

# The development and use of SFDs for better sanitation investment planning A case story from Lusaka (Zambia)



## Overview of CFS-Lusaka programme (GIZ)

The CFS-Lusaka (Climate-friendly sanitation services in peri-urban areas of Lusaka) project focusses on the improvement of prerequisites for climate-friendly Faecal Sludge Management (FSM) in peri-urban areas of Lusaka. The project is complementary to the KfW Development Bank, European Investment Bank (EIB), World Bank (WB) and African Development Bank (AfDB) investment programme called the Lusaka Sanitation Programme (LSP). The CFS-Lusaka project works to improve measures for improved FSM and contribute to the establishment of the framework conditions for the emptying, transportation and treatment of faecal sludge in close cooperation with the LSP implementing partners Lusaka Water and Sewerage Company (LWSC) and Lusaka City Council (LCC).

The CFS-Lusaka project provides advisory and capacity development work in four action areas:

1. Procedures for implementing climate-friendly onsite sanitation services and FSM, reducing greenhouse gas emissions.
2. Coordination mechanisms for OSS and FSM stakeholders.
3. Monitoring of climate relevant regulations in sanitation services.
4. Capacity development for public and private service providers in climate-friendly sanitation services including FSM and wastewater management.

## Foreword / Introduction

CSF-Lusaka project supports its implementing partners in the use of the Shit Flow Diagrams (SFDs) to better understand and illustrate the sanitation situation in Lusaka City, the capital of Zambia. In 2018, a number of SFD reports have been prepared covering Lusaka City as a whole and looking into peri-urban areas or specific aspects of Lusaka Sanitation Programme.

This brochure provides an overview and summary findings of the production of SFDs in Lusaka. It further shows how SFDs are utilized by decision-makers and sanitation actors in Lusaka in their joint effort to significantly improve the sanitation situation for the population of Lusaka. LWSC is currently working on increasing its capacity both in off-site and on-site services. Thus, the analysis of the city context, in conjunction with the baseline SFD graphic of the Lusaka Sanitation Program (LSP) areas, has characterised the performance of the sanitation systems and provided the

percentage of excreta that are managed safely in the whole sanitation chain, from containment to treatment and disposal, showing, where improved sanitation management services are needed in LSP intervention areas.

The projected SFDs aimed to evaluate the impact of the sanitation infrastructure that has been planned to be implemented under the LSP based on the programmes initial planning documents, identifying in which parts of the sanitation chain the interventions will have a significant impact, according to three different scenarios, ensuring the sustainability of investments in the LSP areas.

Therefore, the development of a baseline SFD of the Lusaka Sanitation Program (LSP) areas and the development of projected SFDs looking into post LSP impacts supports LWSC decision makers to visualise the potential changes in the impact in the LSP areas.



## Introduction to SFDs

### What are SFDs?

Excreta flow diagrams, also known as Shit Flow Diagrams (SFDs), are a visualization tool for excreta management in cities. SFDs are based on population numbers and provide an indication of where their excreta goes, looking at the entire sanitation service chain and providing a representation of the public health hazard.

### Why use SFDs?

Achieving sustainable sanitation for all has increasingly become a daunting task in many countries due to rapid uncontrolled urbanization. Therefore, a change of approach is necessary. Traditional strategies have only been addressing the problem from the end-user front. SFDs allow for a holistic evaluation of the entire sanitation service chain and enable decision-makers to identify and communicate sanitation priorities based on the flow and fate of excreta in cities. The SFD provides a strong basis for making suitable investments in sanitation, and the scaling-up of specific efforts in the future can be better justified on analysing their impacts.

### Different applications of SFDs

Besides giving an insight into the current sanitation situation of a city, SFDs can as well be used to analyse and evaluate the effect of implemented sanitation changes. By creating a progress SFD after the implementation of certain sanitation measures, the impact on the entire sanitation service chain can be seen by comparing the progress SFD to the SFD showing the baseline situation before implementation. Scenario SFDs on the other hand,

are used to project the likely outcome of implementing specific sanitation interventions and feeding the expected outcomes into the SFD graphic. This can give an insight into the expected impact of different interventions on the entire sanitation service chain in a city.

### The SFD Promotion Initiative

The SFD Promotion Initiative (SFD PI) is supported by the Bill & Melinda Gates Foundation and managed by GIZ under the umbrella of the Sustainable Sanitation Alliance (SuSanA). CSE, Eawag, the University of Leeds, Loughborough University's Water, Engineering and Development Centre (WEDC) and the former Water and Sanitation Program of the World Bank (current Global Water Practice) are implementing partners. Information and guidance on how to produce an SFD, and SFD reports and various case stories from cities around the world, including the SFD Report from Lusaka, can be downloaded from the SFD Webportal.

