SFD Report

Enugu
Nigeria

Final Report

This SFD Report – SFD initial - was prepared by WaterAid Nigeria.

Date of production: 24/09/2018

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SFD Report Enugu, Nigeria, 2018

Produced by: WaterAid Nigeria

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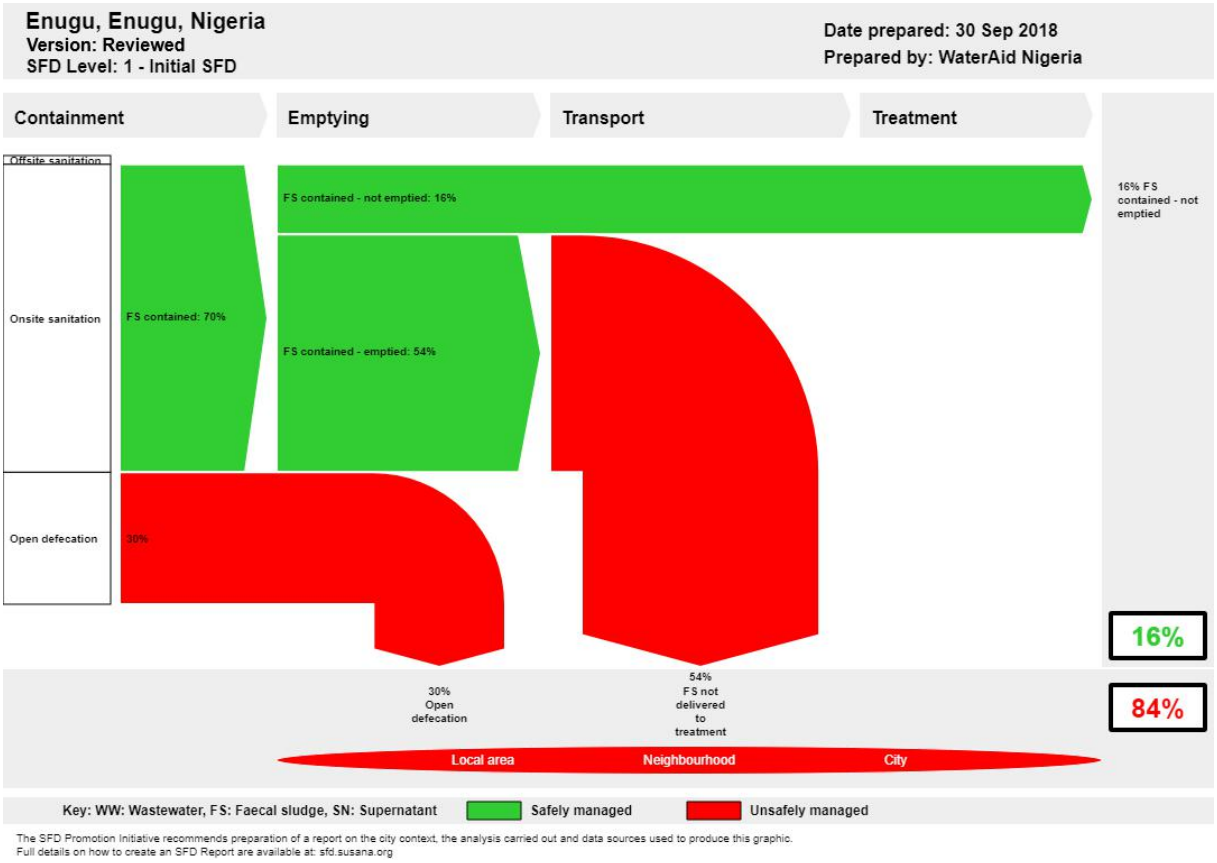
This Executive Summary and SFD Report are available from:

www.sfd.susana.org

1. The SFD Graphic



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

2. Diagram information

SFD Level:

This is an Initial SFD report.

Produced by:

This SFD report was produced by WaterAid Nigeria.

Collaborating partners:

- Chinedum Igwe.
- Enugu State Government.
- Enugu Capital Territory Development Authority.
- Enugu State Ministry of Water Resources.
- Enugu State Waste Management Authority.

Status:

This is a Final SFD report.

Date of production: 24/09/2018

3. General city information

Enugu City is a major commercial and industrial hub in south eastern Nigeria with an estimated population of just under a million people, although this figure increases during the daytime as many residents of the state come to the city to work and trade. The boundary used for the SFD was a combination of the three local government areas (LGAs) that make up the 564 km^2 Enugu Metropolis – Enugu East, Enugu North and Enugu South (NPC, 2010). The city has a tropical climate with two seasons: a rainy season from April to October and a dry season from November to March (Okagbue and Ifedigbo, 1995). It has a hilly topography and clay soils that drain poorly (Ofomata & Umeuduji, 1994; Nwankwor, Egboka & Orajaka, 1988). Enugu is also rich in sub-bituminous coal, with estimated reserves of up to 200 million tonnes. Exploitation of the coal has been identified as a key source of groundwater pollution (Ogbonna, Nzegbule & Okorie, 2015; Ezeigbo & Ezeanyim, 1993, Awalla, 2014).

