SFD Promotion Initiative

Yei
South Sudan

Final Report

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SFD Promotion Initiative

sustainable sanitation alliance

giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

On behalf of Federal Ministry for Economic Cooperation and Development

UNIVERSITY OF LEEDS

WORLD BANK GROUP Water

wsp water and sanitation program

WEDC

Loughborough University

CSE

eawag aquatic research

Sandec Sanitation, Water and Solid Waste for Development

Bill & Melinda Gates foundation

SFD Report Yei, South Sudan, 2015

Produced by:

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This Executive Summary and SFD Report are available from:

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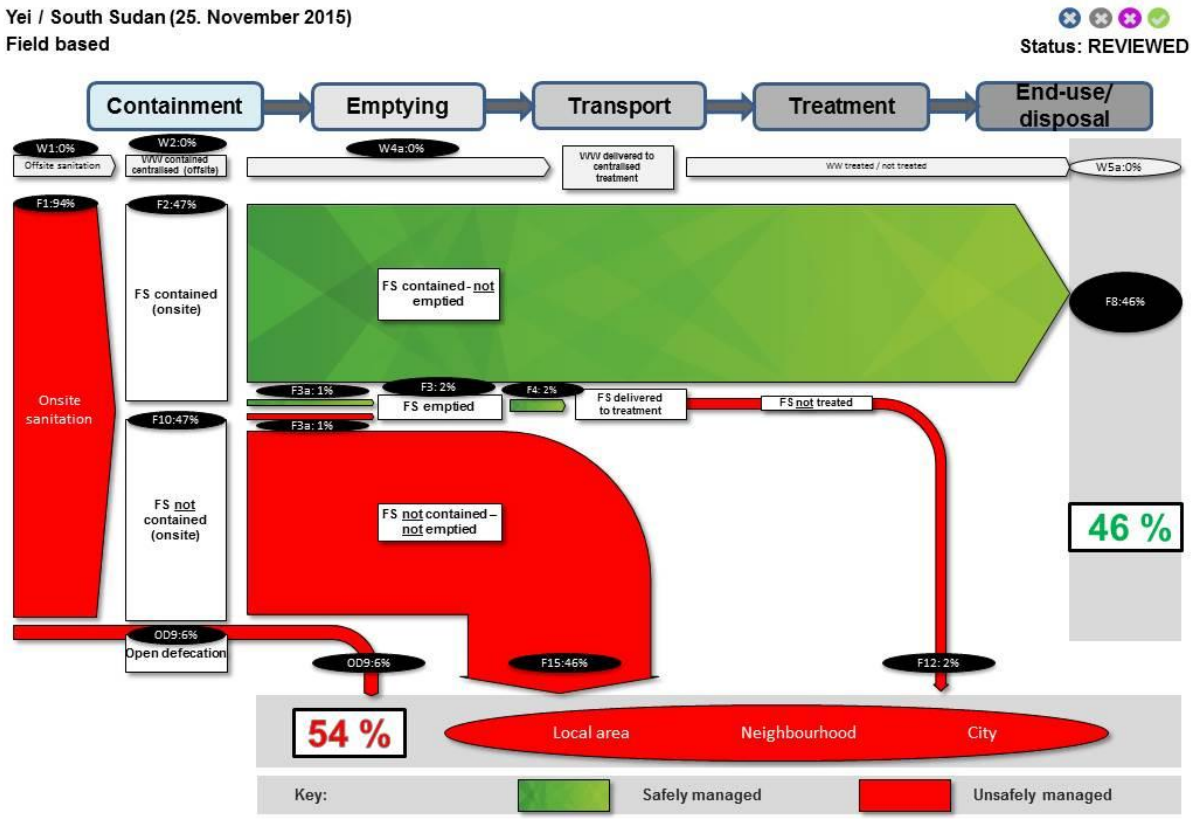
1. The Diagram



2. Diagram information

Desk or field based:

This SFD is an update of the previous SFD (August 2014). The field-based-approach was applied involving Key Informant Interviews (KIIs) and Focus Group Discussions (FGDs)

Produced by:

The SFD was produced by Younes Hassib with support from Cyrill Buergi, John Bebe Khamis (all GIZ) and Leonie Kappauf (GfA).

Status:

This is a Final SFD.

Date of production:

25/11/2015

3. General city information

Yei is the second largest urban center in Central Equatoria State (CES) (the largest is Juba, the capital of the new Republic of South Sudan), with a population of around 230,000 (GG 2015). It is bordered to the south (towards Uganda) by Morobo County and to the west by the DR-Congo. The town lies within Yei River County, one of six counties in CES. Yei River County itself is divided into five administrative sub-units. The main part of the town lies within Yei Town payam (districts), which consists of five bomas (sub-districts), namely Yei, Ronyi, Gimunu, Pokula and Minyori (GG 2010).

Yei Municipality falls under the tropical savannah climate. It is located in the so-called “Greenbelt”, the most fertile and traditional cereal surplus producing zone of Southern Sudan. It also has very reliable rainfall. The average annual rainfall is 1.336 mm with a pronounced peak in August and with a high evapotranspiration of 1.400 to 1.600 mm per year.

The population in Yei town has been exposed to several outbreaks of Cholera in the past decade (2006, 2009, 2014).

4. Service delivery context

The Republic of South Sudan acquired independence in July 2011. As a new nation, South Sudan has the dual challenge of dealing with the legacy of more than 50 years of conflict and continued instability, along with huge development needs. Core administrative structures and mechanisms of political representation were emerging, and the government was beginning to provide basic services, among them water and sanitation to the population when conflict broke out in December 2013. A peaceful resolution to the conflict has not yet been achieved. As a consequence a number of indicators are showing in the wrong direction; the incidence of poverty for example has worsened, from 45% in 2011 to more than 57% in 2015 (WB, 2015).

The Government of South Sudan (GoSS) developed a Water Sector Policy and a Water, Sanitation and Hygiene (WaSH) Sector Strategic Framework in 2011. A draft Water Bill which, once approved by cabinet and signed into law will constitute the national Water Act. An Environmental Policy is also under preparation. Institutional responsibilities for Urban WaSH are split between three ministries, namely: i) Ministry of Water Resources and Irrigation (MWRI) which is mandated to oversee development and management of urban water supply ii) Ministry of Housing and Physical Planning (MHPP) which is responsible for urban sanitation, and iii) Ministry of Health (MoH) which is responsible for hygiene promotion.

