SFD Promotion Initiative

SFD Manual
Volume 1 and 2

Version 2.0
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SFD Promotion Initiative

sustainable sanitation alliance

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On behalf of Federal Ministry for Economic Cooperation and Development

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eawag aquatic research

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SFD Manual – Volume 1 and 2

Version 2.0 I Last updated: April 2018

The complete Manual for SFD Production and SFD Reports are available from: www.sfd.susana.org

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Abbreviations

FGD	Focus group discussion
KII	Key informant interview
SFD	Shit Flow Diagram: a graphic tracking the flow and management of all excreta within a city, from source to final fate (or destination
SFD-PI	SFD Promotion Initiative

SFD Manual

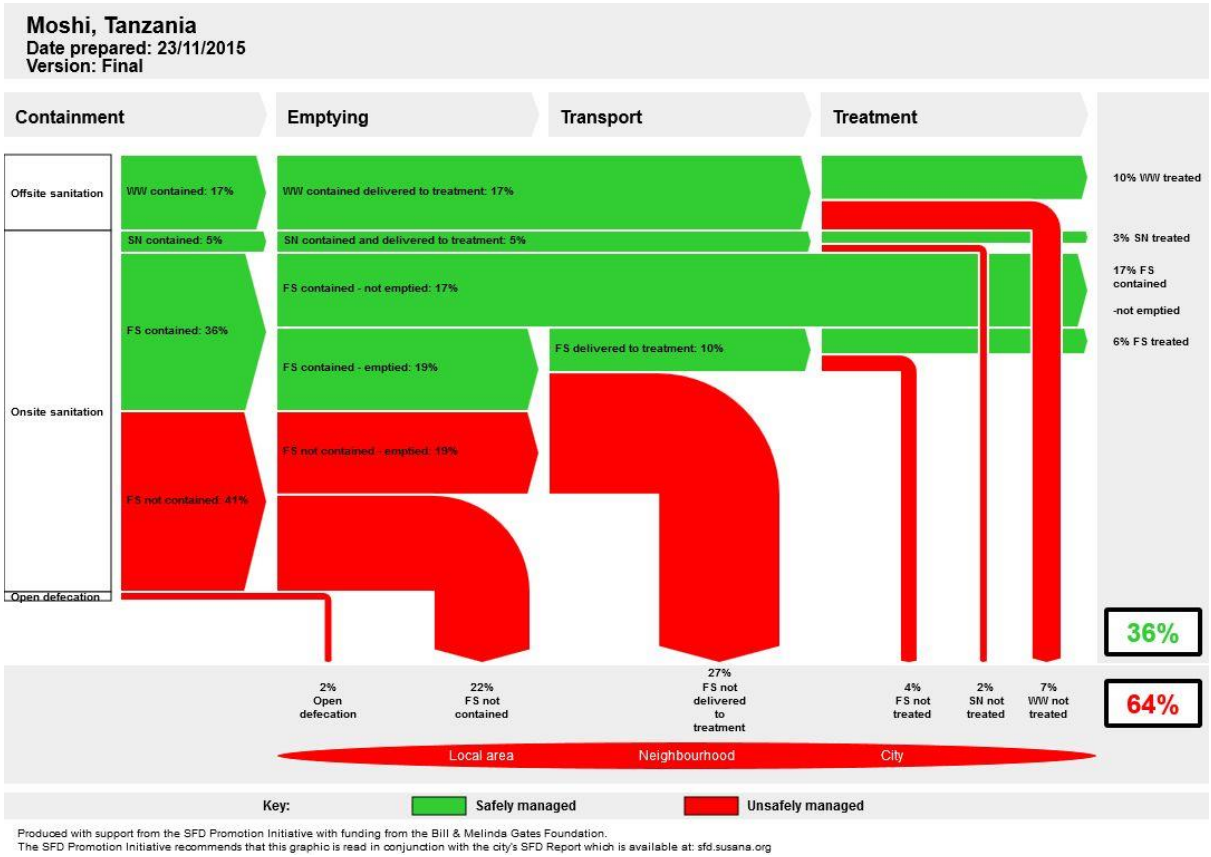
VOLUME 1

1. Introduction

A Shit Flow Diagram (SFD) is an easy-to-understand advocacy and decision-support tool comprising a report (SFD Report) which contains a graphic (SFD Graphic). An SFD summarises service outcomes in terms of the flow and fate of excreta in urban areas. It includes a qualitative assessment of the context in which service delivery takes place and a complete record of data sources. The process of developing the report is as important as the report itself. Use of the SFD method enables a standardised assessment of excreta flows in urban areas. Due to the sensitivity around the term "shit", the following terms are often used interchangeably: Excreta Flow Diagram or Faecal Waste Flow Diagram.

The SFD Graphic is a visual representation that enables stakeholders to identify service outcomes in terms of the flow and fate of excreta produced by the population. Excreta which is safely managed and move along the sanitation service chain are represented by green arrows moving from left to right in the graphic, while excreta which are unsafely managed are represented by red arrows. Unsafely managed flows discharging to the environment are represented by red arrows turning towards the bottom of the graphic. The width of each arrow is proportional to the percentage of the population whose excreta contribute to that flow.

Figure 1: SFD Graphic Example



1.1. Purpose of this manual

This manual identifies and describes the process followed within the SFD Promotion Initiative (SFD-PI) for the production of an SFD Report and includes guidance on how to use the SFD Graphic Generator. Volume 1 of this manual is a guide for the data collection and analysis and should be read in conjunction with the accompanying Volume 2 that includes the Master SFD Graphic; the Definitions of SFD Graphic Variables; the Definitions of Terms and Sanitation Containment System: SFD Schematics.

The aim of the full manual is to guide readers through the methodological process, developed by the SFD-PI, for collecting and analysing data on the service delivery context in a city or urban area in order to generate the SFD Report. By using a standardized methodological approach, **credible** SFD Reports will be produced that are based on data from reliable sources that are assessed and documented.

2. Key definitions of the SFD-PI

The following definitions are used to describe the SFD production process and the tools that have been developed to support this:

- **SFD Manual:** describes the methods for the production of a **SFD Report** and provides guidance on the use of the tools.
- **SFD Report:** the output from the SFD production process. It contains the **SFD Graphic**, an assessment of the service delivery context and a record of the data sources used.
- **SFD Graphic Generator:** the tool used to generate the **SFD Graphic** and the **SFD Matrix**. It contains the **SFD Selection Grid** and **Assessment of the risk to groundwater pollution.**
- **Master SFD Graphic:** the visual representation of the excreta flows across a town or city that shows the pathways taken by all excreta from defecation to disposal along the sanitation service chain.
- **SFD Matrix:** a table which contains the means to calculate the variables for each of the sanitation systems chosen in the **SFD Selection Grid**.
- **SFD Selection Grid:** enables the user to define the set of sanitation containment systems present in the city and forms the basis of the **SFD Matrix**.
- **Assessment of the risk of groundwater pollution:** the means to assess the risk associated with people drinking water that is potentially contaminated by the sanitation systems used in the town or city. It is estimated from data on drinking water and groundwater sources, geology and the distance between drinking water sources and sanitation facilities.

Excreta/Shit: consists of urine and faeces combined with any flushing water.

Enabling environment: is the range and inter-relationships of non-technical elements that are needed to support service delivery. For urban sanitation services, the enabling environment is likely to consist of aspects relating to policy (including legislation and regulation), strategy and direction, institutional arrangements, programme methodology, implementation capacity, availability of products and tools, financing, cost-effective implementation, and monitoring & evaluation.

Faecal sludge (FS): is undigested or partially digested slurry or solids containing mostly excreta and water, in combination with sand, grit, metals, solid waste and/or various chemical compounds. Faecal sludge comes from on-site sanitation technologies, resulting from the collection and storage of excreta or black water, with or without greywater.

Sanitation service chain: for on-site sanitation systems, this typically comprises excreta capture and storage in a latrine pit or septic tank; emptying of the pit or tank; transport of the contents; sludge treatment; end-use or final disposal of the resulting products.

For off-site sanitation systems this typically comprises wastewater from a flush toilet transported through sewers to a wastewater treatment facility and end-use or final disposal of the treated wastewater or by-products.

Service delivery context: this addresses aspects of the policies, legislations and regulations used to guide the design and operation of sanitation services delivered by the different stakeholders all along the sanitation service chain. The service delivery context is also the setting in which the institutional capacities and tools are arranged to provide the delivery of those services.

Stakeholder: is any group, organisation or individual that can influence or be influenced by the sanitation services under consideration and that has a vested interest in the sanitation sector (covering off-site or on-site sanitation services). Stakeholders may be grouped into the following types of categories: international, national, local, political, public / private sector, non-governmental organizations (NGOs) / civil society, operators and users / consumers.

3. Levels of SFD Report

Completing an SFD Report, including service delivery context information and the SFD Graphic, involves two broad aspects (see Table 1). These are to:

1. Collect information about the service delivery context in order to assess the status of sanitation services within the defined area;
2. Using this information, assess the situation with regards to all sanitation services and management of excreta, from which an SFD Graphic will be prepared

Table 1: Components of an SFD Report

Aspects to Assess	Objective	Output
Service Delivery Context	To identify the status of sanitation service delivery within the urban area	Narrative sections of the SFD Report
Management of excreta through the sanitation service chain	To identify the proportions of excreta that are safely or unsafely managed through the sanitation service chain	SFD Graphic

There are four levels of SFD Report that can be produced and they differ on the basis of four main criteria:

1. The purpose of the SFD,
2. The resources required,
3. The extent of data collected,
4. The extent of stakeholder engagement and
5. The depth of data analysis.

The process requires assessment of the Enabling Environment for sanitation to varying degrees for each level of SFD. The extent of data required and depth of analysis for an Initial SFD is less than that for a Comprehensive SFD. The data to be collected will relate to the key components of the Enabling Environment for sanitation service delivery (refer to Section 2, Key Definitions of the SFD-PI). Table 2 that follows shows how criteria 2 and 3 relate to the amount of data required for each level of SFD.

3.1. 'Level 1' - Initial SFD

An Initial SFD is appropriate when limited amounts of secondary data are available and there is limited access to stakeholders due to time, logistics or resources. The same reporting format is used as in an Intermediate SFD, but any data gaps are clearly identified and the assumptions made are clearly justified. This level of SFD may be suitable as an advocacy document, to generate interest and initiate a conversation with relevant stakeholders about the situation in the city. The initial level can support the identification of data gaps and assess the need for conducting a more detailed report. An Initial SFD Report can be upgraded to an Intermediate SFD when additional secondary data and improved access to other relevant stakeholders is obtained.

3.2. 'Level 2' - Intermediate SFD

An Intermediate SFD is appropriate when extensive secondary data are available and a range of stakeholders can be interviewed, either in-person or remotely. Primary data, from interviews observations or measurements, may be included and will allow you to validate your assumption based on other experts' opinions. An Intermediate SFD implies that data has been triangulated and inconsistencies could be identified. An Intermediate SFD will provide you will a broad understanding of the service delivery situation in the city and can be upgraded to a Comprehensive SFD with the systematic collection of primary data.

3.3. 'Level 3' - Comprehensive SFD

A Comprehensive SFD requires at least the same amount of secondary data as for an Intermediate SFD, but with additional stakeholder engagement and systematic primary data collection. A Comprehensive SFD requires data from in-person interviews, informal and formal observations and direct measurements in the field, to verify data accuracy. This level will be appropriate to inform the planning of service improvement options or investment decisions.

The main methods adopted for data collection are:

- A literature review of **secondary data**, including published and grey literature, government documents, performance reports and previous field studies carried out by others. Annex 1 for further guidance. Literature alone is unlikely to provide sufficient detailed, up-to-date information about the realities of sanitation services that are actually experienced by the population on a day to day basis. For this reason it is valuable to identify further details relating to the current realities. Such information can help to produce a more credible SFD Graphic as well as provide qualitative data and perhaps additional quantitative data relating to the service delivery context.
- Collection and interpretation of **primary data** as a means of fact-checking and triangulation of secondary data. This may consist of:
    - ***Qualitative*** data, that can be obtained through, for example:

- **Key Informant Interviews** (KIIs) – either conducted in person or remotely. Key informants may include community leaders, people in charge of different aspects of sanitation in the city (i.e. utilities, FS truck operators), government agencies (i.e. planning, regulators) amongst other (see Annex 2)
- **Observation of service provision and facilities** through the sanitation service chain (see Annex 3)
- **Focus Group Discussions** (FGDs) with community representatives or service providers (see Annex 4)

o ***Quantitative*** data: direct measurements of service provision and facilities through the sanitation service chain (see Annex 3)

3.4. SFD Lite

An SFD Lite report allows you to prepare an SFD Graphic with a minimum amount of supporting data and referenced sources for that data. The data to be collected focuses on the management of excreta through the sanitation service chain to identify the Service outcomes, without the supporting service delivery context information. Such a report may prove to be a valuable starting point from which to then develop a more detailed SFD Report at a later stage.

3.5. The SFD production process

The process for developing Level 1, 2 or 3 SFD Reports starts by getting a broad understanding of the urban area and assessing the enabling environment for sanitation where the SFD is going to be developed (and country when national policies and legislation affect sanitation services).

The process focuses on the collection of data needed to develop the SFD Report through an analysis of each stage of the sanitation service chain. Often there are regional variations to the term referring to specific technologies; therefore, it is important that the terminology used is consistent with that of the SFD terminology (see Volume 2 of the manual). Additionally, the sources of data used, as well as any assumptions made, need to be carefully explained. This allows the SFD to be reproduced and complemented when new data becomes available and also refutable. All of these aspects are vital to ensure good quality standards for any SFD Report that is developed using the methodology of the SFD-Promotion Initiative.

Stakeholder engagement is a critical part of the SFD production process in that it serves as a means of gaining wider acceptance and support for the process. Experience has proven that the better the level of stakeholder engagement, the more likely the SFD Report and accompanying SFD Graphic will be accepted and used by decision makers.

Table 2: Data requirements and recommendations for different types of SFD Report

Enabling environment to service delivery	Data collected at all stages of the service chain: containment to end-use or disposal	Data collection ✓ = required ✗ = not required **If collected** = recommended, where available **KII** = Key Informant Interview **Possible sources of data** (primary and secondary)	Level of SFD			
			Lite	**Initial**	**Intermediate**	**Comprehensive**
Policy, legislation and regulation	**Policy:** To what extent is provision of sanitation services enabled by appropriate, acknowledged and available policy documents (National/Local or both)?	Policy documentation	✗	✓	✓	✓
	Institutional roles: To what extent are the institutional roles and responsibilities for sanitation service delivery clearly defined and operationalized?	Policy / strategy documents Existing reports KIIs with lead institutions	✗	✓ ✓ **If collected**	✓ ✓ **If collected**	✓ ✓ ✓
	Service provision: To what extent do the policy, legislative and regulatory framework enable investment and involvement in sanitation services by appropriate service providers (public or private)?	Policy / strategy documents Existing reports KIIs with public and private institutions	✗	✓ ✓ **If collected**	✓ ✓ **If collected**	✓ ✓ ✓
	Standards: To what extent are norms and standards for each part of the sanitation service chain systematically monitored and reported?	Existing reports KIIs with lead institutions	✗	✓ **If collected**	✓ **If collected**	✓ ✓
Planning	**Targets:** To what extent are there service targets for each part of the sanitation service chain in the city development plan, or a national development plan that is being adopted at the city level?	City/national development plans KIIs with city authorities	✗	✗	**Include if data is collected**	✓ ✓
	Investment: How much was invested in sanitation services in the last investment plan and how much has been incorporated into the next approved investment plan? What has been achieved as a result of the last level of investment (including investing in human resources, Technical Assistance, etc. as well as infrastructure)?	City investment plans Investment plans of donors, private sector, etc. KIIs with lead institutions	✗	✗	**Include if data is collected**	✓ ✓ ✓

Equity	**Choice:** To what extent is there a range of affordable, appropriate, safe and adaptable technologies for sanitation services available to meet the needs of the urban poor?	KIIs with lead institutions Observations	×	×	**Include if data is collected**	✓ ✓
	Reducing inequity: To what extent are there plans and measures to ensure sanitation serves all users, and specifically the urban poor?	City authority reports KIIs with lead institutions	×	×	**Include if data is collected**	✓ ✓
Outputs	**Quantity / capacity:** Is the capacity of each part of the sanitation service chain growing at the pace required to ensure access to sanitation meets the needs/demands and targets that protects public and environmental health?	Studies / reports KIIs with lead institutions	×	×	**Include if data is collected**	✓ ✓
	Quality: To what extent are the procedures and processes for monitoring and reporting access to sanitation services applied, to ensure safe and functioning facilities and services through the service chain? Is the quality of the facilities and services sufficient to ensure they protect against risk throughout the service chain?	Policy documentation Reports KIIs with lead institutions Observations or measurements	×	✓ ✓ **If collected** ×	✓ ✓ ✓ **If collected**	✓ ✓ ✓ ✓
Expansion	**Demand:** To what extent has government (National or Local) developed any policies and procedures, or planned and undertaken programs to stimulate demand for sanitation services and behaviours by households?	KIIs with lead institutions	×	×	**Include if data is collected**	✓
	Sector development: To what extent does the government have ongoing programs and measures to strengthen the role of service providers (public or private) in the provision of sanitation services, in urban or peri-urban areas?	KIIs with lead institutions	×	×	**Include if data is collected**	✓
Service outcomes	**Quantity:** To what extent is the excreta generated from on-site and off-site sanitation technologies effectively managed within each part of the service chain? *(Note: This information is used to generate the SFD Graphic)*	Policy documentation Reports KIIs with lead institutions Observations or measurements	✓ ✓ **If collected** ×	✓ ✓ **If collected** ×	✓ ✓ ✓ **If collected**	✓ ✓ ✓ ✓

4. Assessing the enabling environment

4.1. Urban context

Whatever level of study is going to be developed, the process requires the report to include certain general facts and characteristics related to the urban area. The minimal information to be included in any SFD Report is:

Location of the town / city and country, urban boundaries1, boundaries of the area that the SFD Report is representing (if different) and a map highlighting significant areas and aspects (districts, zones, etc.)

- Climate: type of climate, average temperature (minimal and maximum), rainy/dry seasons, etc.
- Key physical and geographical features: topography (a general range within the area of the study), geology, rivers, extent of frequent floods, etc. Data about groundwater levels has to be included in this section (details of the data needed to assess the risk to groundwater pollution can be found in Section 5.4.3).
- Population and population growth rate, including any significant variations in population sizes/movements/patterns (e.g. diurnal, seasonal), distribution (poor vs. wealthy settlements) and density. If possible include information about:
    - Diurnal variation of the population: the difference in the number of people during the working day and during the night;
    - Weekly variation of the population: the difference in the number of people between different days of the week (e.g. weekdays and weekends);
    - Seasonal variation of the population: the extent to which the number of people can vary during specific times of year, affected for example by national public holidays or tourism.
- Economics: principal economic activities within the area.

This information may be available through carrying out a literature review of the secondary data (see Table 2 and Annex 1). The use of additional data sources, such as Key Informant Interviews, may be a helpful in filling in any gaps in information.
The following sections identify the information to be collected, analysed and documented about the enabling environment for sanitation for a Comprehensive SFD.

Table 2 shows the guiding questions that should be answered based on the collected information. The questions in the table should be considered and responded to in relation to all sanitation

[1] Note that the physical urban boundary may not be the same as political or administrative urban boundaries. It is useful to define and identify differences, as they can have an effect on the operating areas of service providers.

technologies, systems and services (centralised and decentralised, off-site and on-site, formal and informal) operating in an area. The response to each question should also consider all stages of the sanitation service chain (from containment to end-use / disposal), with relevant information documented for each question at each stage.

4.1.1. Policy, legislation and regulation

The following information is required:

- **Overview of policies** affecting all stages of the sanitation service chain: consider national, regional and local policies, legislation and regulatory frameworks that will affect excreta management in the area:
    - National documents such as the Constitution, Laws, or decrees affecting environmental aspects, water resources, drainage, sewerage and on-site sanitation services, wastewater and faecal sludge (FS) treatment, disposal and reuse.
    - Regional or local bylaws, regulations or master plans affecting environmental aspects, water resources, drainage, sewerage and on-site sanitation services, wastewater and FS treatment, disposal and reuse, waste management (including solid waste) services.
- **Institutional roles, including** the formal (*de jure*) and informal (*de facto*) roles played by public and private institutions engaged in the sanitation service chain are to be considered in relation to:
    - National level: Ministries and agencies that are involved in excreta management; such as Water, Works, Environment, Education, Finance, Regulatory Agencies, National Standard Bodies (for technologies and procedures)
    - Regional level: any functions regarding excreta management, such as setting bylaws, enforcing regulations, or service provision.
    - Local government: responsibility for sanitation service provision.

It can be helpful to prepare a table showing a summary of collected information (see Table 3):

Table 3: Summary of data collected

Level	Institution	Role(s)	Formal responsibilities (*de jure*)	Informal, or developed responsibilities (*de facto*)
National				
Regional				
Local				

- **Data on service provision**, which relates to those providing services along the sanitation service chain. Where data is available, it can help to assess the extent to which policies and regulations enable investments and involvement of a range of appropriate service providers – either public or private providers, or through public-private partnerships.
- **Standards and norms affecting the services**, such as water quality standards and monitoring systems, Service Performance Indicators (those existing and those monitored) and infrastructure design standards related to sanitation. Any records held by the water utility or within the different levels of government relating to standards of sanitation services and installations along the sanitation service chain will be a valuable source of information.

4.1.2. Planning

This aspect of the analysis considers the different national, regional and local plans or strategies from which the following data is required:

- **Service development targets** and specific actions. A comparison of these targets can be made by institution or by considering city-level, or national, development plans.
- **Current and future investments.** Recent expenditure or budgets allocated to investment in sanitation services, including:
    - Budget distribution in the WASH sector (national, regional and local).
    - Percentage of the budget going to each stage of the sanitation service chain.
    - Results of recent expenditure on services through the sanitation service chain (including human resource allocation and technical assistance).

4.1.3. Equity

This considers the sanitation technologies and services that are present in a city and how they meet the needs of the urban poor. In particular, information should be collected about:

- Which technologies the urban poor rely on.
- Plans and measures to ensure services are available for all: priority actions, budget allocation to reducing inequity or prioritising sanitation.
- Levels of access and affordability for excreta containment, emptying and conveyance (sewerage or otherwise) technologies, and the extent to which they are serving low-income communities.

4.1.4. Service outputs

Information to collect should consider:

- Capacity through the service chain to meet the needs and demands of the population – with consideration of the urban growth rate and how this will affect future service provision.
- Procedures for monitoring and reporting on access to services and the extent to which the resulting services can be considered as safe.

4.1.5. Expansion of services

The expansion of services takes into consideration the extent to which policies, procedures, plans and/or programs are considering the increasing demand for services and responding to that demand through plans and investments for strengthening supply chains.

5. Producing the SFD: Sanitation service chain analysis

It is important to be aware that uncertainties in the data may occur at any stage of the sanitation service chain. It is expected that each SFD Report will identify any discrepancies between reported conditions and the local reality.

5.1. Terminology

A key aspect to consider while analysing the sanitation service chain is the terminology to be used in order to achieve standard information in all SFD Reports.

Experience suggests that there may be little, if any, global consensus amongst stakeholders for terms used to define the different technologies or concepts. For example, the term septic tank is frequently used to describe a range of technologies (including unlined or semi-lined 'septic' tanks, cesspits (sealed tanks with no outflow) or aqua privies. Discussions with stakeholders will be necessary in order to reach a level of agreement.

The Definition of Terms, as used for this methodology, can be found in SFD Manual Volume 2: Glossary.

5.2. Service outcomes

This aspect focuses on collecting the data and making the assumptions that are needed to develop the SFD Graphic. Identify the range of off-site and on-site sanitation technologies and systems in use (refer to SFD Manual Volume 2: Glossary for more information) and analyse the collected data to produce the SFD Graphic. In addition, all assumptions that are used to select the types of systems in use and to calculate values for the SFD Graphic are to be clearly stated. Refer to Table 4 for guiding questions.

Table 4: Questions and data collection methods to analyse the range of sanitation service chain

	System type	Containment	Emptying	Transport	Treatment	End-use/disposal	Possible sources of information
System technologies and methods used in the city	**Off-site sanitation: Wastewater direct to sewer (centralised)**	- What off-site sanitation technologies are used to connect the population to centralised/decentralised sewers? - What percentage of the population are using off-site sanitation technologies that connect directly to centralised/decentralised sewers?	- What methods are used to transport the wastewater? - What percentage of this population are actually connected to and served by centralised/decentralised sewers? - What percentage of the population served by centralised/decentralised sewers has their wastewater reaching treatment facilities?		- What methods are used to treat the wastewater? - What percentage of the wastewater is considered to be effectively treated?	- What methods are used for end-use or disposal of the wastewater? - What percentage of the population served by decentralised/centralised sewers has their wastewater disposed of with/without treatment? - What percentage of the transported wastewater has a further end-use?	Documented studies and municipal, utility or private local service provider records (secondary data-see Annex 1) Key Informant Interviews (online or face to face) with city authorities, local government departments and service providers (see Annex 2) Observation (see Annex 3) Focus Group Discussions with community representatives and/or service providers (see Annex 4)
	Off-site sanitation: Wastewater direct to sewer (decentralised)						
	On-site sanitation: Excreta contained on-site	- What on-site sanitation technologies are used that contain excreta on-site? - What percentage of the population are using on-site sanitation technologies that contain excreta on site?	- What methods are used to empty the faecal sludge from these technologies? - What percentage of this population have their on-site sanitation technology emptied?	- What methods are used to transport the faecal sludge that is emptied from these technologies? - What percentage of the emptied faecal sludge is transported away from the containment facility and what percentage is transported to a faecal sludge treatment plant?	- What methods are used to treat the faecal sludge? - What percentage of the faecal sludge reaching a treatment plant is considered to be effectively treated?	- What methods are used for end-use/disposal of the faecal sludge? What percentage of the transported faecal sludge is disposed of with/without treatment? - What percentage of the transported faecal sludge has a further end-use?	
	On-site sanitation: Excreta not contained on-site	- What on-site sanitation technologies are used where excreta is not contained on-site? - What percentage of the population are using on-site sanitation technologies that do not contain excreta on site?					
	Open defecation	What percentage of the population is practising open defecation?					

