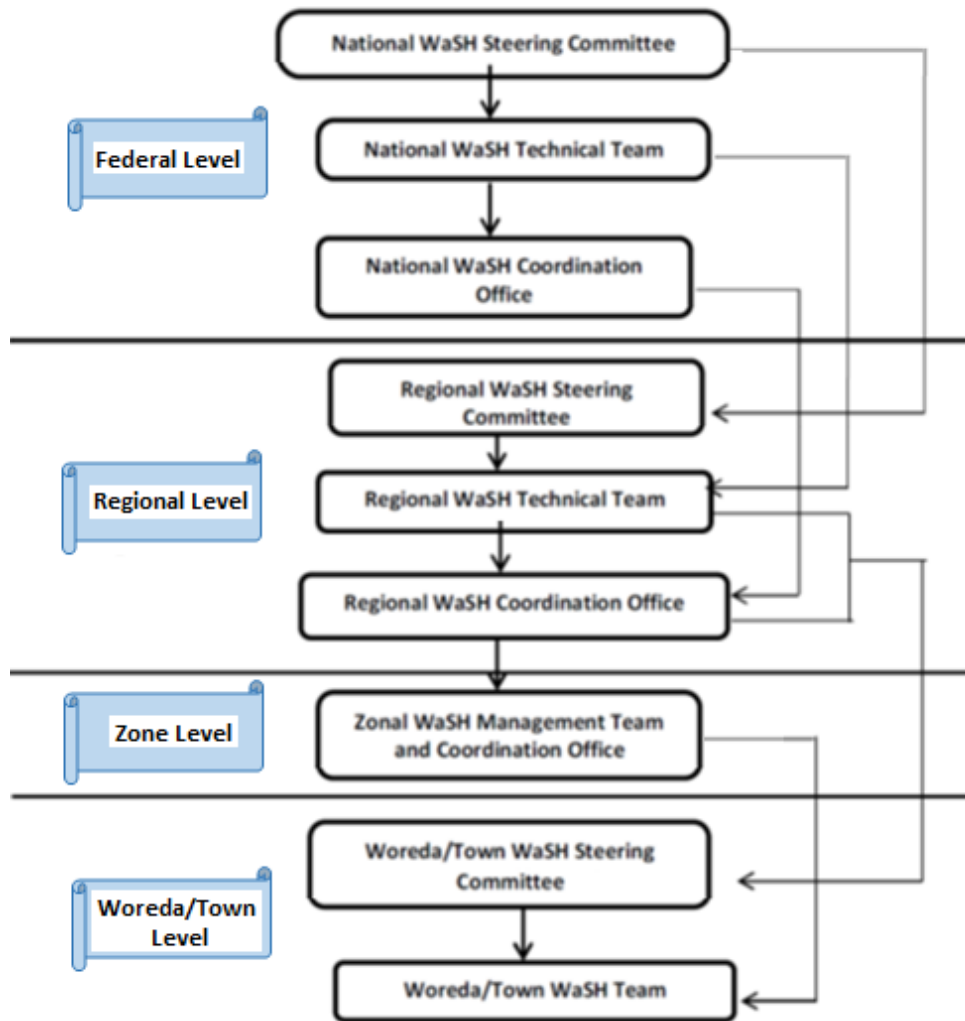


Figure 2: Organizational arrangement for OWNPs implementation. Adapted from (GoE, 2013a).

A summary of the institutional roles of each WaSH structure is presented in Table 1.

In addition to those institutions, about 100 Civil Society Organizations (CSOs) work in water and sanitation service delivering, hygiene promotion, piloting new approaches and reaching remote areas and groups. CSOs have also created the Water and Sanitation Forum to coordinate planning and implementation of WaSH activities even in conjunction with the Millennium Water Alliance (MWA) (GoE, 2013a).

Table 1 Summary of the duties and responsibilities of WaSH structures. Adapted from (GoE, 2013a).

Institution	Duties and Responsibilities
National WaSH Steering Committee	-Reviews and endorses the National WaSH Strategic Plan and Annual WaSH Plans -Oversees the proper functioning of the WaSH Program
National WaSH Technical Team	-Regularly monitors program implementation -Designs programs for experience-sharing within and outside the country
National WaSH Coordination Office	-Preparation of manuals, guidelines and generic training materials -Maintains national WaSH management systems and records -Promotes and facilitates national networks among WaSH actors
Regional WaSH Steering Committee	-Ensures the establishment and functioning of WaSH structures in the region
Regional WaSH Technical Team	-Facilitates inter-sectoral communication and cooperation -Regularly monitors program implementation and provides guidance
Regional WaSH Coordination Office	-Ensures Woredas have consolidated WaSH plans -Maintains regional WaSH management systems and records
Woreda WaSH Team	-Prepares consolidated Woreda WaSH plans (strategic and annual) -Review and monitor WaSH program implementation at woreda level -Support training and engagement of artisans in the private sector

Finally, The Urban Health Extension Program (UHEP) targets the wellbeing of urban populations through selected high-impact interventions, which include improving sanitation and waste management services and practices (AXM, 2016e; AXM, 2016f). There are 18 HEWs (plus 2 supervisors) directly addressing the community on sanitation and hygiene education and promotion based on 16 health packages (WaterAid, 2013).