The Local Government Act (2009) in conjunction with the Water Policy (2009) and the Water Sector Strategic Framework (2011), grants local authorities in South Sudan the responsibility for water supply and sanitation service provision within their jurisdictions. The institutional frame conditions provide a number of alternatives to local authorities as to how they fulfill this responsibility. In view of the low technical capacities of local authorities they generally do not directly act as service providers but delegate these services to an entity that enjoys financial autonomy. Accordingly service provision in Yei is assumed by the Yei Town Water Supply and Sanitation Services Ltd. (YTWSS).

YTWSS was recently created (2012) and operates the small new water distribution system (8km network) with a total of 11 kiosks. Two of which are not operational as they need to be supplied by water tankers. So far YTWSS has no stake in sanitation.

5. Service outcomes

Water supply in Yei is organized in various ways. The recent household survey (Gg 2015) revealed that 62% of the population have access to improved water sources, of which the largest faction (36%) use public hand pumps, which usually tap into the shallow aquifer. A centralized water supply reaches only 7% of the population, predominantly through water kiosks. Further 7% use water from unsafe open water sources.

Figure 1: Pilot pit latrine provided by DUWSS
(Source: GIZ 2015)

Correspondingly, sanitary facilities rarely depend on piped water. Barely 1% of the population use either flush- or pour-flush facilities (Gg 2015). The overwhelming majority of households use traditional pit latrines, which only provide minimal stability, a mud floor and some protection for privacy (60%). When full, the pits are abandoned and a new pit is dug. In an effort to save space, pits are occasionally very deep (reportedly 7 to 9 m). Consequently the risk of faecal matter negatively affecting the water quality of the upper groundwater layer is of concern.

Results of groundwater analysis conducted in 2012 clearly show a microbial contamination of anthropogenic origin (36%). Interviews in hospitals confirm that water-born diseases increase in the rainy season, when water levels in boreholes and the probability of interference with faecal matter from pit latrines rise.

Emptying the containment facilities is practiced by only 7% of the households. The current lack in emptying infrastructure, such as adequate disposal sites and service providers are further reasons for the current situation.

Septic tanks with a solid substructure account for less than 1%. These structures, serving

hotels, restaurants and public toilets, require occasional emptying.

Vacuum trucks have to come all the way from Juba (170km) to empty septic tanks and discharge the septage in an unregulated solid waste dump site in Minyori 30 km to the south. Reason, why emptying and discharging 10m³ amounts to over 1200 SSP (1 USD = 3 SSP) (600 SSP truck service, 500 SSP Municipality Block charge, 120 Boma charge). The facility can not be reached in the rainy season.

Sludge drying beds and wetlands are under construction (see Figure 2) and shall be taken into operation beginning of 2016. Additionally, vacuum trucks are due to be handed over to improve the unresolved disposal of faecal matter in Yei.

Figure 2: Construction site of future sludge drying beds (Source: GIZ 2015)

6. Overview of stakeholders

Responsibilities for WaSH are fragmented on national level as responsibility for urban water supply is under MWRI while MHPP is in charge of urban sanitation and MoH for hygiene promotion respectively.

Table 1: Key Stakeholders

Key Stakeholders	Institutions / Organizations
Public Institutions	○ Yei Municipality ○ Yei Town Water Supply and Sanitation Services Ltd. ○ Departments for Public Infrastructure and Water and Sanitation ○ Hospitals (Yei & Martha)
Private Sector	3 public toilet operators
Development Partners, Donors	GIZ "Development of the Urban Water and Sanitation Sub-Sector" (DUWSS) Program

The delegation of sanitation responsibilities to the newly created utility YTWSS is confined to operating the few public sanitation facilities and future emptying and disposal infrastructure.

Interviews were conducted with the stakeholders presented in above Table.

7. Credibility of data

In absence of official census data and officially published reports of national institutions the main sources of information used for the present SFD are studies, reports and survey results produced within the past 5 years. A representative survey covered 8% of the population in 2010 (GG 2010) and a recent survey exclusively on sanitation service levels covered some 4% of the population (GG 2015) provide a comprehensive description of the state of sanitation in Yei.

Nine KIIs have been conducted with different stakeholders in addition to 3 FGDs which confirmed the general state of faecal sludge disposal in Yei town.

Among the challenges which were faced during the preparation of the SFD are the following:

- The lack of officially published data that is being used by public authorities to forecast and plan interventions in the water and wastewater/sanitation sectors.
- Generally low degree of mapping water quality data of water sources and sanitation facilities on the level of public institutions.

Assumptions for preparing the present SFD:

- Based on water quality analysis results it was assumed that high groundwater levels in 50% of Yei town interfere with existing pit latrines.
- Contamination of drinking water leads to recorded high prevalence of water-born diseases in Yei and subsequently to classifying FS disposal practices in large parts of town as "unsafe disposal".

Recommendations for updating the SFD:

- Groundwater map and/or ground water quality analysis to be used for an update of SFD.
- Record keeping of vacuum truck operation in town.
- Comprehensive pit latrine inventory.

8. Process of SFD development

The present SFD was prepared on the basis of the methodology developed by the BMGF project.

Secondary data was subject to review and verification through Key Informant Interviews (KII) with relevant stakeholders and Focus Group Discussions (FGD) as listed in Table 1.

Additionally, field information was collected.

Based on the access 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 Yei result in 46% safe disposal. The majority of households however remain caught between insecure access to water safe for drinking and unsafe sanitation that pollute their drinking water.

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.

- Studies and reports:
  - (AECOM 2014), South Sudan Household Survey Reveals Diversity of Community WASH Conditions, Preliminary Survey Findings, AECOM International Development 2014
  - (AfDB 2013), Small and medium town water supply and sanitation feasibility study and detailed design, African Development Bank September 2013
  - (CoM 2011), South Sudan Development Plan 2011-2013, Council of Ministers Draft, 4th July 2011
  - (Gauff 2015), Yei Urban Water Supply and Sanitation Project, Hydrogeological & Geophysical Investigations Report, Gauff GmbH on behalf of KfW, MARCH 2015
  - (GG 2010) Feasibility Study for the Establishment of a Poverty Oriented Development of Water Supply and Sanitation Services for Yei, GfA-Gauff on behalf of GIZ, May 2010
  - (GG 2015), Household Sanitation Survey in Yei – Survey Report, GfA-Gauff on behalf of GIZ , June 2015
  - (ODI 2011), Urban displacement and vulnerability in Yei, Working paper by the Humanitarian Policy Group within Overseas Development Institute, December 2011
- KIIs with representatives from:
  - Yei Municipality
  - Yei Town Water Supply and Sanitation Services Ltd.
  - Department for Public Infrastructure
  - Department for Water and Sanitation
  - Yei Civil Hospital
  - Martha Lutheran Health Centre
  - Private operators of public toilet
- Focus Group Discussions held with:
  - 12 Chiefs (community leaders) in Yei
  - 8 representatives from 4 NGOs
  - 3 operators of public toilets.

