

SFD Promotion Initiative

Moshi Tanzania

Final Report

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SFD Report Moshi, Tanzania, 2015

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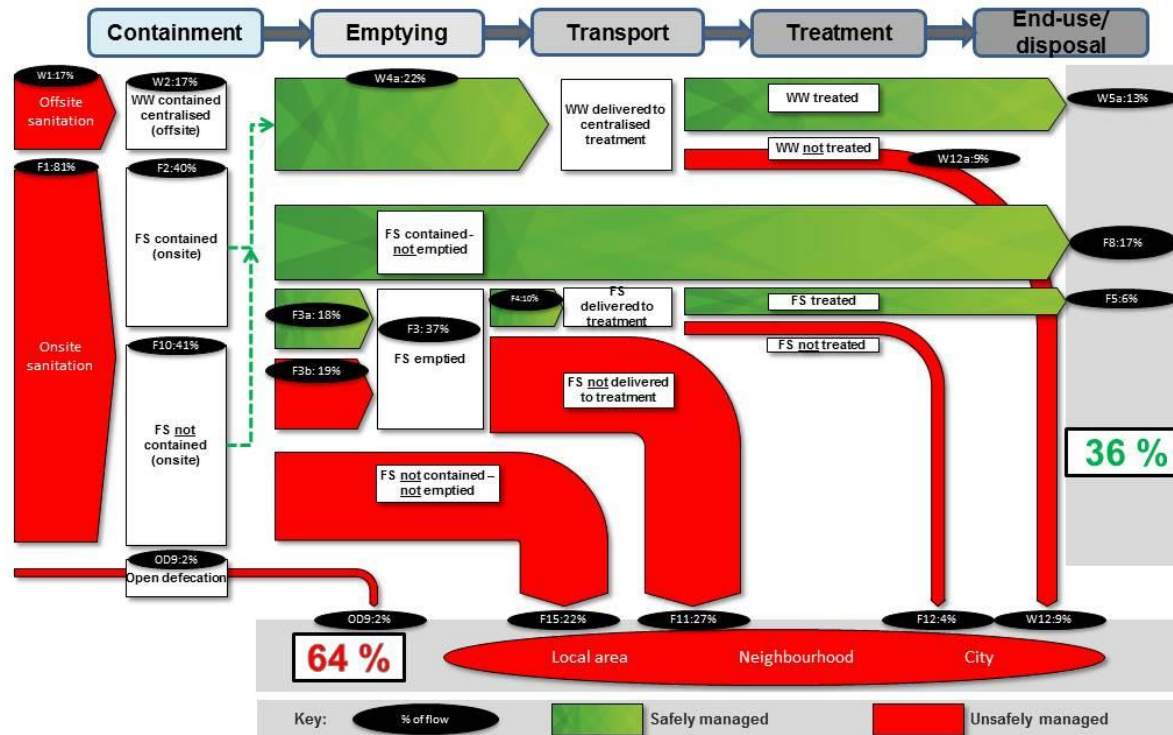
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This Executive Summary and SFD Report are available from:

1. The Diagram

Moshi / Tanzania (23. November 2015)
Desk based

Status: REVIEWED



2. Diagram information

Desk or field based:

This SFD is an update of the previous SFD (October 2014). It was prepared applying the desk-based –approach. Field observations were made but no Focus Group Discussions were held.

Produced by:

The SFD was updated by Lasse Roeder and Younes Hassib with support from Hajo Schaefer (all GIZ). Support was provided further by Sebastian Mgeta from the Moshi Municipal Council and Phulbert Myangue from the Moshi Urban Water Supply and Sewerage Authority (MUWSA).

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3. General city information

Moshi Municipality is located in Kilimanjaro Region, in the North-East of Tanzania. The Municipality is an administrative district in the Kilimanjaro province. Administratively, the municipality is divided into 21 wards and 60 hamlets. Moshi population has grown from a small urban area of less than 10,000 residents (in 1948) to about 185,000 today with an estimated annual growth rate of currently 2.8%.

The literacy rate is appr. 95% and employment rate is appr. 50%. International tourism (Kilimanjaro, Serengeti) is, next to agriculture, one of the industries. There is no seasonal variation in population.

The town is seated on the fertile southern slopes of Mt. Kilimanjaro at an altitude of 950 masl in the north to 700 masl in the south. The climate is moderate tropic with an average annual rainfall of 970mm.

With an area of 58 km² the physical feature of the town is characterized by three distinct parts delimited by the rivers Rau (in the East) and Karanga (in the West).

4. Service delivery context

The Water Supply and Sanitation Act of 2009 constitutes the legal basis for all activities in the sanitation sector. The institutional arrangement of the sanitation sector must be described as fragmented because of the different roles which are assigned to a number of national institutions.

However, government agencies with sanitation and hygiene responsibilities recognized in 2010 the need for cooperation and coordination. Consequently, a MoU was issued between the Ministry of Health and Social Welfare (MoHSW), the Ministry of Water and Irrigation (MoWI), the Ministry of Education and Vocational Training (MoEVT), and the Prime Minister's Office, represented by the Regional Administration and Local Government (PMO•RALG) to facilitate cooperation and coordination. The MoU expired recently (June 2015) and was not extended.

MUWSA, the public water utility of Moshi, provides both water and sewer-based sanitation services. The majority of households depend on on-site sanitation which is neither regulated nor monitored. Formally, the municipal health department is in charge of these facilities.

Collected wastewater and emptied faecal sludge are conveyed to the Mabogini wastewater treatment ponds (WWTP) in the south of the town through the sewer network or by emptying trucks respectively.

Investments in the fields of on-site or off-site sanitation are not reported. The number of sewer connections increased in the reporting period (2013/14) by some 200 new connections which correspond with an annual increase of some 9% according to EWURA. The sewerage system however was extended during that period by only 1.5 km. The approximate annual public spending over the past years on sewer extension is not known. In this regard it is worth to mention that residents are not obliged to connect to the sewerage if a sewer was laid in their street. No information is available on funds which were reserved for public on-site sanitation (markets, bus stations).

The building code required house owners to provide a sanitary facility. Urban growth is taking place predominantly in "unplanned" areas, where MUWSA has no mandate to operate. It is the urban poor which settle in these areas and provide an on-site solution of convenience which, in most of the cases is a traditional pit latrine. The mission has not revealed any mechanisms in place that provide

guidance for poor urban dwellers to facilitate access to sanitation or even information to cope with sanitary needs.