2.1.3 Service provision

Except Addis Ababa, equipped with a sewage system to serve part of the town and an ongoing project to expand it (ETP, 2016a; ETP, 2016c), the rest of the cities in Ethiopia have onsite sanitation systems. Service provision is maintained by the following institutions (Stolz et al. 2013; ETP, 2016e):

- Sewage utilities. Septage collection, treatment and disposal is mainly conducted by the utilities. They are also responsible for technical interventions, operation and maintenance, customer services and financial and administrative aspects.
- Sanitation and beautification agencies. They administer public latrines.
- Municipality. In some cities, municipalities provide septage collection, treatment and disposal.

Axum Town Water Supply and Sewerage Service Enterprise (ATWSSSE) is the organization that should be in charge of sewerage management. However, the municipality is currently in charge of faecal sludge management in the town with a signed agreement with the private sector. The municipality owns a vacuum truck with a capacity of 8m³ to provide emptying services. There is also one private company operating and providing this service. In both cases, customers pay the same tariff for the service (AXM, 2016a; AXM, 2016g).

In the future, the city administration is planning to transfer the management of the faecal sludge to the ATWSSSE (AXM, 2016a; AXM, 2016f).

2.1.4 Service standards

Following the Ethiopian Constitution, The Food, Medicine and Health Care Administration and Control (FMHCAC) 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).

Although there are national quality standards regarding the maximum concentration of several chemicals that can be discharged into the receiving waters for several industries such as tanneries or processing of steel, among others (EEPA, 2011), there are no quality standards set for wastewater or sludge disposal.

However, in the “Guidelines for Social, Environmental and Ecological Impact Assessment and Environmental Hygiene Impact Assessment and Environmental Hygiene in Settlement Areas”, a draft from the Ethiopian Environmental Protection Authority (EEPA) from 2004, it is stated that “latrines should be connected to digesters to produce both biogas and slurry as organic fertilizer. As a minimum, they should be connected to a compost pit and the human waste should be used to produce compost”.

Table 2 Articles related to WaSH in Proclamation No. 661/2009.

Waste handling and disposal (art. 30)	Availability of toilet facilities (art. 31)
<p><u>30/1.</u></p> <p>“No person shall collect or dispose solid, liquid or other wastes in a manner contaminating the environment and harmful to health”</p>	<p><u>31/1.</u></p> <p>“Any institution providing public service shall have the obligation to organize clean and adequate toilet facilities and keep it open to its customers”</p>
<p><u>30/2.</u></p> <p>“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”</p>	<p><u>31/2.</u></p> <p>“Any city or rural administration shall be responsible to provide public toilet and ensure its cleanliness”</p>
<p><u>30/3.</u></p> <p>“It is prohibited to discharge untreated waste generated from septic tanks, seepage pits, and industries into the environment, water bodies or water convergences”</p>	<p>----</p>

The WaSH situation in Axum has improved recently but several problems and challenges such as budget allocation, the unsafe disposal site and the low attention of political leaders to faecal sludge management need to be addresses in the near future (AXM, 2016d).

Reports related to socio-economic aspects of the city as well as water quality assessments are not published online and were only accessible locally. However, both the municipality and the ATWSSSE provided any document, study or report if it was requested and available, always collaborating in the process of data collection.

At local level, there is a lack of data availability and reliability regarding the percentage of people using onsite sanitation technologies. However, at national level, the CSA conducted a survey in 2007 where this information could be extracted. More recently, the Axum Town Health Office conducted a survey with up-to-date information on this (AXM, 2016e).

It is known that illegal dumping occurs in Axum but there is a lack of law enforcement (AXM, 2016a; AXM, 2016g). Motorised emptying is the common way to empty the sanitation technologies as explained in section 3.5.

2.2 Planning

2.2.1 Service targets

Ethiopia's water and sanitation coverage was reported as 19% and 5% respectively in 1990 (Defere, 2015). Since that time, important progress has been achieved. The Millennium Development Goal (MDG) target was to achieve a 56% of people with sanitation coverage. According to the National WaSH Inventory (NWI), in 2011 national access to water supply and sanitation was 52.1% and 63%, respectively (GoE, 2013b), suggesting almost a complete accomplishment of the MDG target.

Despite that improvement, those numbers indicate that the practice of open defecation (37%, over 35 million people from 2011 data) result in a risk of disease infection and/or transmission. However, there are differences between people living in rural areas practicing open defecation (43%) and people living in urban areas (8%) (Jones, 2015).