SFD Yei, South Sudan, 2015

Produced by:

Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH, Hassib, Y.

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Abbreviations

BOD5	Bio-chemical Oxygen Demand (indicator for wastewater content of pollution)
BMGF	The Bill & Melinda Gates Foundation
COD	Chemical Oxygen Demand (indicator for wastewater content of pollution)
DoPI	Department of Physical Infrastructure
DP	Development Partner
EAWAG	Eidgenössische Anstalt für Wasser, Abwasser und Gewässerschutz - The Swiss Federal Institute of Aquatic Science and Technology
FS	Faecal sludge
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
GoSS	Government of South Sudan
JICA	Japan International Cooperation Agency
masl	Meters above sea mean level
MEDIWR	Ministry of Electricity, Dams, Irrigation and Water Resources
MDG	Millennium Development Goals
MWRI	Ministry of Water and Irrigation until September 2015 Ministry of Energy, Dams, Irrigation and Water Resources, MEDIWR
MHPP	Ministry of Housing and Physical Planning
MoH	Ministry of Health
QA /QC	Quality assessment / Quality control
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	Faecal Matter Flow, Sludge Flow or short Shit Flow Diagram
SSP	South Sudanese Pound (Exchange rate August 2015: 1 USD = 2,94 SSP)
SSUWC	South Sudan Urban Water Corporation
UOL	University of Leeds
WEDC	Water, Engineering and Development Centre of the School of Civil and Building Engineering at Loughborough University
WWTP	Wastewater Treatment Plant
YTWSS	Yei Town Water Supply and Sanitation Services Ltd.

1 City context

Yei is the second largest urban center in Central Equatoria State (CES) (the largest is Juba, the capital of the Republic of South Sudan), with a population of around 230,000 (GFA, 2015). It is bordered to the north by Maridi County, to the south (towards Uganda) by Morobo County, to the east by Lainya County and to the west by the DRC. The town lies within Yei River County, one of six counties in CES. Yei River County is divided into five administrative sub-units, or payams. The main part of the town lies within Yei Town payam, which consists of five bomas – Yei, Ronyi, Gimunu, Pokula and Minyori (GTZ, 2010).

Yei features prominently in the history of Southern Sudan. During the colonial period it was a vibrant commercial hub, and a center for trade between Uganda and the DRC. The surrounding areas were considered the breadbasket of South Sudan thanks to their fertile soil and reliable rainfall (GTZ, 2010). Reportedly, the town had a well-developed infrastructure including roads and electricity supplies, and water and sanitation systems in the town center during the 1970s.

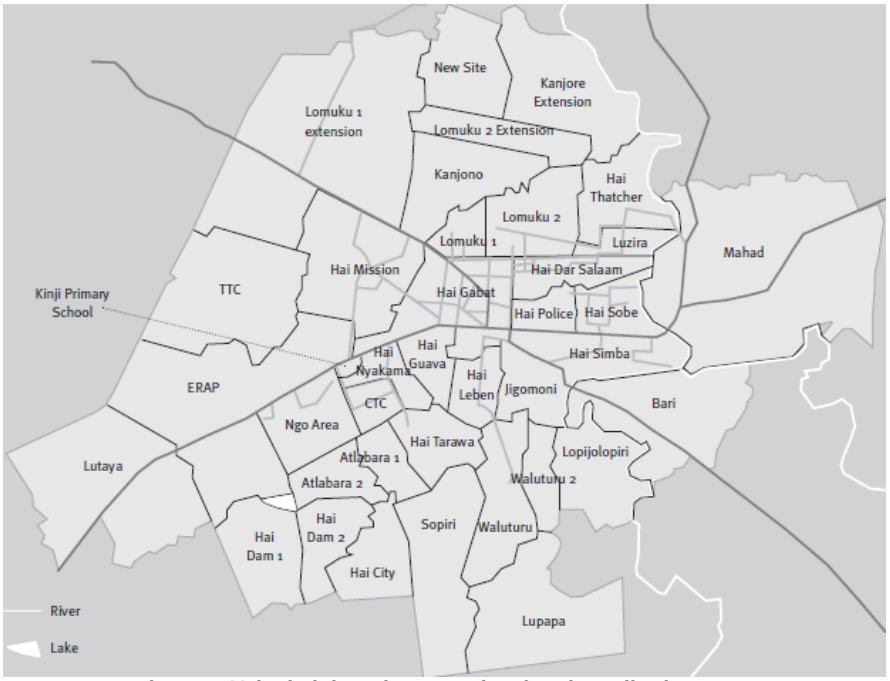

Figure 1: Yei administrative map showing the 5 districts

The administrative boundaries of the town were established in 1978. At that time just 15% of its inhabitants originated from the town itself. The majority were Kakwa, a Nilotic ethnic group. Almost 70% originated from different parts of Equatoria, while 5% came from other provinces in South Sudan. The remaining 10% were Northerners or foreign nationals. Twenty per cent of the inhabitants were employed as soldiers, whilst 18% were engaged in entrepreneurial activities. The rest, including many Kakwa, worked predominantly in agriculture.

The main economic activity is farming, including the production of sorghum, maize, millet, cassava, groundnuts, rice, sweet potatoes, fruits, sesame, tobacco, sugarcane, soya beans, vegetables and coffee.

Yei Municipality falls under the tropical savannah climate. It is located in the so-called "Greenbelt", the most fertile and traditional cereal surplus producing zone of Southern Sudan. With an altitude of around 820 masl it also has very reliable rainfall. The average annual rainfall is 1336 mm with a pronounced peak in August and with a high evapotranspiration of 1.400 to 1.600 mm per year.

The population in Yei town has been exposed to several outbreaks of Cholera in the past decade (2006, 2009, 2014).

2 Service delivery context analysis

2.1 Policy, legislation and regulation

The Republic of South Sudan became the world's newest nation and Africa's 55th country on July 9, 2011. As a new nation, South Sudan has the dual challenge of dealing with the legacy of more than 50 years of conflict and continued instability, along with huge development needs. South Sudan also has significant oil wealth, which if effectively used to drive development, could provide the basis for progress in the coming years. When conflict broke out December 2013, core administrative structures and mechanisms of political representation were emerging, and the government was beginning to provide basic services, among them water and sanitation to the population. A peaceful resolution to the conflict has not yet been achieved. As a consequence a number of indicators are showing in the wrong direction; the incidence of poverty for example has worsened, from 44.7% in 2011 to more than 57.2% in 2015 (WB, 2015).