## Background information Lusaka, Zambia

Zambia is a landlocked country in south-central Africa. The high population growth, high urbanisation rate, and poor sanitation are contributing to annual disease outbreaks, e.g. of cholera. 85% of the urban population in Zambia is connected to a drinking water system, but only 60 % have access to sanitation services.

The capital city Lusaka is with approximately 2.5 million inhabitants the biggest city of the country (data from 2018).

The city's sewerage network covers 30 % of the city area and around 14 % of the households are connected to it.

The high hydrological vulnerability results in a potential high risk of groundwater pollution in Lusaka. In 2007, it was estimated that around 70 % of Lusaka's population resides in peri-urban areas. The rapid urbanization process resulted in a lack of proper infrastructure in these peri-urban areas, where 90 % of the people use pit latrines mostly unlined, and poorly managed, posing a high risk of ground water pollution and a risk to human health and the surrounding environment.





## Lusaka Sanitation Program

The Lusaka Sanitation Program (LSP) is an initiative of the Lusaka Water and Sewerage Company (LWSC) aiming to achieve the Sanitation Master Plan (SMP), hence, to provide affordable sanitation options to reduce the health risk by protecting the drinking water sources of the city. The project focuses on selected districts within Lusaka (see figure 2) and its targets are:

- Construction of 520 km of new sewer lines (generating 14,000 new connections).
- Provide improved toilet options (12,000 improved empty-able household latrines) designed to protect the groundwater for households that cannot be connected to the sewer lines.
- Implement new services to empty septic tanks and pit latrines.
- Build 4 additional treatment facilities to cope with the increasing flow of incoming wastewater.
- Construction of 100 public toilets.

This 5-year program of the LWSC is supported in part, through technical advice by the GIZ project Climate-friendly sanitation in peri-urban areas in Lusaka (CFS-Lusaka).