The GoE developed the Universal Access Plan (UAP), a document setting the following targets for sanitation and hygiene within the government's policy (Girma and Suominen, 2013):

- 98.5% access to water supply, and reduction of the proportion of non-functioning facilities to 10%.
- All Ethiopians will have access to basic sanitation by 2015.
- 77% of the population will practice hand washing at critical times.
- Safe water handling and water treatment at home.
- 80% of communities in the country will achieve open defecation free status.

Targets after 2015 and the following years, proposed by the World Health Organization (WHO), the Joint Monitoring Program (JMP) and UNICEF have also been set and are outlined in Table 3 (JMP, WHO/UNICEF, 2013).

Table 3 Proposed targets for WaSH within the years 2025-2040.

	Water	Sanitation	Hygiene
2025		*Open defecation free status.	
2030	*Universal basic drinking water in schools and health centres. *Universal basic drinking water at home.	*Universal adequate sanitation in schools and health centres.	*Universal adequate handwashing in schools, health centres and households.
2040	*Progress towards intermediate drinking water at home.	*Universal adequate sanitation at home. *Progress towards safe management of excreta.	

Emptying of pit latrines, septic tanks or fully lined (sealed) tanks is carried out by either the municipality or a private company; customers pay a tariff for this service. According to the Axum Town Health Office (AXM, 2016e, AXM, 2016f), the percentage of people practicing open defecation is low (around 4%).

There is no plan to build a sewerage network and wastewater treatment plant for the town due to a budget limitation (AXM, 2016a).

In addition to that, proper access to drinking water needs to be improved to meet the proposed targets for WaSH within the years 2025-2040 since the water supply coverage is 63% of the population, as it will be showed in section 3.7.

2.2.2 Investments

The OWNP objective is “to contribute to improving the health and well-being in rural and urban areas by increasing water supply and sanitation access and the adoption of good hygiene practices in an equitable and sustainable manner” (GoE, 2013b). The total budget is distributed in four main components: Rural and Pastoral WaSH, Urban WaSH, Institutional WaSH and Program Management and Capacity Building. The costs of these components are shown in Table 4.

Table 4 Distribution of the budget designated for WaSH in the OWNP.

Component	Destination	Water supply¹	Sanitation and hygiene¹
1	Rural and Pastoral WaSH	USD 1.03 billion	USD 0.4 billion
2	Urban WaSH	USD 786 million	USD 95.7 million
3	Institutional WaSH	USD 545.7 million	
4	Program Management and Capacity Building	USD 178.8 million	

¹USD exchange rate in 2013

Urban WaSH budget designated to sanitation and hygiene is mainly assigned to desludging equipment and facilities and management of wastewater and public toilets in selected locations. Institutional WaSH budget is designated to improve water supply, sanitation facilities and hygiene practices at health institutions and schools (GoE, 2013b).

USD78.6 million (out of USD178.8 from the component 4) are designated for urban WaSH program management and capacity building, including training, post-construction management support, equipment, tools, and support to monitoring and reporting. Finally, there is also an amount of money from the project designated to train WaSH professionals (GoE, 2013b).

Apart from the OWNPN, the GoE created in 2002 the Water Resources Development Fund (WRDF) to promote development of viable and sustainable urban water supply and sanitation services throughout the country (GoE, 2013b). International aid funding plays an essential role for funding WaSH activities since 61% of water budget and 70% of sanitation budget is financed by external agencies such as donors and NGOs (Girma and Suominen, 2011). Donors involved in the WaSH sector include the Department for International Development, the European Development Bank, the World Bank and the Government of Italy. International NGOs such as WaterAid, Netherlands Development Organization (SNV), Plan International and about 70-100 local NGOs are active in the sector (Stolz et al. 2013).

There is no budget assigned for the construction of new facilities such as pit latrines since the national policy states that the household itself has the obligation to build its own pit latrine (or any other sanitation system) to contain the faecal sludge (AXM, 2016a).

Finally, the promotion of activities related to the WaSH sector at household level mainly lies on the Health Extension Workers (HEWs).

2.2.3 Policy and Program Initiatives

A further revision of the GTP, currently under development (GTP II), includes a target to increase the proportion of households using latrines to 93% in all Ethiopia by 2017 (Jones, 2015).

2.3 Reducing inequity

2.3.1 Current choice of services for the urban poor

There is no sewerage system and thus, no offsite sanitation options available. All people use onsite sanitation facilities, no matter of their social status.

Although there is an obligation for each new household to have a pit latrine, the poor people who cannot afford to build one rely on communal or public latrines since the government or the municipality does not provide any kind of funding for such purpose (AXM, 2016a; AXM, 2016g).

The practice of open defecation has decreased in the period 2007-2015, going from 42% down to around 4% according to the municipality of Axum (AXM, 2016a).

2.3.2 *Plans and measures to reduce inequity*

The OOWNP states that, first it is necessary to identify and target areas with low access to safe water or improved sanitation and once they are identified, propose priority action plans to reduce inequity in the areas identified. In concordance with this, reducing regional and social disparities in access to safe drinking water and improved sanitation must be accomplished. Gender disaggregated indicators are to be used to track gender equity in roles and benefits (GoE, 2013b).