MKUKUTA, the National Strategy for Growth and Reduction of Poverty issued in 2010 by the Poverty Eradication and Economic Empowerment Department within the Ministry of Finance and Economic Affairs addresses a number of measures to reduce inequity. The translation of these measures on local level to improve the sanitary conditions of poor urban dwellers however is not visible as yet.

5. Service outcomes

Quality water supply levels are assumed to reach 100% in Moshi with 90% of the households subscribed and 137 kiosks for those who have no connection of their own. The metering rate is 100% and the average supply time is 18 hours per day.

In view of this background wastewater management and, more particularly, faecal sludge management in Moshi are based on three pillars: centralized sewerage, septic tanks and pit latrines.

The sewer network has a total length of ca. 58 km and connects to the Mabogini wastewater treatment ponds. With an estimated volume of 145,000 m³ and retention time of more than 30 days the facility disposes of sufficient treatment capacity to accommodate an extension of the sewer network.

Onsite solutions are poorly documented and a differentiated assessment of their condition is not available. The facilities are spread all over the service area and are emptied upon demand of the users. Three privately operated emptying trucks are in operation to serve between 10% and 20% of households which dispose of flush or pour flush facilities. The trucking capacity is considered sufficient to cope with increased demand in rainy season and will be increased further once the road to the WWTP is completely paved (currently in process, Aug.2015).

In general terms, on-site sanitation seems to be not recognized as a viable alternative, although low urban densities, which signify large parts of Moshi's urban structure, justify appropriate on-site solutions.

Responsibilities with regard to sanitation are somewhat fragmented. According to statements made by municipal health practitioners illegal dumping is heavily fined.

Emptying of private facilities is not regulated though.

There is no full-fledged documentation of on-site practices. The survey that was conducted under the National Sanitation Campaign (NSC) covered over 30% of the households but in selected wards only, which makes an extrapolation on the whole city difficult.



Figure 1: Inflow section of Mabogini treatment ponds (Younes Hassib/GIZ 2015)

The Mabogini treatment ponds are poorly maintained but treatment efficiency is reportedly compliant with national standards. Effluent however is immediately used for unrestricted irrigation.



Figure 2: Paddy fields irrigated with effluent from Mabogini treatment ponds (Younes Hassib/GIZ 2015)

There are plans to extend the treatment ponds. It is however assumed that these plans will not materialize any time soon, also because the ponds, if well managed, dispose of significant additional capacity.

Currently, some 2,500 m³ of wastewater in addition to an average volume of 120 m³ of septage from emptied septic tanks are assumed to reach the facility. Emptying comes at 60,000 TZS (32 USD, in 7/2015) per septic tank and discharging the tanker at Mabogini costs 13,000 TZS (7 USD).

6. Overview of stakeholders

Where the Water Supply and Sanitation Act (2009) assigns the responsibility of (off-site) sewer operation to the water utilities the Public Health Act (2009) has appointed the regional and local health institutions to take care of on-site sanitation facilities.

Accordingly, the Key Informant Interviews were conducted with the following stakeholders:

Key Stakeholders	Institutions / Organizations /
Public Institutions	<ul style="list-style-type: none"> ○ Moshi City Council (MCC) ○ Moshi Urban Water and Sanitation Authority (MUWSA) ○ Regional Secretariat / Regional Health Office Kilimanjaro (RS/RHO-Kili)
Private Sector	3 private emptiers
Development Partners, Donors	GIZ Water Program "Development of the Water Sector"

Table 1: Key Stakeholders

7. Credibility of data

The SFD produced in October 2014 was the starting point for the current SFD. The prime sources of information to verify and check its plausibility have been:

- Survey data by the National Sanitation Campaign conducted in March 2015 in 9 (of 22) wards of Moshi.
- Annual reports by the regulator EWURA.
- Key Informant Interviews.

Data of containment, emptying and disposal as well as financing and operation were retrieved during various discussions held in Moshi. No Focus Group Discussions were held.

Among the challenges which were faced are the following:

- EWURA data are very comprehensive with a strong focus on water. Off-site sanitation is partially covered. On-site sanitation is not covered at all.
- MUWSA documentation of fixed sewerage assets is available as a hard copy.
- NSC survey data has proven to be very helpful. An extrapolation however that would allow covering the whole town could be misleading because the survey covers specific wards only. Randomly selecting 30% of the households would have resulted in statistically more viable data.
- FS emptiers are not registered which leads to vague assumptions.
- Discrepancy observed between verbally communicated sewer coverage levels and documented coverage levels.
- Contradiction between reported waste water treatment quality and observed treatment performance.

- No data available on formal or informal reuse of FS and treated wastewater.

Assumptions for preparing the present SFD:

- Groundwater presence in 50% of Moshi which implies that groundwater in these areas is vulnerable to on-site sanitation. Expected contamination results in classification as “unsafe disposal”.

Recommendations for updating the SFD:

- Conduct beforehand a comprehensive sanitation survey that covers the entirety of Moshi and that complements to the results of the NSC-survey.
- Documentation of wastewater flow at the Mabogini ponds.
- Record keeping of septage truck operation in town.
- Groundwater map and/or ground water quality analysis to be used for an update of SFD.

8. Process of SFD development

The SFD is based on the SFD that was previously developed in October 2014 on the initiative of various stakeholders in Moshi with the support of a development worker of GIZ.

The mission team reviewed secondary data and verified information in the field by conducting KIIs with relevant stakeholders.

Census data, annual reports of the regulator, survey reports and city maps were used to better understand the situation on the ground.

Based on the service levels of the population to specific sanitary facilities the SFD calculation tool was used to subsequently calculate the excreta flow. Assuming the presence of groundwater in 50% of the cases, on-site facilities have a significant impact on polluting the underground.

According to the SFD, current practices of excreta disposal in Moshi result in 36% safe disposal.

Limitations of SFD:

In circumstances where groundwater is a relevant environmental media that is prone to

contamination detailed groundwater maps need to be used to precisely determine affected parts of town.