Enugu city has about twenty distinct neighbourhoods, which may be broadly categorised as low, medium and high-density areas, although mixed density neighbourhoods do exist. A study estimated that 70 percent of Enugu city's population live in the higher density, lower income areas in tenement-type housing (Ogbuna, 2015).

4. Service outcomes

Currently, most residents use on-site sanitation technologies. Just 70 percent of Enugu's population have their faecal waste contained, while 54 percent contain their faecal waste and have their facilities emptied, mainly by non-sewer vacuum tankers. About 84 percent of the faecal waste generated in the city is released untreated into the environment (into water bodies), while 16 percent is contained on-site and allowed to decompose naturally. Furthermore, many of the containment technologies are inappropriately close to the shallow groundwater resources in the city.

All of these, together with groundwater pollution from coal mining sources, pose serious public health and environmental risks that state institutions are not taking any measures to mitigate.

5. Service delivery context

Enugu city has almost no sewer systems and no faecal waste treatment facilities, although there are institutions in the city with mandates to provide varying levels of sanitation access and service management. The combination of the poor housing and limited incomes of most of its residents means that inadequate sanitation access persists in the city. This situation of poor access to sanitation is fairly common across the country, leading to the federal government to declare a state of emergency in the sector. However, this declaration is against the backdrop of no national sanitation policy that speaks to sewage and faecal sludge management.

In Enugu state, the state government has established a full-fledged Ministry of Water Resources (MWR), which has sole responsibility for ensuring that potable water is consistently available to all residents in Enugu state, and leads in delivering sanitation interventions. The MWR has two agencies under it, the Enugu State Water Corporation (ENSWC) and the Enugu State Rural Water and Sanitation Agency (ENRUWASA).

Under existing state WASH policy, the ENSWC is charged with the production and distribution of urban water and management of sewage (through sewerage networks) within urban settlements. In reality, sanitation promotion, management of non-sewered sanitation, management of disposal sites, and oversight of sanitation service providers in Enugu City is the responsibility of the Enugu State Waste Management Authority (ESWAMA), an agency under the State Ministry of Environment. Their ability to execute this role is, however, limited by the lack of a strong framework to guide the management of non-sewered sanitation beyond evacuation from households. In Enugu City, there are few systematic measures to ensure the urban poor have access to services, but there are piecemeal efforts to relocate poor people out of slums that include provision of subsidised public toilets (Enugu State Ministry of Environment, 2018).

6. Overview of stakeholders

An overview of the key stakeholders involved in the sanitation service delivery context in outline in Tab. 1.

Key Stakeholders	Institutions / Organizations
Public Institutions	MWR, ENSWC, ENRUWASA, ESWAMA, Ministry of Environment, LGAs
Non-governmental Organizations	WaterAid, CHI Nigeria
Private Sector	VTOs
Development Partners, Donors	World Bank
Others	WASH committees

Tab. 1: Overview of Key Stakeholders

7. Process of SFD development

Adequate data was available about Enugu city's location, population, climate and physical features, and it was accessed via the internet or from existing literature. There was also existing data on old water schemes, with insights on new/ongoing and/or rehabilitated schemes given by the ESWC. Limited information on sanitation facilities and services is documented, and the rest of the data was drawn from on-site monitoring, visits and interviews with the relevant stakeholders such as vacuum tanker operators (VTOs), households, hotels, markets, public toilet operators and partner government agencies such as Ministry of Water Resources, Ministry of Environment, ESWAMA, and Environmental Health Officers of Enugu North, Enugu South, and Enugu East Local government areas (LGAs). An example of interviews used in this study, is the direct interview of some VTOs who gave information about their operational charges, the service charges they pay to their union, number of trips they carry out per day, and the peak period of the year they carry out operations. There is a plan to present this report to stakeholders in the city for validation, but ongoing political campaigns and the deadline for drafting this SFD have meant that

the date for such presentation must still be negotiated with the key stakeholders.

8. Credibility of data

The data for the SFD was collated from academic reports and the rest of the data was drawn from on-site monitoring, field visits and interviews with relevant stakeholders including VTOs, households, hotels, markets, public toilet operators and partner government agencies. Limited information on sanitation facilities, services and policies is documented, and that contributed to some data gaps. A key assumption underlying the SFD was that the information obtained from government sources is correct and can be taken at face value without verification within the limited timeframe of this research.

9. List of data sources

- Enugu State Ministry of Environment (2018).
- Ezeigbo, H.I. and Ezeanyim, B.N., 1993. Environmental pollution from coal mining activities in the Enugu area Anambka State Nigeria. Mine water and the Environment, 12(1), pp.53-61.
- National Population Commission – NPC (2010), 2006 PHC Priority Tables. http://population.gov.ng/core-activities/surveys/dataset/2006-phc-priority-tables/
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- Ofomata, G. E. K., & Umeuduji, J. E. (1994). Topographic constraints to urban land uses in Enugu, Nigeria. Landscape and urban planning, 28(2-3), 129-141.
- Ogbonna, P. C., Nzegbule, E. C., & Okorie, P. E. (2015). Environmental impact assessment of coal mining at Enugu, Nigeria. Impact Assessment and Project Appraisal, 33(1), 73-79.
- Ogbuna, C.F. (2015) Analysis of Housing Demand in Enugu Metropolis, Enugu State, Nigeria. dissertation submitted in partial fulfilment of the requirements for the award of Master's Degree in Urban and Regional Planning (MURP) University of Nigeria, Enugu Campus.
- Okagbue C.O. and Ifedigbo O.T. (1995), Engineering Properties and Slope Stability of Road Cuttings along the Enugu-Onitsha Express Road, South Eastern Nigeria.