The budget for the OOWNP clearly prioritizes the water supply over sanitation and hygiene both at rural and urban levels (Table 4). This is in concordance with previous reports where different policies in developing countries have been assigning higher budget and thus, more importance, on water supply over sanitation and hygiene over the last years (Sandec/Eawag, 2015).

One of the major problems, not only in Axum but also in all Ethiopia, is the lack of awareness of people (and also the local authorities) regarding WaSH (AXM, 2016a; AXM, 2016d; AXM, 2016f, ETP, 2016a; ETP, 2016d). For that reason, the Health Extension Program (HEP) “targets the wellbeing of urban populations through selected high-impact interventions, which include improving sanitation and waste management services and practices (ACIPH, 2015)”.

All HEWs in Axum are females, previously trained as nurses, becoming HEWs after training according to the policy developed by the MoH. Each HEW is responsible for the training of different households on education, awareness creation and monitoring of the WaSH practices (WaterAid, 2013; AXM, 2016e; AXM, 2016f). HEWs provide advice and capacity building on how to make a latrine, how to manage properly solid and liquid wastes at household level, good hygiene practices, etc.

There are no initiatives to produce compost or biogas from faecal sludge (AXM, 2016a; AXM, 2016g).

2.4 Outputs

2.4.1 *Capacity to meet service needs, demands and targets*

According to the municipality, although there is some room for improvement, the capacity to meet service needs, demands and targets is fine (AXM, 2016a). However, there is still a gap between the required solid waste to be collected and the theoretical faecal sludge generated in the town, discussed in section 3.8. While a lack of coordination between the municipality and the ATWSSSE, a lack of skilled people, and the need for a better laboratory for water quality analyses remain unsolved challenges (AXM, 2016a; AXM, 2016g).

2.4.2 *Monitoring and reporting access to services*

Before 2004, all WaSH interventions in the country were project-based and therefore, there was no integration between water supply, sanitation and hygiene. However, GoE’s policy on the WaSH sector is now being addressed jointly. That is the reason why MoH, MoWIE, MoE and MoFED share the responsibility for achieving WaSH targets set by the GoE’s policy (GoE, 2013b).

The OWNP entitled the MoH to operate a monitoring system to develop one plan, one budget and one report for the WaSH sector (Jones, 2015). In Table 5, a summary of the monitoring responsibilities from organizations at different levels currently being taken by the WIF under the frame of the OWNP is presented.

Table 5 Summary of monitoring responsibilities at different levels. Adapted from (Jones, 2015).

Institution	Responsibilities
<i>Kebele WaSH Teams</i>	<ul style="list-style-type: none"> - Study data and complete analysis of Kebele WaSH situation - Prepare monthly, quarterly and annual WaSH progress reports and send the Woreda - Conduct quarterly WaSH progress review meeting with WaSH stakeholders
<i>Woreda WaSH Team</i>	<ul style="list-style-type: none"> - Conduct technical assessment every 3 years - Prepare monthly, quarterly and annual WaSH progress reports and send the Zone/Regions - Conduct quarterly WaSH progress review meeting with WaSH stakeholders
<i>Region/ Zone Coordination Office</i>	<ul style="list-style-type: none"> - Prepare Regional Annual WaSH Plan - Prepare monthly, quarterly and annual WaSH progress reports and send the National WaSH Coordination Office - Conduct quarterly WaSH progress review meeting with WaSH stakeholders
<i>National WaSH Coordination Office</i>	<ul style="list-style-type: none"> - Prepare and propose investment plan, loan/grant applications and national annual WaSH plan - Prepare monthly, quarterly and annual WaSH progress reports

Between 2010 and 2011, a National WaSH Inventory in all regions (Somali region was later added in 2014) was carried out by the MoWIE with financial support from the World Bank and UNICEF (ETP, 2016b). This has provided the country with a first baseline of the WaSH sector at a national level. Furthermore, a successful initiative between UNICEF and Akvo (a not-for-profit foundation) used mobile phone software (Akvo FLOW) to collect WaSH inventory data in the Somali region in 2014 has the potential to open new possibilities on future data gathering and analysis (Jones, 2015). It can be said that both the development of OWNP and NWI has strengthen the monitoring and reporting activities of the WaSH sector in the country but needs further follow up (Jones, 2015).

All census studies regarding population and sanitation preferences among people are carried out by government institutions and by the municipality at local level. Reports on the town background and the water supply and monitoring analysis were only accessible upon arrival on the town since neither of them was published on the internet.

Despite the agreement between the municipality and the private sector for providing service on the faecal sludge management, there is a problem in terms of lack of monitoring of service standards (AXM, 2016a; AXM, 2016c; AXM, 2016d). Both the municipality and the ATWSSSE are aware of the problem of the unsafe final disposal of the faecal sludge and stated that they are willing to increase the communication and coordination between those two organisations (AXM, 2016a; AXM, 2016d; AXM, 2016g).