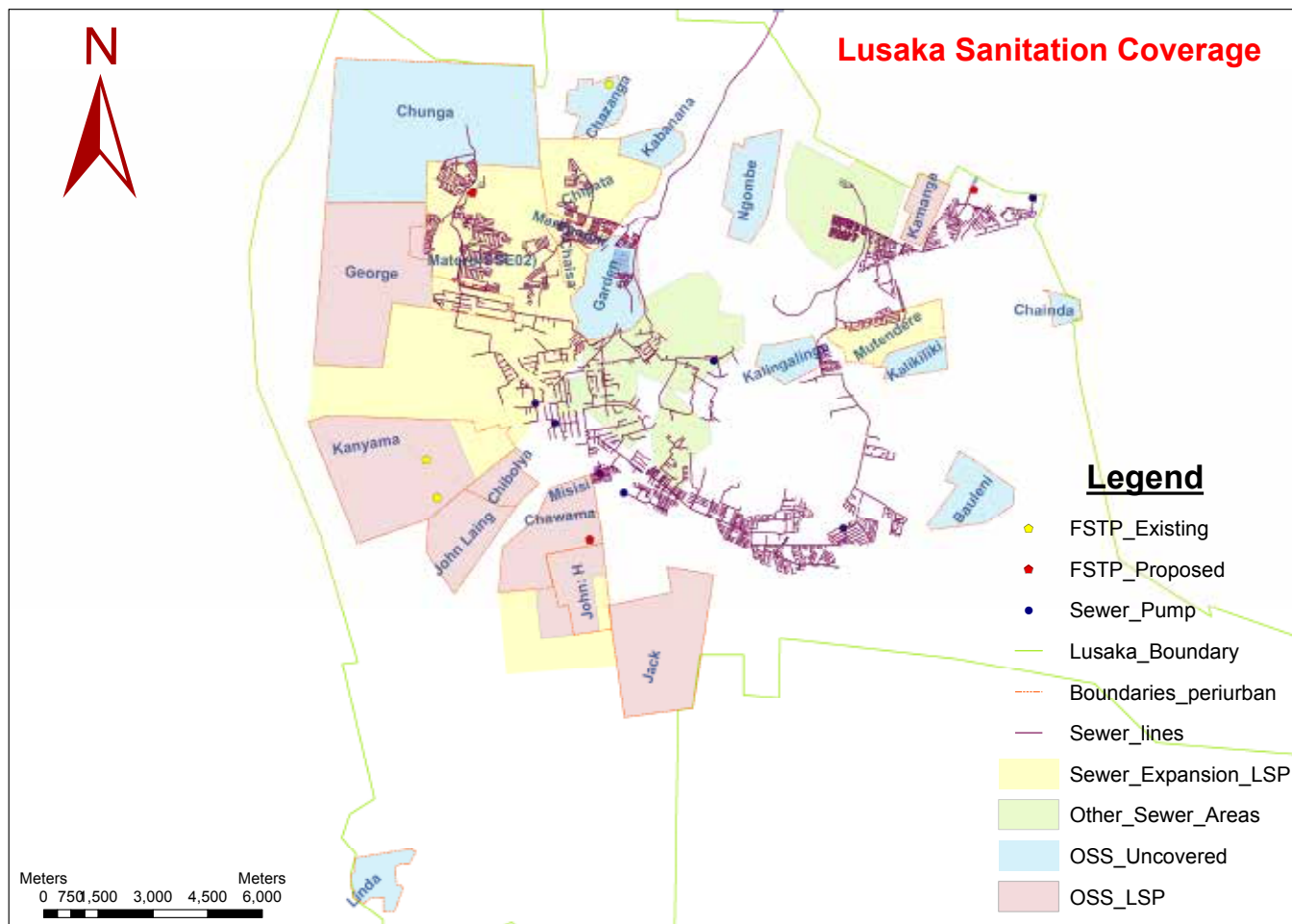


Figure 2: Map of Lusaka Sanitation Coverage showing the LSP intervention areas



## Using Scenario SFDs for strategic decision-making for the Lusaka Sanitation Programme

In addition to the citywide SFD report and as part of CFS-Lusaka's support to the LWSC, an SFD for the LSP intervention areas has been produced, showing the baseline situation in 2018. Furthermore, three Scenario SFDs have been developed (LSP Vision 2022 a, b, c) showing how the sanitation situation could look like depending on the measures implemented in the selected areas. These Scenario SFDs do not address the city as a whole, but cover only the LSP intervention areas.

The LSP Baseline SFD (see Figure 3) is representing the baseline situation of the current sanitation service delivery in the LSP intervention areas, including the following information:

- Over one million people live in the intervention areas.
- The sewer coverage is approximately 16 %.
- 11 % of the population rely on septic tanks.
- 68 % on pit latrines.
- Open defecation is practised by 5 % of the population.

The LSP Baseline SFD shows that 85% of the excreta is not safely managed (see Figure 3). The 15% of the excreta safely managed originates from wastewater (4%) and FS (1%) treated at the wastewater treatment plants (WWTPs) and stabilization ponds, and sludge contained and not emptied in areas of low risk of ground water pollution (10%).

The sewer network in the LSP area covers only about 16% of the population. The offsite sanitation flow includes 5% of wastewater not delivered to treatment due to a dilapidated state of the sewer network, 7% of wastewater delivered to treatment but not treated and 4% of wastewater treated, demonstrating an insufficient capacity to handle the current wastewater flows.

The faecal sludge not properly managed consists of: 1% of FS delivered to treatment but not treated; 28% of FS emptied from onsite systems but not delivered to treatment; 39% of FS not contained from pits located in areas of high risk of groundwater pollution. In addition, 5% of people practise open defecation (see Figure 3).



