

Predicting the impact of sanitation investment projects on the Sanitation Service Chain using excreta flow diagrams (SFDs)

L. Fernandez-Martinez, C. Furlong, R.E. Scott

Water, Engineering and Development Centre (WEDC), Loughborough University, UK

Introduction

The SFD Promotion Initiative (SFP PI) has developed more than 40 SFD reports for cities across the globe, using their methodology.

This study explores the potential of SFDs to:

- illustrate changes produced by on-going or planned sanitation investments in a city
- assess the possible impact of those investments across the sanitation service chain.

The case study city chosen for the study was Kumasi, Ghana.

Methodology

An SFD graphic for Kumasi had already been produced (Figure 1):

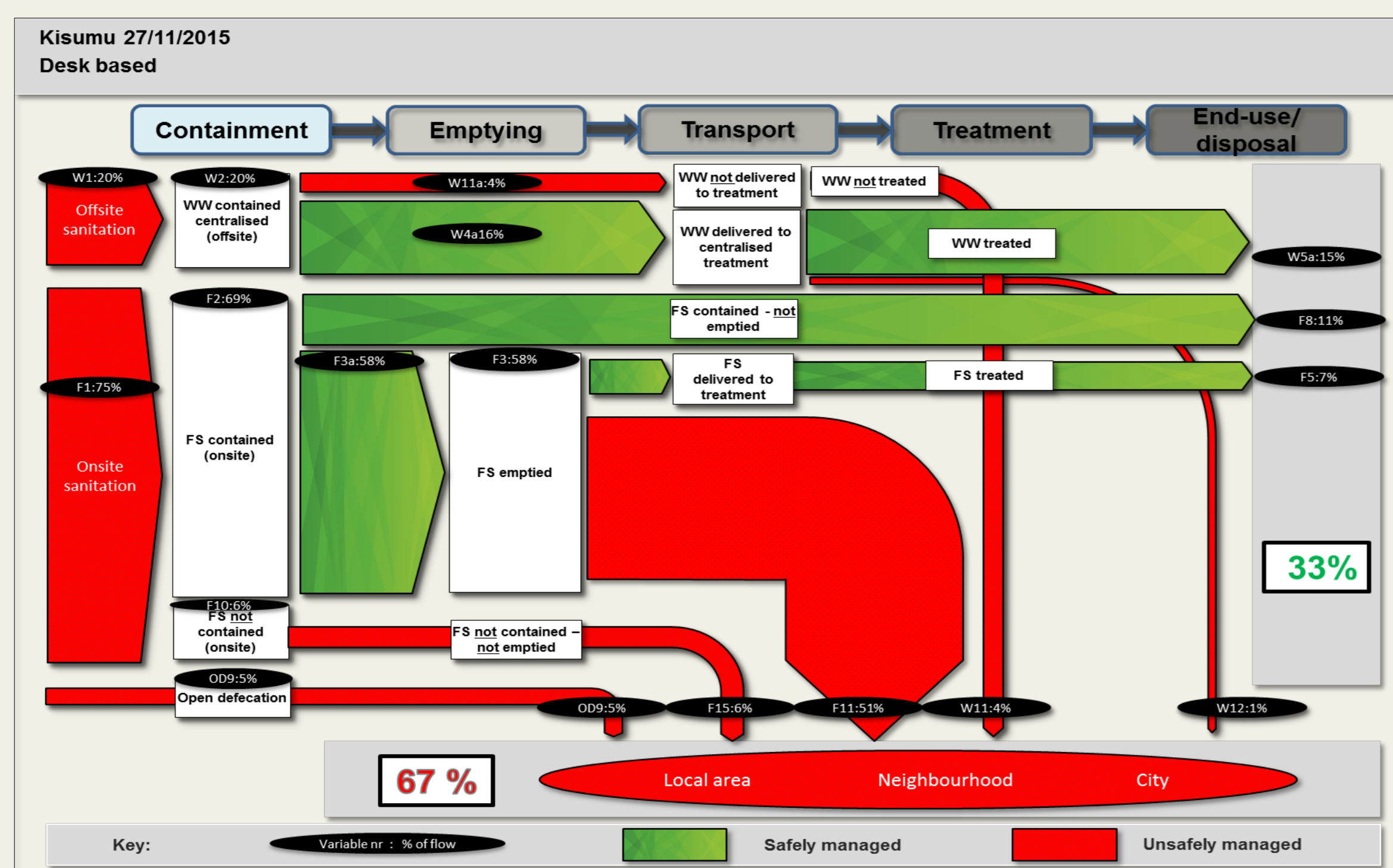
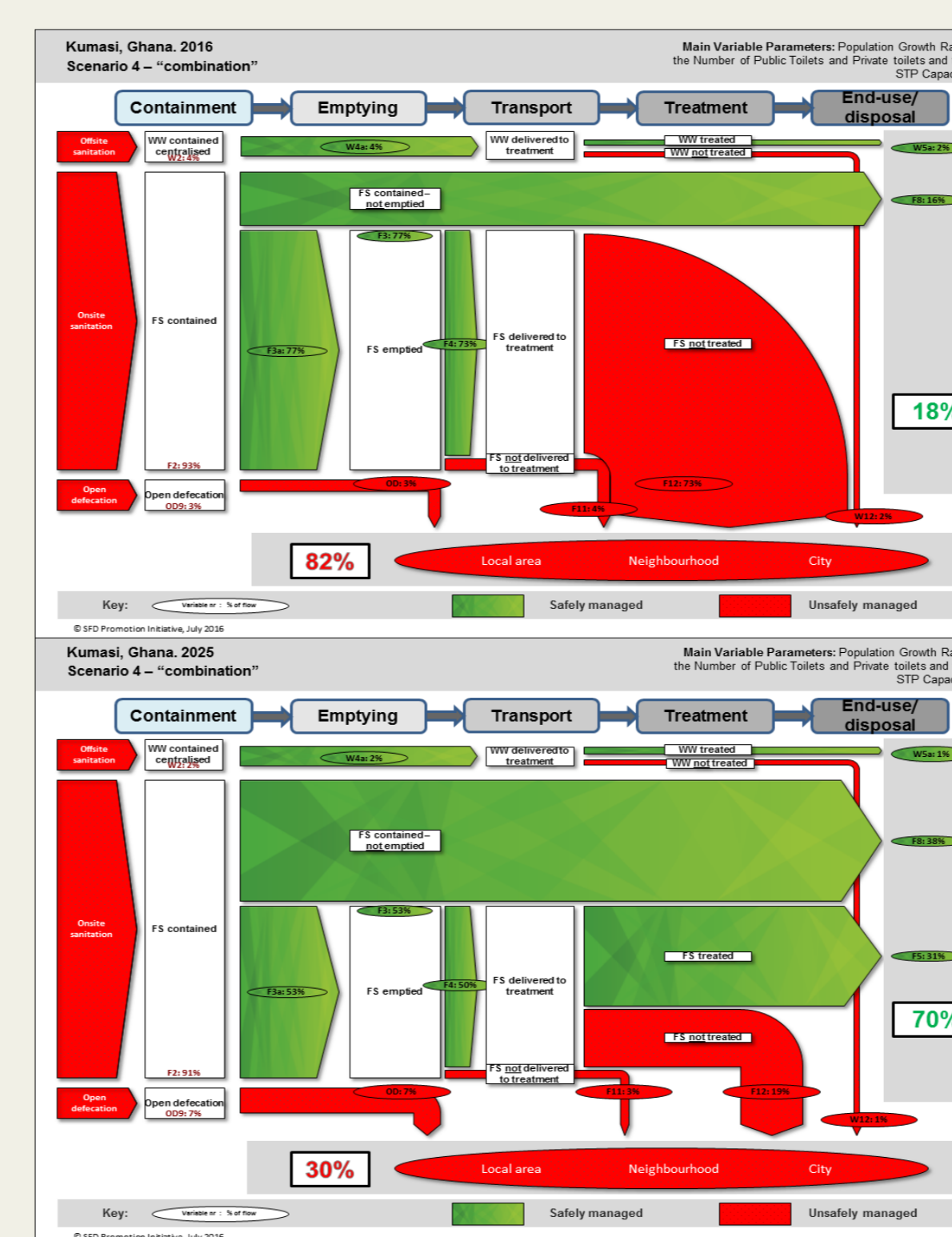


Figure 1: SFD Graphic for Kumasi, Ghana (Furlong, 2015).

Using this as a starting point, three sanitation investment projects in Kumasi were identified and used to develop four scenarios (Table 1).