2.5 Expansion

2.5.1 *Stimulating demand for services*

Although there is not much experience in sanitation marketing in Ethiopia, part of the national budget for OWNP is assigned to urban WaSH program management and capacity building as mentioned in section 2.2.2. The responsibility of promoting household sanitation and good hygiene practices lies in the town health office under the town/city administration. The idea of using trained HEWs for sanitation and hygiene promotion at household level was launched by the GoE and increased the WaSH promotion in the country (Stolz et al. 2013).

The GoE developed a National Sanitation Marketing Guideline to foster sanitation marketing and promote, with the participation of the private sector, the use of different technologies to assess sanitation issues. The guideline also includes approaches including micro and small enterprise development agencies, microfinance institutions and technical and vocational education and trainings in the woredas to identify and develop appropriate environments for the private sectors (MoH, 2013).

In order to meet national and global commitments, the GoE developed in 2013 the Sanitation and Hygiene Strategy, Sanitation Protocol, Strategic Sanitation Action Plan. This plan was created to facilitate changes in the sanitation and hygiene situation in Ethiopia and promote improved sanitation (MoH, 2013).

There are no compensations for avoiding illegal dumping, but there is no proper disposal site either. This issue, in conjunction to the lack of legislation regarding faecal sludge management, constitutes one of the main challenges that need to be addressed (AXM, 2016a; AXM, 2016d). As previously stated, the HEWs are the main actors in order to advice people on the importance on having an adequate WaSH practices at household level.

2.5.2 *Strengthening service provider roles*

The OWNP includes a section to promote and strengthen private sector capacity by generating information, training and business opportunities in the WaSH sector (GoE, 2013b). According to Stolz et al. (2013), there are several individual consultants and consultancy companies doing capacity building activities in the WaSH sector. However, there is no policy framework for private-sector engagement on faecal sludge management or any particular government institution responsible for promoting private-sector engagement in urban waste management (ACIPH, 2015).

The National Hygiene & Sanitation Strategic Action Plan for Rural, Per-Urban & Informal Settlements in Ethiopia is a guideline that includes several targets such as capacity building of the private sector, creation of lines of credit, development and promotion of products and services that respond to consumer preferences (GoE, 2011). However, it is only targeted for rural, per-urban and informal settlements, not for urban areas (GoE, 2011).

There is a project to build a dam outside Axum to provide water supply and energy to the area to be completed in the following years (AXM, 2016g). However, there is no budget or skilled people to build an appropriate sanitary landfill or faecal treatment works (AXM, 2016a; AXM, 2016d; AXM, 2016g).

All wastes, including faecal sludge, are unsafely discharged in an open field in the outskirts of the city. The absence of capacity building in solid and liquid waste management also increases this problem (AXM, 2016a; AXM, 2016c; AXM, 2016d; AXM, 2016g).

3 Service Outcomes

3.1 Offsite technologies

There is no sewerage system (AXM, 2016a).

3.2 Onsite technologies

All solid and liquid wastes are collected and discharged to an open field on the outskirts of the town (AXM, 2016a; AXM, 2016d; AXM, 2016g).

3.2.1 Flush toilets

Flush toilets (locally known as water closets) are only found in high-income households and hotels. All flush toilets are connected to fully lined tanks (sealed) with no outlet (often referred to locally as septic tanks).

3.2.2 Pit latrines

These latrines mainly consist of a slab over a pit. Pit latrines are used by the majority of the population (AXM, 2016a).

3.2.3 Improved latrines

People who can afford to build an improved latrine (VIP latrine) to reduce fly and odour nuisance by ventilating the pit by means of a pipe, use this type of latrine (AXM, 2016a).

3.3 Usage

Table 6 shows a comparison of data from two sources on usage of sanitation technologies by percentage of population. These include a study carried out by the CSA in 2007 (CSA, 2007) and estimates provided by the Axum Town Health Office.

Table 6 Percentage of people using different sanitation technologies according to two data sources.

	CSA (2007)	Axum Town Health Office (2016)
No toilet	42%	4%
Flush toilet	20%	3%*
VIP latrine	10%	93%
Pit latrine	28%	

*The 3% is calculated by subtracting the 97% (93%+4%) from the 100%

3.4 Categories of origin

Categories of origin can be classified as households, shared or communal latrines, public toilets and institutional toilets. A brief description of each origin is presented as follows.

3.4.1 Households

The majority of people use pit latrines or VIPs (Table 6). According to the urban health extension program coordinator (AXM, 2016e), 59% of the households have complete hand washing facilities (water and soap).

3.4.2 Shared or communal latrines

People with less economic resources who cannot afford to build a latrine use shared or communal latrines.

3.4.3 Public toilets

There are 20 public toilets (Figure 3), which consist of several latrines equipped with a slab. Toilets for male and females are separated and users are charged 0.15 ETB per use (AXM, 2016g).



Figure 3: Inside and outside of a public latrine (photo credit: Oscar Veses).