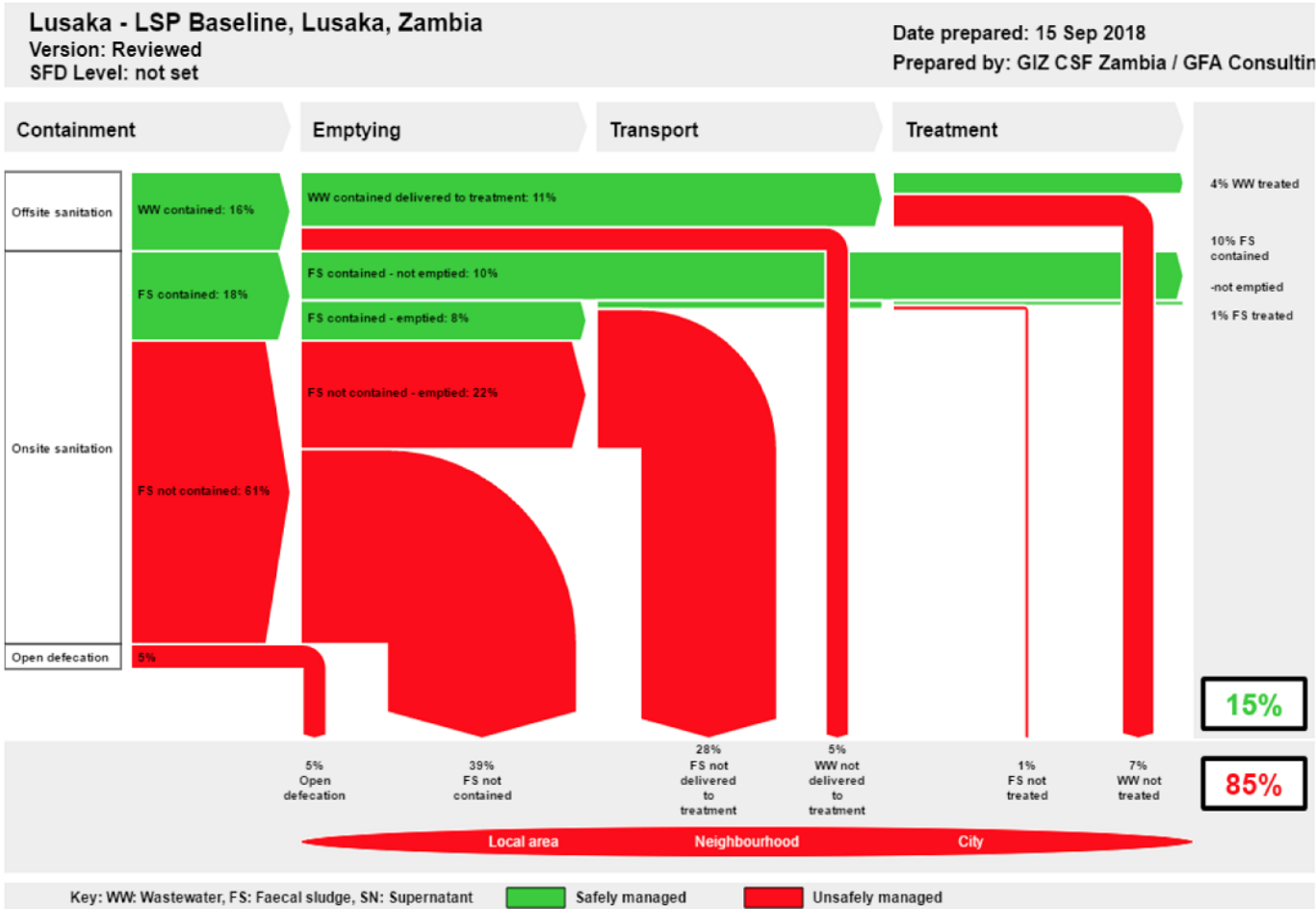


Figure 3: SFD representing the LSP Baseline situation in Lusaka, Zambia; produced in 2018 by GFA, commissioned by GIZ.

Lusaka is the first city in Zambia, for which Scenario SFDs have been produced, to project the impact certain investments can have on the entire sanitation service chain in the future. In Lusaka, the Scenario SFDs have been useful in visualising and reconsidering planned investments for decision makers. For the following three Scenario SFDs sets of (assumed) measures have been applied: The interventions for scenario

a) correspond to the targets formulated by the LSP initial planning documents. Therefore, the Scenario SFD a) shows the assumed impact and outcome for the entire sanitation service chain for the LSP intervention areas in 2022, in case LSP Vision 2022 a) measures are being implemented successfully (see table 1).

**Table 1: LSP target measures (a) and adjusted scenarios of LSP measures (b,c)**

Scenario	New toilet facilities	New FSTPs*	Pit latrine coverage
LSP Vision 2022 a	12,000	4	30%
LSP Vision 2022 b	6,000	2	16%
LSP Vision 2022 c	4,000	1	10%

\*FSTPs= Faecal sludge treatment plants

To visualise the outcome for the entire sanitation service chain, if the targets will not be met, the scenarios b) and c) offer a projection of the sanitation situation in 2022, according to the successful implementation of the measures mentioned in LSP Vision 2022 b) and c) (see table 1). The three Scenario SFDs are presented in Figure 3a-3c.

In all scenarios, the percentage of safely managed excreta is increased by improving offsite sanitation management (building new sewer connections, rehabilitation of the sewer network, rehabilitation and extension of Ngewere ponds,

decommissioning of failed facilities, improve operation and maintenance of the WWTPs) and onsite sanitation management (increase pit latrine coverage). The three scenarios share the same feature of improving offsite sanitation in the same terms. This is reflected in a better sewerage service coverage (23% vs 16% of the LSP Baseline SFD) along with an increased wastewater treatment capacity by rehabilitating and expanding the sewer network. Open defecation is also assumed to be lower (3% vs 5% of the LSP Baseline SFD) in the three scenarios due to the implementation of hygiene promotion campaigns.