Scenario	Projects	Main variables
S1	None: Baseline scenario	<ul style="list-style-type: none"> • Population growth rate • No investments for 10 years • Infrastructure remains constant
S2	<ul style="list-style-type: none"> • "A toilet in every compound" • Rehabilitation of the FSTP 	<ul style="list-style-type: none"> • Population growth rate • Percentage of population living in compounds with access to new private toilets • Treatment efficiency of Faecal Sludge Treatment Plant (FSTP)
S3	Public Toilets project	<ul style="list-style-type: none"> • Population growth rate • Number of public toilets
S4	Scenarios 2 and 3 combined	<ul style="list-style-type: none"> • Population growth rate • Percentage of population living in compounds with access to new private toilets • Treatment efficiency of FSTP • Number of public toilets

Table 1: Scenarios defined for modeling future scenarios



For each scenario, a list of questions was developed to set the minimum data requirements. Each stage of the sanitation service chain was analyzed producing a qualitative and quantitative summary for each scenario and all assumptions were clearly defined.

The SFD Graphic Generator (sfd.susana.org) was used to produce an SFD Graphic for Year 1 (2016), Year 5 (2020) and at Year 10 (2025) for scenarios 1 to 4 (examples in Figure 2)

Changes in the flow of faecal waste in Kumasi, from one scenario to another, could be observed in the SFD graphics. However changes within the same scenario were more difficult to observe. This led to the development of "Trend Graphs", which highlight the changes at different stages of the sanitation service chain (Fernández-Martínez, 2016)