Both off-site sanitation and on-site sanitation systems are analysed for each part of the sanitation service chain.

- **Off-site sanitation:** Considers how many people are connected to sewerage networks and the type of sewerage system they are connected to (centralised or decentralised and separate or combined.
- **On-site sanitation:** Considers the complete range of technologies and services that exist at all stages of the sanitation service chain.

Where variations in characteristics affecting where excreta is *produced* and *managed* through the sanitation service chain can be identified, they should be explained clearly within the SFD Report. For instance, seasonality is likely to be important, as the management of excreta often changes during the year. This may be affected by, for example, households or institutions having on-site containment emptied during the rainy season if pits and tanks fill more rapidly with the ingress of rising groundwater or storm water. Similarly, this may occur where families have on-site containment emptied before major festivals, when visitors are expected.

The following sections consider the information to be collected for each stage of the sanitation service chain

5.2.1. Containment (on-site and off-site sanitation)

A complete description and analysis is to be made of the different technologies that exist in the area. The range of technologies that can be considered by the SFD Graphic Generator is provided in SFD Manual Volume 2: Glossary (see the SFD Selection Grid in the SFD Graphic Generator: http://sfd.susana.org/data-to-graphic). The technologies identified in the SFD Graphic Generator are:

- No on-site container. Toilet discharges directly to a specific destination
- Septic tank
- Fully lined tank (sealed)
- Lined tank with impermeable walls and open bottom
- Lined pit with semi-permeable walls and open bottom
- Unlined pit
- Pit (all types), never emptied but abandoned when full and covered with soil
- Pit (all types), never emptied, abandoned when full but NOT adequately covered with soil
- Toilet failed, damaged, collapsed or flooded
- Containment (septic tank or tank or pit latrine) failed, damaged, collapsed or flooded
- No toilet. Open defecation

These containment technologies may be connected to one or more of the following (although not all options are applicable in all cases):

- to a centralised or decentralised combined sewer
- to a centralised or decentralised foul/separate sewer
- to a soak pit
- to an open drain or storm sewer
- to a water body
- to open ground
- to 'don't know where'
- no outlet or overflow

Firstly, the author needs to identify the range of technologies within the area (note: where technologies are identified that are not included in this list, the author needs to decide which are the most similar technologies on the SFD Graphic Generator that can be used as an equivalent). Next, the author must identify their features and whether they are properly constructed and/or located in areas where there is a low or significant risk of groundwater contamination (see Section 5.4.3 for details on how to assess the groundwater contamination risk).

Categories of origin (of excreta flows)

This refers to the percentage contribution of excreta from each sanitation technology or system, accounting for different settings, as listed below:

- Households/domestic facilities: this includes individual occupancy households, multiple-occupancy households (e.g. high-rise apartment blocks and compounds) and multiple households sharing one system
- Shared or communal toilets (i.e. not open to the general public)
- Public toilets (e.g. on-street, in public transit areas, at markets or bus stations)
- Institutions: including schools and universities, prisons and military barracks
- Commercial areas: including businesses, offices, shopping areas
- Industrial areas: (includes domestic excreta coming from sanitation facilities in factories, but not industrial effluent)
- Restaurants and hotels.

Comprehensive knowledge about the use of non-household facilities, and how this relates to the use of the main sanitation facility that someone uses, is required if this information is to be included, in order to avoid a misrepresentation of excreta flows in the SFD Graphic.

Usage level

Having analysed and described all of the containment technologies, what they are connected to and the categories of origin of the excreta, the percentage of people that use each technology needs to be assessed and indicated.
At this stage, it is recommended to prepare a table to summarise, for each type of technology, how the information will be captured by the SFD Selection Grid in the SFD Graphic Generator and the percentage of the population using each technology that will be captured by the SFD Matrix in the SFD Graphic Generator (see Section 5.4 for further details)

If a specific technology or category of origin is used by less than 1% of the population, it is recommended that this is not considered when generating the SFD Graphic.

5.2.2. Emptying and Transport

Off-site sanitation

Consider information on sewer coverage (centralised and decentralised), and the functionality of transport through the sewers (i.e. the percentage of wastewater delivered to a treatment facility and the percentage identified (or considered) to be lost through leakage in the sewers).

On-site sanitation

Consider the percentage of each type of on-site sanitation technology that is emptied (either by manual or motorised means). For each method used, information is needed about the quality, effectiveness and functionality of operations – for private or public sanitation facilities and by formal or informal service providers.

For the transport stage, the capacity of transport infrastructure (including numbers and volumes of trucks, tankers, etc. and the scale of operations or service coverage), as well as the quality, effectiveness and functionality of services (e.g. how much removed faecal sludge is delivered to a treatment plant and how much is not) is to be identified.

5.2.3. Treatment (of wastewater and/or faecal sludge)

Consider a description of all treatment facilities (wastewater and faecal sludge), including influent and effluent volumes of wastewater treatment, input and output volumes of faecal sludge treatment, scale (capacity of the treatment plant – as compared to the volumes received and treated), operation and maintenance issues, and extent of treatment provided (that is the percentage of wastewater or faecal sludge that is considered as treated). In addition, a general assessment of the quality, effectiveness, and functionality and performance standards of treatment facilities is to be included, where appropriate to the context.

5.2.4. Disposal and end-use

Consider information about the use (both informal and formal) of output products from treatment plants, the location of all disposal points for wastewater and faecal sludge (including transfer stations), scale (capacity of end-use – as compared to the volumes treated), operation and maintenance affecting their use. Again, a general assessment of the quality, effectiveness, and functionality and performance standards of different types of end-use and disposal facilities is to be included, where appropriate to the context.

5.3. Performance data

A comprehensive SFD should allow time for the collection of performance data, which aims to identify the extent to which sanitation services are effective, reliable, achieve performance standards and targets, respond to existing demand for services and address future demand. Performance data may be obtained by interviewing people face to face, through Focus Group Discussions (FGDs) or observations. Including performance data will help prepare a strongly evidence-based SFD.

Performance data should include both **quantitative** and **qualitative** data, as shown in the following tables (Table 5 and Table 6 respectively).

Table 5: Quantitative performance data

Stage of the service chain	Data to collect	Data sources
Emptying services	• Customer base • How often people have on-site sanitation technologies emptied • Volume (or percentage) of on-site sanitation technologies emptied each time	• Community representatives and representatives of non-domestic institutions (e.g. schools, business) • Emptying and transportation service providers (formal/informal) • Organisations supporting emptying/transport service providers
Transport (by vehicles)	• Types and capacities of vehicles used to transport faecal sludge from on-site sanitation technologies (an 'inventory' of service providers; manual and motorized) • Number of vehicles used to transport faecal sludge from on-site sanitation technologies	• Emptying and transportation service providers (formal/informal) • Organisations supporting emptying/transport service providers • Licensing authorities for transportation of waste • Municipality • Sanitation authorities
Transport (sewers)	• Average water consumption (litres/person/day) and percentage of population connected to sewers • Volumes of wastewater transported to and arriving at treatment plants / disposal sites through sewer networks (pump readings / flow meters)	• Sewer pumping stations • Inlets to treatment works
Treatment	• Quantities of wastewater or faecal sludge received for treatment at each location (pump readings / flow meters / volume gauge) • Capacity (design and operating), type and condition of facilities used to treat wastewater and faecal sludge (pump readings / flow meters)	• Inlet to treatment works • Stages through the treatment works • Final effluent outlet • Design reports and records • Records of number and capacity of emptying and transportation service providers delivering faecal sludge to treatment facilities
End-use	• Quantities of faecal sludge, wastewater, treated faecal sludge or treated sewage sludge received, at each location • Quantities of faecal sludge or sewage sludge that get reused; how it is reused and who manages the process	• Scale of resource recovery practices
Disposal	• Quantities of wastewater and faecal sludge being disposed of, at each location	• Observation • Community representatives • Emptying and transportation service providers (formal/informal)

Table 6: Qualitative performance data

Stage of the service chain	Data to collect	Data sources
Containment	• Level and ease of access to containment for emptying	• Emptying and transportation service providers (formal/informal) • Community representatives • Households
Emptying services	• Extent to which emptying services operate in particular localities • Whether different income groups use different emptying services • Practices and equipment used to remove faecal sludge from on-site sanitation technologies in different parts of the area	• Emptying and transportation service providers (formal/informal) • Organisations supporting emptying/transport businesses
Transport (by vehicles)	• Performance targets • Geographic coverage • Destination of vehicles transporting faecal sludge	• Emptying and transportation service providers (formal/informal) • Organisations supporting emptying/transport service providers • Licensing authorities for transportation of waste
Transport (sewers)	• Performance targets • Geographic coverage • Leakage records / reports of pollution incidents	• Observation • Treatment plant operators
Treatment	• Location of treatment facilities • Performance standards of treatment processes	• Observation • Treatment plant operators
End-use	• Destination / final use of faecal sludge, wastewater, treated faecal sludge or treated sewage sludge, at each location • Evidence of the nature of resource recovery practices • Demand for end-use products	• Observation • Discussion with organisations involved with, or supporting, end-use operations
Disposal	• Locations and scale of official and unofficial disposal sites (e.g. after treatment or with no treatment) • Management of disposal sites	• Observation • Disposal site operators

5.3.1. Dealing with uncertainty in the data

During the data collection process, it is important to be aware that local realities will vary from data that is reported through more formally documented routes (such as local authority reports of the percentage of septic tanks emptied and the extent to which faecal sludge is taken to registered treatment facilities). Uncertainties in the data may occur at any stage of the sanitation service chain. Each SFD Report should identify any areas of uncertainty, where this is thought to have a significant impact on the resulting SFD Report and Graphic.

Provided below are a few examples of where the difference between reported and actual data may be significant:

- **Containment**: the range of sanitation technologies in use (refer to SFD Manual volume 2: Glossary for more details), the quality of construction and in what numbers they exist (e.g. reports may show 100% coverage of septic tanks in certain areas, when many are in fact partially-lined tanks fundamentally operating as soak pits);
- **Emptying**: the number of households using informal manual (and motorized) emptying and transport service providers;
- **Transport**: the number of sludge truck journeys occurring over a given period (the generally accepted numbers may not reflect the actual reality), or the volumes of wastewater actually conveyed in sewers, compared to reported values;
- **Treatment**: the reported performance of treatment plants compared with performance based on measurements, or conversations with plant operators; and
- **End-use/disposal**: how end-use arrangements cope with changes in the weather or fluctuating demand for end products (e.g. linked to crop growing seasons), extent of end-use or disposal at recognised sites compared with arrangements not officially recognised or reported.

5.4. SFD Graphic Generator

5.4.1. Introduction

This section provides guidance on how to use the SFD Graphic Generator to draw an SFD Graphic for any city or urban area. The SFD Graphic Generator is available at [http://sfd.susana.org/data-to-graphic].

This section and the SFD Graphic Generator should be used in conjunction with the SFD Manual Volume 2: Glossary.

On the SFD Graphic Generator landing page there are three options:

- Start new SFD graphic – this is the place to start if you are making a new SFD graphic.
- Choose one of your own SFD files – use this to load an SFD Graphic file you previously created and saved, this is stored in 'json' (JavaScript Object Notation) format.
- Select from the SFD library – use this to select and then load an SFD Graphic file stored on the SFD Webportal.

The Start new SFD graphic button allows the user to create a new SFD graphic by entering data for any city in three steps:

Step One: Provide general information about the city, the level of SFD, date of production and author's name (these information will be added to your graphic). Then, select the sanitation systems in use in the city.

Step Two: Enter data about the proportion of people using each type of system and the proportion of each system that is emptied, transported and treated.

Step Three: Draw the SFD Graphic and save data for sharing and/or using in reports and publications.

Clicking one of the ⓘ icons will prompt a pop-up window with more detailed instructions on how to use the SFD Generator.

Clicking on one of the two the ↻ icons will delete all input data, allowing the user to start again or start an SFD Graphic for a new city.

5.4.2. Step One: Enter general city information and select sanitation systems

After clicking the Start new SFD graphic, in **Step One** users are required to enter general information about the city and select the sanitation systems in use in the city.

That following information should be entered in the boxes provided:

- Name of city or urban areaProvince or state
- Country
- Population of city or urban area SFD Level
- Date on which data was entered
- Name of person and/or organisation entering the data

The SFD Selection Grid enables the user to define the set of sanitation containment systems present in the city. It consists of a matrix showing each possible sanitation containment system described in terms of the place to which the toilet discharges (for instance a sewer or containment technology) and the place to which the containment technology discharges (for instance a soak pit or open drain). The SFD Matrix comprises:

List A (first column of the matrix), which shows the list of possible technologies:

1. No onsite container, toilet discharges directly to destination given in List B.
2. Septic tank.
3. Fully lined tank (sealed).
4. Lined tank with impermeable walls and open bottom.
5. Lined pit with semi-permeable walls and open bottom.
6. Unlined pit.
7. Pit (all types), never emptied but abandoned when full and covered with soil.

8. Pit (all types), never emptied but abandoned when full and NOT adequately covered with soil
9. Toilet failed, damaged, collapsed or flooded.
10. Containment (septic tank or tank or pit latrine) failed, damaged, collapsed or flooded
11. Open defecation.

List B (top row of the matrix), which shows the list of all possible places to which the containment technology could be connected (i.e. where the outlet or overflow discharges to, if anything):

1. To centralised combined sewer.
2. To centralised foul/separate sewer.
3. To decentralised combined sewer.
4. To decentralised foul/separate sewer.
5. To soakpit.
6. To open drain or storm sewer.
7. To water body.
8. To open ground.
9. To 'don't know where'.
10. No outlet or overflow.

The term *Not applicable* on the Selection Grid indicates that the combination of technologies is not possible. These cells cannot be selected and are permanently white.

As the user moves the cursor over each grid square, the containment technology (from List A) and what it is connected to (from List B) is highlighted. The system is selected by clicking on the chosen cell. The selected cell will turn green. The system can be deselected by clicking again.

Some systems require the assessment of the risk of groundwater pollution. A split cell in the system selection grid represents these systems. For these systems, the user can select:

- The top half of the split cell if there is a Significant risk of groundwater pollution. If selected, the cell will turn blue.
- The lower half of the split cell if there is a Low risk of groundwater pollution. If selected, the cell will turn yellow.

5.4.3. Estimating risk of groundwater pollution

The risk of groundwater pollution can be estimated from data on drinking water from groundwater sources, hydrogeology and the distance between groundwater sources and sanitation facilities.

After clicking the ⓘ icon and then clicking on the Risk of groundwater pollution button, the user is redirected to a web-based tool to identify areas of the city where the risk of groundwater pollution is either low or significant.

The risk of groundwater pollution is assessed according to four criteria:

1. The vulnerability of the aquifer (Q1).
2. The typical lateral spacing between sanitation systems and ground water sources (Q2).
3. The degree to which drinking water supplies are provided from groundwater sources inside the city (Q3).
4. The type of technology used to produce groundwater including the level of protection that this provides (Q4).

-Question **Q1: Vulnerability of the aquifer** is divided into two sub questions:

A. What is the rock type in the unsaturated zone? Five options are provided:
   - Fine sand, silt and clay.
   - Weathered basement.
   - Medium sand.
   - Coarse sand and gravels.
   - Sandstones/limestones fractured rock.

   Supplementary information can be obtained by clicking on the Table 1 button.

B. What is the depth of the water table? In general this should be the depth to the groundwater table during the wettest period of the year. Three options are displayed:
   - <5m.
   - 5-10m.
   - >10m.

   Supplementary information can be obtained by clicking on the Figure 1 button.

-Question **Q2: Lateral separation** is divided into two sub questions:

A. What is the percentage of sanitation facilities that are located <10m from groundwater sources? Two options are given:
   - Greater than 25%.
   - Less than 25%.

   This data should be estimated. In a city, a good way to think about this question is to consider whether there are large numbers of tube wells, wells and springs located within densely populated areas.

   Supplementary information can be obtained by clicking on the Figure 1 button.

B. What is the percentage of sanitation facilities, if any, that are located uphill of groundwater source? Two options are displayed:
   - Greater than 25%.
   - Less than 25%.

-Question **Q3: Water supply.** What is the percentage of drinking water produced from groundwater sources? Three options are given:

- Greater than 25%.
- Between 1% and 25%.
- 0%.

-Question **Q4: Water production**. What is the water production technology used? Three options are provided:

- Protected boreholes, protected dug wells or protected spring where adequate sanitary measures are in place.
- Unprotected boreholes, dug wells or springs.
- No groundwater sources used.

Supplementary information can be obtained by clicking on the Table 2 button.

All answers are displayed as drop-down menus. When the user has provided answers to all questions, the OVERALL RISK will be shown automatically. Answering these four questions will give the user an estimate of whether the groundwater pollution presents Low risk or Significant risk.

Note: Different regions of the city may experience different levels of risk of groundwater pollution depending on hydro-geological conditions, and variations in the way in which water supply is provided. It is possible for one city to have several areas using the same sanitation containment systems, some which have low risk of groundwater pollution and some which have significant risk of groundwater pollution.

5.4.4. Step two: Create SFD Matrix

In **Step Two** users enter data for each selected sanitation system on the SFD Matrix. Where onsite sanitation systems are used, users are required to enter the proportion of the contents of each type of onsite container (either septic tanks; or fully lined tanks (sealed); or lined tanks with impermeable walls and open bottom and all types of pits), which are faecal sludge. Clicking the ⓘ icon will open a pop-up window with more detailed instructions to help the user enter the numerical values for these proportions.

Clicking the Create SFD Matrix button will reveal the SFD Matrix so that the user can enter the data for each selected sanitation system.

This SFD Matrix consists of all the sanitation systems selected in the SFD Selection Grid. The first column (system description) contains all the systems selected and the first row (system label)

shows the additional data regarding the performance of each system that is required to be entered. The values to be entered are expressed as a percentage of the preceding variable.

For detailed descriptions and definitions of the various sanitation systems and labels, the user is referred to the SFD Manual Volume 2: Glossary.

> **Note:** If the percentages for the proportion of population using all types of system do not add up to 100%, a warning message appears in a pop-up window to indicate that the total population does not sum to 100%. The user should correct this by changing the "Population" entries in the SFD matrix.

5.4.5. Step Three: Draw SFD graphic

In **Step Three,** by clicking the Draw SFD Graphic, the SFD Graphic Generator uses the input data to draw an SFD Graphic for the city. If changes are required, the user can go back and make changes to data input on the SFD Selection Grid and/or on the SFD Matrix. Any unchanged data will not be lost.

Finally, users can save data and/or create outputs, which can be shared or uploaded into reports and publications, using the following options:

- **Download Data:** This button will create a *.json* file of the data in the user's Download folder. This file format can be uploaded to the generator if you would like to edit the data entry or generate another SFD based on the same data.
- **Download the selected file**: using the drop-down menu, users can choose to save different outputs to their Download folder:
    - SFD Graphic as *png*: This will create a *.png* file of the SFD Graphic.
    - SFD Matrix as *png*: This will create a *.png* file of the SFD Matrix.
    - SFD Selection Grid as *png*: This will create a *.png* file of the SFD Selection Grid.
    - SFD Data as *csv*: This will create a *.csv* file of the data.
    - SFD Graphic as *svg*: This will create a *.svg* file of the SFD Graphic.
- **Attach to SFD Report** button. The SFD Graphic will be automatically attached to the report in the SFD Helpdesk.

Clicking the ⓘ icon will prompt a pop-up window with more detailed information on saving data and downloading outputs.

6. Ethical Considerations

The main ethical considerations to bear in mind during data collection are described below:

- **Informed voluntary participation:** Informed oral consent must be obtained from participants before data collection is conducted. Participants are to be informed about the purpose, methods, risks, benefits and intended possible uses of the results of the study.
- **Right to refuse or withdraw:** The participants will be informed that they are free to refuse to answer any questions. They will also have the right to ask questions at any point before, during or after the study is completed.
- **Confidentiality and privacy:** No personal identifiers will be used in any form of reporting or dissemination. Personal identifications will be linked with a unique identifier (e.g. id code) and kept securely. No information will be published that could identify the respondents. Paper copies of collected data will be stored for three years in a secure location; only the study team should be able to access them. While confidentiality cannot always be guaranteed (especially where data is collected in a group, or public setting), participants are requested not to disclose details of what was discussed.
- **Risks and benefits:** The risk of participation in the study is considered minimal. The respondents will not be directly benefited by participating, however the information that they will provide may give some important information to the policy makers to improve the overall sanitation condition of their city and they may eventually have an indirect benefit from that.
- **Payment:** There will be no compensation payment to the participants and nor will they have to pay to participate in the study.

6.1. Data Management

Good data collection and quality control must be followed-up by sound data management. An SFD Report is to be prepared using the available template (refer to the SFD Report template), to consistently capture the significant issues raised during data collection.

- All details shared during interviews, focus group discussions or observations need to be adequately recorded by a note-taker. This may be done in hard copy or soft copy format.
- All word documents should be allocated a unique identification name/label that will clearly identify the location of the activity and nature of the data collection method used. Copies of original write-ups (in soft and/or hard copy) must be kept securely throughout the duration of the study.

Findings from a review of literature should be included in the SFD Report, with good citation of sources of data and a full reference list of both published and grey literature.

7. Stakeholder Engagement

Engaging with other stakeholders in your city is important to the success of any study. It is a valuable aspect of any report as it ensures transparency, involves stakeholders in decisions and also helps to better understand the many perspectives of sanitation provision. A wide range of stakeholders exist around the provision of urban sanitation services and it is important to know which stakeholders to engage with at each stage of the study.

Identifying and accessing credible data for each study requires a clear process of engagement with the key stakeholders who have influence and/or are involved in sanitation services. It is important to adopt a clear and consistent process for engaging these key stakeholders during the study, to gain both acceptance and support for the work.

7.1. Principles of stakeholder engagement

Six principles of stakeholder engagement were identified by (Sharma, 2008) for the context of Supply Chain Management. The following five principles are based on this publication and have been adapted to the urban sanitation context, to follow when planning or managing a study.

7.1.1. Principle 1: Stakeholder identification

It is important to develop a comprehensive understanding of who stakeholders are, what their interests are, and how they relate to the study. When performing this initial step, it helps to view stakeholders from two different perspectives: vertically and horizontally.

The vertical perspective includes all stakeholders from within an organisation's highest position (where budget and policy decisions are made) down to individuals (those directly impacted). An effective outreach strategy can only be implemented if key players at each level of the organisation are identified.

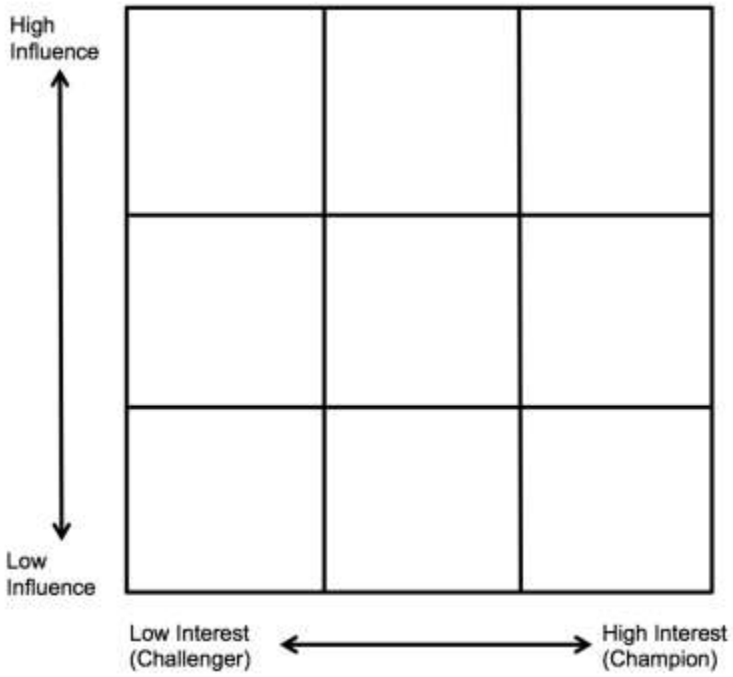
The horizontal dimension includes stakeholders across an organisation (or organisations), which is likely to include many people whose roles relate to the study in different ways. Each level of stakeholder(s) across organisations represents a different perspective and type of expertise.

Additionally, it is recommended to consider internal and external stakeholders. Internal stakeholders can be the city authority or utility having responsibility for providing sanitation and FSM services, while external stakeholders may include the national government, which has a direct interest in the study. Stakeholders can then be classified into four different groups:

1. High Influence Challengers;
2. High Influence Champions;
3. Low Influence Challengers; and
4. Low Influence Champions.

These can then mapped into a stakeholder influence-interest matrix, which helps to identify the primary focus of stakeholder engagement efforts (see Figure 2). It is recommended to perform this stakeholder mapping activity for every SFD Report.

Figure 2: Stakeholder influence-interest matrix



Source: adapted from Sharma (2008) and Strande et al. (2014)

Additionally it is recommended to identify in which part of the sanitation service chain the stakeholders are working as illustrated by an example in Table 7.

Table 7: Stakeholders working on different parts of the sanitation service chain

Stakeholder	**Group** (depending on the influence-interest matrix)	**Part of the sanitation service chain the stakeholders are working in**				
		Containment	**Emptying**	**Transport**	**Treatment**	**Reuse/Disposal**
Institution example 1	High Influence Champions					
Institution example 2	Low Influence Champions.					
Institution example 3	Low Influence Challengers					
Institution example 4	High Influence Challengers					

According to this, and depending on the level of SFD that is going to be developed (see Section 3), the author has to decide which stakeholders to contact ensuring the representativeness of the sanitation service chain in the city. When a high influence stakeholder could not be contacted has to be clearly stated in the report.

7.1.2. Principle 2: Early engagement

It is important to contact stakeholders at the beginning of a study, not just present the final deliverable as "the solution". Throughout the study it is important to continuously encourage participation, where appropriate. This approach achieves three main objectives:

1. It gives key stakeholders a sense of involvement and ownership in the process, and shows that their expertise and opinions are valued.
2. It starts to sensitise stakeholders about the potential benefits of the study.
3. It allows the team carrying out data collection to gain additional, potentially valuable, information and insights that may or may not support the findings compiled through data alone.