SFD Enugu, Nigeria, 2018

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Abbreviations

CLTS	Community-Led Total Sanitation
ENRUWASSA	Enugu State Rural Water Supply & Sanitation Agency
ESWAMA	Enugu State Waste Management Authority
ENSWC	Enugu State Water Corporation
ESAMATA	Enugu State Amalgamated Market Traders Association
GRA	Government Reserved Areas
HH	Households
IDA	The International Development Association (IDA)
LGAs	Local government areas
MWR	Ministry of Water Resources
NBS	National Bureau of Statistics
NPC	National Population Commission
NWRMP	National Water Resources Management Policy
ODF	Open defecation free
PEWASH	Partnership for Expanded Water Sanitation and Hygiene
PPE	Personal protective equipment
SFD	Shit Flow Diagram
TDS	Total dissolved solids
UNICEF	United Nations Children's Fund
VTO	Vacuum Tanker Operators
WASH	Water, Sanitation & Hygiene

1 City context

1.1 Location and Population

Enugu City, which has a population estimated at just under a million people, is the administrative capital of Enugu state. It comprises three local government areas (LGAs, the lowest administrative division in Nigeria's federal system) – Enugu East, Enugu North and Enugu South. Engu City is 291 km from Abuja (by air) and is considered the most important city in south eastern Nigeria. It has served as the capital of various defunct geopolitical regions known as Eastern Region, East Central State and Anambra State, and even the shorter-lived Biafran nation (Figure 1).

Enugu is renowned as a centre of commerce, industry and entertainment. It serves as a major transportation hub, linking to the southern port city of Port Harcourt by rail, and is the major connecting city between South and South-East Nigeria and Central and Northern Nigeria. The city is home to manufacturing industries, a car assembly plant and a variety of office buildings, including small businesses and telecommunications and financial services firms. Enugu has three main open air urban markets (Ogbete, New and Akwunanaw) that attract trade from all around the South East and South regions of Nigeria. In the daytime, the population of Enugu City increases as many residents of the state come into the city to work in the offices, and many traders come to buy and sell in the markets there. It seems that this daily population increase has a negligible overall impact on the sanitation outcomes of the city, although further investigation is needed to confirm that there are adequate working public toilets to serve market traders and their customers, and that open defecation(OD) is not a problem in the vicinity of the markets.

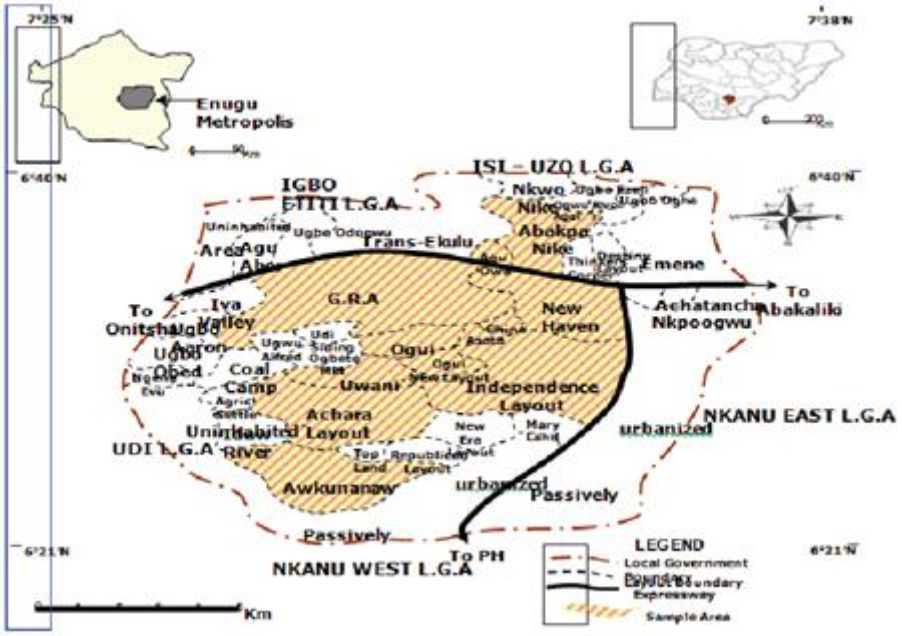

Figure 1: Map of Enugu Metropolis (Google maps, 2018).

Historically created as a working camp to mine coal exclusively for export to Europe, Enugu city has since evolved into a major metropolis covering an area of 564km^2 across the three

LGAs (NPC, 2010). Although, the 2016 national population estimates by the NPC and NBS puts the population at 968,300, anecdotal evidence suggests the night-time population of the city in 2018 may be over a million and the day-time population far higher. Much of Enugu City's population growth has been ascribed to migration from rural areas of Enugu state.

Enugu city has about twenty (20) distinct neighbourhoods that may be broadly categorised as low, medium and high-density areas, although mixed density neighbourhoods do exist. Planned and unplanned areas co-exist in Enugu metropolis as a result of a high demand for residential accommodation (Table 1).