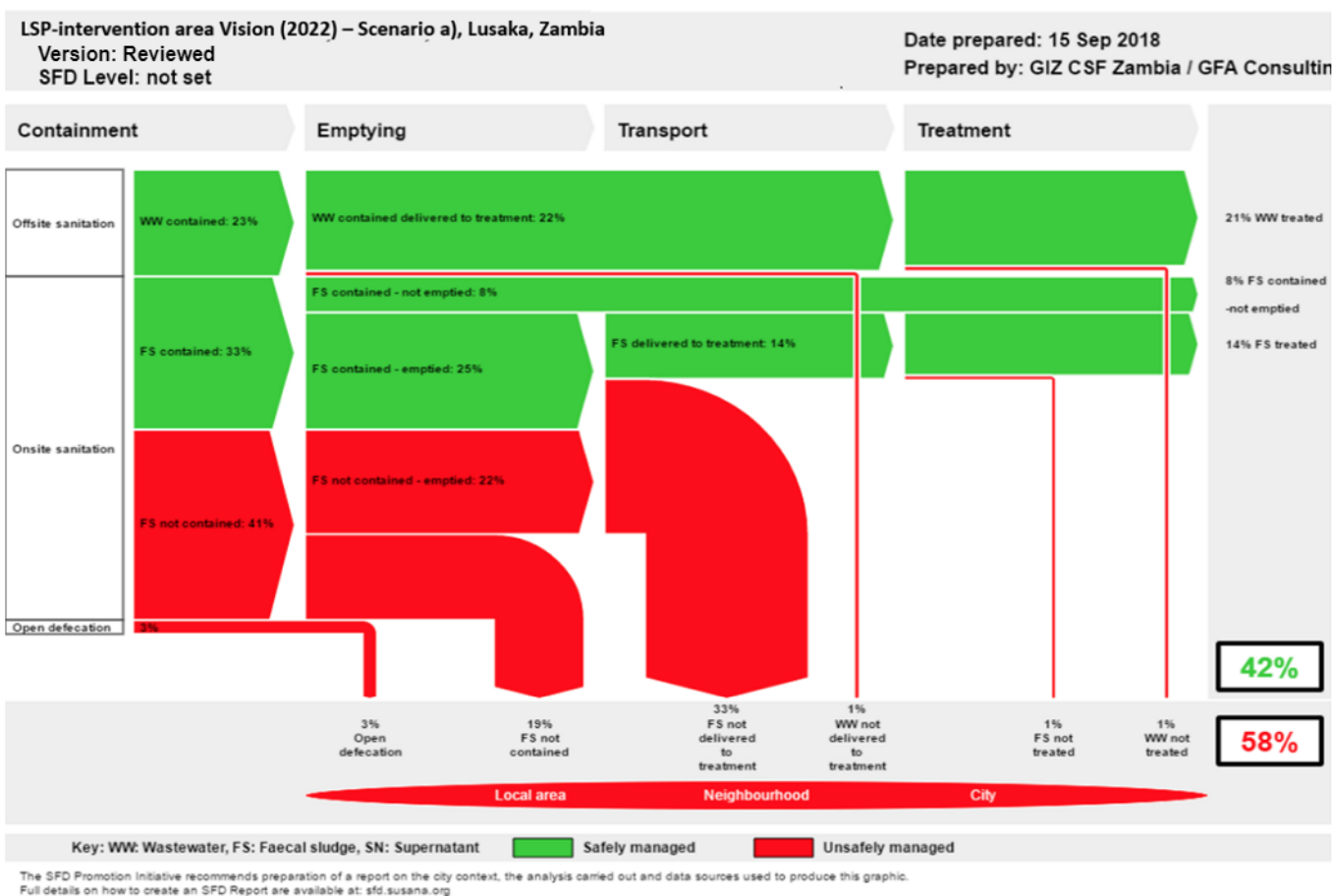


Figure 3a: Scenario SFD “LSP Vision 2022 a)”; produced in 2018 by GFA, commissioned by GIZ.

Scenario LSP Vision 2022 a shows the greater improvements in sanitation management, where 42% of the excreta would be safely managed (vs 15% of the LSP Baseline SFD), multiplying almost by three the total safely managed flow. The FS emptied is also better managed since

a higher pit emptying coverage (30%) allows for a greater percentage of FS emptied and delivered to treatment due to the establishment of new emptying teams. This FS will be treated in the 4 new FSTPs to be constructed (see Figure 3a).