Depending on the group outlined under principle one, some stakeholders require more active engagement than others and identifying an appropriate level of involvement (based on experience, judgement and common sense) is necessary to save time and resources.

7.1.3. Principle 3: Respecting opinions

When conducting interviews, having FGDs or having any other type of direct conversation with stakeholders, it is always important to ensure that the stakeholder's opinions are being considered. If this cannot be achieved, the following outcomes can be expected:

- Stakeholders tell the interviewee what they believe she/he wants to hear, but not what they really think. The conversation, and ultimately the study, will be dismissed.
- Stakeholders tell the interviewee their honest opinion, but have mistrust towards the study.
- Stakeholders simply don't participate.

When taking the time to ask stakeholders for their opinions or when creating space for participation, it should be ensured that the participation is serious and meaningful. Effective stakeholder engagement must be valued by all parties involved.

7.1.4. Principle 4: Communication

Regular communication helps to ensure that stakeholders are aware of the study's existence and purpose, and additionally to ensure that a clear understanding of the study's goals and benefits is provided. In particular, in cities where the resulting service delivery context analysis and corresponding SFD Graphic will show rather negative results, appropriate communication is of major importance.

Appropriate communication can be achieved in many different ways, some of which are:

- Providing background material that informs about the basics of the study and serves as a source of reference for the stakeholder (e.g. factsheets in hard- and soft-copy);
- Informing stakeholders about the study's status, communicating decisions and providing updates (e.g. through a newsletter or email updates); and
- Transfer of knowledge through compiling findings, lessons learned and best practices, which can be shared among appropriate stakeholder groups.

Before engaging with stakeholders on a city level, it is recommended that a simple communication strategy should be developed to outline how communication will be practised amongst the city and study partners.

7.1.5. Principle 5: Ethical considerations

The following points should be addressed during interviews or focus group discussions with, or observation of, stakeholders, to ensure the collection of data meets with ethical standards:

- State the purpose of the interview, focus group discussion or observation and use of findings, before starting.
- Offer anonymity – and ensure it is followed if requested.
- Only use a voice-recorder with the prior knowledge and consent of all those involved.
- Gain verbal consent to start the interview, focus group discussion or observation and note this in the write-up.
- Allow the participants to "pass" on specific questions and the opportunity to stop the interview at any time they wish.
- Provide a write-up of the interview, focus group discussion or observation, if requested.
- Indicate the next steps or possible follow up, if appropriate.

Besides providing a necessary level of respect towards those involved, these standards have to be followed to produce credible results, which ultimately contribute towards higher quality service delivery context analysis and description, as well as enhancing the quality of the related SFD Graphic.

7.2. Stakeholder engagement for each method of data collection

For each method of data collection a different type of stakeholder engagement is required depending on the purpose of the method.

The methods of data collection required to follow the process include (but are not limited to) literature reviews (secondary data reviews), key informant interviews, observations and focus group discussions.

7.2.1. Literature review of existing secondary data

During the initial literature review, it is suggested to use the Stakeholder influence-interest matrix (see Figure 2) as a tool for stakeholder mapping and identification of key stakeholders. Contact details that cannot be obtained through existing literature or websites may need to be collected through Key Informant Interviews, which are likely part of the group identified in Table 8.

Table 8: Stakeholder Groups

No.	Stakeholder group
1	City council / Municipal authority / Utility
2	Ministry in charge of urban sanitation and sewerage
3	Ministry in charge of urban solid waste
4	Ministries in charge of urban planning, environmental protection/ health, finance and economic development, agriculture
5	Service provider for construction of on-site sanitation technologies
6	Service provider for emptying and transport of faecal sludge
7	Service provider for operation and maintenance of treatment infrastructure
8	Market participants practising end-use of faecal sludge end products
9	Service provider for disposal of faecal sludge (sanitary landfill management)
10	External agencies associated with FSM services: e.g. NGOs, academic institutions, donors, private investors, consultants

When establishing contact with the stakeholder, the process (date and purpose) of engagement should be documented, as well as a short summary of the outcomes.

7.2.2. Key Informant Interviews

Key informant interviews can be held with all stakeholders having a role or interest in sanitation services within the city. They are likely to include:

- City council/ Municipality/ Utility
- Government Ministries/ Departments with responsibility for: urban sanitation/ sewerage (liquid waste), urban solid waste collection, urban water supply, urban planning, environmental health/ protection, finance, economic development and agriculture.
- Service providers (private and/or public) covering: manual and mechanised emptying and transportation services, public sector operation of faecal sludge and wastewater treatment and disposal sites, private sector operation of faecal sludge and wastewater end-use sites (including re-use for agriculture and industry)
- NGOs and other ‘external’ agencies providing support to sanitation services. In this context, ‘external’ refers to individuals and agencies that are not service providers but have interests related to sanitation management and service delivery. In addition, key informants could include those who are not key stakeholders (i.e. those with a direct interest or ‘stake’ in sanitation services) but perhaps more ‘neutral’ or ‘objective’

observers of the sector, including academics or researchers with expertise and relevant knowledge in sanitation and faecal sludge management or, in some cases, even the media.

It may help to phase the timing of interviews, to build-up the level of understanding about the context and extent of sanitation services in the City. This will depend to some extent on existing experience and any existing relationships developed with the stakeholders involved.

An example of phasing is shown below:

Table 9: Example of phasing

Phase	Type of stakeholder
1st set	External agencies associated with sanitation services (to also feed into sampling of other sets of key informants and stakeholders)
2nd set	City council/ Municipality/ Utility Ministry responsible for sanitation and faecal sludge management services Ministry responsible for solid waste management
3rd set	Ministries responsible for: • urban planning, • environmental protection, • health, • finance and economic development, • agriculture
4th set	Emptying / transportation service providers (following household interviews) Treatment plant / end-use / disposal site service providers

The identification, prioritisation and sampling of respondents from each stakeholder group may be based on an initial quick assessment of institutional responsibilities. This will help identify key stakeholders and the potential perspectives and responsibilities they may have, to help focus on appropriate questions for particular respondents.

Key informants and stakeholders with different positions and perspectives bring their own sets of interpretive biases and analysis. For some of the study areas, there may be no single absolute truth and it can be useful to understand differences of opinion (rather than expect standardisation). Trustworthiness in interpretation can nonetheless be strengthened by cross-checking – or triangulating – the views and analysis of different key informants (and focus groups). It is important to remember that these may include people who might not normally be talked to, in order to ensure multiple and different perspectives are gathered. It is critical that women are interviewed and that the gender of each respondent is recorded on all interview reports.

The total number of interviews required, as well as the range and extent of questioning, will also be influenced by the availability of current and reliable data from other sources, as well as constraints on time and resources. The actual range of stakeholders and interviewees should be determined following an initial stakeholder mapping activity.

The final list of stakeholders and proposed interviews should ensure appropriate representation from a range of government ministries and service providers, as well as external agencies. Representation of service providers through the sanitation service chain should reflect the percentage of roles and responsibilities that each plays in sanitation and faecal sludge services for the study city. For example, in a city where manual emptying service providers are dominant, they must account for the majority of those observed and interviewed during emptying and transportation procedures; likewise, where private companies carry out mechanised emptying and transportation services for most areas of the city, they should account for the majority of providers observed and interviewed during emptying and transportation procedures.

7.2.3. Observations

Observations can be undertaken at each stage of the sanitation service chain to identify actual practices that take place day to day in a given city. It is therefore expected that most observations will take place during an emptying and transport event, from containment to potential treatment and/or disposal and end-use.

Engagement with emptying and transportation service providers, in particular, requires a certain level of discretion from the initial contact and throughout the process of data collection.

Possible scenarios for emptying and transporting faecal sludge that can be expected include:

1. Emptying and transportation services are completely formalised and a public service;
2. Emptying and transportation services are completely formalised and undertaken by both public and private service providers;
3. Emptying and transportation service are formal and informal, and undertaken by both public and private service providers; and
4. Emptying and transportation service are completely informal and undertaken by private service providers.

Each of these situations requires different principles when engaging with stakeholders performing emptying and transportation services. In line with the four groups described above, the following principles should be followed:

1. *Emptying and transportation services are completely formalised and a public service:* With the stakeholder engaged directly at the municipal level, an agreement needs to be reached with the responsible authority to allow observation of the process from

emptying and transportation to treatment and/or disposal and end use. Due to the formality of the sector, it could be assumed that all collected faecal sludge is transported to a designated treatment and/or disposal site, which should be confirmed through observations and Key Informant Interviews.

2. *Emptying and transportation services are completely formalised and undertaken by both public and private service providers*: Engaging with private emptying and transportation service providers differs from engaging with public service providers, as those running a business can be expected to be more cautious about having someone join and observe the team providing emptying and transportation services. It is important to identify how the private emptying and transportation service provider sector is structured, in order to identify key stakeholders who may be responsible for managing the logistics of the service providers. Often, emptying and transportation service provider associations exist, of which some are managed by one or two single persons (heads of association). Those individuals are not necessarily the owners of the trucks; and the drivers themselves may not own the trucks that they drive. Depending on which data are to be collected, it is recommended to first consult with the head of a potential association to gain interest and acceptance, before directly consulting owners or drivers. Due to the formality of the sector, it could be assumed that all collected faecal sludge is transported to a designated treatment and/or disposal site. However, this should be cross-checked through Key informant interviews.
3. *Emptying and transportation service are formal and informal, and undertaken by both public and private service providers*: Where emptying and transportation services are managed informally, discretion is required when engaging with stakeholders. It can be expected that some amount of faecal sludge is illegally dumped directly into the urban environment, either because no designated treatment and/or disposal sites exist, or due to the fact that discharge fees can be saved rather than spent and higher revenues generated by service providers. It is probable that service providers will not agree to observers joining the process of emptying and transporting faecal sludge due to the illegal nature. It is important not to antagonise or alienate the service providers. Information about the sector should be obtained from the other key stakeholders through Key informant interviews.
4. *Emptying and transportation service are completely informal and undertaken by private service providers*: The same applies as for point three.

8. Evaluating credibility of data sources

As literature is identified, the credibility of each source should be assessed. Before assessing the information, it is vital to ascertain the integrity and authority of the source. Good judgement will be needed as to the accuracy and reliability of the information. Bias in information may be deliberate or it may be due to an observer's cultural, educational and social background. Be aware of likely sources of bias.

Interpreting 'grey' / unpublished literature needs more care: look at who "owns" the data, how and when it was collected, who carried out a survey, how they were trained and what their experience was. This can all help to give an indication of its reliability. The principle of triangulation or cross-checking, allows for two independent sources of information to be used to corroborate and support each other. If there is a discrepancy, then further investigation and seeking additional views and sources of information are required.

All literature included in the final study must be cited and referenced consistently, comprehensively and according to an approved standard format (such as Harvard referencing).

8.1. Self-assessment

The procedure on how to assess credibility of the sources used to produce the SFD Report and Graphic is presented in the SFD Review Procedure document. The idea of this stage in the process is to consider the credibility of sources used in a quantitative way by creating a source assessment ranking that identifies one of three outcomes: Poor, Medium and High.

8.2. Reviewing Process

A prepared SFD Report can be submitted for review by the SFD Promotion Initiative through the helpdesk (http://sfd.susana.org/toolbox/sfd-helpdesk), once the self-assessment has been completed. This process will allow for classification, consistency and improvements in the quality of an SFD Report whilst providing informed comments to the authors and constructive criticism to help improve the report. This is done through:

- Reviewer checklist
- Recommendation on whether the report is suitable for publication on the SFD Webportal.

9. Reporting

The SFD Report should be written using the process described in the SFD Reporting Template and SFD Lite Template - Guidance Note documents. In this way, a record can be kept of the information collected, gaps in data identified, and all assumptions made as analysis of the sanitation service chain is being carried out.

9.1. Guidelines

The main guidelines to produce the report are the SFD Reporting Template Document and the SFD Lite Template - Guidance Note. Guidance is provided about which data to report and to what level.

The SFD report (Level 1, 2 or 3) is defined by three parts:

1. **Executive summary:** a 4 page document in which the key outcomes and conclusions, as well as the major assumptions that have been made, are clearly presented.
2. **Detailed report:** this includes all of the information collected, covering all the relevant and credible information. It should not be longer than 20 pages with additional details provided in the appendices. At the end of the report the references must be included, with all literature cited and referenced consistently, comprehensively and according to an approved standard format (such as Harvard referencing).
3. **Appendices**: Relevant information to understand the sanitation situation in the area should be included in the appendices in addition to the Stakeholder Identification, (see Section 7), the SFD Selection Grid and SFD Matrix (see Section 5.4) and the Evaluation of the Quality and Credibility of data (see Section 8)

The detailed report can be uploaded to the SFD website portal using the standard agreed format after being subject to the procedure for quality assurance through the SFD helpdesk.

10. Key resources

Blackett, I., Hawkins, P. and Heymans, C. (2014). *The Missing Link in Sanitation Service Delivery*. 1st ed. [ebook] Washington D.C.: World Bank WSP. Available at: http://www.susana.org/_resources/documents/default/2-2037-wsp-fecal-sludge-12-city-review-research-brief.pdf [Accessed 3 May 2017].

Fernández-Martínes, L. (2016). *Using the Shit/Excreta Flow Diagrams (SFDs) for modelling future scenarios in Kumasi, Ghana*. 1st ed. [ebook] Loughborough: Loughborough University, p.132. Available at: http://sfd.susana.org/resources/recommended-readings?details=2688 [Accessed 3 May 2017].

Furlong, C., Mensah, A., Donkor, J. and Scott, R. (2016). http://www.susana.org/_resources/documents/default/3-2264-22-1434719256.pdf. *WEDC International Conference*, [online] 39(2567). Available at: http://www.susana.org/_resources/documents/default/3-2659-7-1478270204.pdf [Accessed 3 May 2017].

Landscape study on Fecal Sludge Management. (2015). 1st ed. [ebook] New Delhi: Population Services International. Available at: http://www.susana.org/_resources/documents/default/3-2264-22-1434719256.pdf [Accessed 3 May 2017].

Peal, A. and Evans, B. (2013). *A Review of Fecal Sludge Management in 12 Cities*. 1st ed. [ebook] Washington D.C.: World Bank WSP. Available at: http://www.susana.org/_resources/documents/default/3-2212-7-1435304068.pdf [Accessed 3 May 2017].

Rohilla, S., Watwani, J., Luthra, B., Varma, R., Padhi, S. and Yadav, A. (2016). *URBAN SHIT*. 1st ed. [ebook] New Delhi: Centre for Science and Environment. Available at: http://www.susana.org/_resources/documents/default/3-2738-7-1488463389.pdf [Accessed 3 May 2017].

Strande, L., Ronteltap, M. and Brdjanovic, D. (2014). *Faecal sludge management*. 1st ed. London: IWA Publishing.

Tilley, E., Ulrich, L., Luthi, C., Reymond, P. and Zurbrugg, C. (2017). *Compendium of Sanitation Systems and Technologies*. 2nd ed. [ebook] Duebendorf, Switzerland: Swiss Federal Institute of Aquatic Science and Technology (Eawag). Available at: http://www.susana.org/_resources/documents/default/3-454-7-1413804806.pdf [Accessed 3 May 2017].

Williams, A. and Overbo, A. (2015). *Estimates for the Unsafe Return of Human Excreta to the Environment*. 1st ed. [ebook] Chapel Hill: The Water Institute at UNC. Available at: http://www.susana.org/_resources/documents/default/3-2304-22-1440421678.pdf [Accessed 3 May 2017].

SFD Manual

VOLUME 2: Glossary

Glossary

This Volume contains four parts:

- Part 1: Master SFD Graphic
  - This locates all the possible variables used in the SFD Graphic Generator and shows how they are connected.
- Part 2: Definition of SFD Graphic Variables
  - This describes and defines all the variables used in the SFD Graphic Generator.
- Part 3: Definition of Terms
  - This defines all the terms used in the SFD Graphic Generator, and provides examples of commonly used regional variations.
  - Terms in each definition starting with a Capital Letter are also defined within this document.
- Part 4: Sanitation Containment System: SFD Schematics
  - These schematic drawings show all of the possible sanitation containment systems defined on the selection grid within the SFD Graphic Generator.

This Glossary should be used in conjunction with the SFD Graphic Generator (SFD GG), which is a tool for drawing SFD Graphics.

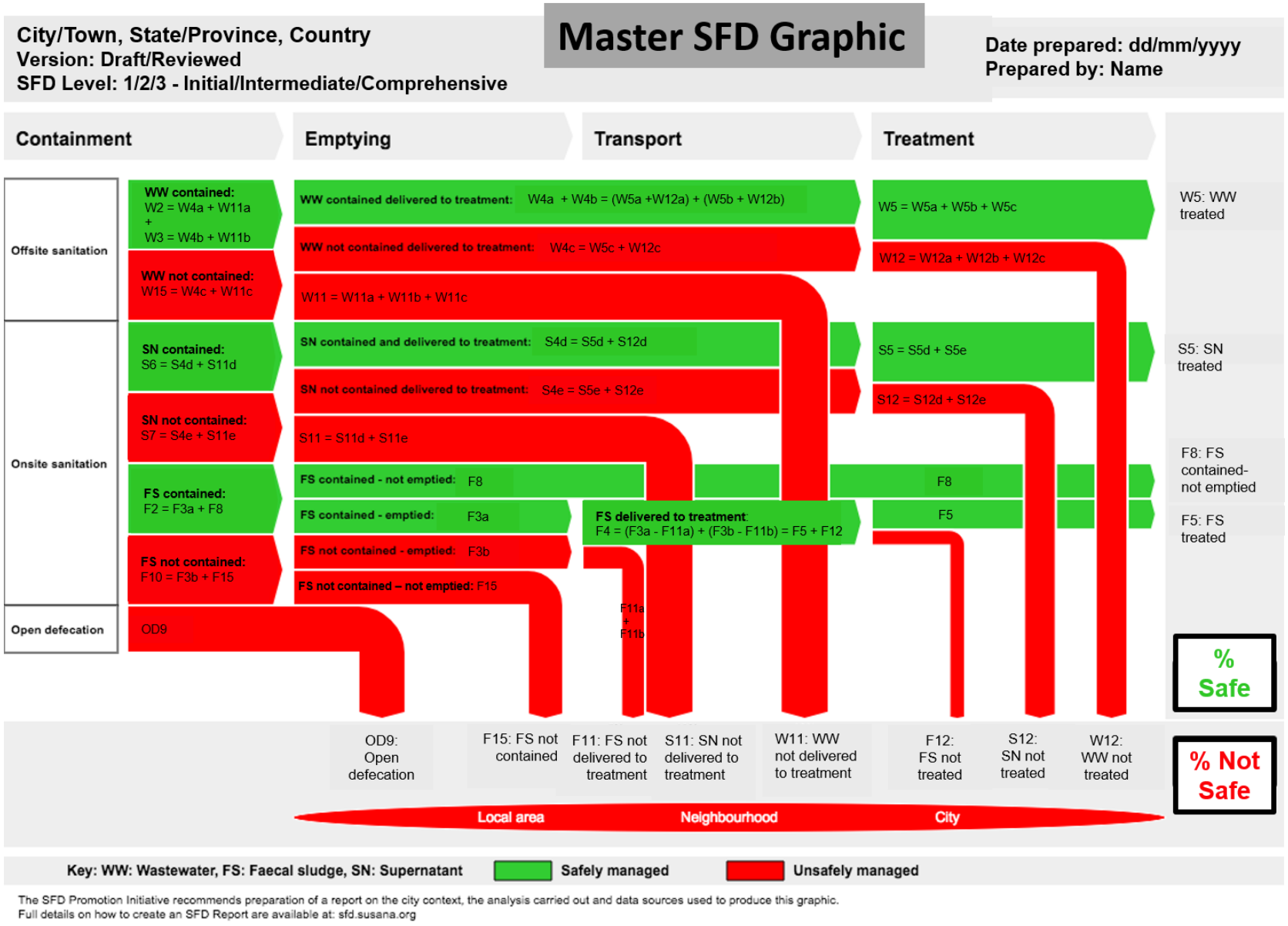
Guidance on how to use the SFD Graphic Generator is given in SFD Manual Volume 1, Section 5.4.

All the definitions contained in the Glossary are provided for use with the SFD Graphic Generator and for the purpose of the SFD Promotion Initiative only.

Part 1 – Master SFD Graphic

Notes:

1. This document should be read in conjunction with Section 5.4 of the SFD Manual Volume 1 and with the three other parts of this Volume 2:
   - Part 2 - Definition of SFD Variables
   - Part 3 - Definition of Terms
   - Part 4 – Sanitation Containment System: SFD Schematics
2. The Master SFD Graphic (see over) locates all the possible variables used in the SFD Graphic Generator and shows how they are connected.
3. Using relevant input data for a given city, the SFD Graphic Generator assigns values to the appropriate variables and draws an SFD Graphic for the given city.



The SFD Promotion Initiative recommends preparation of a report on the city context, the analysis carried out and data sources used to produce this graphic.
Full details on how to create an SFD Report are available at: sfd.susana.org

Part 2 - Definition of SFD variables

Notes:

1. This document should be read in conjunction with Section 5.4 of the SFD Manual Volume 1 and the three other parts of this Volume 2:
   - Part 1 – Master SFD Graphic
   - Part 3 - Definition of Terms; and
   - Part 4 - Sanitation Containment System: SFD Schematics.
2. This document describes and defines all the variables used in the SFD Graphic Generator and shown on the Master SFD Graphic.
3. The System Selection Grid (see below) shows the variable group labels (e.g. L7) and individual references (e.g. T1A2C5) for each sanitation containment system.
4. The SFD Variables Table (see over) shows all the variables used in the SFD Graphic Generator and shown on the Master SFD Graphic, and are listed the order in which they are defined in the following pages.
5. Refer to Part 3 – Definition of Terms for full explanations of all the technical terms used.

System Selection Grid

List A: Where does the toilet discharge to? (i.e. what type of containment technology, if any?)	List B: What is the containment connected to? (i.e. where does the outlet or overflow discharge to, if anything?)									
	to centralised combined sewer	to centralised foul/separate sewer	to decentralised combined sewer	to decentralised foul/separate sewer	to soakpit	to open drain or storm sewer	to water body	to open ground	to don't know where	no outlet or overflow
No onsite container. Toilet discharges directly to destination given in List B.	T1A1C1 L1	T1A1C2	T1A1C3 L2	T1A1C4	T2A1C5 S1 L3 T1A1C5	L4 T1A1C6	T1A1C7 L5	T1A1C8	T1A1C9	Not applicable
Septic tank	T1A2C1	T1A2C2	T1A2C3	T1A2C4	T2A2C5 S2 L7 T1A2C5	T1A2C6 L8	T1A2C7	T1A2C8 L9	T1A2C9	
Fully lined tank (sealed)	T1A3C1	T1A3C2 L6	T1A3C3	T1A3C4	T2A3C5 S2 L7 T1A3C5	T1A3C6	T1A3C7	T1A3C8	T1A3C9	L10 T1A3C10
Lined tank with impermeable walls and open bottom	T2A4C1	T2A4C2 S3	T2A4C3	T2A4C4	T2A4C5 S2 L7 T1A4C5	T1A4C6	T1A4C7	T1A4C8	T1A4C9	T2A4C10 S4
	T1A4C1	T1A4C2 L6	T1A4C3	T1A4C4						L11 T1A4C10
Lined pit with semi-permeable walls and open bottom	Not applicable									T2A5C10 S4 L11 T1A5C10
Unlined pit										T2A6C10 S4 L11 T1A6C10
Pit (all types), never emptied but abandoned when full and covered with soil										T2B7C10 S5 L12 T1B7C10
Pit (all types), never emptied, abandoned when full but NOT adequately covered with soil										L13 T1B8C10
Toilet failed, damaged, collapsed or flooded	T1B9 C1 TO C10	T1B9 C1 TO C10	T1B9 C1 TO C10	T1B9 C1 TO C10	T1B9 C1 TO C10	L14 T1B9 C1 TO C10	T1B9 C1 TO C10	T1B9 C1 TO C10	T1B9 C1 TO C10	T1B9 C1 TO C10
Containment (septic tank or tank or pit latrine) failed, damaged, collapsed or flooded	T1B10 C1 TO C4	T1B10 C1 TO C4 L15	T1B10 C1 TO C4	T1B10 C1 TO C4	L16 T1B10C5	L17 T1B10C6	T1B10 C7 TO C9	L18 T1B10 C7 TO C9	T1B10 C7 TO C9	L19 T1B10C10
No toilet. Open defecation	Not applicable						T1B11 C7 TO C9	L20 T1B11 C7 TO C9	T1B11 C7 TO C9	Not applicable

KEY:

- indicates low risk of groundwater pollution
- indicates significant risk of groundwater pollution
- indicates excreta is not contained, which could result in a significant risk of pollution
- Not applicable — indicates where the combination of technologies is not possible

SFD Variables Table

Table 10: SFD Variables Table

Description on Master SFD Graphic	SFD variable number and name	Page no.
Containment step		
WW contained (W2 + W3)	W2 - Wastewater contained centralised (offsite) W3 - Wastewater contained decentralised (offsite)	45
WW not contained: W15	W15 - Wastewater not contained (offsite)	46
SN contained: S6	S6 - Supernatant contained (onsite)	47
SN not contained: S7	S7 - Supernatant not contained (onsite)	54
FS contained: F2	F2 - Faecal sludge contained (onsite)	47
FS not contained: F10	F10 - Faecal sludge not contained (onsite)	54
Open defecation: OD9	OD9 - Open defecation	64
Emptying and transport steps		
WW contained delivered to treatment (W4a + W4b)	W4a - Wastewater delivered to centralised treatment	65
	W4b - Wastewater delivered to decentralised treatment	65
WW not contained delivered to treatment: W4c	W4c – Wastewater not contained delivered to treatment plants	65
W11: WW not delivered to treatment (W11a + W11b +W11c)	W11a - Wastewater contained not delivered to centralised treatment plants W11b – Wastewater contained not delivered to decentralised treatment plants W11c – Wastewater not contained not delivered to treatment plants	66/67
SN contained delivered to treatment: S4d	S4d - Supernatant contained delivered to treatment	67
SN not contained delivered to treatment: S4e	S4e - Supernatant not contained delivered to treatment	67
S11: SN not delivered to treatment (S11d + S11e)	S11d - Supernatant contained not delivered to treatment	68
	S11e - Supernatant not contained not delivered to treatment	68
FS contained not emptied: F8	F8 - Faecal sludge contained - not emptied	69
FS contained – emptied: F3a	F3a – Faecal sludge contained - emptied	69
FS not contained – emptied: F3b	F3b – Faecal sludge not contained - emptied	70
F15: FS not contained	F15 - Faecal sludge not contained - not emptied	70
FS delivered to treatment: F4	F4 - Faecal sludge delivered to treatment	70
F11: FS not delivered to treatment (F11a + F11b)	F11a - Faecal sludge contained – emptied, not delivered to treatment plants F11b - Faecal sludge not contained – emptied, not delivered to treatment plants	71
Treatment step		
W5: WW treated (W5a + W5b + W5c)	W5 - Wastewater treated	72
W12: WW not treated (W12a + W12b + W12c)	W12 - Wastewater not treated	72
S5: SN treated (S5d + S5e)	S5 - Supernatant treated	74
S12: SN not treated (S12d + S12e)	S12 - Supernatant not treated	74
F5: FS treated	F5 - Faecal sludge treated	75
F12: FS not treated	F12 - Faecal sludge not treated	75

Variable No: W2 - Wastewater contained centralised (offsite)

Variable group *(See System Selection Grid in Part 4)*	Reference *(See System Selection Grid in Part 4)*	Description *(See System Selection Grid in Part 4)*	Definition
L1	**T1A1C1**	Toilet discharges directly to a centralised combined sewer	This is a fully functioning toilet discharging directly to a correctly designed, properly constructed, fully functioning centralised combined sewer. The excreta is raw, untreated and hazardous, but since it is captured in the sewer, all the excreta in this system will contribute to variable W2.
L1	**T1A1C2**	Toilet discharges directly to a centralised foul/separate sewer	This is a fully functioning toilet discharging directly to a correctly designed, properly constructed, fully functioning centralised foul/separate sewer. The excreta is raw, untreated and hazardous, but since it is captured in the sewer, all the excreta in this system will contribute to variable W2.