Figure 2: Scenario 4, SFD Trend Graphs Year 1 and 10

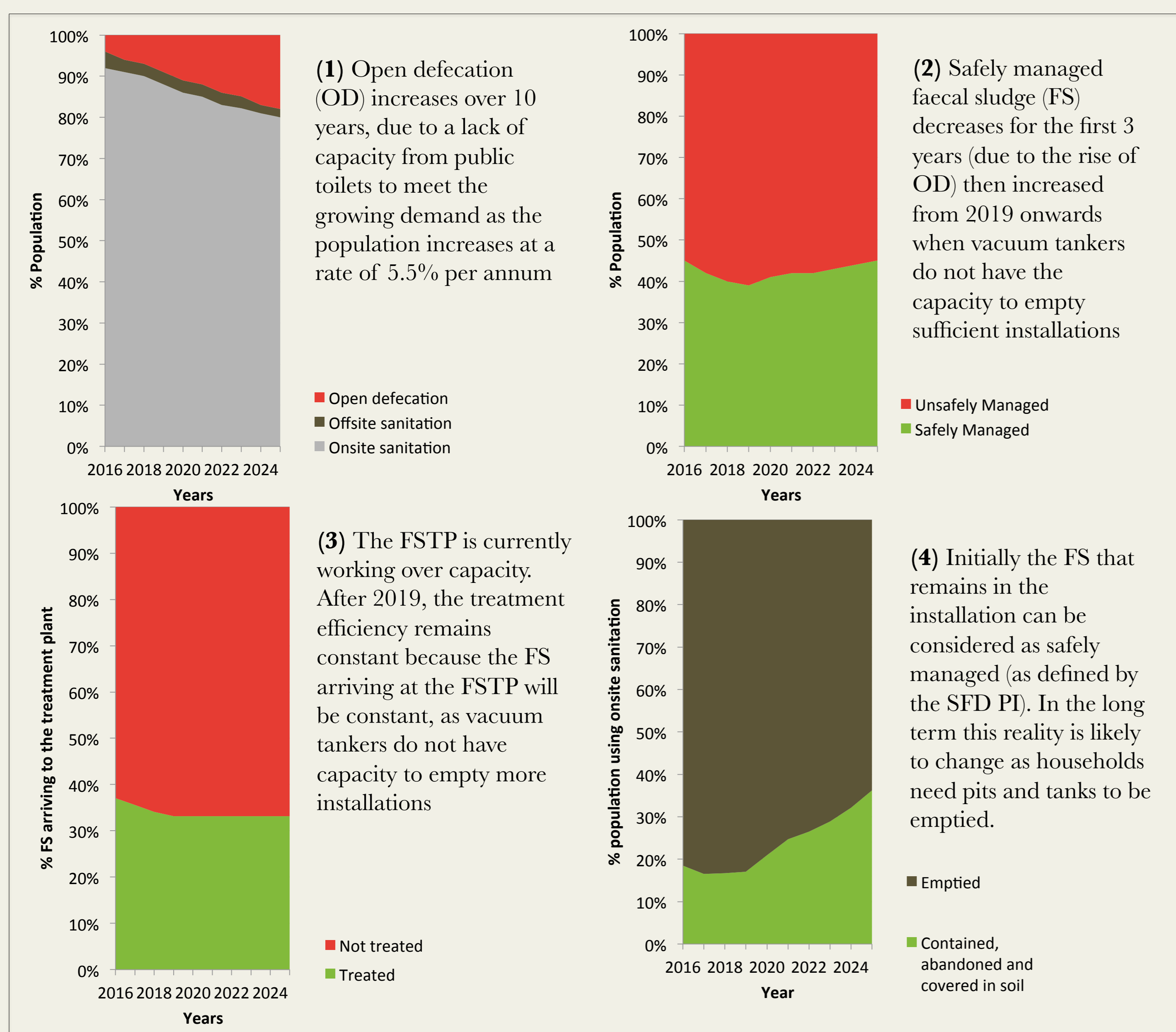
SFD Trend Graphs

SFD Trend Graphs were developed for each part of the sanitation service chain and scenario. The graphs were produced with data introduced on the SFD Graphic Generator on a yearly basis and outcomes from the SFD Graphics for each year (within each scenario).

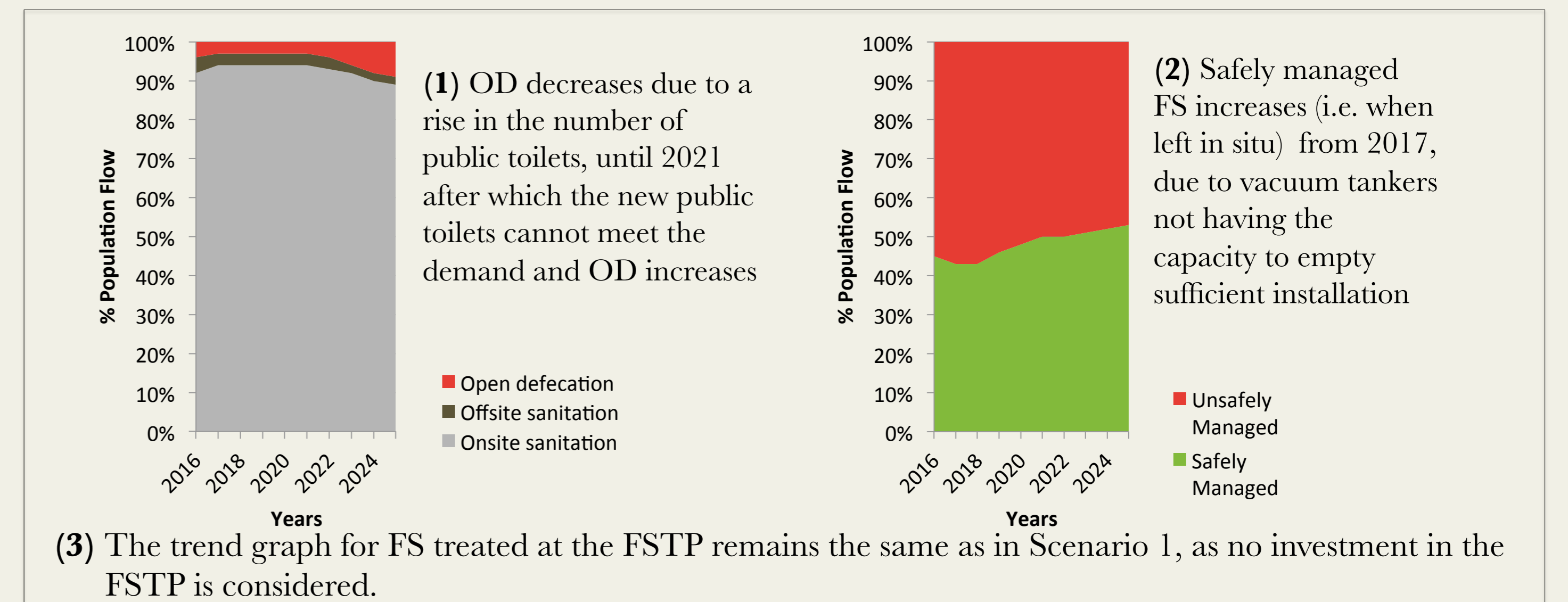
The Trend Graphs were used to analyse the sanitation service chain and assess each scenario's ability to meet future predicted sanitation service demands in Kumasi.