9. List of data sources

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

Published reports and books:

- (ARDHI 2010), Formulation of a Water and Sanitation Concerted Strategy and Action Plans in Moshi (Tanzania)
- (EWURA 2014), Water Utilities Performance Review Report 2013/14,
- (GoT 2009), The Water Supply and Sanitation Act, the Gazette of the United Republic of Tanzania Nr. 20, Vol. 90 dated 15th May, 2009
- (MKUKUTA 2005, 2010, 2013, 2014), Integrated Strategy for Growth and Reduction of Poverty
- (MoH 2009), The Public Health Act
- (MoWI 2009), Water Sector Status Report
- (MoWI 2013), Water Sector Development Programme 2007-2014
- (MoWI 2014), The Water Sector Status Report

KIIs with representatives from

- Moshi Municipal Council
- Moshi Urban Water and Sanitation Authority
- Service providers: Private emptiers

Websites/web links:

- <http://www.muwsa.or.tz/>
- <http://www.ewura.go.tz/>
- <http://www.maji.go.tz/>
- <http://www.moh.go.tz/>

SFD Moshi, Tanzania, 2015

Produced by:

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Abbreviations

BOD5	Bio-chemical Oxygen Demand (indicator for wastewater content of pollution)
BMGF	The Bill & Melinda Gates Foundation
CLTS	Community Led Total Sanitation
COD	Chemical Oxygen Demand (indicator for wastewater content of pollution)
CSE	Centre for Science and Environment, New Delhi - India
DP	Development Partner
EAWAG	Eidgenössische Anstalt für Wasser, Abwasser und Gewässerschutz - The Swiss Federal Institute of Aquatic Science and Technology
EWURA	Energy and Water Utilities Regulatory Authority
FS	Faecal sludge
GIZ	Gesellschaft für Internationale Zusammenarbeit
GoT	Government of Tanzania
JICA	Japan International Cooperation Agency
masl	Metres above mean sea level
MDG	Millennium Development Goals
MKUKUTA	National Strategy for Growth and Poverty Reduction
MoEVT	Ministry of Education and Vocational Training
MoU	Memorandum of Understanding
MoHSW	Ministry of Health and Social Welfare
MoW	Ministry of Water MoEVT
MMC	Moshi Municipal Council
MUWSA	Moshi Water Supply and Sanitation Authority
NSC	National Sanitation Campaign
PMO	Prime Minister's Office
RALG	Regional Administration and Local Government
QA /QC	Quality assessment / Quality control
RHO	Regional Health Officer, Kilimanjaro
RS	Regional Secretariat, Kilimanjaro
SANDEC	Department of Water and Sanitation in Developing Countries at the Swiss Federal Institute of Aquatic Science and Technology (EAWAG)
SDG	Sustainable Development Goals
SFD	Shit Flow Diagram
SWAp	sector-wide approach to planning
TZS	Tanzanian Schilling (Exchange rate July 2015: 1 USD = 2,120 TZS)
UOL	University of Leeds
WEDC	Water, Engineering and Development Centre of the School of Civil and Building Engineering at Loughborough University
WSDP	Water Sector Development Programme
WSSA	Water Supply and Sanitation Authority
MUWSA	Moshi Water Supply and Sanitation Authorities
WWTP	Wastewater Treatment Plant

1 City context

Moshi Municipality is an administrative district located in Kilimanjaro Region, in the north eastern horn of Tanzania. Administratively, the municipality is divided into 21 wards and 60 hamlets. Moshi Municipality has grown from a small urban area of less than 10,000 residents in 1948 to almost 100,000 residents in 1998. 2012, the population reached about 184,000 with an estimated annual growth rate of 2.8%. The literacy rate is appr. 95% and employment rate is appr. 50%. International tourism (Kilimanjaro, Serengeti) is one of the industries in town, with no pronounced seasonal variation.

The town is seated on the fertile southern slopes of Mt. Kilimanjaro at an altitude of 950 masl in the north to 700 masl in the south. The climate is moderate tropic with an average annual rainfall of 970mm.

With an area of 58 km² the physical feature of the town is characterised by three distinct parts delimited by the rivers Rau (in the East) and Karanga (in the West).

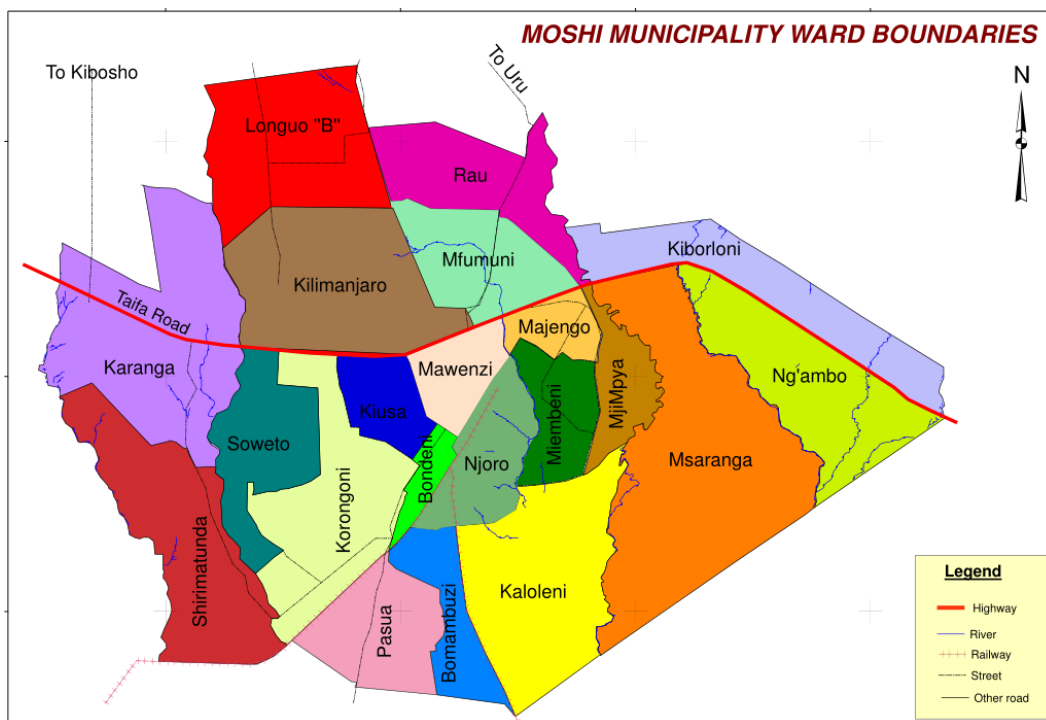


Fig. 1: Moshi administrative map of the boundaries of the town and its 21 wards

2 Service delivery context analysis

2.1 Policy, legislation and regulation

2.1.1 Policy

The Government of Tanzania (GoT) has set out goals in the National Strategy for Growth and Poverty Reduction (MKUKUTA) issued in 2010 by the Ministry of Finance and Economic Affairs, and the National Development Vision 2025. It has committed itself to meeting the Millennium Development Goal for sanitation. The National Water Policy of 2002 and the Water Supply and Sanitation Act of 2009 constitute the legal basis for all activities in the sanitation sector. The act defines the objectives of policy with regard to sanitation as well as the tools to efficiently channel funds and manage the sector.