Variable No: W3 - Wastewater contained decentralised (offsite)

Variable group *(See System Selection Grid in Part 4)*	Reference *(See System Selection Grid in Part 4)*	Description *(See System Selection Grid in Part 4)*	Definition
L2	**T1A1C3**	Toilet discharges directly to a decentralised combined sewer	This is a fully functioning toilet discharging directly to a correctly designed, properly constructed, fully functioning decentralised combined sewer. The excreta is raw, untreated and hazardous, but since it is captured in the sewer, all the excreta in this system will contribute to variable W3.
L2	**T1A1C4**	Toilet discharges directly to a decentralised foul/separate sewer	This is a fully functioning toilet discharging directly to a correctly designed, properly constructed, fully functioning decentralised foul/separate sewer. The excreta is raw, untreated and hazardous, but since it is captured in the sewer, all the excreta in this system will contribute to variable W3.

Variable No: W15 - Wastewater <u>not</u> contained (offsite)

Variable group *(See System Selection Grid in Part 4)*	Reference *(See System Selection Grid in Part 4)*	Description *(See System Selection Grid in Part 4)*	Definition
L4	**T1A1C6**	Toilet discharges directly to open drain or storm sewer	This is a fully functioning toilet discharging directly to an open drain or storm sewer. The excreta is raw, untreated and hazardous and since it discharges directly to an open drain or storm sewer, all the excreta in this system is considered NOT contained; contributing to variable W15.
L5	**T1A1C7**	Toilet discharges directly to water body	This is a fully functioning toilet discharging directly to a water body. The excreta is raw, untreated and hazardous and since it discharges directly to a water body, all the excreta in this system is considered NOT contained; contributing to variable W15.
L5	**T1A1C8**	Toilet discharges directly to open ground	This is a fully functioning toilet discharging directly to open ground. The excreta is raw, untreated and hazardous and since it discharges directly to open ground, all the excreta in this system is considered NOT contained; contributing to variable W15.
L5	**T1A1C9**	Toilet discharges directly to 'don't know where'.	This is a fully functioning toilet discharging directly to 'don't know where'. The excreta is raw, untreated and hazardous and since it discharges directly to 'don't know where', all the excreta in this system is considered NOT contained; contributing to variable W15.

Variable No: F2 - Faecal sludge contained (onsite); and S6 - Supernatant contained (onsite)

Variable group *(See System Selection Grid in Part 4)*	Reference *(See System Selection Grid in Part 4)*	Description *(See System Selection Grid in Part 4)*	Definition
L3	**T1A1C5**	Toilet discharges directly to soak pit, where there is a 'low risk' of groundwater pollution.	This is a fully functioning toilet discharging directly to a correctly designed, properly constructed, fully functioning soak pit. The excreta is raw, untreated and hazardous, but since it is captured in the soak pit, all the excreta in this system is considered contained; contributes to variable F2 only.
L6	**T1A2C1**	Septic tank connected to a centralised combined sewer	This is a correctly designed, properly constructed, fully functioning septic tank with an effluent outlet connected to a correctly designed, properly constructed, fully functioning centralised combined sewer. The supernatant/effluent flowing from the tank is only partially treated and is still hazardous, but since it is captured in the sewer, all the excreta in this system is considered contained; the faecal sludge fraction contributes to variable F2, and the supernatant/effluent fraction contributes to variable S6.
L6	**T1A2C2**	Septic tank connected to a centralised foul/separate sewer	This is a correctly designed, properly constructed, fully functioning septic tank with an effluent outlet connected to a correctly designed, properly constructed, fully functioning centralised foul/separate sewer. The supernatant/effluent flowing from the tank is only partially treated and is still hazardous, but since it is captured in the sewer, all the excreta in this system is considered contained; the faecal sludge fraction contributes to variable F2, and the supernatant/effluent fraction contributes to variable S6.

Variable group *(See System Selection Grid in Part 4)*	Reference *(See System Selection Grid in Part 4)*	Description *(See System Selection Grid in Part 4)*	Definition
L6	**T1A2C3**	Septic tank connected to a decentralised combined sewer	This is a correctly designed, properly constructed, fully functioning septic tank with an effluent outlet connected to a correctly designed, properly constructed, fully functioning decentralised combined sewer. The supernatant/effluent flowing from the tank is only partially treated and is still hazardous, but since it is captured in the sewer, all the excreta in this system is considered contained; the faecal sludge fraction contributes to variable F2, and the supernatant/effluent fraction contributes to variable S6.
L6	**T1A2C4**	Septic tank connected to a decentralised foul/separate sewer	This is a correctly designed, properly constructed, fully functioning septic tank with an effluent outlet connected to a correctly designed, properly constructed, fully functioning decentralised foul/separate sewer. The supernatant/effluent flowing from the tank is only partially treated and is still hazardous, but since it is captured in the sewer, all the excreta in this system is considered contained; the faecal sludge fraction contributes to variable F2, and the supernatant/effluent fraction contributes to variable S6.
L7	**T1A2C5**	Septic tank connected to soak pit, where there is a 'low risk' of groundwater pollution	This is a correctly designed, properly constructed, fully functioning septic tank with an effluent outlet connected to a correctly designed, properly constructed, fully functioning soak pit. The supernatant/effluent flowing from the tank is only partially treated and is still hazardous, but since it is captured in the soak pit, all the excreta in this system is considered contained; contributes to variable F2 only.
L6	**T1A3C1**	Fully lined tank (sealed) connected to a centralised combined sewer	This is a correctly designed, properly constructed and well maintained fully lined tank with impermeable walls and base. It includes poorly designed and/or constructed and/or maintained septic tanks that, because of these faults or deficiencies, are NOT performing as septic tanks, instead they are acting as sealed vaults (consequently the excreta is potentially more toxic than the excreta in a septic tank). Since the tank is fitted with a supernatant/effluent overflow connected to a correctly designed, properly constructed and fully functioning centralised combined sewer, the excreta in this system is considered contained; the faecal sludge fraction contributes to variable F2, and the supernatant/effluent fraction contributes to variable S6.

Variable group *(See System Selection Grid in Part 4)*	Reference *(See System Selection Grid in Part 4)*	Description *(See System Selection Grid in Part 4)*	Definition
L6	**T1A3C2**	Fully lined tank (sealed) connected to a centralised foul/treated faecal sludge	This is a correctly designed, properly constructed and well maintained fully lined tank with impermeable walls and base. It includes poorly designed and/or constructed and/or maintained septic tanks that, because of these faults or deficiencies, are NOT performing as septic tanks, instead they are acting as sealed vaults (consequently the excreta is potentially more toxic than the excreta in a septic tank). Since the tank is fitted with a supernatant/effluent overflow connected to a correctly designed, properly constructed and fully functioning centralised foul/separate sewer, the excreta in this system is considered contained; the faecal sludge fraction contributes to variable F2, and the supernatant/effluent fraction contributes to variable S6.
L6	**T1A3C3**	Fully lined tank (sealed) connected to a decentralised combined sewer	This is a correctly designed, properly constructed and well maintained fully lined tank with impermeable walls and base. It includes poorly designed and/or constructed and/or maintained septic tanks that, because of these faults or deficiencies, are NOT performing as septic tanks, instead they are acting as sealed vaults (consequently the excreta is potentially more toxic than the excreta in a septic tank). Since the tank is fitted with a supernatant/effluent overflow connected to a correctly designed, properly constructed and fully functioning decentralised combined sewer, the excreta in this system is considered contained; the faecal sludge fraction contributes to variable F2, and the supernatant/effluent fraction contributes to variable S6.
L6	**T1A3C4**	Fully lined tank (sealed) connected to a decentralised foul/separate sewer	This is a correctly designed, properly constructed and well maintained fully lined tank with impermeable walls and base. It includes poorly designed and/or constructed and/or maintained septic tanks that, because of these faults or deficiencies, are NOT performing as septic tanks, instead they are acting as sealed vaults (consequently the excreta is potentially more toxic than the excreta in a septic tank). Since the tank is fitted with a supernatant/effluent overflow connected to a correctly designed, properly constructed and fully functioning decentralised foul/separate sewer, the faecal sludge fraction contributes to variable F2, and the supernatant/effluent fraction contributes to variable S6.

Variable group *(See System Selection Grid in Part 4)*	Reference *(See System Selection Grid in Part 4)*	Description *(See System Selection Grid in Part 4)*	Definition
L7	**T1A3C5**	Fully lined tank (sealed) connected to a soak pit, where there is a 'low risk' of groundwater pollution.	This is a correctly designed, properly constructed and well maintained fully lined tank with impermeable walls and base. It includes poorly designed and/or constructed and/or maintained septic tanks that, because of these faults or deficiencies, are NOT performing as septic tanks, instead they are acting as sealed vaults (consequently the excreta is potentially more toxic than the excreta in a septic tank). Since the tank is fitted with a supernatant/effluent overflow connected to a correctly designed, properly constructed and fully functioning soak pit the excreta in this system is considered contained; contributes to variable F2 only.
L10	**T1A3C10**	Fully lined tank (sealed), no outlet or overflow	This is a correctly designed, properly constructed and well maintained fully lined tank with impermeable walls and base. It includes poorly designed and/or constructed and/or maintained septic tanks that, because of these faults or deficiencies, are NOT performing as septic tanks, instead they are acting as sealed vaults (consequently the excreta is potentially more toxic than the excreta in a septic tank). However, since the tank is NOT fitted with a supernatant/effluent overflow this system is considered contained; contributes to variable F2 only.
L6	**T1A4C1**	Lined tank with impermeable walls and open bottom, connected to centralised combined sewer, where there is a 'low risk' of groundwater pollution.	This is a correctly designed, properly constructed and well maintained lined tank with sealed, impermeable walls and an open, permeable base, through which infiltration can occur. It includes wall-lined but open bottomed tanks and containers which are sometimes mistakenly referred to as septic tanks (e.g. cubluks in Indonesia). Since the tank is fitted with a supernatant/effluent overflow connected to a centralised combined sewer, the excreta in this system is considered contained; the faecal sludge fraction contributes to variable F2, and the supernatant/effluent fraction contributes to variable S6.

Variable group *(See System Selection Grid in Part 4)*	Reference *(See System Selection Grid in Part 4)*	Description *(See System Selection Grid in Part 4)*	Definition
L6	**T1A4C2**	Lined tank with impermeable walls and open bottom, connected to centralised foul/separate sewer, where there is a 'low risk' of groundwater pollution.	This is a correctly designed, properly constructed and well maintained lined tank with sealed, impermeable walls and an open, permeable base, through which infiltration can occur. It includes wall-lined but open bottomed tanks and containers which are sometimes mistakenly referred to as septic tanks (e.g. cubluks in Indonesia). Since the tank is fitted with a supernatant/effluent overflow connected to a centralised foul/separate sewer, the excreta in this system is considered contained; the faecal sludge fraction contributes to variable F2, and the supernatant/effluent fraction contributes to variable S6.
L6	**T1A4C3**	Lined tank with impermeable walls and open bottom, connected to decentralised combined sewer, where there is a 'low risk' of groundwater pollution.	This is a correctly designed, properly constructed and well maintained lined tank with sealed, impermeable walls and an open, permeable base, through which infiltration can occur. It includes wall-lined but open bottomed tanks and containers which are sometimes mistakenly referred to as septic tanks (e.g. cubluks in Indonesia). Since the tank is fitted with a supernatant/effluent overflow connected to a decentralised combined sewer, the excreta in this system is considered contained; the faecal sludge fraction contributes to variable F2, and the supernatant/effluent fraction contributes to variable S6.
L6	**T1A4C4**	Lined tank with impermeable walls and open bottom, connected to decentralised foul/separate sewer, where there is a 'low risk' of groundwater pollution.	This is a correctly designed, properly constructed and well maintained lined tank with sealed, impermeable walls and an open, permeable base, through which infiltration can occur. It includes wall-lined but open bottomed tanks and containers which are sometimes mistakenly referred to as septic tanks (e.g. cubluks in Indonesia). Since the tank is fitted with a supernatant/effluent overflow connected to a decentralised foul/separate sewer, the excreta in this system is considered contained; the faecal sludge fraction contributes to variable F2, and the supernatant/effluent fraction contributes to variable S6.

Variable group *(See System Selection Grid in Part 4)*	Reference *(See System Selection Grid in Part 4)*	Description *(See System Selection Grid in Part 4)*	Definition
L7	**T1A4C5**	Lined tank with impermeable walls and open bottom, connected to a soak pit, where there is a 'low risk' of groundwater pollution.	This is a correctly designed, properly constructed and well maintained lined tank with sealed, impermeable walls and an open, permeable base, through which infiltration can occur. It includes wall-lined but open bottomed tanks and containers which are sometimes mistakenly referred to as septic tanks (e.g. cubluks in Indonesia). Since the tank is fitted with an effluent overflow connected to a correctly designed, properly constructed and fully functioning soak pit the excreta in this system is considered contained; contributes to variable F2 only.
L11	**T1A4C10**	Lined tank with impermeable walls and open bottom, no outlet or overflow, where there is a 'low risk' of groundwater pollution.	This is a correctly designed, properly constructed and well maintained lined tank with sealed, impermeable walls and an open, permeable base, through which infiltration can occur. It includes all lined but open bottomed tanks and containers which are sometimes mistakenly referred to as septic tanks (e.g. cubluks in Indonesia). However, since the tank is NOT fitted with a supernatant/effluent overflow this system is considered contained; contributes to variable F2 only.
L11	**T1A5C10**	Lined pit with semi-permeable walls and open bottom, no outlet or overflow, where there is a 'low risk' of groundwater pollution.	This is a correctly designed, properly constructed and well maintained pit with semi-permeable, honeycombed lined walls and an open, permeable base, through which infiltration can occur. The tank is NOT fitted with a supernatant/effluent overflow so this system is considered contained; contributes to variable F2 only.
L11	**T1A6C10**	Unlined pit, no outlet or overflow, where there is a 'low risk' of groundwater pollution.	This is a correctly designed, properly constructed and well maintained unlined pit with permeable walls and base, through which infiltration can occur. The tank is NOT fitted with a supernatant/effluent overflow so this system is considered contained; contributes to variable F2 only.

Variable group *(See System Selection Grid in Part 4)*	Reference *(See System Selection Grid in Part 4)*	Description *(See System Selection Grid in Part 4)*	Definition
L12	**T1B7C10**	Pit (all types), never emptied but abandoned when full and covered with soil, no outlet or overflow, where there is a 'low risk' of groundwater pollution.	This is a pit latrine that when full will be abandoned and completely covered and sealed with soil (or earth, mud, local aggregate or similar material etc.). Since the excreta is entirely confined or buried under the fill material it is considered contained; contributes to variable F2 only.

Variable No: F10 - Faecal sludge <u>not</u> contained (onsite); and S7 - Supernatant <u>not</u> contained (onsite)

Variable group *(See System Selection Grid in Part 4)*	**Reference** *(See System Selection Grid in Part 4)*	**Description** *(See System Selection Grid in Part 4)*	**Definition**
S1	**T2A1C5**	Toilet discharges directly to soak pit, where there is a 'significant risk' of groundwater pollution.	This is a fully functioning toilet discharging directly to a correctly designed, properly constructed, fully functioning soak pit. The excreta is raw, untreated and hazardous and it is captured in the soak pit. However, since there is a 'significant risk' of groundwater pollution, all the excreta in this system is considered NOT contained; contributes to variable F10 only.
S2	**T2A2C5**	Septic tank connected to soak pit, where there is a 'significant risk' of groundwater pollution	This is a correctly designed, properly constructed, fully functioning septic tank with a supernatant/effluent outlet connected to a correctly designed, properly constructed, fully functioning soak pit. The supernatant/effluent flowing from the tank is only partially treated and is still hazardous, since there is a 'significant risk' of groundwater pollution and the effluent is captured in a soak pit, all the excreta in this system is considered NOT contained; contributes to variable F10 only.
L8	**T1A2C6**	Septic tank connected to open drain or storm sewer	This is a correctly designed, properly constructed, fully functioning septic tank with an outlet connected to an open drain or storm sewer. The supernatant/effluent flowing from the tank is only partially treated and is still hazardous, therefore all the excreta in this system is considered NOT contained; the faecal sludge fraction contributes to variable F10, and the supernatant/effluent fraction contributes to variable S7.
L9	**T1A2C7**	Septic tank connected to open water body	This is a correctly designed, properly constructed, fully functioning septic tank with an outlet connected to an open water body. The supernatant/effluent flowing from the tank is only partially treated and is still hazardous, therefore all the excreta in this system is considered NOT contained; contributes to variable F10 only.
L9	**T1A2C8**	Septic tank connected to open ground	This is a correctly designed, properly constructed, fully functioning septic tank with an outlet connected to open ground. The supernatant/effluent flowing from the tank is only partially treated and is still hazardous, therefore all the excreta in this system is considered NOT contained; contributes to variable F10 only.

Variable group *(See System Selection Grid in Part 4)*	Reference *(See System Selection Grid in Part 4)*	Description *(See System Selection Grid in Part 4)*	Definition
L9	**T1A2C9**	Septic tank connected to 'don't know where'	This is a correctly designed, properly constructed, fully functioning septic tank with an outlet connected to 'don't know where'. The supernatant/effluent flowing from the tank is only partially treated and is still hazardous, therefore all the excreta in this system is considered NOT contained; contributes to variable F10 only.
S2	**T2A3C5**	Fully lined tank (sealed) connected to a soak pit, where there is a 'significant risk' of groundwater pollution	This is a correctly designed, properly constructed and well maintained fully lined tank with impermeable walls and base. It includes poorly designed and/or constructed and/or maintained septic tanks that, because of these faults or deficiencies, are NOT performing as septic tanks, instead they are acting as sealed vaults (consequently the excreta is potentially more toxic than the excreta in a septic tank). The tank is fitted with a supernatant/effluent overflow connected to a correctly designed, properly constructed and fully functioning soak pit but since the supernatant/effluent flowing from the tank is untreated and since there is a 'significant risk' of groundwater pollution all the excreta in this system is considered NOT contained; contributes to variable F10 only.
L8	**T1A3C6**	Fully lined tank (sealed) connected to an open drain or storm sewer	This is a correctly designed, properly constructed and well maintained fully lined tank with impermeable walls and base. It includes poorly designed and/or constructed and/or maintained septic tanks that, because of these faults or deficiencies, are NOT performing as septic tanks, instead they are acting as sealed vaults (consequently the excreta is potentially more toxic than the excreta in a septic tank). Since the tank is fitted with a supernatant/effluent overflow connected to an open drain or storm sewer the excreta in this system is considered NOT contained; the faecal sludge fraction contributes to variable F10, and the supernatant/effluent fraction contributes to variable S7.

Variable group *(See System Selection Grid in Part 4)*	Reference *(See System Selection Grid in Part 4)*	Description *(See System Selection Grid in Part 4)*	Definition
L9	**T1A3C7**	Fully lined tank (sealed) connected to a water body	This is a correctly designed, properly constructed and well maintained fully lined tank with impermeable walls and base. It includes poorly designed and/or constructed and/or maintained septic tanks that, because of these faults or deficiencies, are NOT performing as septic tanks, instead they are acting as sealed vaults (consequently the excreta is potentially more toxic than the excreta in a septic tank). Since the tank is fitted with a supernatant/effluent overflow connected to a water body the excreta in this system is considered NOT contained; contributes to variable F10 only.
L9	**T1A3C8**	Fully lined tank (sealed) connected to open ground	This is a correctly designed, properly constructed and well maintained fully lined tank with impermeable walls and base. It includes poorly designed and/or constructed and/or maintained septic tanks that, because of these faults or deficiencies, are NOT performing as septic tanks, instead they are acting as sealed vaults (consequently the excreta is potentially more toxic than the excreta in a septic tank). Since the tank is fitted with a supernatant/effluent overflow connected to open ground the excreta in this system is considered NOT contained; contributes to variable F10 only.
L9	**T1A3C9**	Fully lined tank (sealed) connected to ‘don't know where’	This is a correctly designed, properly constructed and well maintained fully lined tank with impermeable walls and base. It includes poorly designed and/or constructed and/or maintained septic tanks that, because of these faults or deficiencies, are NOT performing as septic tanks, instead they are acting as sealed vaults (consequently the excreta is potentially more toxic than the excreta in a septic tank). Since the tank is fitted with a supernatant/effluent overflow connected to 'don't know where' the excreta in this system is considered NOT contained; contributes to variable F10 only.

Variable group *(See System Selection Grid in Part 4)*	Reference *(See System Selection Grid in Part 4)*	Description *(See System Selection Grid in Part 4)*	Definition
S3	**T2A4C1**	Lined tank with impermeable walls and open bottom, connected to a centralised combined sewer, where there is a 'significant risk' of groundwater pollution.	This is a correctly designed, properly constructed and well maintained lined tank with sealed, impermeable walls and an open, permeable base, through which infiltration can occur - the excreta is therefore likely to be partially treated. It includes wall-lined but open bottomed tanks and containers which are sometimes mistakenly referred to as septic tanks (e.g. cubluks in Indonesia). The tank is fitted with a supernatant/effluent overflow connected to a correctly designed, properly constructed and fully functioning centralised combined sewer but since there is a 'significant risk' of groundwater pollution, all the excreta in this system is considered NOT contained; the faecal sludge fraction contributes to variable F10, and the supernatant/effluent fraction contributes to variable S7.
S3	**T2A4C2**	Lined tank with impermeable walls and open bottom, connected to a centralised foul/separate sewer, where there is a 'significant risk' of groundwater pollution.	This is a correctly designed, properly constructed and well maintained lined tank with sealed, impermeable walls and an open, permeable base, through which infiltration can occur - the excreta is therefore likely to be partially treated. It includes wall-lined but open bottomed tanks and containers which are sometimes mistakenly referred to as septic tanks (e.g. cubluks in Indonesia). The tank is fitted with a supernatant/effluent overflow connected to a correctly designed, properly constructed and fully functioning centralised foul/separate sewer but since there is a 'significant risk' of groundwater pollution, all the excreta in this system is considered NOT contained; the faecal sludge fraction contributes to variable F10, and the supernatant/effluent fraction contributes to variable S7.

Variable group *(See System Selection Grid in Part 4)*	Reference *(See System Selection Grid in Part 4)*	Description *(See System Selection Grid in Part 4)*	Definition
S3	**T2A4C3**	Lined tank with impermeable walls and open bottom, connected to a decentralised combined sewer, where there is a 'significant risk' of groundwater pollution.	This is a correctly designed, properly constructed and well maintained lined tank with sealed, impermeable walls and an open, permeable base, through which infiltration can occur - the excreta is therefore likely to be partially treated. It includes wall-lined but open bottomed tanks and containers which are sometimes mistakenly referred to as septic tanks (e.g. cubluks in Indonesia). The tank is fitted with a supernatant/effluent overflow connected to a correctly designed, properly constructed and fully functioning decentralised combined sewer but since there is a 'significant risk' of groundwater pollution, all the excreta in this system is considered NOT contained; the faecal sludge fraction contributes to variable F10, and the supernatant/effluent fraction contributes to variable S7.
S3	**T2A4C4**	Lined tank with impermeable walls and open bottom, connected to a decentralised foul/separate sewer, where there is a 'significant risk' of groundwater pollution.	This is a correctly designed, properly constructed and well maintained lined tank with sealed, impermeable walls and an open, permeable base, through which infiltration can occur - the excreta is therefore likely to be partially treated. It includes wall-lined but open bottomed tanks and containers which are sometimes mistakenly referred to as septic tanks (e.g. cubluks in Indonesia). The tank is fitted with a supernatant/effluent overflow connected to a correctly designed, properly constructed and fully functioning decentralised foul/separate sewer but since there is a 'significant risk' of groundwater pollution, all the excreta in this system is considered NOT contained; the faecal sludge fraction contributes to variable F10, and the supernatant/effluent fraction contributes to variable S7.