3.4.4 Institutional toilets

In places such as educational institutions, public institutions, hospitals, and some local restaurants and hotels the use of pit latrines are the preferred option. However, in high standard hotels, lodges, etc., a flush toilet connected to a septic or a fully lined (sealed) tank is the normal arrangement.

3.5 Motorised Emptying

Motorised emptying is the main option used to empty the pit latrines or septic tanks and fully lined (sealed) tanks. This is carried out by the municipality and one private company. The truck owned by the municipality has a capacity of 8 m³ (Figure 4). A total amount of 350 ETB are charged to the people for providing the emptying service and transport the sludge to the disposal site. That amount is fixed for all people, regardless of the distance of the household

or hotel to the dumpsite. The truck is equipped with a long hose in case the latrine is not easily reachable (AXM, 2016c; AXM, 2016d, AXM, 2016g).



Figure 4: 8m³ vacuum truck owned by the municipality (photo credit: Oscar Veses).

3.6 Treatment, end-use and disposal

There is one disposal site (an open field) where all kind of wastes (organic, inorganic, solid and liquid wastes) coming from industries, households, public and private institutions are disposed (Figure 5a, b). This open field has no protection such a fence or any proper design (drainage line, multiple layer design, etc.) to handle any waste. During the visit, strong odours were noticeable in the site and some kids were found playing around, clearly representing a potential health risk.



Figure 5a, b: Dumpsite (photo credit: Oscar Veses).

Water runoff is collected in a drainage system distributed through the city with no treatment at all. This network can also serve for grey water collection points and even for improper solid waste disposal as seen in Figure 6.



Figure 6: Drainage system (photo credit: Oscar Veses).

Despite the improper way of handling wastes, there is no plan to build a sanitary landfill or any faecal sludge treatment works to treat and re-use/dispose of wastes in a proper way. However, the University of Axum has already started to build a wastewater treatment plant but only to serve the university campus (Figure 7).



Figure 7: New wastewater treatment plant under construction in Axum University (photo credit: Oscar Veses).

3.7 Drinking water supplies in the town

Water supply is coming from ground and surface water sources. There are six deep wells (Figure 8a) and two surface water sites for water supply with a total production of 8,905.5 m³/month (AXM, 2016g). Groundwater wells are surrounded by a fence but agriculture and cattle rising are common in the proximities of the wells.

Water coverage is 63% assuming a water requirement of 60 litres per capita and per day. However, there is a plan from the ATWSSSE to dig more wells and increase the water production to raise this water coverage (AXM, 2016a). There is also an ongoing project to build a dam about 30 km away from Axum to provide water supply and energy to the area with a budget of 1 billion ETB (AXM, 2016g).

Water is stored and chlorinated in reservoirs as the one showed in Figure 8b before being distributed to the town. This distribution network includes private and public taps to serve the general public. The free chlorine is maintained in the range of 0.2-0.8 mg/l.



Figure 8: a) Groundwater well. b) Water reservoir provided with a chlorine dispenser (photo credit: Oscar Veses).

Water quality is evaluated through measuring different physico-chemical parameters and biological tests at different wells and surface water points every 6 months by the Mekelle Water Testing Laboratory (Table 7). The ATWSSSE also have a laboratory to measure some parameters including free chlorine on a daily basis. However, the interview with the chemist working in this laboratory stated that more resources should be allocated to improve the quality of the facilities and equipment of the laboratory (AXM, 2016b).

Table 7 Parameters/tests used to assess water quality.

Type	Parameter/test
Physico-chemical	Odour, pH, Temperature, BOD, Iron, Copper, Chromium, Manganese, alkalinity, Magnesium, Calcium, Fluoride, Nitrate, Nitrite, Phosphates, Sulphate, Total Dissolved Solids, Conductivity, Turbidity, Colour, Fluoride
Bacteriological	E-Coli/100ml, Total Coliform/100ml

In 2015, high calcium and magnesium concentrations were measured and reported in some wells (above the WHO and Ethiopian standards). In those cases, higher amount of water from surface points is mixed and thus, concentration of those metals are decreased and water becomes potable (AXM, 2016b).

3.7.1 Ground water pollution assumptions

There are no studies regarding the soil type near the ground water sources in Axum but the mean water table is greater than 15m (AXM, 2016a, AXM, 2016f). All wells are located away from waste disposal sites, latrines, septic tanks and fully lined (sealed) tanks but some cross-contamination due to agriculture and farming activities might occur as stated in section 3.7.

3.7.2 Levels of uncertainty

The main uncertainty of the data is the census on the percentage of people using onsite technologies and the percentage of latrines that are covered and safely abandoned when full. The lack of reliable data resulted in use of the assumptions described below in section 3.8.

3.8 SFD Matrix

The data outlined in Table 6 shows two different data sources regarding the percentage of people using onsite sanitation technologies. It was decided to use the latest data (from the Axum Town Health Office) as this refers to the current situation.