2.1.1 Policy

The Government of South Sudan (GoSS) developed a Water Sector Policy and a Water, Sanitation and Hygiene (WASH) Sector Strategic Framework in 2011. A draft Water Bill which, once approved by cabinet and signed into law will constitute the Water Act. An Environmental Policy is also under preparation. Institutional responsibilities for Urban WASH are split between three ministries, namely: i) Ministry of Water and Irrigation (MWRI) which is mandated to oversee development and management of urban water supply ii) Ministry of Housing and Physical Planning (MHPP) which is responsible for urban sanitation, and iii) Ministry of Health (MoH) which is responsible for hygiene promotion.

The Local Government Act (2009) in conjunction with the Water Policy (2009) and the Water Sector Strategic Framework (2011), grants Local Authorities in South Sudan the responsibility for water supply and sanitation service provision within their jurisdictions.

2.1.2 Institutional roles

Following above description, the institutional arrangement of the sanitation sector falls under the responsibility of MHPP.

Various small scale schemes were introduced but mainly as emergency measures and on an opportunistic basis rather than with a coherent strategy for the whole town. Several schemes are operating satisfactorily although not always to optimum design standards once donor

support has ceased (e.g. pump breakdowns not resolved quickly; lack of chlorine for treatment purposes).

The institutional frame conditions provide a number of alternatives to Local Authorities as to how they fulfill this responsibility. In view of poor technical capacities of Local Authorities they generally do not directly act as service providers but delegate these services to an entity that enjoys financial autonomy. Accordingly service provision in Yei is assumed by the *Yei Town Water Supply and Sanitation Services Ltd.* (YTWSS).

2.1.3 Service provision

YTWSS was recently created (2012) and operates the new water distribution system with a total of 11 kiosks, two of which are not operational and need to be supplied by water tankers. There is currently one storage tank operational with a capacity of 50 m³ (out of four storage tanks with a total capacity of 270m³).

Only one domestic water customer is registered. There is however a number of non-domestic customers, such as the public toilet subscribed to YTWSS services.

Table 1: Water services by YTWSS Ltd.

Description	unit	value
Water network length	km	8
Water storage capacity (existing/operational)	m³	270 / 210
Domestic water connections (without kiosks)	-	1
Water Kiosks (operating/existing)	-/-	9 / 11

Correspondingly, sanitary facilities rarely depend on piped water. Barely 1% of the population uses either flush- or pour-flush facilities (Gg 2015). The overwhelming majority of households use traditional pit latrines, which only provide minimal stability, a mud floor and some protection for privacy (59%). When full, the pits are abandoned and a new pit is dug. In an effort to save space, pits are occasionally very deep (reportedly 7 to 9 m). Consequently the risk of faecal matter negatively affecting the water quality of the upper groundwater layer is of concern.

Results of groundwater analysis conducted in 2012 clearly show a microbial contamination of anthropogenic origin (36%). Interviews in hospitals confirm that water-born diseases increase in the rainy season, when water levels in boreholes and the probability of interference with faecal matter from pit latrines rise.

The delegation of sanitation responsibilities to the newly created utility YTWSS is confined to operating the few public sanitation facilities and future emptying and disposal infrastructure.

However, so far, YTWSS has no engagement in sanitation.

2.1.4 Service standards

According to the survey conducted by GIZ in 2015 around 35% of the households in Yei use improved sanitation facilities and 59% use traditional pit latrines. 23% of the users have no

sanitation facility of their own and therefore share existing facilities. Open defecation is practiced in a single digit range.

Except for the public toilet which is operated by YTWSS, none of the sanitary facilities in Yei are operated nor monitored by any official institution. Occasional faecal sludge emptying is carried out by private entrepreneurs but discharge is not possible all year through. Sludge drying beds are currently under construction and will be taken into operation beginning of 2016 (see Figure 2).

Emptying the containment facilities is practiced by only 7% of the households. The current lack in emptying infrastructure, such as adequate disposal sites and service providers are further reasons for the current situation.

Septic tanks with a solid substructure account for less than 1%. These structures, serving hotels, restaurants and public toilets, require occasional emptying.

Vacuum trucks have to come all the way from Juba (170km) to empty septic tanks and discharge the septage in an unregulated solid waste dump site in Minyori 15 km to the North-west. Reason, why emptying and discharging 10m³ amounts to over 1200 SSP (1 USD = ca. 3 SSP) (600 SSP truck service, 500 SSP Municipality Block charge, 120 Boma charge). The facility can not be reached in the rainy season.

Figure 2: The future sludge drying beds (source: GIZ)

Vacuum trucks were handed over but are not yet in use pending the commissioning of the sludge drying beds to improve the unresolved disposal of faecal matter in Yei.

2.2 Planning

2.2.1 Service targets

The South Sudan Development Plan 2011-2013, issued by the Council of Ministers (CoM) in July 2011 gave a high priority to improving sanitation. According to that document the envisaged percentage of population with access to improved sanitation would increase from 37% to 42% in urban settlements (SSDP 2011). This target was not met due to a number of reasons, but is still considered valid.

As concerns the situation on the ground the recent survey (GG 2015) revealed that roughly 40% of the users are clearly not satisfied with their sanitary situation. 50% of the households have plans to invest in a new sanitary facility. 80% of the respondents aim for an improved sanitation technology. The tendency on the ground is obvious: moving up on the sanitary ladder.

2.2.2 Investments

Investments in sanitation are likely to take place on household level. The envisaged improved type of sanitation (pit latrines / VIP or flush / pour flush facilities with a septic tank) are not expected to trigger much change along the sanitation chain however. With emptying cost in the range of a monthly family income users will tend to opt for no-emptying solutions.

Investments on public level involve before mentioned sludge drying beds.

The Urban WASH Investment Plan proposes a phased approach starting with the 10 towns covering 45% of the total urban population in South Sudan.

Implementing the WASH Sector Strategic Framework and operationalizing the Investments Plan requires further detailed studies covering the whole spectrum of program components that will include both the hard and soft aspects required for sustainable management of Urban WASH.

The Ministry of Electricity, Dams, Irrigation and Water Resources (MEDIWR) has in place an Urban WASH Investment Plan (2013-17) estimated to cost 0.5 Billion US$ to be implemented under a programmatic approach through a Project Management Facility with a central Executing Agency and out-posted Project Implementation Units (PIUs) in 10 federal states (AfDB 2013).

In view of the dire budgetary situation no investment can be expected for the time being on national level.