Variable group *(See System Selection Grid in Part 4)*	Reference *(See System Selection Grid in Part 4)*	Description *(See System Selection Grid in Part 4)*	Definition
S2	**T2A4C5**	Lined tank with impermeable walls and open bottom, connected to a soak pit, where where there is a 'significant risk' of groundwater pollution.	This is a correctly designed, properly constructed and well maintained lined tank with sealed, impermeable walls and an open, permeable base, through which infiltration can occur - the excreta is therefore likely to be partially treated. It includes wall-lined but open bottomed tanks and containers which are sometimes mistakenly referred to as septic tanks (e.g. cubluks in Indonesia). The tank is fitted with a supernatant/effluent connected to a correctly designed, properly constructed and fully functioning soak pit but since there is a 'significant risk' of groundwater pollution, all the excreta in this system is considered NOT contained; contributes to variable F10 only.
L8	**T1A4C6**	Lined tank with impermeable walls and open bottom, connected to an open drain or storm sewer.	This is a correctly designed, properly constructed and well maintained lined tank with sealed, impermeable walls and an open, permeable base, through which infiltration can occur. It includes wall-lined but open bottomed tanks and containers which are sometimes mistakenly referred to as septic tanks (e.g. cubluks in Indonesia). Since the tank is fitted with a supernatant/effluent overflow connected to an open drain or storm sewer, the excreta in this system is considered NOT contained; the faecal sludge fraction contributes to variable F10, and the supernatant/effluent fraction contributes to variable S7.
L9	**T1A4C7**	Lined tank with impermeable walls and open bottom, connected to a water body.	This is a correctly designed, properly constructed and well maintained lined tank with sealed, impermeable walls and an open, permeable base, through which infiltration can occur. It includes wall-lined but open bottomed tanks and containers which are sometimes mistakenly referred to as septic tanks (e.g. cubluks in Indonesia). Since the tank is fitted with a supernatant/effluent overflow connected to a water body, the excreta in this system is considered NOT contained; contributes to variable F10 only.

Variable group *(See System Selection Grid in Part 4)*	Reference *(See System Selection Grid in Part 4)*	Description *(See System Selection Grid in Part 4)*	Definition
L9	**T1A4C8**	Lined tank with impermeable walls and open bottom, connected to open ground.	This is a correctly designed, properly constructed and well maintained lined tank with sealed, impermeable walls and an open, permeable base, through which infiltration can occur. It includes wall-lined but open bottomed tanks and containers which are sometimes mistakenly referred to as septic tanks (e.g. cubluks in Indonesia). Since the tank is fitted with a supernatant/effluent overflow connected to open ground, the excreta in this system is considered NOT contained; contributes to variable F10 only.
L9	**T1A4C9**	Lined tank with impermeable walls and open bottom, connected to 'don't know where'	This is a correctly designed, properly constructed and well maintained lined tank with sealed, impermeable walls and an open, permeable base, through which infiltration can occur. It includes wall-lined but open bottomed tanks and containers which are sometimes mistakenly referred to as septic tanks (e.g. cubluks in Indonesia). Since the tank is fitted with a supernatant/effluent overflow connected to 'don't know where', the excreta in this system is considered NOT contained; contributes to variable F10 only.
S4	**T2A4C10**	Lined tank with impermeable walls and open bottom, no outlet or overflow, where there is a 'significant risk' of groundwater pollution.	This is a correctly designed, properly constructed and well maintained lined tank with sealed, impermeable walls and an open, permeable base, through which infiltration can occur - the excreta is therefore likely to be partially treated. It includes all lined but open bottomed tanks and containers which are sometimes mistakenly referred to as septic tanks (e.g. cubluks in Indonesia). The tank is NOT fitted with a supernatant/effluent overflow but since there is a 'significant risk' of groundwater pollution this system is considered NOT contained; contributes to variable F10 only.
S4	**T2A5C10**	Lined pit with, semi-permeable walls and open bottom, no outlet or overflow, where there is a 'significant risk' of groundwater pollution.	This is a correctly designed, properly constructed and well maintained pit with semi-permeable, honeycombed lined walls and an open, permeable base, through which infiltration can occur. The tank is NOT fitted with a supernatant/effluent overflow but since there is a 'significant risk' of groundwater pollution this system is considered NOT contained; contributes to variable F10 only.

Variable group *(See System Selection Grid in Part 4)*	Reference *(See System Selection Grid in Part 4)*	Description *(See System Selection Grid in Part 4)*	Definition
S4	**T2A6C10**	Unlined pit, no outlet or overflow, where there is a 'significant risk' of groundwater pollution.	This is a correctly designed, properly constructed and well maintained unlined pit with permeable walls and base, through which infiltration can occur. The tank is NOT fitted with a supernatant/effluent overflow but since there is a 'significant risk' of groundwater pollution this system is considered NOT contained; contributes to variable F10 only.
S5	**T2B7C10**	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.	This is a pit latrine that when full will be abandoned and completely covered and sealed with soil (or earth, mud, local aggregate or similar material etc.). The excreta will be entirely confined or buried under the fill material but since there is a 'significant risk' of groundwater pollution this system is considered NOT contained; contributes to variable F10 only.
L13	**T1B8C10**	Pit (all types), never emptied but abandoned when full but NOT adequately covered with soil, no outlet or overflow, where there is a 'low risk' of groundwater pollution.	This is a pit latrine that when full will be abandoned but NOT covered over or sealed with soil (or earth, mud, local aggregate or similar material etc.). Since the excreta is NOT confined or buried under a fill material it is considered NOT contained; contributes to variable F10 only.
L14	**T1B9 C1 TO C10**	Toilet failed, damaged, collapsed or flooded, connected to sewer, soak pit, open drain or storm sewer, water body, open ground or 'don't know where'.	The toilet has failed, become damaged, collapsed or been flooded; it may or may not be still in use. The excreta is NOT contained and will contribute to variable F10 only.

Variable group *(See System Selection Grid in Part 4)*	Reference *(See System Selection Grid in Part 4)*	Description *(See System Selection Grid in Part 4)*	Definition
L15	**T1B10 C1 TO C4**	Containment (septic tanks, fully lined tanks, partially lined tanks and pits, and unlined pits) failed, damaged, collapsed or flooded - connected to any sewer type.	The containment technology has failed, become damaged, collapsed or been flooded; it may or may not be still in use. The excreta is NOT contained; the faecal sludge fraction contributes to variable F10, and the supernatant/effluent fraction contributes to variable S7.
L16	**T1B10C5**	Containment (septic tanks, fully lined tanks, partially lined tanks and pits, and unlined pits) failed, damaged, collapsed or flooded - connected to soak pits.	The containment technology has failed, become damaged, collapsed or been flooded; it may or may not be still in use. The excreta is NOT contained and will contribute to variable F10 only.
L17	**T1B10C6**	Containment (septic tanks, fully lined tanks, partially lined tanks and pits, and unlined pits) failed, damaged, collapsed or flooded - connected to open drain or storm sewer.	The containment technology has failed, become damaged, collapsed or been flooded; it may or may not be still in use. The excreta is NOT contained; the faecal sludge fraction contributes to variable F10, and the supernatant/effluent fraction contributes to variable S7.

Variable group *(See System Selection Grid in Part 4)*	Reference *(See System Selection Grid in Part 4)*	Description *(See System Selection Grid in Part 4)*	Definition
L18	**T1B10 C7 TO C9**	Containment (septic tanks, fully lined tanks, partially lined tanks and pits, and unlined pits) failed, damaged, collapsed or flooded - connected to water bodies, open ground or 'don't know where'.	The containment technology has failed, become damaged, collapsed or been flooded; it may or may not be still in use. The excreta is NOT contained and will contribute to variable F10 only.
L19	**T1B10C10**	Containment (fully lined tanks, partially lined tanks and pits, and unlined pits) failed, damaged, collapsed or flooded - with no outlet or overflow.	The containment technology has failed, become damaged, collapsed or been flooded; it may or may not be still in use. The excreta is NOT contained and will contribute to variable F10 only.

Variable No: OD9 - Open defecation

Variable group *(See System Selection Grid in Part 4)*	Reference *(See System Selection Grid in Part 4)*	Description *(See System Selection Grid in Part 4)*	Definition
L20	**T1B11 C7 TO C9**	**Open defecation**	With no toilet, users defecate in water bodies, on open ground and to don't know where; consequently the excreta is NOT contained. Excreta from this practice will contribute to variable OD9.

Variable No: W4a and W4b - Wastewater contained delivered to treatment

Reference (*See Master SFD Graphic in Part 1*)	Description	Definition
W4a	Wastewater delivered to centralised treatment plants	Wastewater discharges into a sewer which is connected to and discharges to a centralised treatment plant
W4b	Wastewater delivered to decentralised treatment plants	Wastewater discharges into a sewer which is connected to and discharges to a decentralised treatment plant

Variable No: W4c - Wastewater <u>not</u> contained delivered to treatment

Reference (*See Master SFD Graphic in Part 1*)	Description	Definition
W4c	Wastewater from open drains or storm sewers delivered to treatment plants (the treatment plant is most likely to be a centralised treatment plant)	Wastewater discharges into a open or storm sewer which is connected to and discharges to a treatment plant

Variable No: W11 - Wastewater not delivered to treatment

Reference (*See Master SFD Graphic in Part 1*)	Description	Definition
W11a	Wastewater contained not delivered to centralised treatment plants	Wastewater discharges into a sewer which is connected to and discharges to a centralised sewer network and a treatment plant but due to leakage and/or failed pumping systems, a known (or estimated) percentage of the wastewater: • Discharges to underground soil structures. • Discharges to the environment (to an open drain, to a water body, to open ground). • Is applied to land (for illegal use without treatment); or • Discharges to 'don't know where'. Or where wastewater discharges into a sewer which is not connected to a centralised treatment plant, instead a known (or estimated) percentage of the wastewater: • Discharges to underground soil structures. • Discharges to the environment (to an open drain, to a water body, to open ground). • Is applied to land (for illegal use without treatment); or • Discharges to 'don't know where'.
W11b	Wastewater contained not delivered to decentralised treatment plants	Wastewater discharges into a sewer which is connected to and discharges to a decentralised sewer network and treatment plant but due to leakage and/or failed pumping systems, a known (or estimated) percentage of the wastewater: • Discharges to underground soil structures. • Discharges to the environment (to an open drain, to a water body, to open ground). • Is applied to land (for illegal use without treatment); or • Discharges to 'don't know where'. Or where wastewater discharges into a decentralised sewer network which is not connected to a treatment plant, instead a known or estimated percentage of the wastewater: • Discharges to underground soil structures. • Discharges to the environment (to an open drain, to a water body, to open ground). • Is applied to land (for illegal use without treatment); or • Discharges to 'don't know where'.

W11c	Wastewater not contained not delivered to treatment plants	All wastewater from toilets discharges going directly to water bodies, open ground or to don't know where. And where wastewater discharges into an open drain or storm sewer, which is connected to and discharges to a treatment plant (either centralised or decentralised), but due to leakage and/or failed pumping systems, a known (or estimated) percentage of the wastewater: • Discharges to underground soil structures. • Discharges to the environment (to a water body, to open ground). • Is applied to land (for illegal use without treatment). • Discharges to 'don't know where' Or where wastewater discharges into an open drain or storm sewer which is not connected to a treatment plant, instead a known (or estimated) percentage of the wastewater: • Discharges to underground soil structures. • Discharges to the environment (to a water body, to open ground). • Is applied to land (for illegal use without treatment); or • Discharges to 'don't know where'.

Variable No: S4d - Supernatant contained and delivered to treatment

Reference (*See Master SFD Graphic in Part 1*)	Description	Definition
S4d	Supernatant contained and delivered to treatment	Supernatant contained by an onsite technology that discharges into a sewer which is connected to and discharges to a centralised or decentralised treatment plant.

Variable No: S4e - Supernatant not contained and delivered to treatment

S4e	Supernatant not contained and delivered to treatment	Supernatant not contained by an onsite technology that discharges into an open drain or storm sewer which is connected to and discharges to a centralised or decentralised treatment plant.

Variable No: S11 - Supernatant not delivered to treatment

Reference (*See Master SFD Graphic in Part 1*)	Description	Definition
S11d	Supernatant contained – not delivered to treatment	Supernatant discharges into a sewer which is connected to and discharges to a centralised or decentralised sewer network and treatment plant but due to leakage and/or failed pumping systems, a known (or estimated) percentage of the supernatant: • Discharges to underground soil structures. • Discharges to the environment (to an open drain, to a water body, to open ground). • Is applied to land (for illegal use without treatment); or • Discharges to 'don't know where'. Or where supernatant discharges into a sewer which is not connected to a treatment plant, instead a known (or estimated) percentage of the supernatant: • Discharges to underground soil structures. • Discharges to the environment (to an open drain, to a water body, to open ground). • Is applied to land (for illegal use without treatment); or • Discharges to 'don't know where'.
S11e	Supernatant not contained – not delivered to treatment	Supernatant discharges into an open drain or storm sewer, which is connected to and discharges to a treatment plant but due to leakage and/or failed pumping systems, a known (or estimated) percentage of the supernatant: • Discharges to underground soil structures. • Discharges to the environment (to a water body, to open ground). • Is applied to land (for illegal use without treatment). • Discharges to 'don't know where' Or where supernatant discharges into an open drain or storm sewer which is not connected to a treatment plant, instead a known (or estimated) percentage of the wastewater:

Reference (*See Master SFD Graphic in Part 1*)	Description	Definition
		• Discharges to underground soil structures. • Discharges to the environment (to a water body, to open ground). • Is applied to land (for illegal use without treatment); or • Discharges to 'don't know where'.

Variable No: F8 - Faecal sludge contained- not emptied

Reference (*See Master SFD Graphic in Part 1*)	Description	Definition
F8	Faecal sludge contained- not emptied	Faecal sludge that is contained within an onsite sanitation technology and not removed. Depending on the sanitation technology type, the faecal sludge may remain in the container and/or infiltrate to the ground.

Variable No: F3a - Faecal sludge contained - emptied

Reference (*See Master SFD Graphic in Part 1*)	Description	Definition
F3a	Faecal sludge contained – emptied	Faecal sludge is removed from an onsite sanitation technology where FS is contained, which can be emptied, using either motorized or manual emptying equipment.

Variable No: F3b - Faecal sludge not contained - emptied

Reference (*See Master SFD Graphic in Part 1*)	Description	Definition
F3b	Faecal sludge not contained - emptied	Faecal sludge is removed from an onsite sanitation technology where FS is not contained, which can be emptied, using either motorized or manual emptying equipment.

Variable No: F15 - Faecal sludge not contained- not emptied

Reference (*See Master SFD Graphic in Part 1*)	Description	Definition
F15	Faecal sludge not contained- not emptied	Faecal sludge that is not contained within an onsite sanitation technology and not removed. Depending on the sanitation technology type, the faecal sludge may remain in the container and/or infiltrate to the ground.

Variable No: F4 - Faecal sludge delivered to treatment

Reference (*See Master SFD Graphic in Part 1*)	Description	Definition
F4	Faecal sludge delivered to treatment plants	Is faecal sludge that is transported to a treatment plant site (without leakage or spillage) by manual or motorized transport. Or, that is dumped in a functioning sewer which is connected to and discharges at a treatment plant (without any leakage or spillage from either the transport to the sewer or from the sewer during transport within it).

Variable No: F11 - Faecal sludge not delivered to treatment

Reference (*See Master SFD Graphic in Part 1*)	Description	Definition
F11a	Faecal sludge contained – emptied, not delivered to treatment plants	Is faecal sludge that is transported to a treatment plant site by manual or motorized transport, but due to leakage or spillage, a percentage of the removed faecal sludge does not reach the treatment plant, instead it either: • Discharges to underground soil structures; • Discharges to the environment (to an open drain, to a water body, to open ground); • Is applied to land (for illegal use without treatment); or • Discharges to 'don't know where.' or; is faecal sludge that is dumped in the local area (within 500m from emptied onsite sanitation technology) and it either: • Discharges to the environment (to an open drain, to a water body, to open ground); • Is applied to landfill; • Is applied to land (for illegal use without treatment); or • Discharges to 'don't know where' or; is faecal sludge that is dumped in the neighbourhood (over 500m from onsite sanitation technology) and it either: • Discharges to the environment (to an open drain, to a water body, to open ground); • Is applied to landfill; • Is applied to land (for illegal use without treatment); or • Discharges to 'don't know where' or; is faecal sludge that is dumped in a sewer which is not connected to a treatment plant and it either: • Discharges to the environment (to an open drain, to a water body, to open ground); • Is applied to landfill; • Is applied to land (for illegal use without treatment); or • Discharges to 'don't know where'
F11b	Faecal sludge not contained – emptied, not delivered to treatment plants	

Variable No: W5 - Wastewater treated

Reference (*See Master SFD Graphic in Part 1*)	Description	Definition
W5a	Wastewater treated at centralised treatment plants	Wastewater in sewer system treated at a correctly designed, properly constructed, fully functioning centralised wastewater treatment plant.
W5b	Wastewater treated at decentralised treatment plants	Wastewater in sewer system treated at a correctly designed, properly constructed, fully functioning decentralised wastewater treatment plant.
W5c	Wastewater treated at centralised/decentralised treatment plants	Wastewater not contained in open drains but treated at a correctly designed, properly constructed, fully functioning centralised/decentralized wastewater treatment plant.

Variable No: W12 - Wastewater not treated

Ref (*See Master SFD Graphic in Part 1*)	Description	Definition	Comment
W12a	Wastewater not treated at a centralised treatment plants	Wastewater in sewer system discharged without treatment from a non-functioning wastewater treatment plant and it either: • Discharges to the environment (to an open drain, to a water body, to open ground); • Is applied to landfill; • Is applied to land (for illegal use without treatment); or • Discharges to 'don't know where'.	Delivered to non-functioning treatment plant and discharged without treatment

Ref (*See Master SFD Graphic in Part 1*)	Description	Definition	Comment
W12b	Wastewater not treated at a decentralised treatment plants	or; wastewater discharged without treatment from a correctly designed, properly constructed wastewater treatment plant functioning sub-optimally and it either: • Discharges to the environment (to an open drain, to a water body, to open ground); • Is applied to landfill; • Is applied to land (for illegal use without treatment); or • Discharges to 'don't know where' or; wastewater discharged with only partial treatment from a correctly designed, properly constructed faecal sludge treatment plant (or a wastewater treatment plant designed to receive faecal sludge) functioning sub-optimally and it either: • Discharges to the environment (to an open drain, to a water body, to open ground); • Is applied to landfill; • Is applied to land (for illegal use without treatment); or • Discharges to 'don't know where'	Delivered to treatment plant functioning sub-optimally (e.g. over capacity, poor maintenance, breakdown or other constraint) and discharged without treatment. Delivered to treatment plant functioning sub-optimally (e.g. over capacity, poor maintenance, breakdown or other constraint), therefore some WW remains partially treated and discharged without further treatment.
W12c	Wastewater not treated at a centralised/decentralised treatment plants	Wastewater not contained in open drains discharged without treatment from a non-functioning wastewater treatment plant.	Delivered to non-functioning treatment plant and discharged without treatment.

Variable No: S5 - Supernatant treated

Reference (*See Master SFD Graphic in Part 1*)	Description	Definition
S5d	Supernatant contained, delivered to treatment and treated	Supernatant in sewer system that is delivered to treatment plants, which is treated at a correctly designed, properly constructed, fully functioning centralised or decentralised wastewater treatment plant.
S5e	Supernatant not contained, delivered to treatment and treated	Supernatant in open drain or storm sewer system that is delivered to treatment plants, which is treated at a correctly designed, properly constructed, fully functioning centralised or decentralised wastewater treatment plant.

Variable No: S12 - Supernatant not treated

Reference (*See Master SFD Graphic in Part 1*)	Description	Definition
S12d	Supernatant contained, delivered to treatment but not treated	Supernatant in sewer system that is delivered to centralised or decentralised treatment plants, which is not treated (refer to W12a and W12b for full definition).
S12e	Supernatant not contained, delivered to treatment but not treated	Supernatant in open drain or storm sewer system that is delivered to treatment plants, which is not treated (refer to W12c for full definition).

Variable No: F5 - Faecal sludge treated

Ref (*See Master SFD Graphic in Part 1*)	Description	Definition
F5	Faecal sludge treated	Faecal sludge treated at a correctly designed, properly constructed, fully functioning faecal sludge treatment plant. Or; Faecal sludge treated at a correctly designed, properly constructed, fully functioning Wastewater treatment plant that is designed to receive faecal sludge.

Variable No: F12 - Faecal sludge not treated

Reference (*See Master SFD Graphic in Part 1*)	Description	Definition	Comment
F12	Faecal sludge not treated	Faecal sludge discharged without treatment from a non-functioning faecal sludge treatment plant (or from a non-functioning wastewater treatment plant) and it either: • Discharges to the environment (to an open drain, to a water body, to open ground); • Is applied to landfill; • Is applied to land (for illegal use without treatment); or • Discharges to 'don't know where'	Delivered to non-functioning treatment plant and discharged without treatment

Reference (*See Master SFD Graphic in Part 1*)	Description	Definition	Comment
		or; Faecal sludge discharged without treatment from a correctly designed, properly constructed faecal sludge treatment plant (or a wastewater treatment plant designed to receive faecal sludge) functioning sub-optimally and it either: • Discharges to the environment (to an open drain, to a water body, to open ground); • Is applied to landfill; • Is applied to land (for illegal use without treatment); or • Discharges to 'don't know where' or; Faecal sludge discharged with only partial treatment from a correctly designed, properly constructed faecal sludge treatment plant (or a wastewater treatment plant designed to receive faecal sludge) functioning sub-optimally and it either: • Discharges to the environment (to an open drain, to a water body, to open ground); • Is applied to landfill; • Is applied to land (for illegal use without treatment); or • Discharges to 'don't know where'	Delivered to treatment plant functioning sub-optimally (e.g. over capacity, poor maintenance, breakdown or other constraint) and discharged without treatment. Delivered to treatment plant functioning sub-optimally (e.g. over capacity, poor maintenance, breakdown or other constraint), therefore some faecal sludge remains partially treated and discharged without further treatment.

Part 3 - Definitions of Terms

Notes:

1. This document should be read in conjunction with Section 5.4 of the SFD Manual Volume 1 and the three other parts of this Volume 2:
   - Part 1 - Master SFD Graphic;
   - Part 2 - Definition of SFD Variables; and
   - Part 4 - Sanitation Containment System: SFD Schematics
2. This document defines all the terms used in the SFD Graphic Generator, and provides examples of commonly used regional variations. The definitions are provided for the purpose of the SFD Promotion Initiative only.
3. Terms in each definition shown in *italics* are also defined within this document.

KEY TERMS

Term	Definition	Comments and Regional Examples	References
Contained	*Sanitation technology* and/or *system* which ensures safe level of protection from *excreta* i.e. pathogen transmission to the user or general public is limited.		Re-worded from WHO, 2001 "Water Quality: Guidelines, Standards and Health: *Excreta-related infections and the role of sanitation'*, pg107
Containment system	First part of the *sanitation service chain*, also referred to as 'containment' on the *excreta* flow diagram. For *offsite sanitation* it includes a) the *toilet* and b) what the *toilet* is connected to (typically a pipe to the *sewer* network) For *onsite sanitation*, it includes a) the *toilet*, b) the *onsite sanitation technology* that the *toilet* discharges to and c) the second stage technology (if anything) that the *onsite sanitation technology* is then connected to (e.g. *soak pit* or *sewer*)	-	
Containment technology	A single sanitation infrastructure immediately downstream of the *toilet* into which *excreta* is discharged.		
Discharge	Distinct and different to *disposal*. Used to describe the flow of *faecal sludge*, *effluent* and *wastewater* between *sanitation technologies* and the illegal practice of using or returning *faecal sludge*, *effluent* or *wastewater* to the environment, without full *treatment*. See also *disposal.*		

Term	Definition	Comments and Regional Examples	References
Disposal	The methods by which the *treatment plant* output products (which should be now reduced-risk materials) derived from a *sanitation system* are ultimately returned to the environment. Where there is an *end-use* for the product, they can be applied or used. Disposal is distinct and different to *discharge* and refers only to the end fate of *treated wastewater* or *faecal sludge*. Any untreated *wastewater* or *faecal sludge* is considered discharged not disposed of. See also *discharge*.	In some locations, disposal occurs with or without *treatment*	Tilley et al, 2014 "Compendium of *Sanitation Systems*" 2nd Edition, pg138-
Effluent **(see also Supernatant)**	The general term for the liquid that leaves a technology, typically after *blackwater* or *faecal sludge* has undergone solids separation or some other type of partial *treatment*. *Effluent* may be completely sanitized or may require further *treatment* before it can be used or disposed of.		Tilley et al, 2014 "Compendium of *Sanitation Systems*" 2nd Edition, pg 11 Note: added 'faecal' before sludge
Emptying	The *manual or motorized* removal of *faecal sludge* from *onsite sanitation systems*.	*See: motorized emptying* and *manual emptying.*	Strande et al, 2014 "*Faecal sludge* Management" Pg 4. Note: compared to original: changed 'mechanical' to '*motorized*' and '*collection*' to 'removal'
End-use	The utilisation of *treatment plant* output products derived from a *sanitation system*.	Application to land, fish pond, groundwater recharge, proteins, biofuels, building materials	Tilley et al, 2014 "Compendium of *Sanitation Systems*" 2nd Edition, Glossary Strande et al, 2014 "*Faecal sludge* Management" Pg 99

Term	Definition	Comments and Regional Examples	References
Not contained	*Sanitation technology* and/or *sanitation system* which does not ensure safe level of protection from *excreta*. i.e. pathogen transmission to the user or general public is likely.		Re-worded from WHO, 2001 "Water Quality: Guidelines, Standards and Health: *Excreta-related infections and the role of sanitation'*, pg107
Offsite sanitation	A *sanitation system* in which *excreta* (referred to as *wastewater*) is collected and transported away from the plot where they are generated. An *offsite sanitation system* relies on a *sewer* technology for t*ransport*.	In some cases *excreta* is collected in *open drains*, this is usually considered an illegal practice. However, there are some examples where *excreta* in *open drains* discharges to a functioning *treatment plant*.	Tilley et al, 2014 "Compendium of *Sanitation Systems*" 2nd Edition, Glossary
Onsite sanitation	A *sanitation technology* or *sanitation system* in which *excreta* (referred to as *faecal sludge*) is collected and stored and *emptied* from or treated on the plot where they are generated.	Single pit, ventilated improved pit, fossa alterna, twin pit, dehydration vaults, *septic tank*, anaerobic baffled reactor, biogas reactor.	Tilley et al, 2014 "Compendium of *Sanitation Systems*" 2nd Edition, Glossary
Safely managed	A service delivery outcome which results in a combination of hazard (*excreta* in the environment) and population exposure which is likely to result in a low public health risk.	-	-
Sanitation facility	The *toilet* or *user interface* where people defecate and urinate and, where used, the *onsite sanitation technology* that it *discharges* to; e.g. a pan with an *unlined pit*.		