Since there is no data on emptying and transport the following assumption was made. Assuming that humans produce an average of 1 l/day of excreta (around 0.8 l of urine plus 0.2 l of faeces) (Franceys et al. 1992), the total sludge produced per six months is:

$$\frac{1L}{day * person} * 182.5 \frac{days}{6_{months}} * 46,887 person * \frac{1m^3}{1,000L} \approx 8,557m^3$$

According to the municipality, a total of 4,520m³ of faecal sludge per six months is collected and discharged in the dumpsite (AXM, 2016e). Therefore, around 4,037m³/six months (47%) of faecal sludge remains unaccounted for.

From that 47%, 4% is coming from open defecation practises, leaving a 43% of the sludge unaccounted. There is no data that indicates how much of this faecal sludge is safely buried and how much is not safely buried. Therefore it is assumed that 50% of the faecal sludge is safely buried (i.e. the latrines are safely abandoned) and 50% of the faecal sludge is not safely buried (i.e. the latrines are not safely abandoned). Therefore, it is estimated that 21.5% of the total population uses pit latrines that are never emptied but abandoned when full and safely covered with soil – i.e. excreta is safely managed. While 21.5% of the population use pit latrines that are never emptied but abandoned unsafely i.e. excreta is unsafely managed (e.g. pit latrines that are failed, damaged or collapsed, etc.). Of the remainder, 53% of the population uses pit latrines and septic or fully lined tanks (sealed with no outlet or overflow) that are emptied and the faecal sludge either discharged to open drains or at the dumpsite.

Table 8 summarizes the types of the sanitation containment systems currently in use. This table shows the description of the system, how it is defined in the SFD calculation tool and its reference and the percentage of people using each system.

Table 8 Estimation of the containment systems for the SFD matrix calculations.

SFD system description	SFD calculation tool reference	SFD system reference	% of population using system
Open defecation	T1B11C7TOC9	L20	4
Containment (septic tanks and pits) failed, damaged, collapsed or flooded - connected to water bodies, or open ground or 'don't know where'	T1B10C7TOC9	Reference L18	21*
Pit (all types), never emptied but abandoned when full and covered with soil, no outlet or overflow	T1B7C10	Reference L12	22*
Lined pit with semi-permeable walls and open bottom, no outlet or overflow	T1A5C10	Reference L11	51
Fully lined tank (sealed), no outlet or overflow	T1A3C10	Reference L10	2

*Figures are not exactly 21.5 for rounding purposes

4 Stakeholder Engagement

The municipality of Axum was contacted ahead to gain permission to undertake this study. Seven Key Informant Interviews (KIIs) were conducted to primary stakeholders in relation to faecal sludge management in Axum. A telephone call was made upon arrival in Ethiopia to the municipality of Axum (Mr. Haile Dinku from WaterAid kindly did that call in Amharic) to explain the project and to arrange the days of the field trips. Those KIIs included stakeholders from the municipality, one health extension worker, one chemist, etc. All interviews were conducted either in the offices of the stakeholders or during the visits to different places of interest such as the dumping site, the groundwater wells, etc.

In addition to those interviews, five more KIIs were conducted to different stakeholders in Addis Ababa in order to provide with an overview of the sanitation situation in Ethiopia. Previous to the field visit, an introduction letter explaining the project was sent through email to the different stakeholders in Addis Ababa to explain the project and to set up a day for the interview. Those KIIs included stakeholders from the MoWIE, the Ethiopian Institute of Architecture and the Addis Ababa Water and Sewerage Authority, among others.

The town had very few documents available on internet. The visit was essential to collect data and to have access to unpublished reports and documents regarding faecal sludge and solid waste management and water supply. The visit was also essential to gain knowledge

about the current situation of sanitation in Axum as well as for having access to the future plans about the WaSH sector.

Another benefit from the visit was to have first-hand data on the emptying systems used by the emptying service providers and tariffs charged to people for their services. This increases the quality of the data collected and provides with a better understanding of the working capacity, responsibilities and quality of the emptying service provided.

4.1 Key Informant Interviews

All data were collected by unstructured key informant interviews. The unstructured interviews were useful to have access to unpublished reports, first-hand information on the drinking water monitoring procedure and the project on a new wastewater treatment plant under construction in the University of Axum. Some of these interviews were conducted jointly with different stakeholders.

For example, interviews with the head of water development and distribution department from Axum water supply office, the environmentalist expert and the chemist of Axum water supply office were held together during the field visit to the dumpsite. This was helpful to cross-check data regarding the current condition of the dumpsite and the type of treatment given to all wastes (in this case, no treatment at all). Finally, just to mention that all interviewed people answered any question asked and they are willing to participate in further discussions and projects in the future.

4.2 Focus Group Discussions

Unfortunately, focus discussion groups were not carried out since there was a lack of available time. However, as mentioned in section 4.1, some interviews were conducted jointly with different stakeholders, allowing for an interchange of opinions and views regarding the sanitation situation and for data triangulation. Moreover, vivid discussions on the main challenges that need to be addressed were taken during these jointly-made interviews. It is suggested for the future that all the primary stakeholders in the town such as the municipality, the ATWSSSE, the private sector, HEWs, among others, could celebrate a meeting (maybe on a monthly basis) to share their views and interests on the WaSH sector and to address jointly the main problems and challenges of this sector.