The Water Supply and Sanitation Authorities (WSSAs) operate under the act of 2009. The regulator, the Energy and Water Utilities Regulatory Authority (EWURA) had been established under the EWURA Act, 2001. EWURA issues licenses upon which the WSSAs, among them Moshi Water Supply and Sanitation Authorities (MUWSA), operates.

In 2006 the Water Sector Development Programme (WSDP) was launched. It is the largest national water programme operating in Africa today with funding in the order of 1.4 billion USD for Phase 1 (which lasted until 2014). The financial requirements for Phase II (until 2019) are budgeted at about 3.3 billion USD. With a twenty year vision WSDP is a long-term programme that addresses rural and urban water supply and sanitation improvements as well as water resources management and measures to develop sector capacity and strengthen institutional effectiveness. The programme is founded on a sector-wide approach to planning (SWAp) which incorporates structures for joint government-development partner dialogue on planning, financing, coordinating and monitoring. Financing mechanisms include budget support administered via a basket fund, plus additional 'earmarked' funding deployed by a number of development partners (DPs) outside of the basket to support special projects in selected locations.

WSDP Phase I evaluation carried out in 2013 (MoWI, 2013) found that it would be difficult to justify the use of WSDP grant funds for the purpose of sewer construction given that this technology generally benefits predominantly better-off households and because experience shows that the operation and maintenance of sewerage systems is problematic. The same report recommends that greater attention should be given to on-site sanitation including the development and testing of strategies to improve faecal sludge management. Further it recommends that "such initiatives should encompass not only the provision of new equipment and facilities but also promotional and regulatory measures to encourage private sector participation and the regular use of safe pit emptying services by domestic and other consumers".

Only in WSDP Phase II, a separate component dedicated to sanitation was introduced. A main purpose of this component is the implementation of the "National Sanitation Campaign" (NSC), which is led by the Ministry of Health and Social Welfare (MoHSW). While the NSC focuses on behavior change campaigns to enhance the use of improved sanitation, the Ministry of Water still concentrates heavily on provision of sewer connections within WSDP II.

Phase I of the NSC (2011-2015) aimed to improve rural household (and to a lesser extent, urban) sanitation facilities, as well as schools WASH conditions using a combination of CLTS, and social marketing that includes behavior change communication.

NSC II (2016-2019) is envisaged to include a wide range of rural, urban, and institutional sanitation and hygiene, including technical assistance on Faecal Sludge Management. The campaign is also expected to include infrastructure investments in schools and institutions. The total budget for these activities is an estimated USD 150 million. This does not include other investments in sanitation infrastructure covered by different components of WSDP (mainly sewerage lines).

2.1.2 Institutional roles

The institutional arrangement of the sanitation sector must be described as fragmented because of the different roles which are assigned to a number of national institutions.

Lack of congruence between different documents with regards to the separation of roles and lack of clear definition of tasks adds to the missing clarity and guidance for the sector. For example, according to the current National Water Sector Development Strategy (2006-2015), “the Water Sector is considered as covering water resources management, including the planning, development, and protection of resources, and control of pollution; water supply and sewerage services; and the provision of on-site sanitation”; and MKUKUTA states a “utility responsibility for on-site sanitation, sewerage, wastewater disposal”. According to WSDP II, however, the utilities are only responsibility for sewerage lines and construction of stabilization ponds.

In the light of the commitment of GoT to meet its objectives the government agencies with sanitation and hygiene responsibilities recognized the need for cooperation and coordination. A MoU was signed in 2010 by the Ministry of Health and Social Welfare (MoHSW), Ministry of Water and Irrigation (MoWI), Ministry of Education and Vocational Training (MoEVT), and Prime Minister's Office – Regional Administration and Local Government (PMO-RALG) to facilitate cooperation and coordination areas such as policy making, strategy development, planning, budgeting, implementation and monitoring thereby accelerating achievement of the MKUKUTA, MDGs, and Vision 2025 targets. The MoU, together with the establishment of the new sanitation component within WSDP II, lead to some improvements in the collaboration, but still suffered from an overly complex setup. The MoU expired in June 2015 and was not extended. As of October 2015, a new, improved arrangement for the collaboration between the four above-mentioned ministries is being discussed. This is directly linked to the discussion on the second phase of the National Sanitation Campaign.

From the various discussions held in Moshi it became apparent that the division of sanitation responsibilities among MUWSA (being responsible for off-site sanitation, namely sewer operations) and the health department within the municipality (responsible for all kinds of on-site sanitation) manifests the fragmentation of the urban sanitation activities in Tanzania and makes sector planning more complicated.

2.1.3 Service provision

MUWSA provides both water and sanitation services. Water is abstracted from both, springs (8 Million Cubic Metres, MCM/year) and wells (1.5 MCM/year), distributed by gravity through

a piped network that covers the entirety of the planned city area (knowing that many residents live in “unplanned” areas). The main service the following:

Tab. 1: Water and sanitation services by MUWSA (EWURA 2014)

description	unit	value
Water network length	km	371
Reported pipe breaks per year and km	1/km/a	0.2
Water storage capacity	hrs	4.8
Number of water connections pre km	Con./km	60.7
Water connections (without kiosks)	-	21,287
Water Kiosks (operating/existing)	x/y	137 / 166
Length of sewer network	km	57.5
Nr of total sewerage connections	-	2,461
Nr of domestic sewerage connections	-	1,785
Ratio of households connected to sewerage	%	30
Number of blockages per year	1/a	31.3
Number of sewer connections per km network length	Con./km	42.8

The on-site sanitation situation and performance is not subject to reporting by the utility to EWURA. Collected wastewater is conveyed by gravity to the Mabogini wastewater treatment ponds (WWTP) in the south of the town with an active volume of total 145,000 MCM.

2.1.4 Service standards

According to the regulators report of 2013/14 the performance of the Moshi Water Supply and Sanitation Authority ranks among the best in Tanzania. According to the latest annual report Moshi WSSA is the best performer with sewerage services.