Term	Definition	Comments and Regional Examples	References
Sanitation system	A context-specific series of *sanitation technologies* (and services) for the management of *faecal sludge* and/or *wastewater* through the stages of *containment*, *emptying*, *transport*, *treatment* and *end-use/disposal*.		Adapted from: Tilley et al, 2014 "Compendium of *Sanitation Systems*" 2nd Edition, pg 10
Sanitation technologies	The specific infrastructure, methods, or services designed to support the process of managing *faecal sludge* and/or *wastewater* through the stages of *containment*, *emptying*, *transport*, *treatment*, and *end-use/disposal*.	e.g. urinals, pans, *septic tanks*, vacutug, drying bed, reed bed	Adapted from: Tilley et al, 2014 "Compendium of *Sanitation Systems*" 2nd Edition, pg 13
Supernatant **(see also effluent)**	The general term for the liquid in an *onsite technology* (e.g. tank or pit) lying above the *faecal sludge*, typically after *blackwater* or *faecal sludge* has undergone solids separation or some other type of *treatment*. (If the supernatant leaves the technology it is generally referred to as *effluent*, which may be completely sanitized or may require further *treatment* before it can be used or disposed of).		Adapted from Tilley et al, 2014 "Compendium of *Sanitation Systems*" 2nd Edition, pg 11
Toilet	Refers to any type of toilet, pedestal, pan, or urinal that is the user interface with the sanitation system.	Dry toilet, urine- diverting toilet, urinal, pour flush toilet, cistern flush toilet, urine- diverting flush toilet	

Term	Definition	Comments and Regional Examples	References
Transport	For *offsite sanitation* this refers to the conveyance of *wastewater* using a *sewer* network. For *onsite sanitation* this refers to the *manual* or *motorized* conveyance of *faecal sludge emptied* from *onsite sanitation* technologies.	*See; sewers, manual emptying and motorized emptying* May also utilise transfer stations (both fixed and mobile). In some cases *excreta* is collected in *open drains*, this is usually considered an illegal practice. However, there are some examples where *excreta* in *open drains* discharges to a functioning *treatment plant*.	
Treatment	Process/es that changes the physical, chemical and biological characteristic or composition of *faecal sludge* or *wastewater* so that it is converted into a product that is safe for *end-use*. .	*See: wastewater treatment plant and faecal sludge treatment plant*	David Blockley, 2005 "The New Penguin Dictionary of Civil Engineering" Strande et al, 2014 "*Faecal sludge* Management" Pg 98
Unsafely managed	A service delivery outcome which results in a combination of hazard (*excreta* in the environment) and population exposure which is likely to result in a significant public health risk.	-	-
User interface	The type of toilet, e.g. pedestal, pan, or urinal used by the user.	Dry toilet, urine- diverting toilet, urinal, pour flush toilet, cistern flush toilet, urine- diverting flush toilet	Tilley et al, 2014 "Compendium of *Sanitation Systems*" 2nd Edition pg 42

GENERAL TERMS

Term	Definition	Comments and Regional Examples	References
Abandoned pit latrine	A pit which is never *emptied* but instead, once full, the content is covered over with soil and the pit abandoned.	e.g. Arbor loo	
Applied to land	*Wastewater*: May be applied to agriculture, home gardening, forestry, sod and turf growing, landscaping, parks, and golf courses. *Faecal sludge*: May be applied to agriculture, home gardening, forestry, sod and turf growing, landscaping, parks, golf courses, mine reclamation, as a dump cover, or for erosion control.		Tilley et al, 2014 "Compendium of *Sanitation Systems*" 2nd Edition, p148
Blackwater	*Blackwater* is the mixture of urine, faeces and *flushwater* along with anal cleansing water (if water is used for cleansing) and/or dry cleansing materials		Tilley et al, 2014 "Compendium of *Sanitation Systems*" 2nd Edition, p10
Centralised sewer system	A *system* used to collect, treat, discharge, and/or reclaim *wastewater* from large user groups (i.e. municipal and city level applications).	In some locations, *sewer systems* do not *discharge* to a centralised *treatment plant* but instead *discharge* untreated *wastewater* direct to a *water body*.	Tilley et al, 2014 "Compendium of *Sanitation Systems*" 2nd Edition, p98
Combined sewer	*Sewer* network where *blackwater* and *stormwater* runoff are carried by the same *sewer*s.		David Blockley, 2005 "The New Penguin Dictionary of Civil Engineering"
Decentralised sewer system	A *system* used to collect, treat, *discharge*, and/or reclaim *wastewater* from a neighbourhood, small community or pilot service area.	In some locations, *sewer systems* do not *discharge* to a *decentralised treatment plant* but instead *discharge* untreated *wastewater* direct to a *water body*.	Tilley et al, 2014 "Compendium of *Sanitation Systems*" 2nd Edition, p98

Term	Definition	Comments and Regional Examples	References
Excreta	Consists of urine and faeces that is not mixed with any f*lushwater*. *Excreta* are small in volume, but concentrated in both nutrients and pathogens. Depending on the quality of the faeces, it has a soft or runny consistency.		Tilley et al, 2014 "Compendium of *Sanitation Systems*" 2nd Edition pg 11
Faecal sludge	*Faecal sludge* comes from *onsite sanitation technologies* or *systems*, i.e., it has not been *transport*ed through a *sewer*. It can be raw or partially digested, a slurry or semisolid, and results from the *collection* and storage/*treatment* of *excreta* with or without *greywater*.	In many countries (e.g. India) *faecal sludge* is commonly referred to as septage, although this usage is often limited to describe the contents of *septic tanks* only.	Tilley et al, 2014 "Compendium of *Sanitation Systems*" 2nd Edition, pg12 Note have changed '*systems*' to '*technologies*'
Faecal sludge treatment plant	Infrastructure designed to convert f*aecal sludge* into a product that is safe for *end-use* whether it is used or not.	Sedimentation/thickening tanks/ponds, drying beds, solar drying, incineration, anaerobic digestion, co-composting with organic solid waste, vermi composting, LaDePa, thermal drying, co-treatment with *wastewater*	Strande et al, 2014 "*Faecal sludge* Management" Pg 99 Tilley et al, 2014 "Compendium of *Sanitation Systems*" 2nd Edition , pg98
Flushwater	The water *discharge*d into the *toilet* to *transport* the content and/or clean it. Freshwater, rainwater, recycled *greywater*, or any combination of the three can be used as a *flushwater* source.		Tilley et al, 2014 "Compendium of *Sanitation Systems*" 2nd Edition ,pg11

Term	Definition	Comments and Regional Examples	References
Fully lined tank (sealed)	A correctly designed, properly constructed and well maintained *fully lined tank* with impermeable walls and base. It includes poorly designed and/or constructed and/or maintained *septic tanks* that, because of these faults or deficiencies, are not performing as *septic tanks*, instead they are acting as *sealed vaults* (consequently the *faecal sludge* and *effluent* is potentially more toxic than the *faecal sludge* and *effluent* in a *septic tank*).	Dehydration vaults; composting chambers. For the purposes of this analysis removable containers (such as those used by 'Clean Team' in Ghana); and bucket latrine containers (as used in India) are considered as *fully lined tank*s (sealed) with no *outlet* or overflow – see the 'L10' type *sanitation containment system*.	
Greywater	All water generated from washing food, clothes and dishware, as well as from bathing and house cleaning, but not from toilets.		Tilley et al, 2014 "Compendium of *Sanitation Systems*" 2nd Edition, pg11
Groundwater	Water located beneath the earth's surface in soil pore spaces and in the fractures of rock formations. It can be found in sand, gravel, silt, clay, sedimentary rocks, limestone beds or even in impermeable rocks such as granite when such rocks are weathered or fractured. On the surface of the earth, it can be seen in wells and as springs. The water percolates downward in response to gravity or differences in pressure.		Centre for Science and Environment (CSE)," Catch water where it falls - Toolkit on urban rainwater harvesting"

Term	Definition	Comments and Regional Examples	References
Groundwater table	The level below the earth's surface where the ground is saturated with water. It corresponds to the level where water is found when a hole is dug or drilled into the ground. A *groundwater table* is not static and can vary by season, year or usage.		Tilley et al, 2014 "Compendium of *Sanitation Systems*" 2nd Edition, Glossary
Landfill	Relates to the *disposal* of solid waste. Methods used can include: • Open dump: indiscriminate disposal of waste and limited measures to control operations, including those related to environmental effects of landfill. • Operated or semi-controlled dump: these operate with some form of inspection and recording of incoming wastes, practice extensive compaction of waste and control the tipping front and application of soil cover. However, only limited measures to mitigate environmental impacts are undertaken e.g. leachate, landfill gas management. • Sanitary landfill: those landfills that engage in waste compaction and apply daily soil cover to reduce nuisances.		The World Bank, 1999 "Observations of Solid Waste *Landfill*s in Developing Countries: Africa, Asia, and Latin America document", pg 4
Lined pit with semi-permeable walls and open bottom	A correctly designed, properly constructed and well maintained pit with semi-permeable lined walls and an open, permeable base, through which infiltration can occur.	Single pit latrine, ventilated pit latrine, twin pit latrine, fossa alterna.	

Term	Definition	Comments and Regional Examples	References
Lined tank with impermeable walls and open bottom	A correctly designed, properly constructed and well maintained lined tank with sealed, impermeable walls and an open, permeable base, through which infiltration can occur. It includes all lined but open bottomed tanks and containers which are sometimes mistakenly referred to as *septic tanks*.	Indonesia: Cubluks	
Manual emptying	Refers to the *emptying* of *faecal sludge* from *onsite sanitation technologies*, where humans are required to manually lift the sludge. Manual emptying can be used with either *manual transport* or *motorized transport*.	Shovels, buckets, ropes, the MAPET, the Gulper, the Rammer, the MDHP.	Strande et al, 2014 "*Faecal sludge* Management" Pg 86
Manual transport	Refers to the human-powered *transport* of *faecal sludge emptied* from *onsite sanitation technologies*. Manual transport can be used with *manual emptying* or *motorized emptying*.	Hand-drawn cart or animal drawn cart controlled by humans, consisting of a load-bed mounted on a single axle with one or more wheels	Strande et al, 2014 "*Faecal sludge* Management" Pg 86
Motorized emptying	Refers to the use of motorized equipment for the *emptying* of *faecal sludge* from *onsite sanitation technologies*. Humans are required to operate the equipment and manoeuvre the hose, but the *faecal sludge* is not manually lifted. Motorized emptying is most commonly followed by *motorized transport*, but it is also used with *manual transport*.	Vacuum tanker with pump and holding tank. The Vacutug, Molsta, Dung Beetle, Mini-trucks and Kedoteng all carry a pump and a small holding tank; these are all designed to negotiate narrow roads or pathways. Small, light petrol driven pumps carried by humans are also used.	Variation of: Tilley et al, 2014 "Compendium of *Sanitation Systems*" 2nd Edition, Pg 88

Term	Definition	Comments and Regional Examples	References
Motorized transport	Refers to the use of motorized equipment for the *transport* of *faecal sludge* from *onsite sanitation technologies*. Humans are required to operate the equipment, but the *faecal sludge* is not manually transported. Motorized transport can be used with either *motorized emptying* or *manual emptying*.	See *motorized emptying*, plus trailer mounted holding tanks pulled by tractor or other motorized vehicles.	
Open defecation (OD)	Situation where no *toilet* is in use; people defecate in fields, forests, bushes, bodies of water or other open spaces. Note: where people defecate into bags that are left in the environment (including added to solid waste) then this is defined as OD; but where the bags are put into a *sanitation technology* then this is not OD.		*Sanitation* for All website (*sanitation* the drive to 2015) http://*sanitation*drive2015.org/faqs/what-do-we-mean-by-open-defecation/
Open drain	Open channel used to carry *greywater*, *surface water* or *stormwater*.	Also known as a storm drain In many locations, open drains also receive flows direct from toilets or from onsite sanitation technologies. Depending on the technology and its functionality, this may be in the form of raw excreta, or a mix of partially or untreated faecal sludge and partially or untreated supernatant.	David Blockley, 2005 “The New Penguin Dictionary of Civil Engineering
Open ground	Solid surface of the earth.	Park, farmland, forest, community square, vacated plot, road.	David Blockley, 2005 “The New Penguin Dictionary of Civil Engineering

Term	Definition	Comments and Regional Examples	References
Outlet	A pipe or hole through which w*astewater* is discharged or a gas may vent.		David Blockley, 2005 “The New Penguin Dictionary of Civil Engineering
Overflow	An *outlet* for excess *wastewater*.		David Blockley, 2005 “The New Penguin Dictionary of Civil Engineering
Pit latrine	An *onsite sanitation technology* which is a pit dug into the ground to contain *excreta*.	Depending on the pit design, the *toilet*, and the anal cleansing method, the pit may also contain any of the following: anal cleansing water, toilet paper, other anal cleansing materials and pour *flushwater*.	WHO (adapted)
Sanitation service chain	The *containment*, *emptying*, *transport*, *treatment* and *end-use* or *disposal* of *excreta*.		Strande et al, 2014 “*Faecal sludge* Management” Pg 4
Sealed vaults	Watertight chambers which prevent external moisture from entering.	Dehydration vaults	Tilley et al, 2014 “Compendium of *Sanitation Systems*” 2nd Edition, pg.70
Foul/separate sewer	A *sewer* which may carry *blackwater* and *greywater* but from which *stormwater* is excluded.		David Blockley, 2005 “The New Penguin Dictionary of Civil Engineering

Term	Definition	Comments and Regional Examples	References
Septic tank	A *septic tank*, if correctly built, is a watertight chamber made of concrete, brickwork or blockwork, fibreglass, pvc or plastic, through which *blackwater* and *greywater* flows for primary *treatment*. Settling and anaerobic processes reduce solids and organics, but the *treatment* is only moderate. *Septic tanks* should have at least two chambers. The first chamber should be at least 50% of the total length, and when there are only two chambers, it should be two thirds of the total length. Most of the solids settle out in the first chamber. A correctly designed *septic tank* has an *outlet* from the second chamber to a sub-surface infiltration *system* (such as a *soak pit*) or to a *sewer* for further management of the liquid *effluent*. See also *lined tanks with impermeable walls and open bottom*: these are often mistakenly identified as *septic tanks*. They may be single- or multi-chambered, with partially lined or fully lined walls and an open bottom. This open bottom means that they effectively operate as a *soak pit*, with little (if any) *treatment* occurring in the tank itself.	For Indian context see: Bureau of Indian standards, 1993 "Code of practice for installation of Septic tanks" Part -1, Pg 4	Adapted from: Tilley et al, 2014 "Compendium of *Sanitation Systems*" 2nd Edition, pg.74
Sewer	An underground pipe that *transports blackwater*, *greywater* and, in some cases, *stormwater* (combined *sewer*) from individual households and other users to *treatment plants*, using gravity or pumps when necessary. The *treatment plant* and *sewer* network can either be centralised or decentralised.	Simplified sewer, solids-free sewer, conventional gravity sewer. In some locations the sewer system does not discharge to a treatment plant but discharges untreated wastewater to an open *water body.*	Tilley et al, 2014 "Compendium of *Sanitation Systems*" 2nd Edition, Pg 94

Term	Definition	Comments and Regional Examples	References
Soak pit	A pit or chamber that allows e*ffluent* to soak into the surrounding ground.	Also known as a soakaway, leach pit or infiltration trench. For Indian context see: S.K.Garg,1979 "Sewage *Disposal* and Air pollution Engineering" Pg 394 and Central public health and environmental engineering organisation, 2013 "*Manual* on *sewer*age and sewage *Treatment systems*", Part-A Pg 9-23	David Blockley, 2005 "The New Penguin Dictionary of Civil Engineering"
Stormwater	The general term for the rainfall runoff collected from roofs, roads and other surfaces before flowing towards low-lying land. It is the portion of rainfall that does not infiltrate into the soil.		Tilley et al, 2014 "Compendium of *Sanitation Systems*" 2nd Edition pg 12
Surface water	A natural or man-made *water body* that appears on the surface, such as a stream, river, lake, pond or reservoir.		Tilley et al, 2014 "Compendium of *Sanitation Systems*" 2nd Edition, Glossary
Treated faecal sludge	*Faecal sludge* that has undergone a *treatment* process and has successfully been converted into a product that is safe for *end-use*.		Strande et al, 2014 "*Faecal sludge* Management" Pg 98
Treated wastewater	*Wastewater* that has undergone a *treatment* process and has successfully been converted into a product that is safe for *end-use*.		
Unlined pit	A correctly designed, properly constructed and well-maintained *unlined pit* with permeable walls and base, through which infiltration can occur.	Single pit latrine, ventilated pit latrine, twin pit latrine, fossa alterna	

Term	Definition	Comments and Regional Examples	References
Wastewater	Used water from *sanitation technologies* in households and those within any combination of domestic, industrial, commercial industrial, commercial or agricultural premises, but not the *wastewater* from these industrial, commercial or agricultural activities; and *surface water* runoff or *stormwater* and any *sewer* inflow/infiltration. In domestic cases this is commonly made up of *blackwater*, *greywater* and possibly *stormwater*, depending on whether combined or separate *sewer*s are in use.		Tilley et al, 2014 "Compendium of *Sanitation Systems*" 2nd Edition, Glossary
Wastewater treatment plant	Infrastructure designed to convert *wastewater* into a product that is safe for *end-use* or *disposal*.	Anaerobic digestion, waste stabilisation ponds, aerated ponds, constructed wetlands, trickling filter, activated sludge	Tilley et al, 2014 "Compendium of *Sanitation Systems*" 2nd Edition, pg 98
Water body	Any significant accumulation of water, both natural and manmade (i.e. *surface water*)	Lake, pond, river, sea	

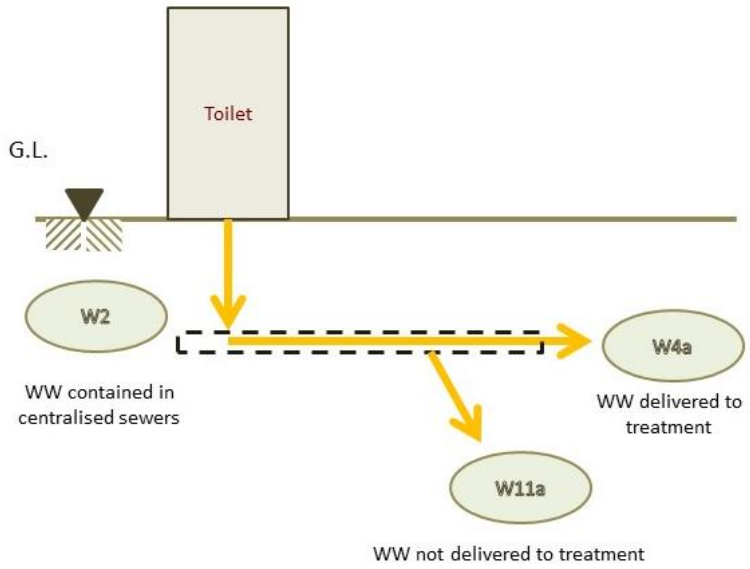
Part 4 – sanitation containment systems: SFD schematics

Notes:

1. This document should be read in conjunction with Section 5.4 of the SFD Manual Volume 1 and with the three other parts of this Volume 2:
   - Part 1 - Master SFD Graphic
   - Part 2 - Definition of SFD Variables
   - Part 3 - Definition of Terms
2. These schematic drawings show all of the possible sanitation containment systems defined on the selection grid (see over).
3. For ease of reference, and to indicate which systems populate the same variables, the systems have been grouped together and numbered L1 to L20 and S1 to S5.
4. Variable group L1 to L20 are for use when pollution of groundwater is a Low Risk.
5. Variable group S1 to S5 are for use when pollution of groundwater is a Significant Risk.

Groundwater Pollution: Low Risk
General description: No onsite container, toilet discharges directly to centralised sewers

Variable group: L1
Apply to systems:
T1A1C1
T1A1C2



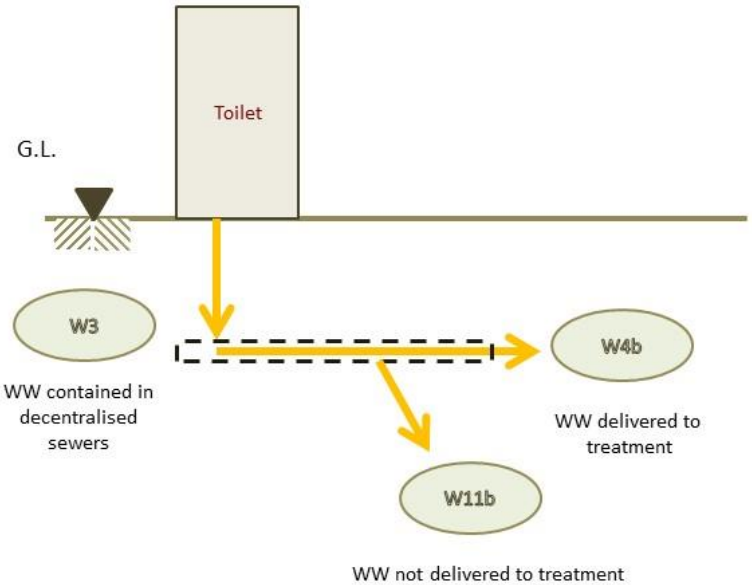
Assumptions (where there is no other data):

50% of WW is delivered to treatment (W4a) and 50% of WW is not delivered to treatment (W11a)

1

Groundwater Pollution: Low Risk
General description: No onsite container toilet discharges directly to decentralised sewers

Variable group: L2
Apply to systems:
T1A1C3
T1A1C4



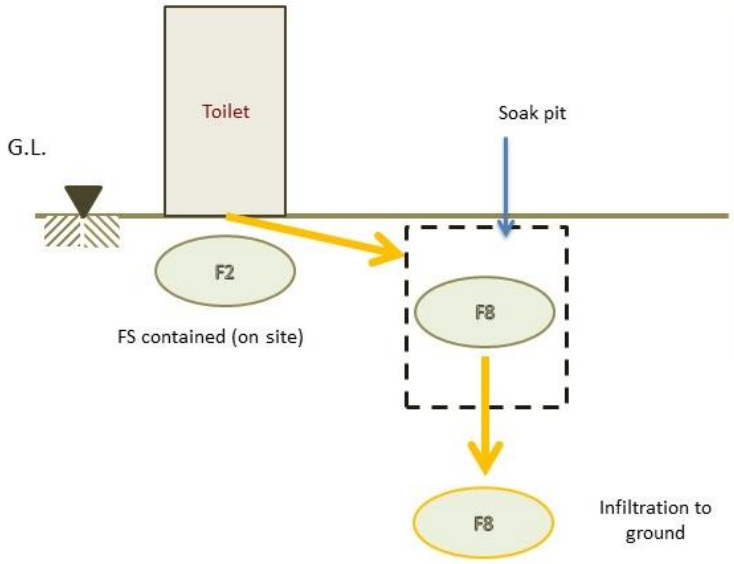
Assumptions (where there is no other data):

50% of WW is delivered to treatment (W4b) and 50% of WW is not delivered to treatment (W11b)

2

Groundwater Pollution: Low Risk
General description: No onsite container, toilet discharges directly to soakpit

Variable group: L3
Apply to systems:
T1A1C5



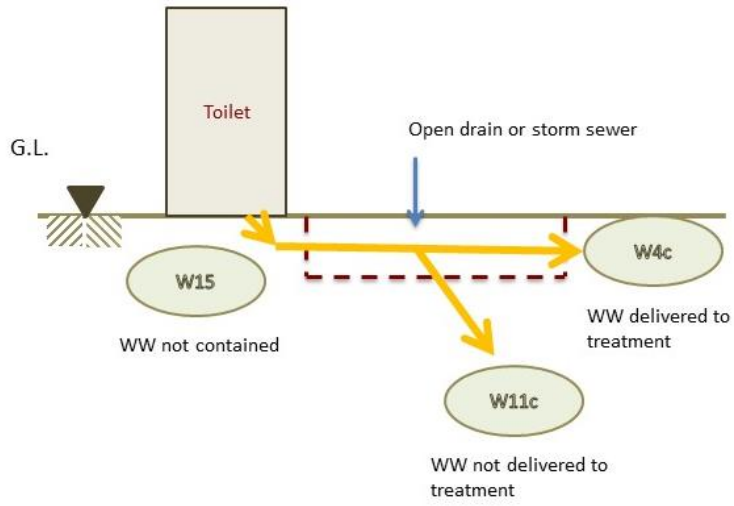
Assumptions (where there is no other data):

100% of FS is contained not emptied (F8) as infiltrate to the ground.