Enugu South LGA is the most densely populated part of the city, with many low-income areas such as Agangwu and Ogui. Enugu East is the least dense part of the metropolis and has large areas of farmland. Enugu North hosts government house, government residential areas and many older, well-planned, higher income settlements including GRA, Ono Quarters, Independence Layout, Tinkers' Corner, Trans-Ekulu and Upper New Haven extending to City Layout, as well as slums like Ugwu Aaron and Ugwu Bottle, where most residents are daily paid labourers and traders (NPC, 2010; Ononugbo, Akpan & Osho, 2010) The Ogbete market, Abakpa Nike, Ugwu Aaron, Iva Valley and New Market sections of the city present varied but daunting sanitation challenges due to population pressures coupled with a lack of social infrastructure and housing with adequate sanitation.

A study estimated that 70 percent of Enugu city's population live in the higher density, lower income areas with tenement-type housing (Ogbuna, 2015). A study on urban slum characteristics across the three LGAs found that about 71 percent of the respondents lived in crowded housing with a density of 12 or more people per room (Ononugbo, Akpan & Osho, 2010). Of the rest, 26 percent live in housing with a density of 8 to 12 persons per room. Also, most of the residents (82 percent) earned far below the state-mandated minimum monthly wage of N7,000 (about US$18) (Ononugbo, Akpan & Osho, 2010).

The lower density areas contain about two percent of the urban population, but the use of space in these higher income areas means they cover about 20 percent of the urban area. Typical housing in these areas includes multi-storey buildings, mansions, semi-detached houses, bungalows and blocks of flats.

Table 1: Administrative Divisions of Enugu City

Local Government Area (LGA)	Land Area (km^2)	Population (2006 census)	Population (2016 Est.)
Enugu East	388.4	277,119	374,100
Enugu North	107.7	242,142	326,900
Enugu South	68.3	198,032	267,300
Total	564.4	717,293	968,300

1.2 Climate and physical features

Enugu is located within the Udi Hills at an elevation of about 223 meters above sea level, although some hills within the city reach elevations of 1,000 metres (Ononugbo, Akpan & Osho, 2010). The city has slopes ranging from one percent to 25 percent that increases the runoff emptying into the city's network of natural drainage rivers. The major water bodies in Enugu include the Ekulu, Asata, Ogbete, Aria, Idaw and Nyaba Rivers as well as the Nike Lake. The city has two distinct seasons, a wet season from April to October and the dry season or 'harmattan' from November to March. The city experiences heavy rainfall of 1500-1830mm annually (Okagbue and Ifedigbo, 1995). The average temperature of Enugu ranges between 28.1°C and 32.2°C, and variation within the seasons is normally less than 10°C (Emodi, 2016; Ononugbo, Akpan & Osho, 2010). Enugu is in the rain forest zone, although there are scholarly opinions that Enugu's vegetation is transforming into a Guinea Savanna type. That said, many of the forests have been cleared due to urbanisation and crop cultivation (Ononugbo, Akpan & Osho, 2010; Onyeabor, 2016).

Much of Enugu's soil is clayey and drains poorly. The lowlands are mainly characterised by shale. During heavy rains, erosive soil drainage is frequent at higher elevations, while water drains quickly into groundwater at lower elevations (Ofomata & Umeuduji, 1994; Nwankwor, Egboka & Orajaka, 1988). Enugu is also rich in sub-bituminous coal with estimated reserves of up to 200 million tonnes (Nwankwor, Egboka & Orajaka, 1988). Coal mining has been identified as a key source of groundwater and surface water contamination, including pyrite oxidation, acidification of water sources, increased leaching action, and increased total dissolved solid (TDS) content (Ogbonna, Nzegbule & Okorie, 2015; Ezeigbo & Ezeanyim, 1993, Awalla, 2014). There is no visible or comprehensive plan to address these issues.

2 Service Outcomes

2.1 Overview

In Enugu city, sanitation systems are highly localised (on-site) and there are no public sewered sanitation, except in a few high-brow private residential estates/gated communities with centralised sewage systems. The vast majority of residents use pour-flush or cistern-flush toilets which drain to some kind of septic tank, although there are some pit latrines and open defecation. For the purposes of the SFD, these centralised sewage systems and pit latrines have not been considered since they represent less than 1% of the total systems in the city. Most emptying is done by vacuum tankers run by private operators, and most of the sludge is discharged to one of the major rivers in the city – the Ogwuaji River.

List A: Where does the toilet discharge to? (i.e. what type of containment technology, if any?)	List B: What is the containment technology 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					Significant risk of GW pollution Low risk of GW pollution					Not Applicable
Septic tank					Significant risk of GW pollution Low risk of GW pollution					
Fully lined tank (sealed)					Significant risk of GW pollution T1A3C5					T1A3C10
Lined tank with impermeable walls and open bottom	Significant risk of GW pollution Low risk of GW pollution	Significant risk of GW pollution Low risk of GW pollution	Significant risk of GW pollution Low risk of GW pollution	Significant risk of GW pollution Low risk of GW pollution	Significant risk of GW pollution Low risk of GW pollution					Significant risk of GW pollution Low risk of GW pollution
Lined pit with semi-permeable walls and open bottom	Not Applicable									Significant risk of GW pollution Low risk of GW pollution
Unlined pit										Significant risk of GW pollution Low risk of GW pollution
Pit (all types), never emptied but abandoned when full and covered with soil										Significant risk of GW pollution Low risk of GW pollution
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	Not Applicable						T1B11 C7 TO C9			Not Applicable