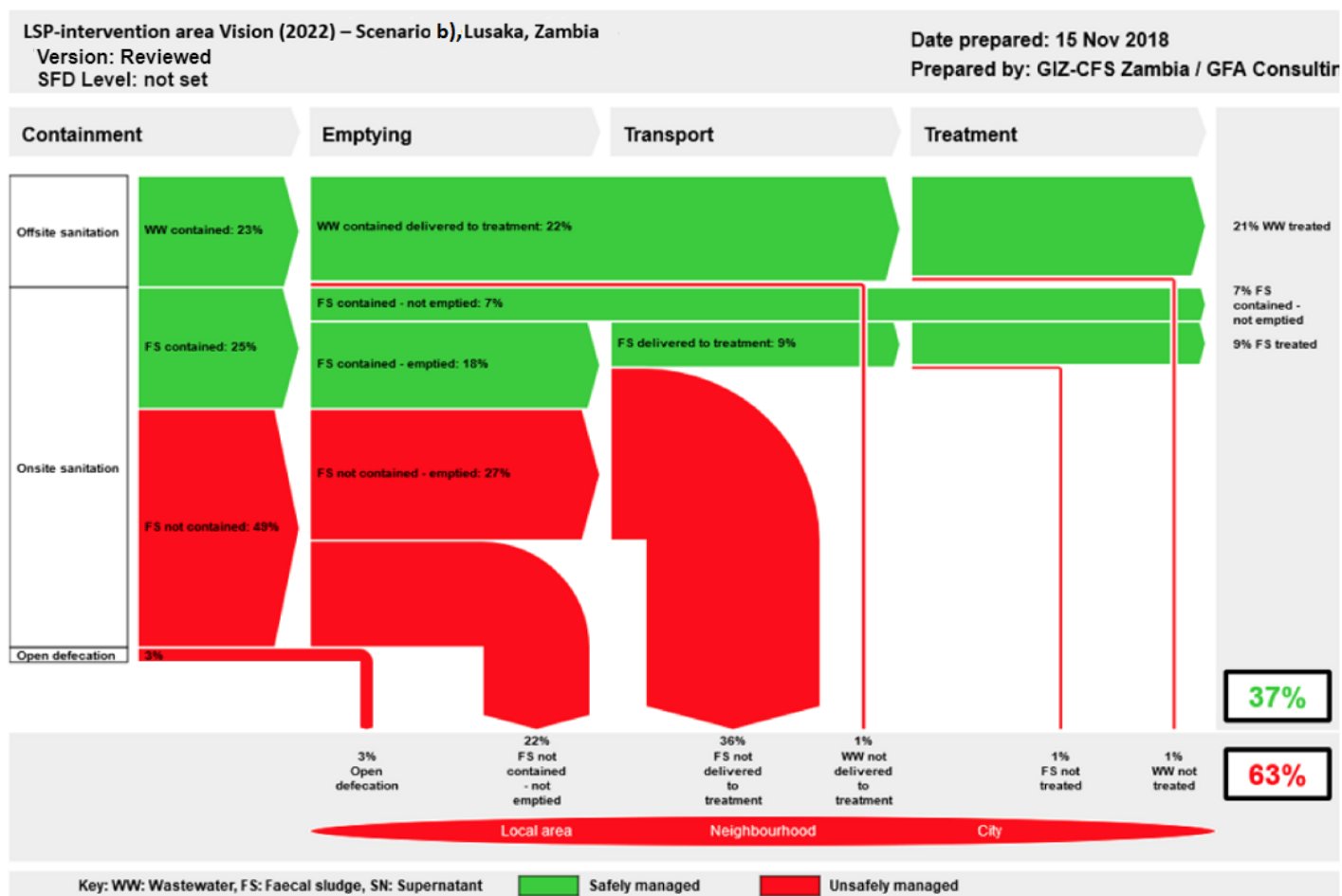


Figure 3b: Scenario SFD “LSP Vision 2022 b”); produced in 2018 by GFA, commissioned by GIZ.

Scenario LSP Vision 2022 b also shows significant improvements in sanitation management, where 37% of the excreta would be safely managed (vs 15% of the LSP Baseline SFD). In this case, FS emptied, delivered

to treatment and treated is increased due to the establishment of new emptying teams but pit emptying coverage is improved to a lesser extent (16%). This FS will be treated in 2 new FSTPs (see Figure 3b).