The Key Performance Indicators (KPI's) which describe the service standards in Moshi best were reported as follows:

Tab. 2: Service standards MUWSA water supply and sewerage KPI's (EWURA 2014)

Description	unit	value
Proportion of population served with water	%	90.3
Average hours of supply	Hrs	18
Proportion of population with 24 hrs supply	%	30

Water quality compliance (e-coli /residual chlorine)	%	88 / 71
Water metering ratio	%	100
Non-Revenue-Water	%	26.5
Revenue-collection-efficiency	%	94.7
Working ratio	%	0.9
Operating ratio	%	1.0
Average water tariff	TZS	506
Wastewater quality compliance	%	100
Proportion of population connected to sewerage	%	29.6

Wastewater quality compliance is reported to reach 100%. Independent analysis conducted by the regulator EWURA confirmed that BOD5 and COD treatment targets are achieved.

Faecal sludge conveyance and transport standards are not reported by EWURA. Transport is arranged on individual basis and initiative by the private sector. Three trucks operate in town and cost the household on average 60,000 TZS per load (reportedly 6 m³) depending on the distance to the discharge site at the Mabogini WWTP.

MUWSA receives an amount of 13,000 TZS upon disposal at the WWTP site.

2.2 Planning

2.2.1 Service targets

On a national level the service targets were expressed in the National Strategy for Growth and Poverty Reduction (MKUKUTA) of 2003. MKUKUTA envisaged for the sanitation an access to basic sanitation for 95% of the population as well as improved sewerage facilities for 30% of urban dwellers until 2010. By that date 100% of the schools should have been equipped with adequate sanitary facilities. MKUKUTA II of 2010 had reviewed and reduced the above ambitious objectives.

The sanitation targets of WSDP II by 2019 are

- 3.8 million rural households with improved sanitation
- 25% of rural households with water treatment and safe storage facilities
- 1.8 million urban households with improved sanitation
- Rehabilitation of latrines in 3,500 Primary schools 700 Secondary schools
- Rehabilitation of WASH in 1,000 Health Facilities
- Construction of Healthcare waste management facilities in 600 health facilities
- 8 WASH facilities constructed in highway bus stops
- 119 wastewater treatment plants constructed

- 15,000 households connected to the conventional public sewer system
- 1,043 km of sewer lines constructed

On local level Moshi town has committed itself to improve water and sanitation service levels as a means to accelerate its conferment from a municipality into a city. As far as sanitation is concerned the expressed wish of the representatives of MUWSA is to develop the sewer system further. Despite the fact that so far the general slope is favourable for an energy efficient transport to the treatment site a further extension will come at significant investment cost and some additional lifting.

On-site sanitation seems currently to be not recognized by MUWSA/Ministry of Water as a viable alternative. This is despite the fact that low urban densities suggest that large parts of Moshi's urban structure generally justify appropriate on-site solutions.

However, the future development will show that treatment capacities need to be extended to cater for increased future wastewater volumes.

2.2.2 Investments

The number of sewer connections in Moshi Urban Area increased in the reporting period 2013-14 by some 200 new connections which correspond to an annual increase of appr. 9% according to EWURA. During that period MUWSA has been expanding the sewer network by only 1.5 km. The approximate annual spending over the past years on sewer extension was requested but not provided. In this regard it is worth to mention that residents are not obliged to connect to the sewer network if a sewer was laid in their street.

No information is available on funds which were reserved for public on-site sanitation (markets, bus stations).

2.3 Reducing inequity

2.3.1 Current choice of services for the urban poor

Moshi is a fast growing town. Growth is taking place predominantly in "unplanned" areas, where MUWSA has no mandate to operate. It is the urban poor which settle in the unplanned areas and arrange for an on-site solution of convenience. There is no mechanism in place that provides support to guide poor urban dwellers through the decision making process or to facilitate access to information.

2.3.2 Plans and measures to reduce inequity

MKUKUTA addresses a number of measures to reduce inequity. The translation of these measures on local level so as to improve the sanitary conditions of poor urban dwellers however is not yet visible. While e.g. WSDP II and NSC refer to e.g. awareness campaigns that are supposed to increase rates of e.g. open defecation free villages and improved sanitation, there is no specific focus yet on low-income areas, low-cost solutions, or financial support schemes for poor households in peri-/urban areas.

2.4 Outputs

2.4.1 Capacity to meet service needs, demands and targets

Faecal sludge management in Moshi is based on three pillars: centralized sewer network, septic tanks and pit latrines.

The centralized sewer network dates back to 1962 when the first system was developed (19km) and treatment was taking place in a trickling filter. The collection system has increased in size and wastewater ponds were erected with the following features:

- Inflow section with grit removal (which was bypassed during inspection), sand removal (not operational) and Venturi flow measurement (not equipped).
- FS-intake for trucks
- Anaerobic pond (1)
- Facultative ponds (2)
- Maturation ponds (6)
- Sludge drying beds (not operational)

With an estimated volume of 145.000 m³ and a retention time of more than 30 days the facility has additional treatment capacity. According to the regulator's official information the treatment efficiency is in accordance with national standards. However, the facility is not well operated and barely maintained (the last desludging of the anaerobic pond was done in the year 2000). Also, the effluent is used for irrigation of different crops which should be reconsidered.

Onsite solutions are poorly documented and a differentiated assessment of their condition is not available. The facilities are spread all over the service area and are emptied upon demand of the users. In total three trucks are in operation with seven to fourteen registered deliveries at the WWTP site. The trucking capacity must be considered sufficient, since the number of tours per day could be increased upon demand. Transport time will be reduced in future because the road to the WWTP is in the process of being paved.

2.4.2 Monitoring and reporting access to services

Currently there are some 2,461 registered connections (both domestic and non-domestic) to the sewer network. Users of on-site sanitation facilities however are neither registered nor monitored. A full-fledged survey however is in preparation that anticipates closing the information gap and that will enable MUWSA and the Moshi Municipal Council to plan its interventions in off-site or on-site sanitation in a structured manner. GIS-mapping will allow pinpointing FS disposal practices and improving service levels.

FS transport is not regulated. Collection and discharge are not monitored. Trucks pay an amount of 13,000 TZS for discharging FS at the WWTP site. The cost per evacuation of one facility is on average 60,000 TZS, which is perceived expensive by households and which, in turn, may result in overflowing facilities or illegal discharge.

Generally, there are no procedures and processes in place for monitoring and reporting access to sanitation services. Because on-site sanitation is not captured by public institutions

no information on growth is registered. Households connected to the sewer network are documented and handled by MUWSA.

2.5 Expansion

2.5.1 Stimulating demand for services

There is a clear commitment on national level to increase access to standardized on-site or de-centralized sanitation facilities. The quarterly progress reports of the NSC show for some areas impressive improvements especially during 2015, however, the monitoring system is extremely weak and the numbers unreliable.