Key findings from the analysis of each scenario are as follows:

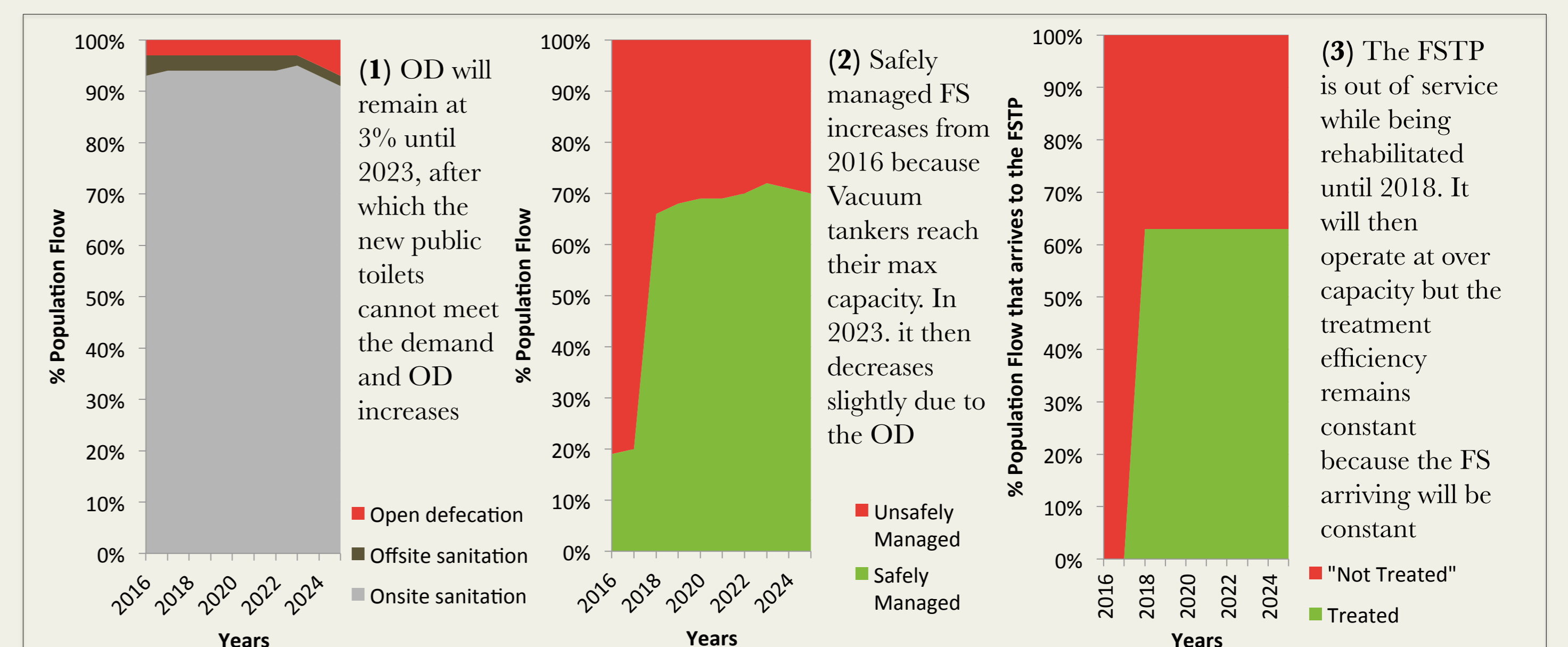
SCENARIO 1: Baseline



SCENARIO 3: Public toilets Project



SCENARIO 4: Scenarios 2 and 3 combined



Analysis of Scenarios

Considering the future management of faecal waste throughout Kumasi, the scenarios highlight that:

- Access to private toilets does not significantly increase in any scenario, creating an increased dependency on public toilets due to the population growth rate.
- The number of existing public toilets cannot meet the future demand (S1 and S2). Even when the newly constructed toilets are considered (S3 and S4), they can only meet demand until 2022;
- If the number of vacuum tankers in operation remains constant (assumed for all scenarios) they will not meet the demand for emptying services beyond 2017;
- The FSTP is already working over capacity and its treatment efficiency will be reduced in all scenarios, even following rehabilitation.

Conclusions

- Changes from one scenario to another are easily observed in the SFD Graphics, but changes within the same scenario over time are difficult to see.
- Trend Graphs help to clarify and identify those changes through all stages of the sanitation service chain.
- With sufficient data and appropriate assumptions, SFD reports and graphics and Trend Graphs can support the analysis of future scenarios within a city.
- The development and future use of Trend Graphs is recommended as a mean to inform better-targeted investments.

References

- FURLONG, C., 2015. *SFD Report Kumasi, Ghana, 2015*. SFD Promotion Initiative.
- FERNANDEZ-MARTINEZ, L., 2016. Using the SFD methodology for modelling future scenarios in Kumasi, Ghana. MSc Dissertation, WEDC, Loughborough, UK.