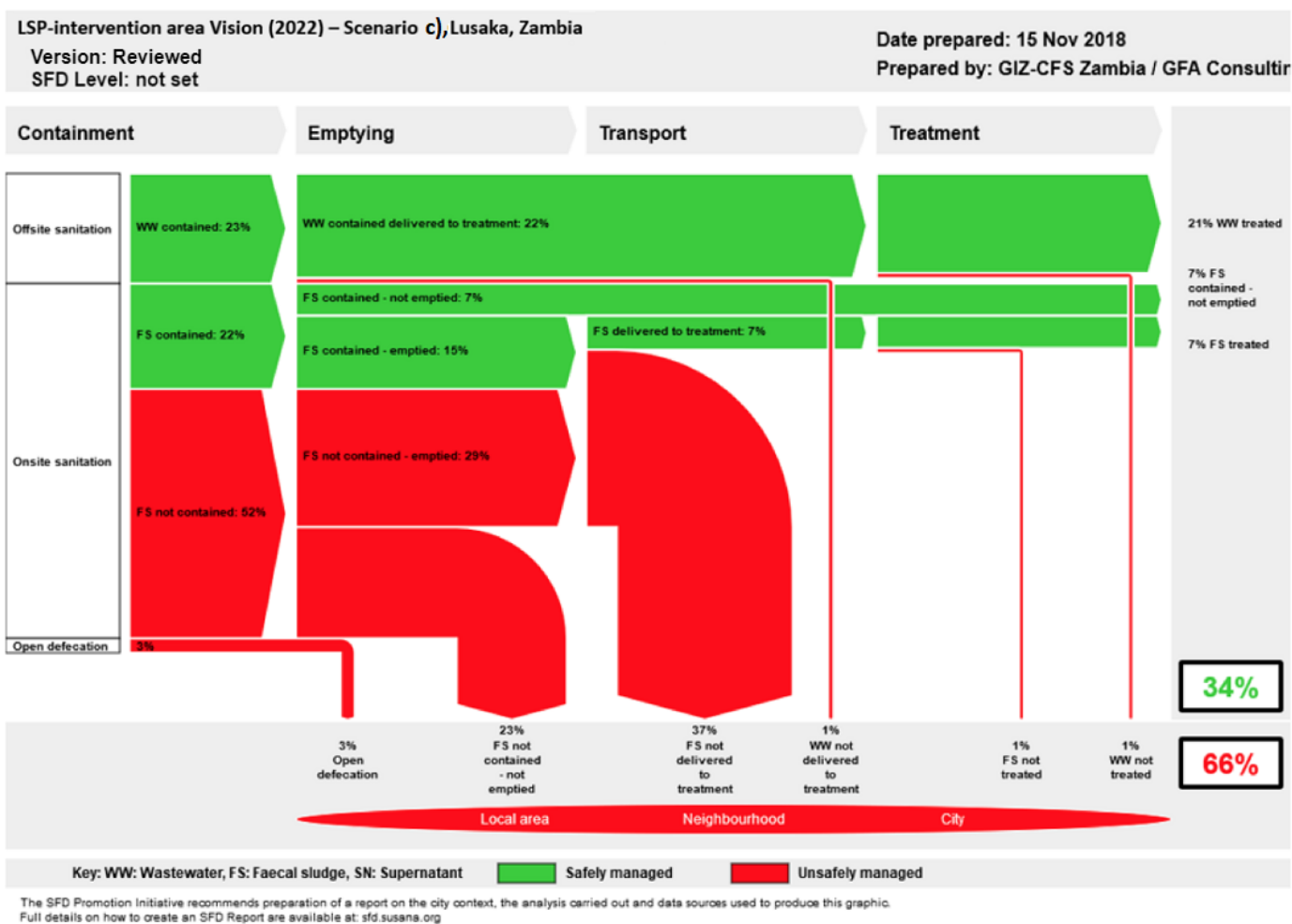


Figure 3c: Scenario SFD “LSP Vision 2022 c”); produced in 2018 by GFA, commissioned by GIZ.

Scenario LSP Vision 2022 c shows that 34% of the excreta would be safely managed (vs 15% of the LSP Baseline SFD), representing the less favourable case in terms of sanitation improvements. In this case, incrementing pit emptying coverage (10%) by establishing new emptying teams results in a lesser amount of FS emptied, delivered to treatment and treated in the new FSTP to be constructed (see Figure 3c).

## Localised SFDs in peri-urban areas of Lusaka

Four comprehensive Localised SFDs have been developed for four low-income peri-urban areas of Lusaka (Kanyama, Chawama, Chazanga, George), that are part of the LSP intervention areas, to create a more refined picture of the sanitation situation in these areas. Comprehensive data collection and mapping was used to present local details that are not showing on the city-wide SFD.