2.5.2 Strengthening service provider roles

There are several service providers active in the sanitation market in Moshi. The water and sanitation utility MUWSA and the health officers on municipal and regional levels are the relevant stakeholders on public level. In addition, there are private truck operators who provide FS-emptying and transport services as well as plumbers, masons etc. who respond to household demand.

Official programs/measures that aim at strengthening the role of public or private service providers in the extension of their services do exist only with regard to expanding centralized sewer network. The natural implementing body is MUWSA.

3 Service Outcomes

3.1 Overview

This report is conducted as a desk-based assessment of the sanitation situation in Moshi, Tanzania. A previous SFD was prepared by the stakeholders in the sanitation sector in March 2015 and was presented at the AfricaSan conference in Dakar in May 2015.

The objective of the present SFD was to strictly follow the methodology of the BMGF-financed SFD promotion project and, thereby provide the possibility to compare outcomes and conclude on improvements. The sanitary situation summarizes as follows for the town of Moshi:

Tab. 3: Sanitary situation (EWURA 2014)

description	unit	value
Offsite / onsite sanitation in use:		
- Households	%	91.8
- Shared / communal toilets	%	0.02
- Public toilets	%	0.1
- Institutions	%	1.8

- Commercial areas	%	6.2
- Industrial areas	%	0.1

Within the National Sanitation Campaign (NSC) a survey was conducted in 9 wards of Moshi earlier in 2015 that looked into the standard of sanitation facilities and made indication on containment of the FS. The results of the survey suggest that the predominant type of sanitation facility is the pit latrine with its various standards. Out of 6,375 households included in the survey, more than 4,000 confirmed they use pit latrine in their homes. The distribution is as follows:

Tab. 4: Sanitation types in use

Interface	unit	value
Pit Latrine	%	63
Flush or pour flush Toilet	%	37
No toilet	%	2

In the case of flush or pour flush toilets no distinction was made however regarding the method of containment after the water closet. These numbers were derived from MUWSA records, which report the number of household connected to the sewer network as 1,758. The following chapter 3.2 elaborates further on the details of the containment.

Open defecation account for 2% in Moshi (NSC) only compared to 20% practiced in rural areas (MoWI 2013).

Onsite sanitation technologies are emptied exclusively by privately operated suction trucks. In total 3 trucks are reported operational which have about 6 to 7 daily transports on average.

The suction trucks are not regulated or monitored. The predominant emptying technology is vacuum emptying with tank volumes between 6 m³ and 10 m³. The SFD carried out by the “round table” assumes that 80% of the pit latrines are emptied manually.

Septage is brought to Mabogini WWTP where it enters the first pond, the anaerobic treatment process. It is assumed that all septage actually reaches the treatment site with no illegal discharge taking place.

The town of Moshi has the ambition to improve sanitation standard by extending the sewer network. Due to the low urban density in areas previously unconnected this endeavor may prove expensive. The Mabogini facility has some additional volume capacities but operation and maintenance will need to be considerably improved to maintain adequate treatment performance.

National policies as expressed in the “Water Supply and Sanitation Act” (2009) and the inter-ministerial Memorandum of Understanding on the “Integrated Implementation of Sanitation and Hygiene” (2010) envisage a sanitation that addresses the needs of the urban poor. It is however not obvious which means shall be mobilized to achieve these objectives. It is unclear to what extent policies and procedures can stimulate demand for sanitation services; programs and measures to strengthen the role of service providers to meet growing demand.

The general situation Moshi along the sanitation chain may be summarized as follows:

- **Containment:** the pre-dominant types of sanitation (with ca. 2% open defecation is not among them) are in descending counting pit latrines, septic tanks and centralized sewerage.
- **Emptying** of septic tanks is mostly organized by privately operating vacuum trucks. Manual emptying is practiced with pit latrines. Soil conditions seem to support infiltration of wastewater into the underground. Because water supply is piped to roughly 90 % of the population no negative repercussions have to be expected on their health. The situation is raising concerns when it comes to those who live in informal settlements where MUWSA is not active yet. These residents are exposed to shortcomings on sanitation (i.e. shallow water wells affected by pit latrines). Therefore, wherever groundwater table is high wastewater infiltration from on-site facilities has to be considered as unsafely disposed.
- The **Transport** of FS generally takes place in vacuum trucks or through sewer network that services the higher density urban areas of town. The trucks seem to be adjusted to the demand of the on-site users. Because the evacuation fee is high and because the service is not regulated an estimate of illegally discharged truckloads is difficult.
- **Treatment** is taking place both on-site and off-site, though in different ways. Whereas off-site treatment happens in the sequence of ponds at Mabogini site to, as far as visual inspection has revealed, satisfactory (though not for reuse-) standard, the treatment in on-site facilities is partially taking place in the septic tank or pit latrine and continues after transport to the WWTP. Septic tanks or pit latrines which in fact are soak pits show generally poor treatment and pollute the underground and possibly aquifer. The precise number of facilities is unknown and should be subject to verification in the upcoming survey (emptying requirements are a good indicator).
- Two different factions are forwarded to **end-use** or **disposal**: Liquid effluent and solid sludge. The largest volume is reused in agriculture without regulation on informal agricultural land and further on paddy fields further downstream. It must be doubted whether the effluent of Mabogini is conform to micro-biological standards reuse in irrigation. Unknown quantities of effluent enter the environment at on-site facilities. Environmental problems have to be expected particularly with the presence of high ground water table. Sludge is not treated or reused adequately in Moshi. The sludge drying beds have not been used for a long time and it is doubtful whether the ponds, especially the anaerobic pond, are regularly emptied, the sludge evacuated and dried and eventually safely disposed in the context of routine operation and maintenance procedures. It is obvious that solid waste enters the treatment facility and is not handled either. This reduces the overall treatment efficiency of the ponds.
- Public **service providers** are the water utility MUWSA and the municipal health department of Moshi. The private service providers are the vacuum truck operators and other smaller businesses involved such as masons and plumbers. Those inhabitants of Moshi which are connected to the sewerage receive services and pay for them. Other services are provided upon demand and are signified generally by limited regulation.