3

Groundwater Pollution: Low Risk
General description: No onsite container, toilet discharges directly to open drain or storm sewer

Variable group: L4
Apply to systems:
T1A1C6



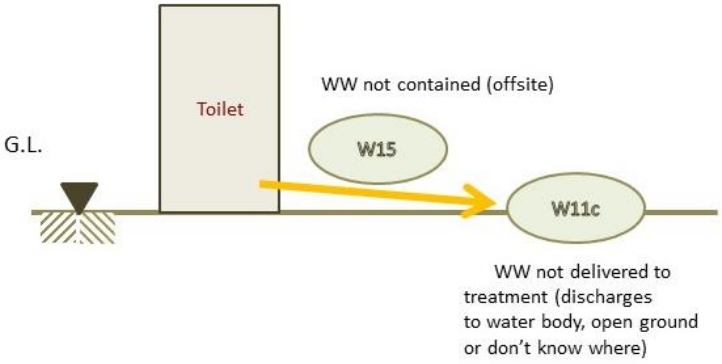
Assumptions (where there is no other data):

50% of WW is delivered to treatment (W4c) and 50% is not delivered to treatment (W11c)

4

Groundwater Pollution: Low Risk
General description: No onsite container, toilet discharges directly to water body, open ground or 'don't know where'

Variable group: L5
Apply to systems:
T1A1C7
T1A1C8
T1A1C9



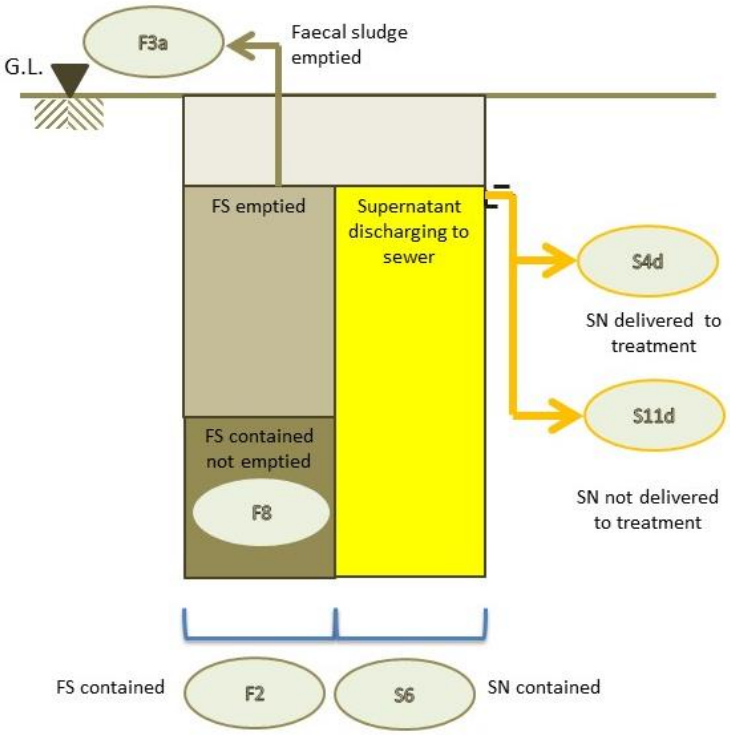
Assumptions (where there is no other data):

100% of WW is not delivered to treatment (W11c)

5

Groundwater Pollution: Low Risk
General description: Tanks connected to sewers

Variable group: L6
Apply to systems:
T1A2C1/C2/C3/C4
T1A3C1/C2/C3/C4
T1A4C1/C2/C3/C4

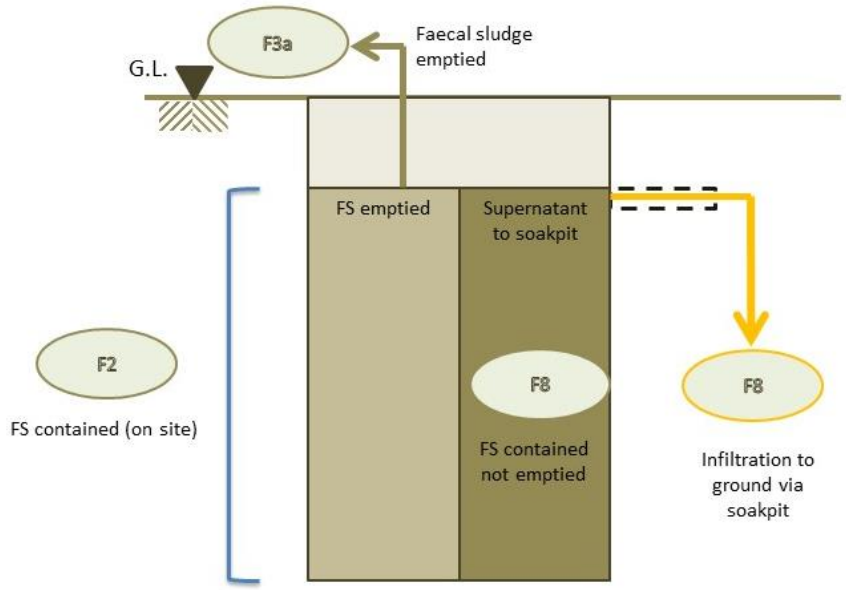


Assumptions (where there is no other data):
50% of tank content is supernatant of which 50% goes to treatment (S4d)

50% of remaining is FS emptied (F3a); and 50% is FS contained not emptied (F8).

6

Groundwater Pollution: Low Risk
General description: Tanks connected to soakpit



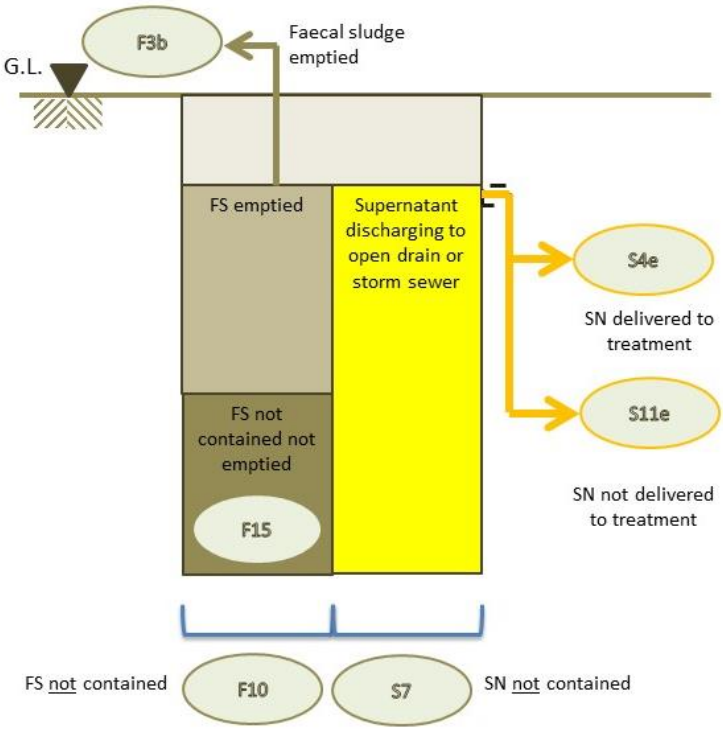
Variable group: L7
Apply to systems:
T1A2C5
T1A3C5
T1A4C5

Assumptions (where there is no other data):

50% of tank content is FS emptied (F3a); and 50% is FS contained not emptied (F8) as faecal sludge not emptied and infiltrate.

7

Groundwater Pollution: Low Risk
General description: Tanks to open drain or storm sewer



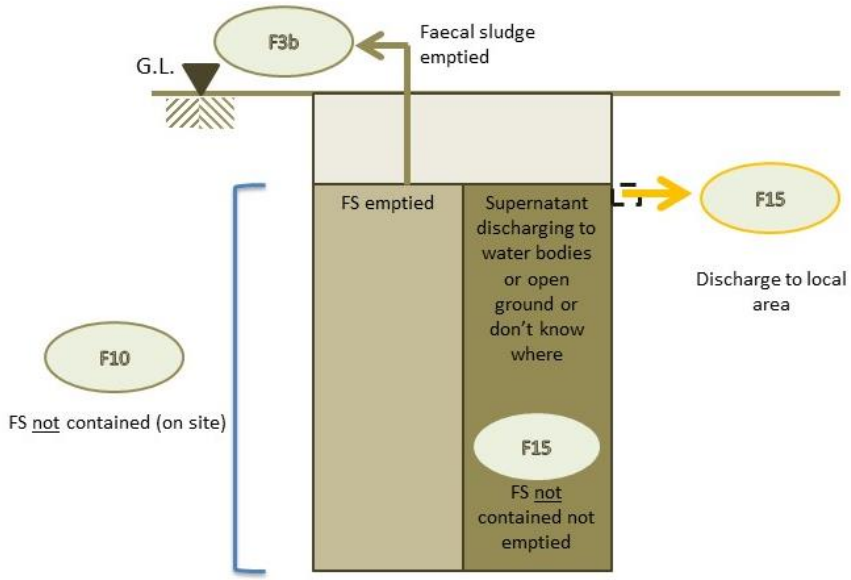
Variable group: L8
Apply to systems:
T1A2C6
T1A3C6
T1A4C6

Assumptions (where there is no other data):
50% of tank content is supernatant of which 50% goes to treatment (S4e).

50% of remaining is FS emptied (F3b); and 50% is FS not contained not emptied (F15).

8

Groundwater Pollution: Low Risk
General description: All tanks to water bodies or open ground or 'don't know where'

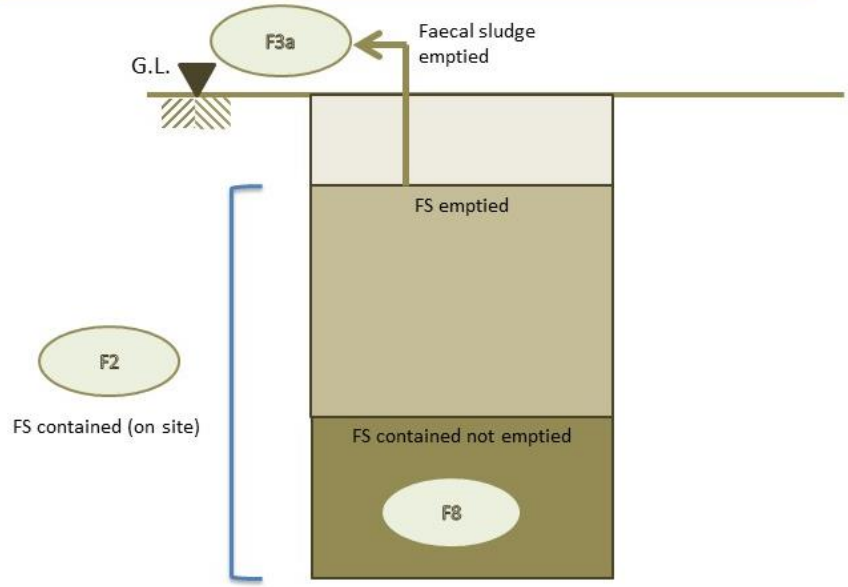


Variable group: L9
Apply to systems:
T1A2C7/C8/C9
T1A3C7/C8/C9
T1A4C7/C8/C9

Assumptions (where there is no other data):
50% of tank content is FS emptied (F3b); and 50% is FS not contained not emptied (F15) as faecal sludge not emptied and/or infiltrate and/or supernatant discharging to water bodies or open ground or don't know where.

9

Groundwater Pollution: Low Risk
General description: Fully lined tanks (sealed) with no outlet or overflow



Variable group: L10
Apply to systems:
T1A3C10

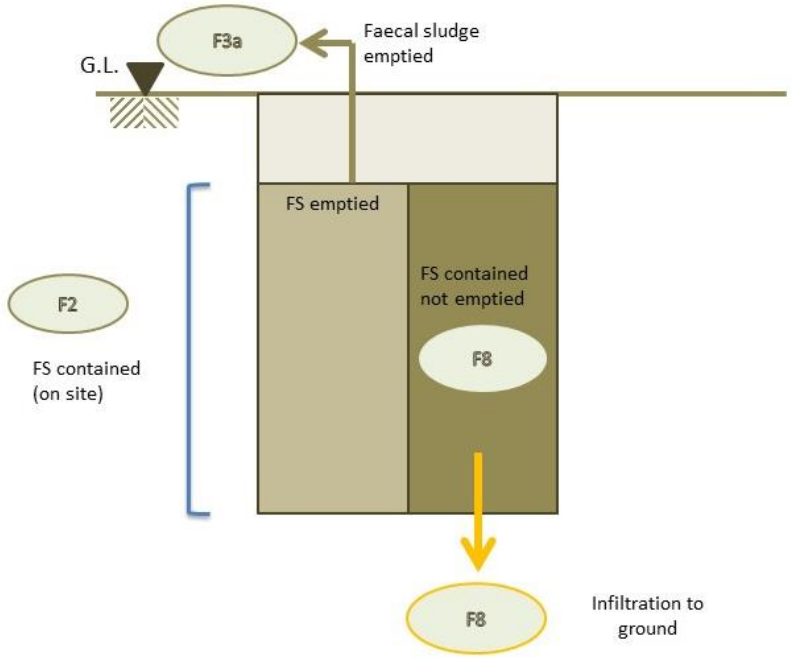
Assumptions (where there is no other data):

50% of tank content is FS emptied (F3a); and 50% is FS contained not emptied (F8).

10

Groundwater Pollution: Low Risk
General description: Lined tank with impermeable walls and open bottom with no outlet; lined pit with semi-permeable walls and open bottom with no outlet or overflow; and unlined pit with no outlet or overflow.

Variable group: L11
Apply to systems:
T1A4C10
T1A5C10
T1A6C10



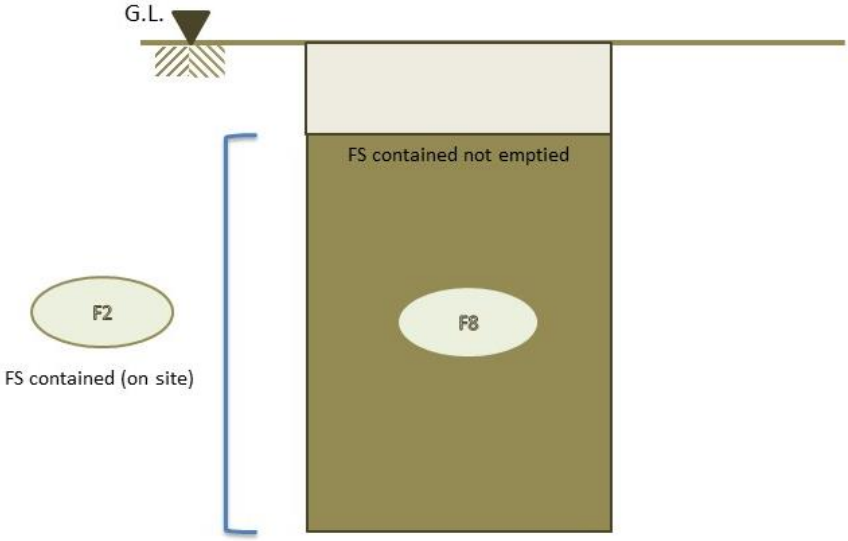
Assumptions (where there is no other data):

50% of tank content is FS emptied (F3a); and 50% is FS contained not emptied (F8) as faecal sludge not emptied and infiltrate.

11

Groundwater Pollution: Low Risk
General description: Abandoned pit covered with soil – no emptying

Variable group: L12
Apply to systems:
T1B7C10



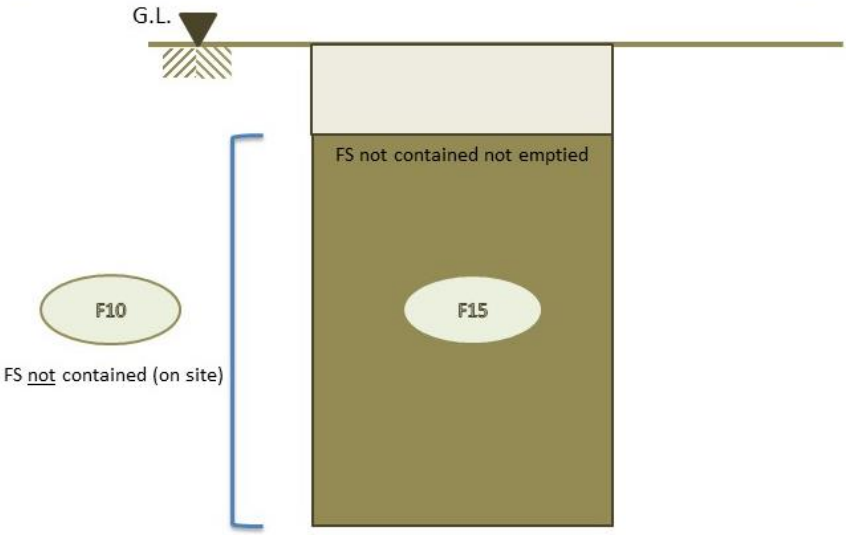
Assumptions (where there is no other data):

100% of pit content is FS contained not emptied (F8) as faecal sludge not emptied and infiltrate.

12

Groundwater Pollution: Low Risk
General description: Abandoned pit not adequately covered with soil – no emptying

Variable group: L13
Apply to systems:
T1B8C10



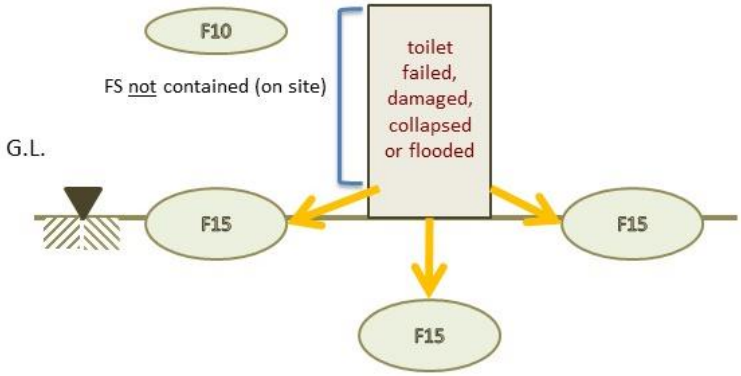
Assumptions (where there is no other data):

100% of pit content is FS not contained not emptied (F15) as faecal sludge not emptied and infiltrate.

13

Groundwater Pollution: Low Risk
General description: toilet failed, damaged, collapsed or flooded

Variable group: L14
Apply to systems:
T1B9 C1 to C10



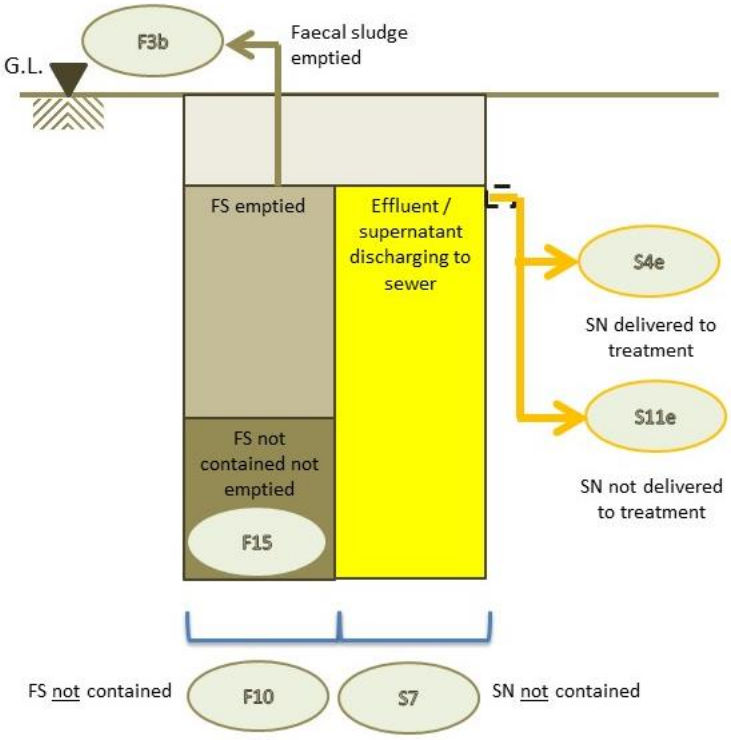
Assumptions (where there is no other data):

100% of content is FS not contained not emptied (F15).

14

Groundwater Pollution: Low Risk
General description: Tanks and pits failed, damaged, collapsed or flooded connected to sewers

Variable group: L15
Apply to systems:
T1B10C1 TO C4



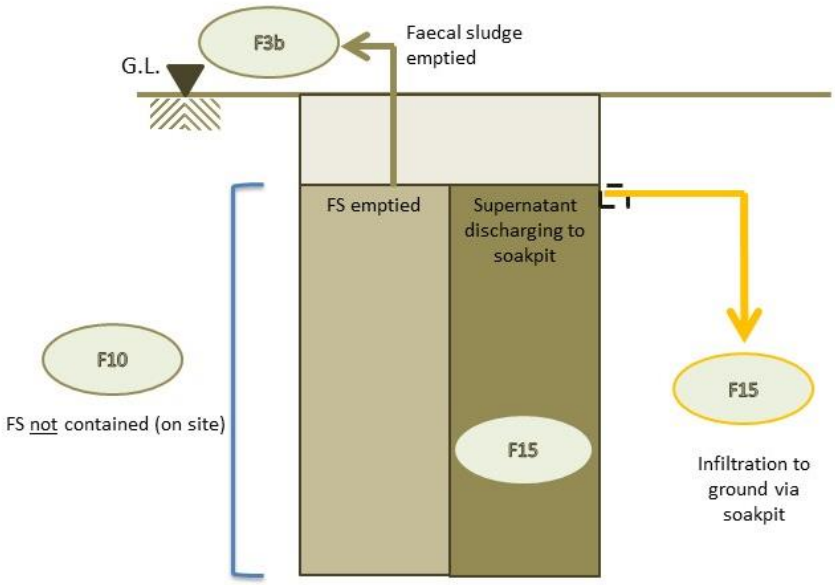
Assumptions (where there is no other data):
50% of tank or pit contents is supernatant of which 50% goes to treatment (S4e).

50% of remaining is FS not contained emptied (F3b); and 50% is FS not contained not emptied (F15).

15

Groundwater Pollution: Low Risk
General description: Tanks and pits failed, damaged, collapsed or flooded connected to soakpits

Variable group: L16
Apply to systems:
T1B10C5



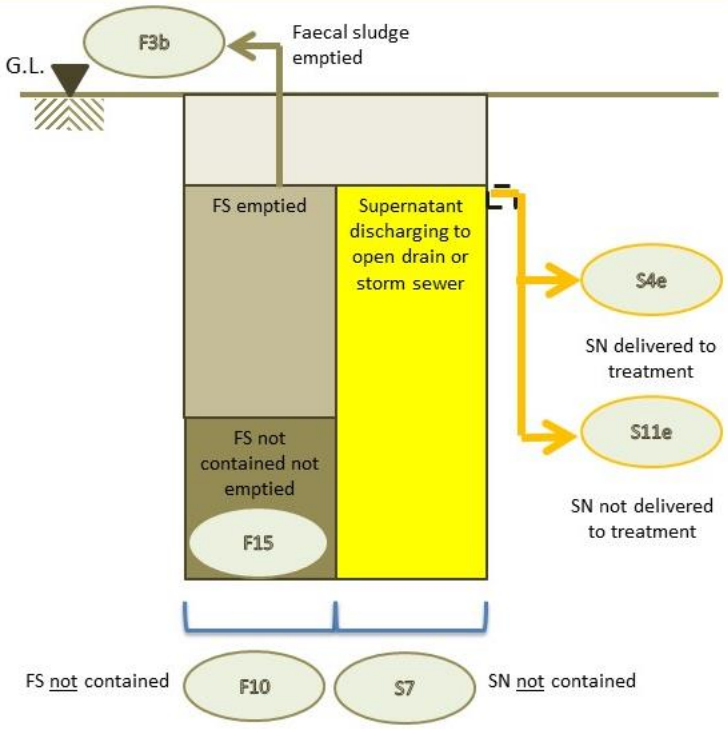
Assumptions (where there is no other data):

50% of tank content is FS not contained emptied (F3b); and 50% is FS not contained not emptied (F15) as faecal sludge not emptied and infiltrate.

16

Groundwater Pollution: Low Risk
General description: Tanks and pits failed, damaged, collapsed or flooded connected to open drains or storm sewers

Variable group: L17
Apply to systems:
T1B10C6



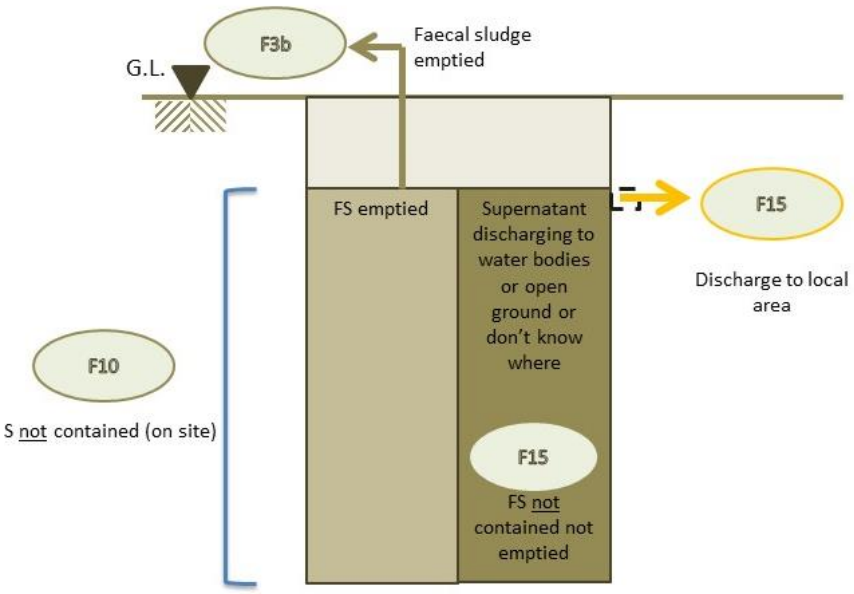
Assumptions (where there is no other data):
50% of tank content is supernatant of which 50% goes to treatment (S4e)

50% of remaining is FS not contained emptied (F3b); and 50% is FS not contained not emptied (F15).