2.3 Reducing inequity

2.3.1 Current choice of services for the urban poor

The political unrest in South Sudan has triggered settling activities by IDP’s in the outskirts of Yei throughout the past decades. The new arrivals typically dig their own pit latrines without any guidance from the part of concerned planning or health institutions. Relevant criteria

from the sanitation point of view, such as excavation depth of the pit latrine and its location with respect to water abstraction points are usually not taken into consideration.

Decisive improvement from the health point of view can only be achieved by providing potable water from controlled sources to the population.

As far as sanitary facilities are concerned, 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. Investing into sanitation frequently collides with issues related to land ownership. Most people in Yei own the accommodation they live in but the actual limits of the plot are frequently not clarified because the demarcation has not taken place and the corresponding documents are missing. A fact that is problematic, when it comes to investing into sanitation.

2.3.2 Plans and measures to reduce inequity

SSDP claims that "*Water and sanitation services … will also receive priority attention due to their impact on poverty, growth and human wellbeing. Both will receive resources to continue expanding access to these basic services and to strengthen operations and maintenance*" and calls for "*… actions to improve key basic social services such as health, education and water and sanitation also address poverty by increasing wellbeing and labour productivity*" (SSDP 2013). It remains to be seen whether the plan can be translated into activities and tangible improvements on the ground.

2.4 Outputs

2.4.1 Capacity to meet service needs, demands and targets

Faecal sludge management in Yei is predominantly based on pit latrines. For the general public in Yei septic tanks and open defecation constitute options in the range of a few per cent. Accordingly, service needs are low. Public institutions fall short when it comes to planning capacities, supporting the general public by providing advice and decision making tools.

2.4.2 Monitoring and reporting access to services

Sanitation is not administered in Yei. None of the public institutions have a stake in sanitation. Accordingly, existing facilities are not systematically monitored. The number of facilities may well reach 20,000 to 25,000 units. Information on access types and quality is derived from two surveys made by the consortium of GfA-Gauff in 2010 and 2015 on behalf of GIZ.

The main results of the last survey are presented in the table below:

Table 2: Access to sanitation in Yei (GG 2015)

	population served		
Total population	**100%**	**230.000**	**cap**
Flush or pour flush Toilet:	**0,7%**	**1.600**	**cap**
sewerage	0,0%	0	cap
septic tank (flush and pour flush toilet)	0,7%	1.600	cap
Pit latrine connections:	**93,4%**	**214.800**	**cap**
Traditional (mud floor)	58,7%	135.000	cap
Improved (concrete slab)	26,7%	61.500	cap
Ventilated improved	8,0%	18.300	cap
Open defecation:	**6,0%**	**13.700**	**cap**

Following common definitions some 35% of the population has access to improved sanitation facilities. In above list this refers to the items; septic tank, improved and ventilated improved pit latrines.

Whether these facilities actually contribute to *safely managed* faecal sludge is discussed later in chapter 3.

As concerns additional services further down the sanitation chain it must be stated that an unknown number of exhauster truck operators from Juba (with some 80 licensed trucks, Senkwe 2014)) offer their services in Yei. The septage is being collected and transported to the unregulated Minyori solid waste dump site.

Currently, sludge drying beds are under construction, which are expected to be taken into operation by the beginning of 2016. By then, vacuum trucks will be operated by YTWSS.

2.5 Expansion

2.5.1 Stimulating demand for services

The need for additional service improvement in the sanitation sector has been identified on national level ever since the independence of South Sudan. Mechanisms, whether regulatory or financial which aim at stimulating the demand of users are not in place however.

The Directorate for Physical Infrastructure for example issues work permits in planned areas but provides no support on the ground when it comes to sanitary solutions or improved standards.

There is demand however, expressed by the respondents to improve their respective sanitary situation. The latest survey revealed clearly:

- that those households who have no toilet of their own (23% of the households) and who use shared sanitary facilities aim for an own facility.
- households which depend on unimproved facilities (59%) plan to have an improved facility.

In average households are willing to spend 1,000 SSP on a new facility (GG 2015). The survey further expresses "*the clear recommendation that all interventions aiming at increasing access to basic sanitation at a considerable scale need to include a financing mechanism supporting households in meeting the cost of sanitation*".

2.5.2 Strengthening service provider roles

Knowing that all households rely on on-site facilities with barely any emptying required and with no regulation of any kind indicates that service provision in the field of sanitary services is confined to digging pits, which is frequently done manually by the concerned households and to a very limited extent, emptying of the few septic tanks which exist currently in Yei (it is assumed that less than 1% of the households have access to such a facility). Masons offer their services for the construction of solid latrines upon demand.

Once the site is handed over, the water and sanitation utility, YTWSS Ltd., will manage the sludge drying beds and will operate a vacuum truck. This is envisaged for early 2016.

3 Service Outcomes

3.1 Overview

This report is conducted as a field-based-assessment of the sanitation situation in Yei, South Sudan. 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 identify priorities, promote decisions and subsequent action.

The prime source of reference of this SFD is the recently conducted survey initiated by GIZ and implemented by the consortium of GfA and Gauff in 2015 (GG 2015). The survey included some 1,286 households (appr. 4% of the total number of households) which were evenly distributed over town. The results of the survey suggest that the predominant type of sanitation facility is the pit latrine with its various standards.

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

- **Containment**: the pre-dominant type of sanitation evidently is the pit latrine (94%).
- **Emptying**: is only undertaken in 7% of all cases. Usually the facilities are filled and replaced. Soil conditions below the top layer of 1 to 2 m thickness (black cotton soil) seem to have high permeability properties which support infiltration of wastewater into the underground. Since water supply depends largely on shallow wells, negative repercussions on health have to be expected. Groundwater levels increase during the wet season thereby further adding to the risk.

- **Transport**: of FS is taking place in exceptional cases. Approximately 0,2% of the FS is collected from septic tanks in hotels, restaurants and public toilets and brought to the Minyori solid waste dump site.
- **Treatment**: of faecal matter is not taking place in a planned manner. The degradation of faecal matter happens within the containment vessels however. It is assumed that pit latrines which are not interfering with the ground water and which are properly filled contribute to a proper decomposition of faecal matter.
- **End-use** or **disposal** of faecal matter is not taking place except for the small quantities which are occasionally being discharged at the Minyori facility. By no means can this practice be described as being orderly and safely handled.

3.2 SFD Matrix

3.2.1 Service levels in Yei

There are no institutionalized services related to the management, operation and maintenance as well as monitoring of sanitation facilities in the town of Yei. All sanitation facilities, with one exception (a public toilet), are private. Service delivery related to erecting, emptying and maintaining these facilities is exclusively handled by the concerned owners of the facilities.