3.2 SFD Matrix

3.2.1 *Service levels in Moshi*

This SFD is based on a first SFD conducted by local stakeholders from October 2014 to January 2015 (see Chapter 5). Through stakeholder meetings and with the help of surveys and monitoring reports (EWURA 2014, ARDHI 2010) all major values needed for the SFD were discussed and agreed upon. By field visits and Key Informant Interviews (KIIs) the data from the first SFD was checked for plausibility and, where possible, adapted or changed. No major changes were made with exception of connection rate to the sewerage and the rate of population equipped with septic tanks as explained further down. Refer to Appendix 3 for the SFD.

The existing sewer network, operated by the public water utility MUWSA, services the center of the town, mainly the wards in between Longuo in the north, Miembeni in the east, Pasua in the south and Soweto in the West. Official numbers show that 30% of the population is connected to the Mabogini treatment pond by sewers (EWURA 2014).

The number of house connections reported by MUWSA over the past years however, suggest a coverage rate of 9% only. 2,461 sewerage connections of which 1,758 connections serve households with an average of 8 to 9 people per household (EWURA 2014) result in 14,000 to 15,800 residents of Moshi connected to the sewerage, which corresponds with a rate of 8% to 9%. However, discussions carried out with stakeholders in the course of the first SFD resulted in an estimate of 17% of the total population with sewer connection. This figure was adopted pending further clarification by a house-to-house survey.

Looking at the amount of wastewater transported to the WWTP, which is estimated to be about 40 l/s at 3 pm in the dry season (estimation done during a field visit of the WWTP). The wastewater arriving at the WWTP does not indicate major infiltration in the sewer network. Judging from the amount of effluent from the WWTP, significant loss by leakage and evaporation is expected.

The remainder of the population, some 90% of the population, relies on onsite sanitation, with pit latrines being by far the most common system. Stakeholder discussions held in the course of the first SFD (2014-SFD) assumed some 65%. The survey of the NSC conducted in early 2015 with 6,000 households resulted in a value of 61% of the households using a pit latrine. This confirms the number chosen for the 2014-SFD.

Determining the rate of septic tanks in use is somewhat more difficult. The percentage of population using flush or pour flush devices added up to 37% in the NSC survey. No distinction was made as to the type of containment (septic tank and soak pit or sewerage). The coverage level of septic tanks (37% minus 17% = 20%) is calculated by deduction.

According to interviews with suction truck operators, about 10% of the population is serviced with FS trucks, mainly from septic tanks (see Chapter 4.3). This value must be used with some caution since a number of parameters come into play; the performance of the septic tank and the soak pit; the actual content of faecal sludge (the degree of dilution in the septic tank); the efficiency of evacuating the sludge and others. Although evacuation cost is low in comparison with other towns, households would tend to save cost and therefore avoid calling the suction truck if not necessary. Different interviewees confirmed that illegal dumping

seems not to be a major concern. For the SFD it was assumed that 100% of the septage is being collected and brought to the treatment site.

Only 2% are said to be practicing open defecation. This number could not be verified, but it is obvious that open defecation is not an option for significant numbers of residents.

No hydrogeological data was available in order to assess the risk of groundwater contamination. As Moshi is situated on the southern slopes of the Kilimanjaro, an overall groundwater flow from north to east is expected. The coverage with piped water in Moshi is above 90% (EWURA 2014) with ‘unpiped’ areas being served with kiosks. The water sources (springs) lay northwest outside the town (on a higher level than the city and with high lateral separation). Therefore, the risk of a contamination of the principal drinking water source is considered low. From the environmental point of view, groundwater contamination is still an issue of concern that needs to be elaborated further especially that urban development is taking place in informal areas which are currently deprived from public water and sanitation services.

Tab. 5: Sanitary service levels of Moshi population

	population served		source	reference in SFD
Total population	100%	185,000 cap		
Flush or pour flush Toilet:	37%	68,450 cap	-	
sewerage	17%	31,450 cap	(round table 2014)	W2
septic tank	20%	37,000 cap	deducted	
Pit latrine connections:	61%	112,850 cap	-	
Traditional	15%	27,750 cap	(NSC 2015)	
Improved	42%	72,150 cap	(NSC 2015)	
Ventilated improved	6%	12,950 cap	(NSC 2015)	
Open defecation:	2%	3.700 cap	(NSC 2015)	Od9

3.2.2 The sanitation chain in Moshi

The term “sanitation chain” refers to the sequence according to which FS is “handled” or “lost” along the way from production at the level of the households until the safe disposal either in agriculture or in the solid disposal process as shown in Figure 2 below.

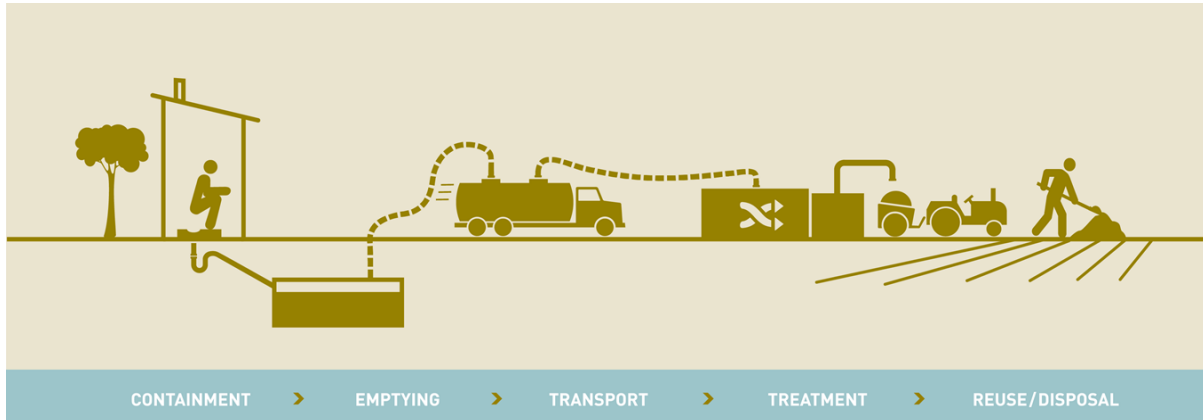


Fig. 2: The Sanitation Chain (source: BMGF)

The NSC survey addressed the interface and the different types are shown in table 5 above. The following step, the containment looks at the means available to accommodate the faecal matter, to store it and to release it after a given period of time. The different types of containment encountered in Moshi are shown in the table below.