Figure 2: SFD Selection Grid for Enugu

2.1.1 Containment

The main onsite technologies identified in Enugu metropolis with the help of the environmental health and sanitation officers of the three local governments are:

Water closets (WC): These may be a pour-flush or cistern flush toilet with a water seal (Figure 3) but no reference is made to the sanitation technology that they discharge to. Most public and private individuals in Enugu use this technology where faeces/urine is transported via a pipe to a sealed septic tank outside the facility that is not connected to a sewer because the city has no central sewage system. An example of a pour-flush WC and an automatic

flush is shown in Figure 3. A majority of these sealed septic tanks are emptied by Vacuum Tanker Operators (VTOs) which are vehicles with mechanical pumps and storage tanks, although in some instances, they are emptied manually using shovels, buckets attached to long ropes if there is land available to bury the faecal sludge. If not, the wastes are dumped in close-by fields/landfills.

Figure. 3: A pour flush WC and an automatic flush WC (Photo credit: Chinedum Igwe)

Pit latrines: These few models were mostly identified at old public schools and also in some private residences especially in the slum areas. A study of water quality and contamination of groundwater sources found that latrine pits are most typically about 3 feet (0.9m) by 4 feet (1.2m) and usually dug 8-10 feet (2.4-2.7m) deep, which coincides with the depth of Enugu's shallow groundwater table (Iloabachie, Igwe & Okogbue, 2011). Most are not emptied, but locals say once the pit is full, salt is poured into the pit which reduces the level of faecal matter. This however, exposes the groundwater to contamination over time. In the SFD, this is considered to be a high risk as the groundwater may be exposed over time to faecal matter.

Aqua privy: Though no longer popular, aqua privies are still in use in some parts of Enugu city, a fact confirmed by the environmental health officer for Enugu North LGA. In the aqua privy, the faeces/urine enter a sealed tank directly below the user interface via a pipe which extends below the level of the effluent, which produces a seal. These systems are also emptied by VTOs and the sludge is taken away to a dumping site.

Mobile toilets: This type (Figure 7) is rarely used in residential areas, and was identified mainly in public places and as a relief measure by government for selected locations. They have a chamber into which faeces and urine are channelled and are emptied by VTOs when filled. Based on the target population for this toilet however, it is safe to assume that while there are not enough public and mobile toilets to serve the high number of day visitors, people make do with available facilities or openly defecate. However, enforcement of sanitation laws against open defecation is generally lax.

2.1.2 Emptying and transport

Motorised Emptying

An estimated 42 percent of the residents of Enugu metropolis make use of the services of vacuum tanker operators (VTOs) to empty the toilets in their homes or compounds (ESWAMA, 2018). An example of this motorised emptying in Enugu can be seen in Figure 4.

The VTOs charge a standard customer fee of N20,500 (US$56.80) per trip, which includes a N500 service fee that is paid to the private operators' union (KII 8 & KII 9, 2018). A large full septic tank may require two trips, and attracts an additional charge of N20,500 for the second emptying trip (KII 8 & KII 9, 2018). Most of the VTOs use minimal protective equipment and are heavily exposed to faecal hazards

Figure 4: A vacuum tanker at Abakpa Nike, Enugu metropolis (Photo credit: Chinedum Igwe).

Manual Emptying

As unpopular and strenuous as this has become in Enugu metropolis, some people still carry out the practice, using buckets attached to ropes. The process is even more expensive than using a VTO as the operators have to charge for digging a hole in the ground first to bury the sludge. This method is most commonly used in places that VTOs cannot access, such as in unplanned and peri-urban settlements with bad roads. The manual emptying operators do not use personal protective equipment (PPE) even though they are aware of the health risks associated with their job. They try to operate without government knowledge and oversight but the government is aware of their existence, and generally turns a blind eye to them.

2.1.3 Treatment

At the time of this study, there was no faecal sludge treatment centre in Enugu State. All the government agencies spoken to confirmed this and attributed it to the fact that in the colonial era, a treatment centre was not in the original plan of Enugu metropolis.

2.1.4 Disposal / End-use

In the post-colonial period, dumping of faecal waste in water bodies has been seen as the logical method of disposal, with the Enugu Capital Territory Development Authority (ECTDA) having a clear mandate to ensure this happens. All the waste collected by VTOs is emptied into a stream in Ugwuaji community in Enugu South LGA (Figure 5). Most manually removed sludge is buried on site.

Figure 5: Emptying of waste by a VTO near a small stream at Ugwuaji community.