17

Groundwater Pollution: Low Risk
General description: Tanks and pits failed, damaged, collapsed or flooded connected to water bodies, or open ground or 'don't know where'

Variable group: L18
Apply to systems:
T1B10C7 TO C9

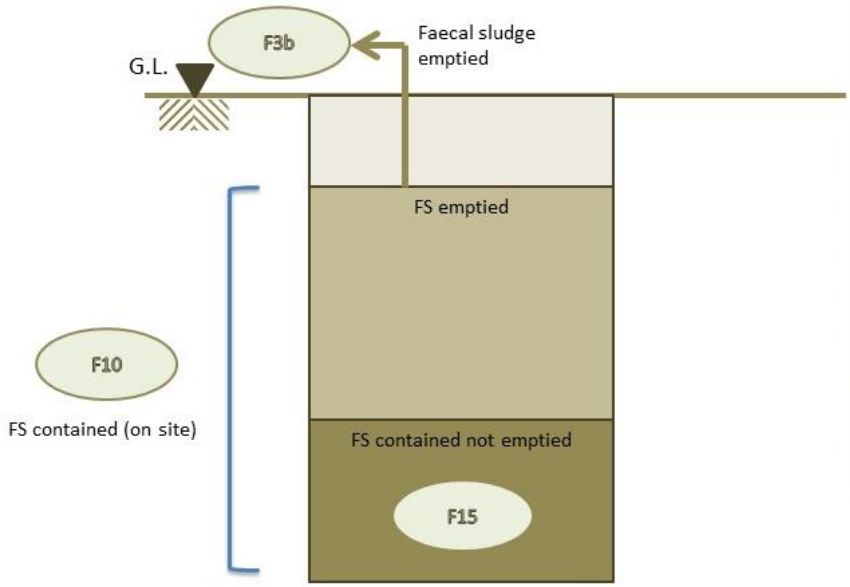


Assumptions (where there is no other data):
50% of tank content is FS emptied (F3b); and 50% is FS not contained not emptied (F15) as faecal sludge not emptied and/or infiltrate and/or supernatant discharging to water bodies or open ground or don't know where.

18

Groundwater Pollution: Low Risk
General description: Tanks and pits failed, damaged, collapsed or flooded with no outlet or overflow

Variable group: L19
Apply to systems:
T1B10C10



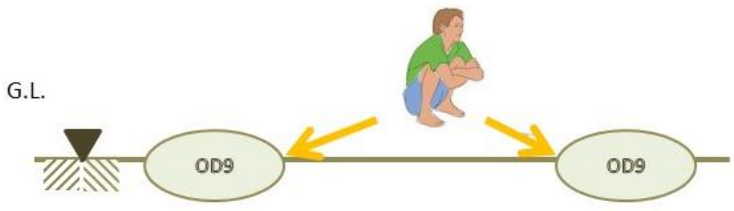
Assumptions (where there is no other data):

50% of tank content is FS emptied (F3b); and 50% is FS contained not emptied (F15) as faecal sludge not emptied and infiltrate.

19

Groundwater Pollution: Low Risk
General description: Open defecation

Variable group: L20
Apply to systems:
T1B11C7 TO C9



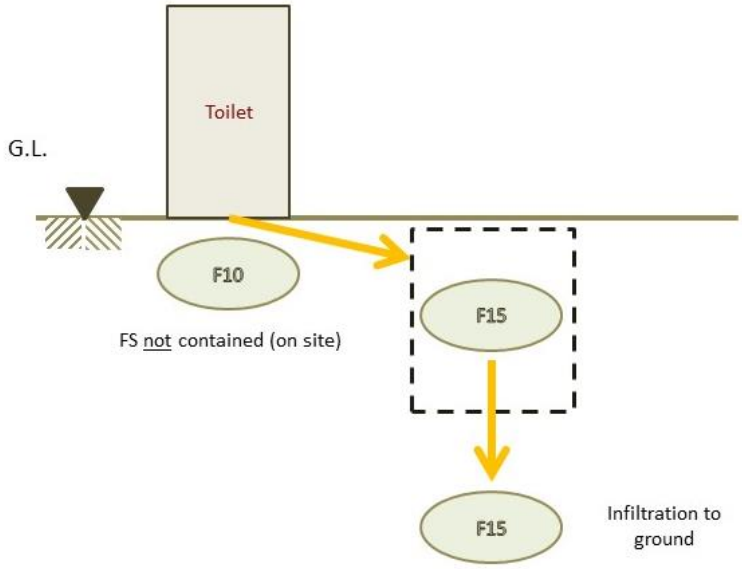
Assumptions (where there is no other data):

Open defecation is NOT contained at all; will contribute to variable OD9 only.

20

Groundwater Pollution: Significant Risk
General description: No onsite container, toilet discharges directly to soakpit

Variable group: S1
Apply to systems:
T2A1C5



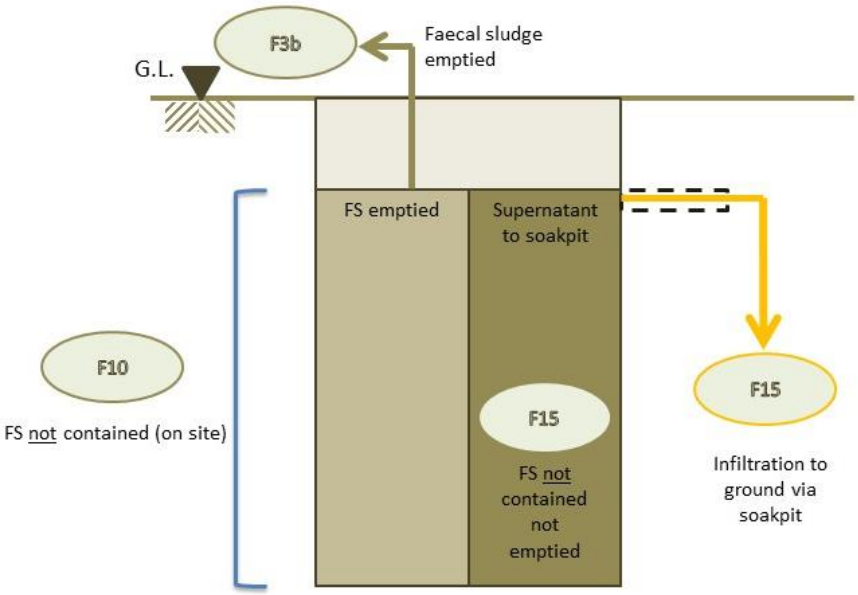
Assumptions (where there is no other data):

100% of FS is not contained not emptied (F15) as infiltrate to the ground.

21

Groundwater Pollution: Significant Risk
General description: Tanks connected to soakpit

Variable group: S2
Apply to systems:
T2A2C5
T2A3C5
T2A4C5

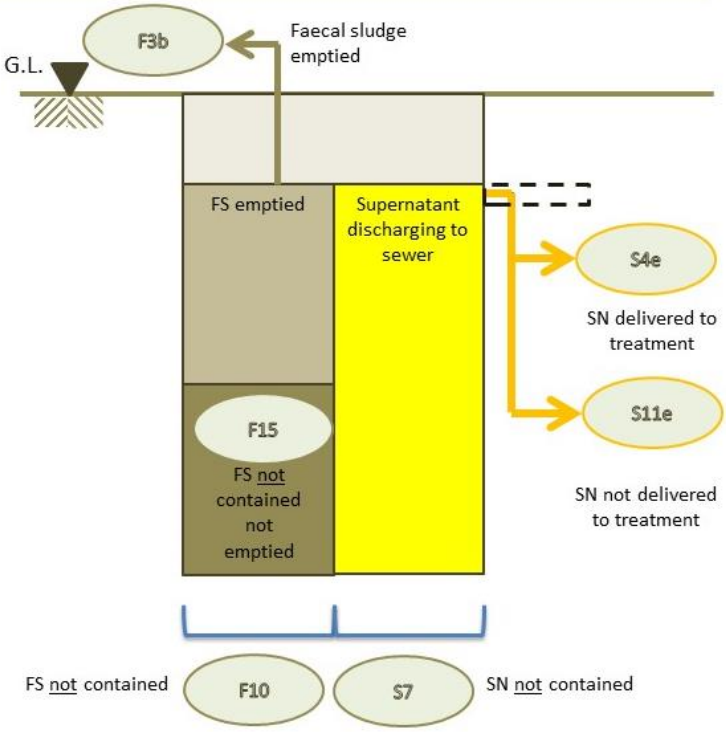


Assumptions (where there is no other data):

50% of tank content is FS not contained emptied (F3b); and 50% is FS not contained not emptied (F15) as faecal sludge not emptied and infiltrate.

22

Groundwater Pollution: Significant Risk
General description: Lined tank with impermeable walls and open bottom connected to sewers



Variable group: S3
Apply to systems:
T2A4C1
T2A4C2
T2A4C3
T2A4C4

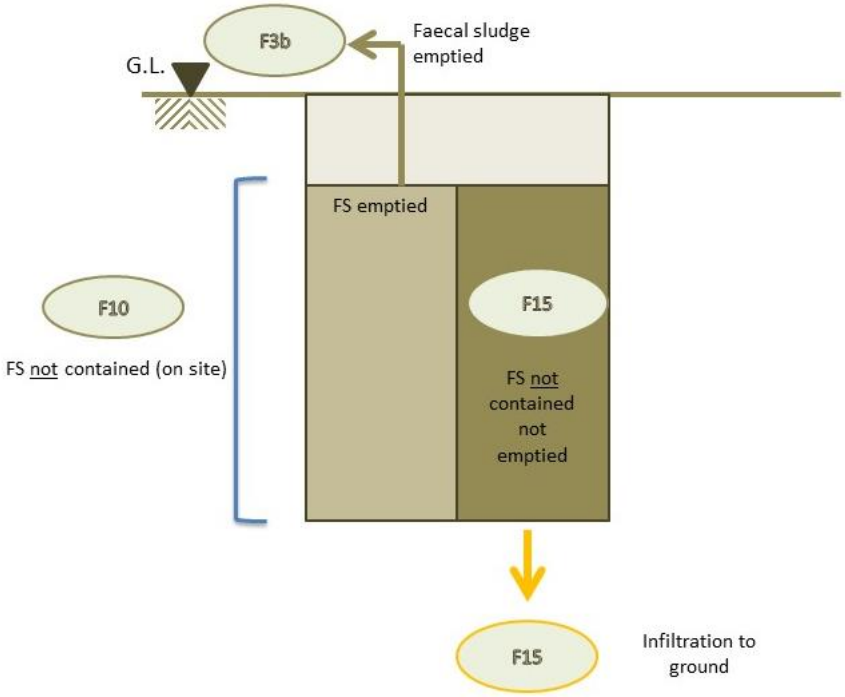
Assumptions (where there is no other data):

50% of tank content is supernatant of which 50% goes to treatment (S4e).

50% of remaining is FS emptied (F3b); and 50% is FS not contained not emptied (F15).

23

Groundwater Pollution: Significant Risk
General description: Lined tank with impermeable walls and open bottom with no outlet; and pit latrines with no outlet



Variable group: S4
Apply to systems:
T2A4C10
T2A5C10
T2A6C10

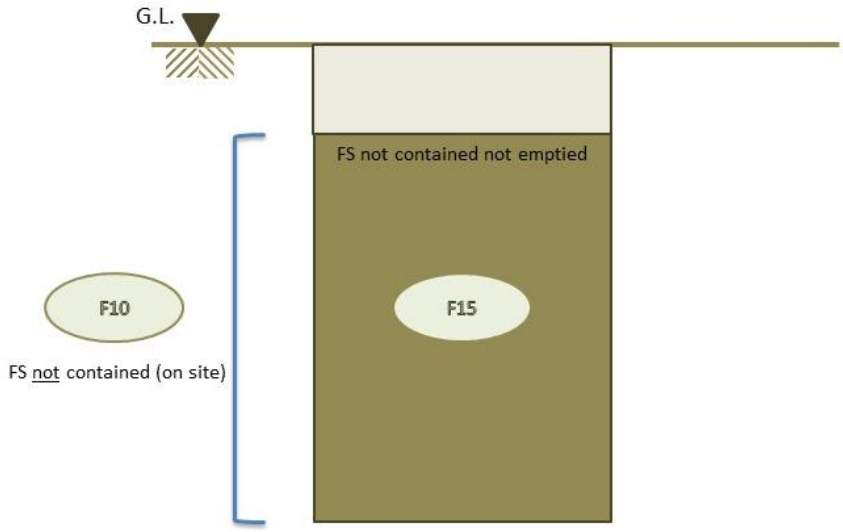
Assumptions (where there is no other data):

50% of tank content is FS emptied (F3b); and 50% is FS not contained not emptied (F15) as faecal sludge not emptied and infiltrate.

24

Groundwater Pollution: Significant Risk
General description: Abandoned pit adequately covered with soil – no emptying

Variable group: S5
Apply to systems:
T2B7C10



Assumptions (where there is no other data):

100% of tank content is FS not contained not emptied (F15) as faecal sludge not emptied and infiltrate.

25

Annex 1: Literature review of existing secondary data

Literature review is necessary to achieve the following objectives:

- To gain an understanding of the general city context, including the scale of sanitation services, range of off-site and on-site sanitation technologies in the city; and
- To identify key stakeholders responsible for sanitation and FSM services in the city. It may be important to engage and consult with some of these stakeholders during the city study, to gather more detailed information or to access other valuable documents.

Methodology

The literature review is likely to have two phases:

- The first phase can develop an understanding of the context of the study. During this phase it is important to search for and collect relevant information in a systematic way. This information is then summarized, synthesized and analysed to record the evidence and arguments given by others, as contained in the literature.

- The second phase of the literature review can be carried out after collecting data from other sources (such as through interviews, FGDs or infield studies), to fill in any remaining information gaps. Where new sources of information have been identified during the study, the literature review can be updated accordingly.

The process of preparing a literature review must be:

- Focused, based upon the questions to be addressed in the city study;
- Comprehensive, yet concise;
- Critical, analysing and commenting on information rather than just reproducing and summarizing it; and
- A discussion of a range of different, reliable perspectives.

When written-up the literature review should:

- Describe the main factors of the study that the literature contributes to;
- Explain the similarities and differences between reported evidence and the arguments, and compare and contrast the findings, opinions, options and approaches presented; and
- Identify any knowledge gaps recognized in the literature, including any supporting evidence that other people have also identified this gap.

A range of existing information sources may be used for the literature review. These include:

- **Published material**: books, journals, conference proceedings, official records (statistics, household surveys, etc.), government publications, newspapers;
- **Unpublished material**: project files (monitoring reports, accounts, etc.), internal reports (e.g. issued by projects, organizations, donors, etc.), consultants' reports;
- **The internet / electronic media** (some of which may be electronic copies of printed literature): databases (e.g. Aqualine), search engines (e.g. Google scholar), CDs;
- **Visual material**: photographs/diagrams/drawings, films/video/Internet/DVDs;
- **Audio material**: taped or digitally recorded interviews/ telephone conversations/ Internet/ CDs and DVDs;
- **Personal communications**: written, emailed or verbal correspondence with key informants.

Literature from non-governmental organizations (NGOs) and other 'external' agencies

A range of 'external' agencies may be engaged in supporting sanitation and FSM services within a given city. These can include academic institutions, NGOs, donors, private investors or consultants. In this context, 'external' refers to agencies that are not service providers, but have interests related to sanitation services, including wastewater and faecal sludge management and service delivery development. They may be well placed to contribute views, reports and data on a range of issues. More 'neutral' key informants – i.e. those without a direct 'stake' or vested interest in sanitation services – are also likely to be in a good position to help with understanding issues where they have a particular neutral interest and/or influence in relation to current and future sanitation, wastewater and faecal sludge management services.

Annex 2: Key Informant Interviews

Key informant interviews (KIIs) are the way in which primary information will be sought to address key questions about how both the 'enabling environment' and the operating environment affects sanitation and FSM services (past, current and future). KIIs with stakeholders having responsibility or interest in sanitation and FSM services at city-level and beyond will allow the enabling and operating environments to be better understood in relation to the influence within the city, or to wider spheres of influence – such as State or National legislation.

KIIs are also a means to engage stakeholders in other aspects of the process, including to:

- Clarify the purpose, objectives and interests of each stakeholder, in relation to current sanitation services and the likely outcomes of changes to those services; and
- Facilitate further data collection, including: providing specific documents/ 'grey literature', granting access to localities, making contacts with other organizations or individuals, triangulating data.

It is anticipated that one individual, with experience in conducting interviews with a broad range of stakeholders, will carry out the interview. However, it is possible that on occasion it may be deemed appropriate to have two people involved – one to facilitate the questions and the other (or both) to take notes. The length of interviews will vary, but it is suggested to keep interviews to a maximum of about 1 hour.

Quality control

Key informant interviews should follow commonly adopted good practice, particularly those outlined in Section 6 under "Ethical Considerations".

If the interviewee invites other participants to join the interview, be aware of their appropriateness to the subject matter, whether their presence may inhibit the original interviewee in answering questions, and any possible disruption this may cause to the exchange of information. If the other participants have valid contributions to make to the interview, incorporate these into the notes, and clearly identify in the write-up who gave which answers and participated in a broader discussion.

Comprehensive notes should be captured electronically (Typed directly into a Word document or similar) – either during the interview itself or within 24 hours of the interview.

Key points relating to the main topic areas of the interview should be identified and summarised, as soon as possible following the interview.

Data Management

A separate Word document should be developed for each interview write-up. The document file name and any original interview forms (hand-written) should have a unique code that identifies the document. It could use for example, a coding for the city, type of stakeholder (e.g. Government/ Private Sector/ NGO/ Development Agency/ International Financial Institutions), if appropriate the organization interviewed (name of the institution, not the individual), date of the interview and, if required a unique number to distinguish the document from others.

Data Analysis

After the completion of all the interviews, the write-ups can be revisited to ensure they present an accurate reflection of the information from all respondents (i.e. not just the initial information from external actors / agencies, or from a particular set of other stakeholders).

Annex 3: Observations

Observation of service providers and facilities may prove a useful tool to triangulate and/or confirm the reliability and consistency of information collected from other means. Observation can be used to collect both quantitative and qualitative data.

The observation of service providers and facilities will help to assess the type of equipment used and actions taken (by households and workers) in relation to containment, emptying, transport, treatment, disposal or end-use of faecal sludge. Observations require making visual inspections about how on-site sanitation technologies are managed. This may involve observing the emptying process, as well as how the removed faecal sludge is transported either to a disposal site or treatment plant. In this way, the stages of operation through the service chain can be identified and reported. Observation can then provide information about the effectiveness of operations and methods used at each stage.

To observe emptying and transportation practices, visits need to be planned, agreed and carried out as and when on-site sanitation technologies are being emptied. Having gained approval to conduct an observation (e.g. from households, those carrying out the emptying service, operators or managers of treatment plants), details should be recorded about the on-site sanitation technology (containment), the practices of the service provider emptying the system (emptying, transportation and disposal), and the facilities handling the faecal sludge (treatment plant, disposal and/or end-use site).

Gaining access to observe treatment plants and disposal sites will need to be arranged with those responsible for managing them.

Observation will generate both quantitative and qualitative data. All information collected should be recorded in note form and transferred into a document. Having a standard reporting format for observations will help to ensure that relevant information is captured as far as possible during each observation visit. Documents should clearly state the type, arrangement and location of services and facilities observed.

A note on holding discussions or interviews with collectors and transporters of faecal sludge

Those who empty and transport faecal sludge from on-site sanitation technologies are not necessarily the same people as the "owners" of the transport vehicles. They have different interests, opinions and knowledge which is often missed during standard research processes.

Where possible, interviews (formal or less formal) should be arranged and held with those directly involved in the emptying and transportation of faecal sludge. Manual collectors, as well as those who operate motorized emptying equipment should be interviewed where possible. Such discussions can help to ensure that all stakeholders are consulted on questions of direct relevance and purpose to the services they provide.

Language is an important factor to consider when talking with informal operators in the city. Use of local dialects may be necessary, which might require the use of a local translator to support the process.

It is also important to be aware that the relationships and dynamics within a city can affect the willingness of those who carry out emptying and transportation services to talk openly about their operations.

The *Stakeholder engagement* document provides more detailed guidance and some examples of the different arrangements that may be encountered.

Sampling for observations

Observations should aim to look at services, facilities and procedures adopted through all stages of the sanitation service chain. The observations should reflect the range of practices, i.e. considering both manual and motorized emptying and transportation service providers.

To achieve this, the following need to be taken into account:

- Discuss emptying schedules with both manual and motorized service providers in advance and identify a range of customers, income groups and types of on-site sanitation technologies that they empty. This requires discussions with a number of service providers, to achieve a representative range.
- Observations need to coincide with a household having their on-site sanitation technology emptied. Information will need to be sought from the service providers, or households, to know when emptying will take place and time visits accordingly. Note that observations of manual emptying procedures may need to be done at night.
- Where possible, the observations should observe the full procedure of a “shift” by the emptying and transportation service providers – following them through the stages of emptying, transporting and disposing of the faecal sludge – to the extent that is possible.
- The visits will require careful thought and preparation to obtain representative results. It may benefit to identify, in consultation with emptying and transportation service providers, the times of day/ days of the week that they are busiest, and then match this against the stage of work to be observed.

Annex 4: Focus Group Discussions (FGDs)

The objective of Focus Group Discussions (FGDs) with community representatives is to gather qualitative data that will complement, validate, or perhaps challenge data collected during the literature review and interviews. Questions will focus on emptying and transportation services and how they affect communities. They will be likely to focus on obtaining information relating to:

- The range of emptying practices and emptying services within the city; and
- Levels of support received (or perceived as being needed) to improve services to areas of the city.

In relation to the service delivery context, questions for FGDs focus on issues relating to the Quality and Equity of emptying services provided. Suggested topic areas and questions to address through FGDs are shown in Table 11 and Table 12 respectively.

Table 11: Topics for FGDs with community representatives

Component	Issue	Topics for discussion
Service delivery context analysis	Quality:	- Extent to which functioning services are available or provided, to support good emptying and transport of faecal sludge
	Equity:	- Extent to which the city's emptying and transport technologies serve low-income communities

Table 12: Questions to be addressed during the FDGs

	Suggested primary questions and 'probing' questions: to stimulate discussion		
Topic areas for discussion	**Primary questions**	**Secondary questions**	**Tertiary questions**
Extent to which functioning services are available: emptying and transport	Can families find suitable latrine **emptying services**, when they want to have their latrine emptied?	Who provides those services?	How reliable are the services? How satisfied are families with these services?
	What are the functioning **transport services** available in the city?	Who provides those services?	How reliable are the services? How satisfied are families with these services?
Extent to which the city provides support to ensure services reach low-income communities: emptying and transport	Do families get any external support for **emptying latrines**?	Who provides the support? How is the support provided?	What are the benefits, if any, of getting this support? What are the disadvantages, if any, of this support?

Specific questions to ask during the FGDs should be considered, that account for the local realities and are prepared in appropriate vocabulary, as well as being translated into the appropriate language to suit the local context and aid understanding. Once translated, the questions should be pre-tested. This allows for the suitability and acceptability of questions to be checked – as well as ensuring those running the FGDs clearly understand the nature of each question. Appropriate modifications to the FGD questions can be made and the final questions used documented.

Sampling

The final selection of groups and areas in which to conduct FGDs should be discussed and agreed, in advance, with the key contact for the city. Up to 10 FGDs with community representatives and service providers is likely to be sufficient to add valuable information to the study.

Those living in informal settlements cannot be considered a homogenous group. A range of perceptions, priorities, practices and challenges will face different residents, depending on various factors. FGDs are a means by which participants can be selected for a specific reason, as a way to help draw-out from the group issues particularly affecting different 'types' of residents in informal settlements.

As a minimum, at least half of the FGDs should be gender-segregated (with similar numbers attending men-only and women-only FGDs), to allow responses to be disaggregated by gender. Other groups may be focused around different socio-economic factors, to suit the characteristics of the population. For example:

- Household characteristics: all participants are tenants, or all are owner-occupiers, or all are landlords
- Presence of a household latrine: all participants own a private household latrine, or all manage a latrine that is shared by a number of families
- Use of shared, community or public toilets on a daily basis.
- Type of containment system: all participants have their on-site sanitation technology (pit latrine, septic tank, etc.) emptied
- Use of service providers for emptying: all participants use manual operators for emptying, or all rely on motorized services.

Methods

Those running the FGDs must have appropriate experience and skills to both facilitate and write-up the discussion during the FGDs. Women interviewers are required to interview women-only FGDs, to enable women to talk more freely, about (for example) the issue of disposal of menstrual hygiene products, who makes decisions on sanitation within the household, etc.

Appropriate approvals to conduct the FGDs should be sought, prior to running them. This will be with individuals invited to participate as a minimum, but may also require approval from officials representing affected communities and households (if deemed necessary).

FGDs should be run by teams of two people. One person facilitates the discussion, while the other person takes notes and observes non-verbal communication. Both team members should have previous experience and suitable skills in running and/or documenting FGDs, as well as technical knowledge in urban sanitation.

Relevant individuals or groups may be identified and invited to participate, but any 'group selection' needs careful discussion and agreement in advance, to ensure it is appropriate and will be effective to the needs of the study.

FGDs should take place in a convenient, quiet and comfortable location for participants. The availability and accessibility of women and other vulnerable groups must be considered when planning all locations and times at which to hold the FGDs. FGDs typically last an hour or more but the duration of each discussion may vary depending on the dynamic of the group and number of participants. Participants should be notified of the expected duration and the facilitator should ensure not to run over this time.

Focus groups are typically 4-10 participants however researchers need to anticipate likely 'no-shows' and recruit accordingly, aiming for no more than 10 participants.

Quality control

The management of FGDs should follow commonly adopted good practice, including:

- Pre-plan: select and invite the right participants;
- Set an appropriate venue, time and duration;
- Explain the purpose of the FGD at the start and gain approval from participants to continue;
- Seek agreement of ground rules with participants (one person speaks at a time, everyone's views are important, there are no right or wrong answers, etc.);
- Only voice-record the FGD with prior knowledge and granted permission of ALL participants;
- Allow participants to opt-out or leave at any time;
- Allow everyone the opportunity to participate and no-one to dominate;
- Summarise key messages received with participants before ending; and
- Re-state what will happen to the data they have supplied.

Comprehensive notes should be captured electronically – either during the FGD itself (typed directly into word document or similar), or within 24 hours of the FGD. Where different languages are used for the group discussion, note-taking and final write-up, the team needs to have adequate language skills to ensure the quality and meaning of information being said, captured and reported is maintained through the process.