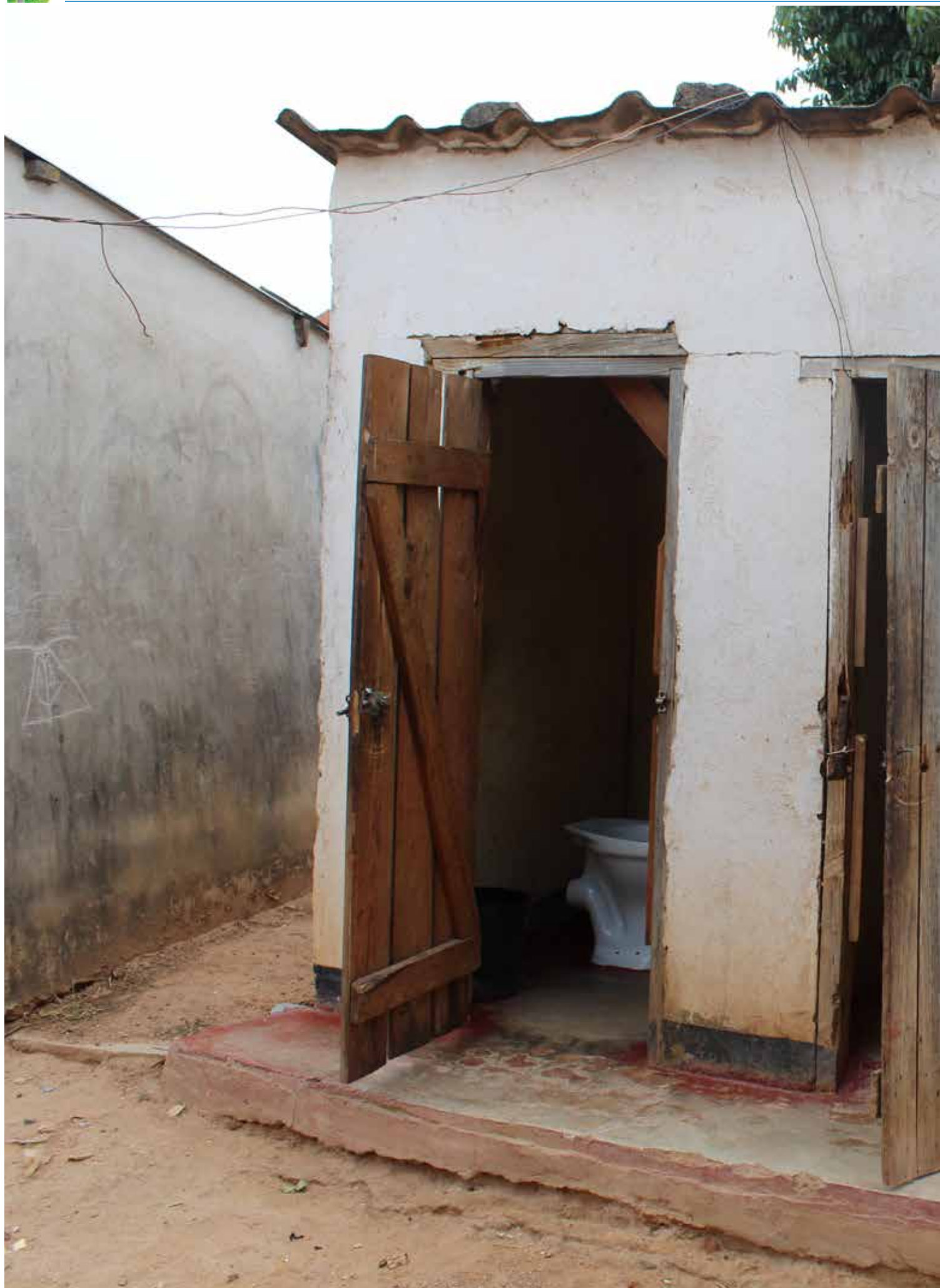
In Lusaka, the additional production of Localised SFDs stimulated further the ongoing exchange amongst decision makers and sanitation experts and helped to focus discussions on the most vulnerable parts of the city in need of dedicated interventions.

Knowing the citywide SFD, it is not surprising that sanitation services in the four low-income areas are poor: in none of the areas, a central sewerage system is available and on-site facilities are of poor quality with limited emptying and treatment services in place. The Localised SFD from Kanyama, Chawama and George show that most of the excreta are unsafely managed. Only the Localised SFD for the Chazanga area presents a higher percentage of safely managed faecal sludge (mainly due to the practise

of abandon pits when they get full and covered by soil) compared to the citywide SFD due to lower groundwater vulnerability in this area compared to the Lusaka average.

A notable finding in all four Localised SFDs is the high open defecation (OD) rate (in the form of flying toilets), which led to a higher assumption of the city-wide OD rate in the city-wide SFD. This assumption was supported by the mapping data, revealing that there is an inadequacy in ownership and access to sanitation facilities in these peri-urban areas, with an average of 2-4 households sharing a single toilet facility, which translates into at least 10-20 people using the same facility. Local treatment facilities (sludge digesters and Manchinchi wastewater treatment plant) are not able to treat the faecal sludge produced, mostly ending up in the environment with no treatment at all.

Taking into consideration that there have been investments and interventions to improve access to sanitation in these four areas in the past, the four Localized SFDs show that there is a clear need to address the entire sanitation service chain in order to reduce the public health hazard in these areas.







The CFS-Lusaka Project is implemented by GIZ on behalf of BMZ



Implementing Partners: LWSC, LCC



Lusaka City Council