4.3 Observation of service providers

Several observations of service providers included the visit to the dumping site, visits to public toilets, interviews with the ATWSSSE staff or HEWs. The field visit to the dumpsite helped to understand how the faecal sludge is disposed and make a visual assessment on the current situation of the disposal site. The visits to the public toilets were useful to understand how the sanitation technologies operate and how they contain the faecal sludge. KIs were conducted during these visits, this allowed for cross-checking of data and also to take photographs to provide credibility on the observations.

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- AXM, 2016d. Interview with Asmehash Ameviya, environmentalist expert from Axum beautification and sanitation.
- AXM, 2016e. Interview with Tikiros Goday, urban health extension program coordinator.
- AXM, 2016f. Interview with Brhu Musu, health extension worker.
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7 Appendix

7.1 Appendix 1: Stakeholder identification

Name of organisation	Name of contact person	Position	Influence (high/medium/low)	Interest (high/medium/low)
AWSO	Mesfin Biru	Manager	High	High
AWSO	Tizozu Glihiwot	Chemist	High	High
Axum beautification and sanitation	Kinfe Brhane	Chemical engineer	Medium	High
Axum beautification and sanitation	Asmehash Ameviya	Environmental expert	Medium	High
Municipality	Tlkiros Goday	Health extension program coordinator	High	High
Municipality	Brhu Musu	HEW	High	High
AWSO	Kibrem Leare	Head	High	High
Ethiopian Institute of Architecture	Tesfaye Hailu	Chair holder of infrastructure design and construction	Low	High
MoWIE	Tamene Hailu	Coordinator of the national WaSH inventory	Low	High
Addis Ababa Water and Sewerage Authority	Ato Yared	Engineer	Low	High
Horn of Africa Regional Environment Centre and Network	Kassahun Bedene	WaSH Project Coordinator	Low	High
JSI	Birhanu Genet	Senior Environmental Health Advisor	Low	High

7.2 Appendix 2: Tracking of Engagement

Comment: List stakeholder that was directly engaged in the study.	Date of Engagement	Purpose of Engagement	Maximum 100 word summary of outcomes
Mesfin Biru	06/02/2016	Introductory call to gain permission to do field work	Interview conducted to provide a view on the WaSH situation and to provide unpublished data and reports on WaSH.
Tizazu Gihiwot	08/01/2016	To know about the water supply in the city	Interview conducted to provide a view on the WaSH situation and to provide unpublished data and reports on WaSH.
Kinfu Brhane	08/01/2016	Gain knowledge on WaSH	Interview to know how the vacuum trucks operate, tariffs of emptying, etc.
Aamehash Ameviya	09/01/2016	To know about the WaSH situation	Information about the drinking water supply and plans to increase the capacity, leakage, water coverage, etc.
Tikiros Goday	09/01/2016	Situation of HEWs and their work	Information on the work of the HEWs was obtained: training, monitoring, etc.
Brihu Musu	09/01/2016	Situation of HEWs and their work	Information on the work of the HEWs was obtained: training, monitoring, etc.
Kibrem Leare	08/01/2016	Field visit to groundwater wells	Information on the groundwater wells: situation, capacity etc.
Tesfaye Hailu	16/12/2015	Introductory email was sent to him to see the willingness to participate in the project	Interview was conducted to gain knowledge about the WaSH situation in Ethiopia on national level.
Tesfaye Hailu	14/01/2016	Introductory email was sent to him to see the willingness to participate in the project	Interview was conducted to gain knowledge about the WaSH situation in Ethiopia on national level.
Tamene Hailu	02/12/2015	Introductory email was sent to him to see the willingness to participate in the project	Interview was conducted to gain knowledge about the WaSH situation in Ethiopia on national level.
Tamene Hailu	15/01/2016	Introductory email was sent to him to see the willingness to participate in the project	Interview was conducted to gain knowledge about the WaSH situation in Ethiopia on national level.
Ato Yared	29/01/2016	Introductory email was sent to him to see the willingness to participate in the project	Interview was conducted to gain knowledge about the WaSH situation in Ethiopia on national level.
Kassahun Bedene	16/12/2015	Introductory email was sent to him to see the willingness to participate in the project	Interview was conducted to gain knowledge about the WaSH situation in Ethiopia on national level.
Kassahun Bedene	14/01/2016	Introductory email was sent to him to see the willingness to participate in the project	Interview was conducted to gain knowledge about the WaSH situation in Ethiopia on national level.
Birhanu Genet	25/11/2016	Introductory email was sent to him to see the willingness to participate in the project	Information about the organizations in charge of WaSH in Ethiopia was acquired

7.3 Appendix 3: SFD matrix