Water Supply in Yei:

To put the sanitation level in Yei into context it is indispensable to understand the water supply service levels. The majority of the population (62%) relies on improved water sources. These may not be safe however. Only 7% receive water from trusted water sources such as kiosks or standpipes. The remainder depends on sources which are prone to pollution. Primarily the estimated 150 shallow wells, which serve some 60% of the population, are exposed to pollution from estimated 20,000 to 25,000 on-site sanitation facilities. Especially where the pits are deep enough a communication with the top water layer cannot be excluded.

The current sanitation practices in Yei must be described as hazardous. Water abstraction practices expose the population to significant health risks.

Consequently, the SFD will rate the faecal sludge discharged (contained and not emptied) via pit latrines as partially “unsafely managed”. Since it must be assumed that not all pit latrines contribute to contaminating the groundwater a reasonable assumption has to be made on how many facilities are “unsafe” (refer to chapter 3.2.4).

3.2.2 Technologies and methods used for different sanitation systems through the sanitation service chain

Because on-site sanitation is the only category of handling faecal waste in Yei there is only a very limited sanitation chain. Different technologies are in use on household level in Yei, but

the traditional pit latrine with mud floor is mainly used, followed by the same type of latrine with a concrete slab.

Table 3: Sanitation facility types in use (GG 2015)

Type	No.	%
Flush toilet connected to septic tank	5	<0,5%
Pit latrine with cement slab	349	27%
VIP	104	8%
Pour flush toilet	4	<0,5%
Total improved:	**462**	**35%**
Traditional pit latrine (mud floor)	766	59%
Plastic bag	1	<0,5%
Open defecation	3	<0,5%
Total unimproved:	**770**	**59%**
Unspecific	**74**	**6%**
Total households included:	**1.306**	**100%**

Both water based interfaces, the flush and the pour flush toilets are assumed to be connected to a septic tank followed by a soak pit. They account for less than 1% of the connections. The majority of households is connected to either traditional pit latrines (59%) which are considered unimproved, or pit latrines with a cement slab (27%) or ventilated improved pit latrines (8%) both of which count as improved facilities.

3.2.3 Services along the sanitation service chain

Service provision along the sanitation chain is not organized nor regulated because of lacking institutional frame conditions. Emptying the containment structures is practiced by only 7% of the respondents as shown in Table 4 below (the first two items 1 and 2 in the table are added). The predominant practice is to simply replace the full pit. This is the preferred option in over 75% of the cases (items 3 and 4). Space limitations lead to digging pits, which, according to statements made during the field visit, could be as deep as 7 to 9 meters.

The use of vacuum trucks is limited currently to the few septic tanks, which generate large quantities of sludge, mainly hotels, restaurants and public toilets. As mentioned earlier, these have to be ordered from Juba and incur significant cost (1,200 SSP per trip to the Minyori site in the north of Yei).

Table 4: Emptying practices (GG 2015)

Type	No.	%
1. It is totally emptied	76	5.9
2. It is partially emptied	11	0.9
3. A new toilet is constructed (i.e. the toilet is not emptied)	314	24.5
4. A new pit is dug (next to the toilet)	650	50.7
5. Add chemicals	12	0.9
6. Toilet never gets full	98	7.6
7. Other	25	2.0
8. Don't know	96	7.5
Total	**1,284**	**100**

3.2.4 Risk of groundwater contamination

A number of hydrological and hydrogeological assessments were made in 2010/2011 in the wake of finding a main source for centrally producing water for Yei. The following documents were consulted for the present assessment:

- Hydrological Study for the Yei and Kembe River Basins, prepared by Blasy/Overland on behalf of GIZ in 2010 (Blasy 2010)
- Yei Town Water Supply Geophysical Survey, prepared by WE Consult on behalf of GIZ in 2010, (WE 2010)
- Geo-hydrological Assessment for the Water Supply of Yei Town, prepared by Roel Mulder on behalf of GIZ in February 2011 (Mulder 2011)
- Hydrogeological & Geophysical Investigations Report, prepared by Gauff Ingenieure on behalf of KfW in March 2015 (Gauff 2015)

Vulnerability of the aquifer (e.g. geology, soil type, depth of groundwater table)

The investigations, as far as groundwater sources were concerned focused on 130 to 180 meter deep aquifers for quality reasons. Drilling results on several boreholes which were drilled in previous years in Yei two main soil compositions appeared:

- Soil 1: the upper layer consists of *black cotton soil* and can reach a depth between 1,0 and 2,0 m. Under this layer laterite is found. Laterite thickness varies between 10 and 12 meters. The horizon lying below laterite is granite forming the bedrock.
- Soil 2: in this soil the laterite layer reaches the surface, no *vertisols* (practically impermeable *black cotton soils*) are encountered in these soils.

Soil 1 must be considered impermeable because of the extremely fine material on top, whereas soil 2 is rather permeable. Pit latrines dug in either soil eventually reach permeable layers.

Water quality analyses from 2012 indicate that 36% of the wells are contaminated with faecal coliforms or E-coli bacteria. More recent data was not provided but should be available with the South Sudan Development Organization (SSDO).

During the rainy season water levels in the top water layer increase, leading to an increased risk of contamination by pit latrines. Interviews conducted in two hospitals in fact report higher prevalence of water-born diseases during the rainy season.

Therefore, the likeliness that current sanitation practices in Yei are hazardous and that water abstraction practices expose the population to significant health risks is considered to be high.

Lateral Separation (e.g. distance between sanitation facilities and groundwater sources)

Adequate lateral separation is an indicator for safely containing FS when water is being abstracted from shallow wells in the vicinity. Soil features and the corresponding permeability affect the travel time and thus the risk of communication between the pit and the well. Generally a travel time of 50 days is considered to be safe as it is sufficient time to make sure that germs have died-off.

Interference between pit latrines and shallow wells can not be excluded given the large number of pit latrines (>20,000) and shallow wells (ca. 200) which are being used for water abstraction and the permeability ranging from $2x10^{-5}$ m/s (corresponds to 860 m travel distance in 50 days) to $2x10^{-7}$ m/s (corresponds to 9 m in 50 days) (Blasy 2010).

Groundwater supply (e.g. groundwater supply technology)

The entire population depends on ground water as the prime source for water. The sanitation survey in Yei (GG 2015) has asked the households for the water sources they use for drinking and cooking. The results in below Table 5 indicate that the prime water source is public hand pumps from shallow wells (36%). Only 7% of the population is currently using water from a centralized system that relies on a safe aquifer.