Tab. 6: Containment types in Moshi

W2	Wastewater contained centralized (off-site)	17%
F2	Faecal sludge contained onsite	40.5%
F10	FS not contained (on-site)	40.5%
OD9	Open defecation	2%

W2: Wastewater contained offsite (through sewerage connection)

Numbers on what percentage of Moshi residents are actually served by a fully functioning user interface that discharges directly to a correctly designed, properly constructed, fully functioning centralized foul/separate sewer remain uncertain. The number ranges from 9%, which could be suggested by the reported house connections to 30%, the number given by the Municipality. The round table agreed to adopt a ratio of 17% until more stable information is available. This percentage was adopted for the present SFD.

The excreta however is raw, untreated and hazardous, but since it is captured in the sewer, all the excreta in this system is contained and transported to the treatment site. It is assumed that 90% of the wastewater carrying the excreta is conveyed to the Mabogini treatment ponds where the treatment efficiency is assumed to be in the order of 60%. This information is based on analysis results presented by MUWSA. Treatment objectives are considered to be achieved.

F10: Septic tanks, septage conveyed to centralized treatment

The NSC reveals that 37% of the population benefit from water borne systems. Assuming that 17% are directly connected to the centralized sewerage leaves the remaining 20% of the

population which depend on septic tanks. The effluent flows from the septic tank either into the sewerage or into a soak pit where it is only partially treated. With a 'significant risk' of groundwater pollution attributed to 50% of the urban area the faecal sludge is considered NOT contained in these areas.

It is assumed further that all septic tanks are subject to emptying. The existing emptying capacities are functioning reasonably well and are affordable (refer also to chapter 4.3 for further information on emptying services). Once discharged at the ponds the treatment efficiency of the ponds (60%) comes into effect.

F2: Pit latrines

The vast majority of the population of Moshi is served by this type of sanitary containment. According to the NSC some 61% of the population is using different types (traditional, improved and ventilated) of pit latrines. The round table of Moshi stakeholders concluded that approximately 66% of the population relies on pit latrines. Pending a comprehensive survey the value proposed by the National Sanitation Campaign was adopted for the present SFD. The majority of facilities (90%) is emptied manually and septage is discharged onto the ground. The remaining 10% are assumed to be not emptied. In either case 50% of the latrines are located in areas where no communication with the groundwater was assumed. The remainder of pit latrines is located in areas with a 'significant risk' of groundwater pollution.

OD9: Open defecation

Some 2% of the population is assumed to defecate in the open. Consequently the excreta are NOT contained. Excreta from this practice contribute to variable OD9 of the SFD.

4 Stakeholder Engagement

4.1 Key Informant Interviews

Key Informant Interviews (KIIs) were conducted in accordance with the methodology to verify the information retrieved from various reports. In appendix 2 the list of stakeholders is presented in detail. Because the main purpose of the interviews was not to generate data and new information but to support information already available. The number of interviews conducted was therefore limited.

The persons interviewed first in a group discussion and later in individual interviews in Moshi are the following:

- Jonas Mcharo, Regional Secretariat / Regional Health Officer Kilimanjaro (RS/RHO-Kili)
- Godfrey Meena, Moshi Municipal Council (MMC)
- Sebastian Mgeta, Moshi Municipal Council (MMC)
- Philbert Nyangwe, Moshi Urban Water Supply and Sanitation Authority (MUWSA)

4.2 Focus Group Discussions

No Focus Group Discussions were held because no such groups exist in Moshi. Individual and informal interviews were conducted instead to verify information retrieved through reports and IKIs. The added value of these interviews consists in capturing the opinions of common users which are exposed to the subject matter. These persons generally have a clear opinion but may not be interested to disclose their opinion freely.

Informal interviews were conducted with inhabitants of Moshi, owners of septic tanks or neighbours of the Mabogini WWTP, i.e. inhabitants which are exposed to the sanitation conditions prevailing in Moshi.

4.3 Observation of service providers

In order to assess the role of privately operating service providers, discussions among stakeholders and informal interviews with inhabitants of Moshi were held.

A field trip to the WWTP was conducted in order to cross-check the outcomes of the discussions. Two interviews with FS truck drivers were conducted. The information of three trucks being in use was confirmed. New data regarding the amount of faecal sludge being brought to the pond was collected. One truck has a tank volume of 10 m³, the other two have a volume of 6 m³ each. With a reported average of 5 to 6 loads a day each, a total amount of faecal sludge being transported to the WWTP between 110 and 132 m³ can be attributed to the FS trucks.



Fig. 3: Privately operated FS truck discharging at Mabogini wastewater treatment ponds (Source: L. Roeder 2015)

5 Acknowledgements

This SFD is dedicated to the citizens of Moshi. It wouldn't be possible without the support of the people that were involved in the first SFD that started taking shape in October 2014.

The main participants in alphabetical order are the following:

- Jonas Mcharo, Regional Secretariat / Regional Health Officer Kilimanjaro (RS/RHO-Kili)
- Godfrey Meena, Moshi Municipal Council (MMC)
- Sebastian Mgeta, Moshi Municipal Council (MMC)
- Phulbert Nyangwe, Moshi Urban Water Supply and Sanitation Authority (MUWSA)
- Hans-Joachim Schäfer, Gesellschaft für Internationale Zusammenarbeit (GIZ)

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7 Appendix

7.1 Appendix 1: Stakeholder identification

Name of organization	Name of contact person	Position
MMC	Wilfred Mena	Environmental Health Officer
MMC	Sebastian Mgeta	Environmental Health Officer
MUWSA	Philbert Myangue	Sewerage Engineer
RS/RHO-Kili	Jonas Mchawo	Environmental Health Officer
GIZ	Hans-Joachim Schäfer	Development Worker

7.2 Appendix 2: Tracking of Engagement

Stakeholder	Date of Engagement	summary of outcomes
Wilfred Mena	19.08.2015	Onsite containment is not regarded to be the main problem. The OD-rate of 2% mentioned in the former SFD seems reasonable.
Sebastian Mgeta	19.08.2015	National Sanitation campaign
Philbert Myangue	19.08.2015	A total of three trucks (privately owned) with a volume of 6 m3 each are currently servicing the people with FS-transport. House-owners pay fees for the service (around 60.000 TSH per tour). A minor part of the FS collected seems not to be brought to the WW stabilization ponds. A Municipality-owned truck is not in use because of mechanical problems. The sewer coverage in the central area of Moshi (around central business district, CBD) is

		complete (only gravity-driven). The northern-most points serviced with sewer are Uhuru Hotel and KCMC. Most newly built housing is unplanned / unofficial.
Jonas Mchawo	19.08.2015	The densely populated area west of the ww-ponds is an unplanned low-income settlement.
Hans-Joachim Schäfer	19.08.2015	

7.3 Appendix 3: SFD matrix