2.2 SFD Matrix

Table 2: SFD Matrix

Enugu, Enugu, Nigeria, 30 Sep 2018. SFD Level: 1 - Initial SFD
Population: 717291
Proportion of tanks: septic tanks: 100%, fully lined tanks: 100%, lined, open bottom tanks

System label	Pop	F3	F4	F5
System description	Proportion of population using this type of system	Proportion of this type of system from which faecal sludge is emptied	Proportion of faecal sludge emptied, which is delivered to treatment plants	Proportion of faecal sludge delivered to treatment plants, which is treated
T1A3C10 Fully lined tank (sealed), no outlet or overflow	19.0	70.0	0.0	0.0
T1A3C5 Fully lined tank (sealed) connected to a soak pit	51.0	80.0	0.0	0.0
T1B11 C7 TO C9 Open defecation	30.0			

2.2.1 Water supply and risk of groundwater contamination

Most Enugu districts, planned and unplanned, have limited social and infrastructural services such as running water supply. The state water corporation supplies water to less than half the city's population, and there is extensive reliance on private providers. A key reason for the water supply challenge is the limited groundwater potential of Enugu due to its location in the dry western edge of the Cross River plain on Asata-Nporo shale. There is however a shallow perched water table beneath the city which rises during rainy seasons and frequently results in springs (Onwuka, Uma & Ezeigbo, 2004).

Enugu's existing central public water supply system is linked to both surface and groundwater sources, often via boreholes at depths of about 110 to 150 meters (in the case of the Oji River stream) (Enugu State Ministry of Water Resources, 2018). Altogether there are four different water supply schemes for Enugu residents, commissioned between 1924 and 2004, which are the Iva, Ekulu, Ajalli-Owa and Oji River water schemes.

Iva is the oldest scheme. It supplies the Government Reserved Area (GRA) and the earliest built-up settlements of Enugu (located mostly in Enugu North LGA). The scheme has a capacity of 4,500m^3/d, but produces only 2,500m^3/d, mostly from spring water sources. The Ekulu scheme is non-functional as the water source is too high in iron and potassium, making the treatment process financially unviable (Enugu State Ministry of Water Resources, 2018). The 12 boreholes with total design capacity of 28,000m^3/d built to augment the scheme are also non-functional. There are no plans to fix the scheme. The Ajalli-Owa scheme, also a spring water-sourced system, was built with an overall design capacity of 77,000m^3/d based on round-the-clock pumping. However, present production is 68 percent of its installed capacity due to frequent pump breakdowns and power failures. The Oji scheme, supplied by gravity-enabled groundwater abstraction from the Oji River bed, has a design capacity of 50,000m^3/day. However, its present production capacity is about 23,000m^3/day, due to under-sized cablings and other malfunctioning (Enugu State Ministry of Water Resources, 2018).

Water from these schemes is stored in seven storage reservoirs located near or within the city. The public water schemes are connected to a distribution system that consists of about 331,601m of mainly A/C pipelines, which has more than nine booster stations due to the large area it has to cover and the hilly surfaces of Enugu. The systems are now dilapidated as evidenced by the frequent reports of pipelines bursts. Two rehabilitation programmes, of the pipelines and water schemes, are currently going on simultaneously under the combined effort of the Enugu state government and World Bank (IDA) assistance (Enugu State Ministry of Water Resources, 2018).

Not all parts of the city are covered by the system. Only areas such as GRA, Independence Layout, Coal Camp, Abakpa Nike, Obiagu, Iva Valley, Asata, New Haven, Trans Ekulu, and Ogui are covered by ongoing plans to extend to other parts of the city.

About 45 percent of the residents in Enugu metropolis depend on ESWC for their water supply (of which 19 percent rely on both ESWC and private sources for their water). About 30 percent of residents buy their water from private water suppliers, which supply water using water tankers, while five percent of the residents (mostly commercial businesses like hotels, banks, malls) either source water privately (from water tankers) or from their own boreholes (Enugu State Ministry of Water Resources, 2018). Some of these private (on-site)

boreholes are chlorinated at source, and many people filter the water through small activated carbon filters.

A few major institutions, such as the Abakpa Military Cantonment of the Nigerian Army in Enugu metropolis, have their own water treatment and supply plants (capable of treating and supplying one million litres of water daily to the barracks and its environs). Other residents, usually in low-income, high density neighbourhoods, have to resort to getting water from hand dug wells and untreated surface water sources. They are at particular risk of exposure to pathogens from poorly managed faecal sludge.

We estimate that the majority of tanks that are not emptied are located in low-risk areas for groundwater contamination.

2.2.2 Data uncertainties

The availability and accessibility of data

Adequate data was available about Enugu city's location, population, climate and physical features, and it was accessed via the internet or from existing literature. There was also existing data on old water schemes, with insights on new/ongoing and/or rehabilitated schemes given by the ESWC. Limited information on sanitation facilities and services is documented, and the rest of the data was drawn from on-site monitoring, visits and interviews with the relevant stakeholders such as VTOs, households, hotels, markets, public toilet operators and partner government agencies such as Ministry of Water Resources, Ministry of Environment, ESWAMA, and Environmental Health Officers of Enugu North, Enugu South, and Enugu East LGAs. An example of interviews used in this study, is the direct interview of some VTOs who gave information about their operational charges, the service charges they pay to their union, number of trips they carry out per day, and the peak period of the year they carry out operations. There is a plan to present this report to stakeholders in the city for validation, but ongoing political campaigns and the deadline for drafting this SFD have meant that the date for such presentation must still be negotiated with the key stakeholders.

Quality of data available and used

The data used for this study is considered high quality as the available data used was verified and confirmed with the relevant stakeholders before being used in the study. Hence the data used (including the pictures) is fit for the intended purpose of this study.