Table 5: Water sources for drinking and cooking (GG 2015)

	households	population served
improved water source:	**1.015**	**63%**
Public hand pump	578	36%
Piped water (connected to private borehole)	180	11%
Kiosk public tap or standpipes	111	7%
Private hand pump	57	4%
Protected spring	49	3%
Rainwater collection	40	2%
unimproved water source:	**595**	**37%**
Public open well	221	14%
Open source (pond, river, dam. Lake, etc.)	123	8%
Water Vendor	109	7%
Private open well	97	6%
Unprotected spring	45	3%

Conclusion on groundwater vulnerability

With 36% of the water samples from 55 shallow wells being negatively affected by anthropogenic pollution and in view of missing reliable information on groundwater flow directions and travel distances it has been assumed that 50% of the pit latrines seep faecal matter into the underground and consequently do not contain faecal sludge. Accordingly, the remaining 50% are assumed to contain FS.

Table 6: Sanitation containment systems used in the SFD calculation tool

Description of sanitation containment system	No.	Reference	Reference in calculation tool
Septic tank connected to soak pit	800	L7	T1A2C5
Septic tank connected to soak pit, where there is a 'significant risk' of groundwater pollution	800	S2	T2A2C5
Unlined pit, no outlet or overflow	67.330	L11	T1A6C10
Unlined pit, no outlet or overflow, where there is a 'significant risk' of groundwater pollution	67.330	S4	T2A6C10
Pit (all types), never emptied but abandoned when full and covered with soil, no outlet or overflow	39.970	L12	T1B7C10
Pit (all types), never emptied but abandoned when full and covered with soil, no outlet or overflow, where there is a 'significant risk' of groundwater pollution	39.970	S5	T2B7C10
Open defecation	13.800	L20	T1B11 C7/C9

As shown in table 6 above only a comparatively small number of inhabitants are assumed to rely on open defecation. For the present SFD users of plastic bags (poo bags) and, for the lack of better information, respondents which were unspecific have been added to those practicing open defecation.

3.2.5 The sanitation chain in Yei

As mentioned earlier in this report, the term “sanitation chain” which refers to the sequence according to which FS is “handled” or “lost” along the way from production at the level of the households until its safe disposal either in agriculture or in the solid waste disposal process (Figure 3 below) is not entirely appropriate. The process generally stops at the containment of faecal matter. According to the household survey (GG 2015, refer also to table 4 earlier) about 7% of the respondents have either fully or partially emptied their facility.

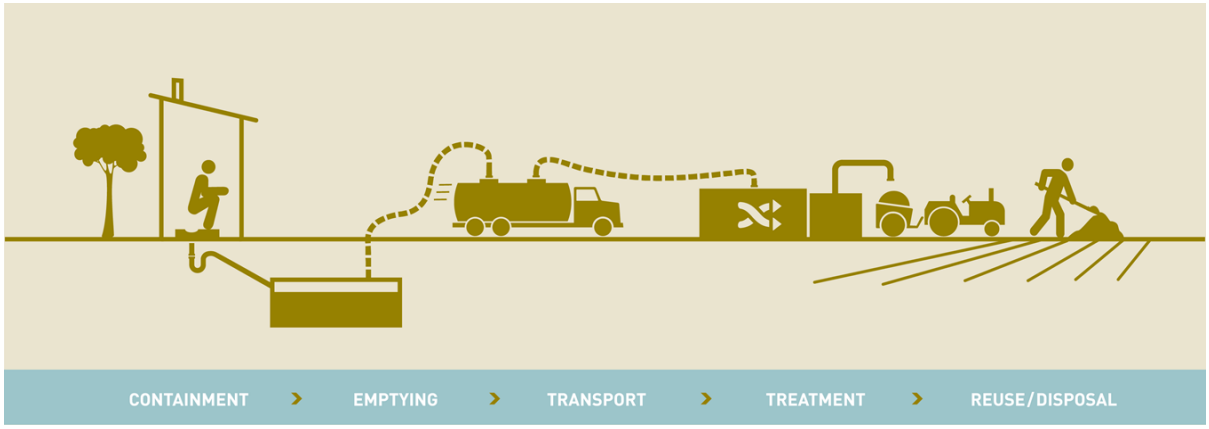

Figure 3: The Sanitation Chain (source: BMGF)

Table 7: Containment types in Yei

W2	Wastewater contained centralized (off-site)	0%
F2	Faecal sludge contained onsite	47%
F10	FS not contained (on-site)	47%
OD9	Open defecation	6%

W2: Wastewater contained offsite

There is no wastewater containment off-site. There are only few water-born sanitation systems in town, accordingly, and due to the absence of the centralized drainage facilities, the faecal matter is contained on-site.

F2: Faecal sludge contained on-site

94% of the faecal matter produced in Yei finds its way into on-site sanitation facilities. 47% contained on-site. Adopting above assumption, that 50% of the pit latrines do properly contain faecal sludge, results in 47% (equals 50% of 94%) of the FS being contained but not emptied. This volume which equals the faecal matter produced by 108,000 inhabitants of Yei remains on-site because the containment structures are safely abandoned (F8).

F10: Faecal sludge not contained on-site

This parameter corresponds with the (other) 50% of the pit latrines which are actually never emptied (8% of the facilities) or which seep into the underground because of groundwater presence. A small fraction (0.2%) of the overall volume is contained on-site in septic tanks. This volume is emptied and taken to the disposal site in Minyori. Given the small volume concerned the respective volume flow (F12) is not included in the graph.

OD9: Open defecation

The household survey revealed that only 3 (out of 1,306) households practice open defecation. 6% of the households were unspecific. Knowing that 23% of the households do not have facilities of their own (refer to table 3) it was assumed that 6% of the population is actually using the open ground under the sky to defecate. Excreta from this practice will contribute to variable OD9 of the SFD.

Assuming the above, the **total percentage of safely managed faecal sludge is calculated at 46 %.**

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 sources. In appendix 2 the list of stakeholders is presented in detail.

The sanitary situation in Yei is simple but because responsibilities in the sector are not clearly enacted, the range of interviewees was wider than initially anticipated. The water utility and (to be) public sanitary facilities operator as well as municipal and regional responsible personnel have been interviewed in addition to health professionals.

4.2 Focus Group Discussions

Focus Group Discussions were held with three different groups who have an active role to play in Yei. The chiefs and headmen are the representatives of different quarters in Yei. The attendees represented twelve residential areas which share more or less the same concerns on water quality and pit latrines affecting it. This category must be regarded as media into their community.

Representatives from four NGO's which primarily have a focus on democratization and governance issues have shown interest in the overarching issue of liquid and solid waste.