Identified data gaps

Identified data gaps include several failed attempts to get higher authorities of ESWAMA and other government agencies to speak and provide needed data. Also, some literature contained data that were not up to date to the year the SFD was being carried out, especially policies on sanitation.

Major assumptions

The major assumptions made in this study are:

1. The population of Enugu metropolis is fairly constant.
2. The information sourced from government sources is correct and can be taken at face value without verification within the limited timeframe of this research.

2.3 SFD Graphic

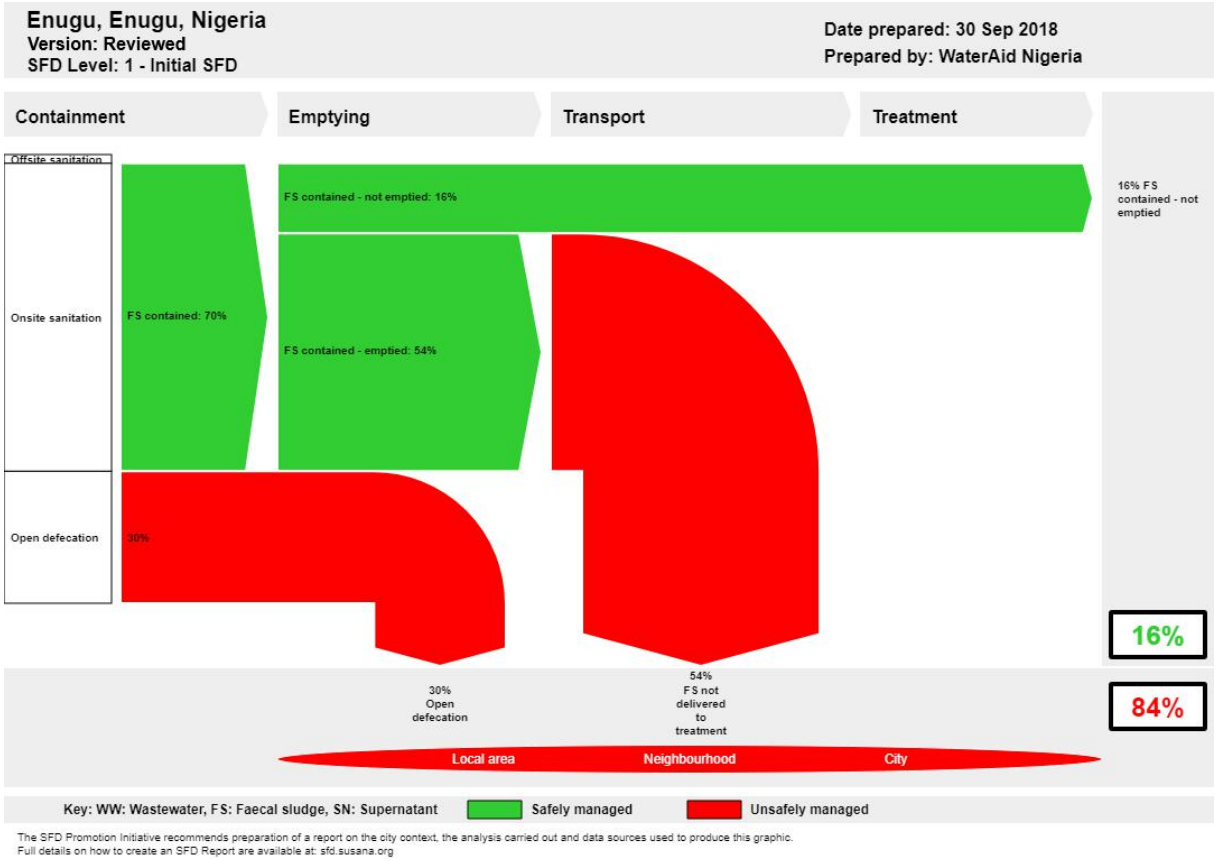

Figure 6: SFD Graphic

The SFD graphic shows that 84 percent of faecal sludge is unsafely managed and 16 percent is safely managed (Figure 6). The 16 percent of the faecal sludge that is safely managed originates from sludge contained and not emptied of fully lined tanks in areas of low risk of ground water pollution. 84 percent of the faecal waste generated in the city is released untreated into the environment and consists of excreta from people practising open defecation (30%) and faecal sludge contained and emptied into water bodies, mainly by non-sewer vacuum tankers.

3 Service delivery context

3.1 Policy, legislation and regulation

3.1.1 Policy & Institutional roles

Nigeria's National Water Resources Management Policy (NWRMP, 2003) broadly defines sanitation to refer to the principles and practices of collection, removal or disposal of human excreta, household wastewater and refuse, and their impact on people and the environment. This SFD report however narrowly defines sanitation as access to and/or provision of sustainable services to manage human faecal material from source of generation to safe disposal. This information is provided within the context that while a national state of emergency has been declared in the WASH sector, Enugu state is yet to sign the declaration, and therefore it has had no impact on current practice.