Three operators of public toilets have revealed their concerns about high emptying cost of septic tanks.

4.3 Observation of service providers

Not many services have emerged so far around the sanitation sector in Yei. Apart from the few private operators of public toilets with which a FGD was conducted no service providers were approached. The category that would have been of interest, the exhauster truck operators from Juba are not emptying any septic tanks during the rainy season.

5 Acknowledgements

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- Alison Samuel Taligi Director, Public Health & Environment Yei Municipality

- Samuel Taban Kilombe, Managing Director, YTWSS
- Mr. Malifida Silvano Ali Sanguson, Deputy Mayor Yei Municipality
- John Pansiano, Block Director, Yei Municipality
- Simon Loro, Director, Public Health Department Yei
- Dr Joseph Malish, Medical Doctor, Yei Civil Hospital
- Dr Stephen Mabe, Medical Officer, Martha Health Centre (anglican)

Additionally the participants of the Focus Group Discussions should be mentioned:

- Fourteen Chiefs and Headmen of Yei
- Eight representatives from four NGO's
- Three representatives of three operators of public utilities.

6 References

1. (AECOM 2014), South Sudan Household Survey Reveals Diversity of Community WASH Conditions, Preliminary Survey Findings, AECOM International Development 2014
2. (AfDB 2013), Small and medium town water supply and sanitation feasibility study and detailed design, African Development Bank September 2013
3. (Blasy 2010), Hydrological Study for the Yei and Kembe River Basins, prepared by Blasy/Overland on behalf of GIZ in 2010
4. (CoM 2011), South Sudan Development Plan 2011-2013, Council of Ministers Draft, 4th July 2011
5. (Gauff 2015), Yei Urban Water Supply and Sanitation Project, Hydrogeological & Geophysical Investigations Report, Gauff GmbH on behalf of KfW, MARCH 2015
6. (GG 2010) Feasibility Study for the Establishment of a Poverty Oriented Development of Water Supply and Sanitation Services for Yei, GfA-Gauff on behalf of GIZ, 2010
7. (GG 2015), Household Sanitation Survey in Yei – Survey Report, GfA-Gauff on behalf of GIZ, June 2015
8. (Mulder 2011), Geo-hydrological Assessment for the Water Supply of Yei Town, prepared by Roel Mulder on behalf of GIZ in February 2011
9. (ODI 2011), Urban displacement and vulnerability in Yei, Working paper by the Humanitarian Policy Group within Overseas Development Institute, December 2011
10. (Senkwe 2014), Opportunities for Fecal Sludge Management in a post-conflict situation, paper by Barbara Kazimbaya Senkwe at the AFWA-Abidjan congress, 2014
11. (WB 2015), http://www.worldbank.org/en/country/southsudan/overview, March 2015
12. (WE 2010), Yei Town Water Supply Geophysical Survey, prepared by WE Consult on behalf of GIZ in 2010
13. (William 2014), Assessment of borehole water quality and consumption in Yei County, South Sudan, Master Thesis by Likambo William for the Makerere University, April 2014

7 Appendix

7.1 Appendix 1: Stakeholder identification

Name of organization	Name of contact person	Position
DoPI	Michael Loke Juma Hassein	A/Commissioner A/Commissioner, water & Sanitation
Martha Health Centre	Dr Stephen Mabe	Medical Officer,
Public Health Dept Yei	Simon Loro	Director,
Yei Civil Hospital	Dr Joseph Malish	Medical Doctor,
Yei Municipality	Mr. Malifida Silvano Ali Sanguson John Pansiano Alison Samuel Taligi	Deputy Mayor Block Director, Director, Public Health & Environment
YTWSS	Samuel Taban Kilombe	Managing Director

7.2 Appendix 2: Tracking of Engagement

Stakeholder	Date of Engagement	summary of outcomes
Chiefs/S/Chiefs/H/Men Focal Group Discussion (FGD):	Sat 1st Aug 2015	Meeting revealed interest of community representatives in developing a better understanding of sanitation and related environmental and health benefits
Director, Public Health & Environment Yei Municipality	Sat 1st Aug 2015	Very engaged in improving sanitary situation in Yei. Strong focus on solid waste. Information on disposal of solid and liquid waste in Yei. Provided information on public facilities.
Managing Director, YTWSS	Mon 3rd Aug 2015	Though YTWSS as the responsible water utility has a prime focus on improving water supply services there is an expressed interest in improved sanitation in Yei.
Deputy Mayor Yei Municipality	Mon 3rd Aug 2015	Highest representative of Yei municipality is aware of the necessity of improved sanitation in Yei. Since the municipality has delegated the services to YTWSS it is the obligation of the water utility of Yei to cope and comply with standards.
A/Commissioner, water & Sanitation	Mon3rd Aug 2015	Rather weak documentation of water and sanitation service levels with hardly any solid numbers on service standards.

A/Commissioner, DoPI	Mon 3rd Aug 2015	Building permits are only provided with a sanitary facility included. Standards are inexistent however. Future role in disseminating hands-on recommendations to the citizens on how to improve sanitation and reduce the risk of groundwater contamination by providing advice on where to locate a sanitary facility
FGD: Members of the Yei Civil Society Forum	Mon 3rd Aug 2015	YEI NGO's have a strong focus on governance aspects but show an interest in improving the sanitary situation and guiding the residents of Yei to improving their individual sanitary situation
Block Director, Yei Municipality	Tue 4th Aug 2015	Informed on emptying and disposal practices of septic tanks. Revealed cost structure and confirmed the information that FS is collected from on-site facilities and discharged in the vicinity of Yei
Director, Public Health Dept Yei	Tue 4th Aug 2015	Provided insight into the records of the largest hospital in Yei. Confirmed that water borne diseases increase in prevalence particularly during the rainy season which is interpreted as an indication that communication between on-site facilities and shallow wells (which is particularly relevant with high ground water levels during rainy season)
Medical Doctor, Yei Civil Hospital	Tue 4th Aug 2015	Confirmed that water borne diseases are a serious issue in Yei.
Medical Officer, Martha Health Centre (anglican)	Tue 4th Aug 2015	Confirmed that water borne diseases are a serious issue in Yei.
FGD: Public Sanitation Facilities (PSF) operators	Tue 4th Aug 2015	Operators of public utilities informed on numbers of customers and volumes of FS discharged. Insight was also provided into cost structure of emptying services and discharging practices of private emptying service providers

7.3 Appendix 3: SFD matrix

(see following page)

Yei / South Sudan (25. November 2015)
Field based

Status: REVIEWED