In Enugu state, the approval of a National Water Supply and Sanitation Policy in 2000 and consequent domestication in states led to the state government establishing a full-fledged Ministry of Water Resources (MWR), which has sole responsibility for ensuring that potable water is consistently available to all residents in Enugu state. The MWR has two major implementation parastatals it oversees, the Enugu State Water Corporation (ENSWC) and the Enugu State Rural Water and Sanitation Agency (ENRUWASA). Under state policy, the ENSWC is charged with the production and distribution of urban water and management of sewage (through a sewerage system) within urban settlements. In reality, sanitation promotion, management of non-sewered sanitation, management of disposal sites, and oversight of sanitation service providers in Enugu City is the responsibility of the Enugu State Waste Management Authority (ESWAMA). Their ability to execute this role is, however, limited by a lack of a strong framework to guide the management of non-sewered sanitation beyond evacuation from households. A range of other agencies also share responsibility for sanitation and waste management within Enugu, as indicated below in Table 3.

Table 3: Institutional arrangements of the sanitation sector in Enugu City (Enugu State Government, 2012).

Institution	Statutory role	Role in sanitation service chain	Level
Federal Ministry of Water Resources	Policymaking and strategic visioning, setting sanitation approaches, developing national legislation	Promotion of and technical support to service chain (such as leading on design and implementation of national ODF advocacy campaign)	National
Enugu State Ministry of Water Resources	Coordination, policymaking, sector performance M&E strategic planning and resource mobilisation (including PPP approaches) for the water supply and sanitation sector in Enugu state	Regulatory and equity monitoring (compliance to standards and pro-poor policies)	State

Enugu State Water Corporation (ESWC)	Service delivery of waterworks and sewerage systems in urban and semi urban areas of the state (including O&M, M&E, tariffing, reporting and quality control)	Operating sewer systems in urban areas	State (urban areas only)
Enugu State Waste Management Authority (ESWAMA)	Management of solid and liquid waste in Enugu State across rural and urban areas; provide environmental education	Regulating and managing the provision of containment, emptying and transportation services for non-sewered waste (including private sector operators – e.g. vacuum tankers), and managing waste disposal; sanitation and hygiene promotion	State
Enugu Capital Territory Development Agency	Coordinating municipal water and sanitation services in Enugu city between LGAs, regulating city building standards	Regulation of building standards, monitoring HH ownership of appropriate user sanitation interface (toilets) and containment technologies (including specifying septic tank or pit designs). Support faecal waste dumping into water bodies	City (state and local interface)
Town Planning unit of the Enugu State Ministry of Lands and Urban Development	Installing city infrastructure including drainage and sewerage systems	Planning and supporting construction of sewerage systems in urban areas	State
Enugu State Ministry of Environment & Mineral Resources	Policymaking, support to urban sanitation sewerage management and control, coordinates environmental Health Safety activities in state, oversees ESWAMA	Oversight for sanitation management in the state (including oversight for ESWAMA), decision making role on framework of private sector participation in sewage management, managing impact of waste disposal on environment	
The 3 LGAs	Promoting adherence and enforcing public health and sanitation laws in LGAs. Providing sanitation education. Works through EHOs	Monitoring and enforcing universal use of appropriate user interface, containment and emptying.	Local

3.1.2 Service provision

Approaches for sanitation provision are set nationally by the Federal Ministry of Water Resources through policy documents. Over the years, many policy documents have been developed to guide sanitation including the 2000 National Water Supply and Sanitation Policy, the 2003 National Water Resources Management Policy, the 2004 National Water Sanitation Policy and the 2005 National Environmental Sanitation Policy (currently being reviewed). However, there is currently no approved national sanitation policy or investment plan for sanitation in urban areas equivalent to the rural-targeted Partnership for Expanded WASH (PEWASH). This is partly due to the conflict of sanitation mandate between the Ministry of Water Resources and the Ministry of Environment.

The 2016 national ODF roadmap serves as the strategic policy document governing service delivery around achieving national usage of improved toilet systems by 2025. It outlines the approaches for achieving ODF, including the use of CLTS (modified for urban settings), institutional facility delivery, media campaigns and the sanitation marketing approach. It is, however, not backed with a strong funding and implementation plan. The Partnership for Expanded WASH also provides some guidance for private sector participation in providing WASH services, but it only applies to rural areas.

In Enugu state, a water supply and sanitation policy was developed in 2016 (and is being reviewed in 2019) as a guiding sector document with service delivery targets, and to promote private sector participation. The major gaps in the policy are its non-alignment with the Sustainable Development Goals, lack of realistic implementation plans and its being benchmarked by the current political administration. For urban sanitation, the policy presents urban service delivery targets (50 percent improved sanitation coverage by 2019), urban service standards (each household in urban areas owns and has access to safe sanitary facility of at least pour-flush toilet to septic tank), cost sharing formula for capital sanitation projects in urban areas (100 percent by government agencies and private sector) and an ideal institutional framework. It does not address faecal sludge management explicitly.

In reality, the private sector has been the key driver of sanitation service provision in the city. Many households employ a range of usually expensive artisans to construct toilets (and septic tanks/soakaways) for them, including a pit digger, a carpenter, a bricklayer, a plumber and an iron-bender. These artisans are usually independent entrepreneurs or they work in small –often informal- enterprises with at most 2-4 persons in apprenticeship-based arrangements. These artisans provide sanitation services as a part of a more diverse service provision repertoire.

All of the VTOs are also small-scaled private sector actors with 1-4 vacuum tankers who are loosely regulated by the ESWAMA. Most claim they are licensed by ESWAMA to provide these services with directions on legal dumping sites, and they receive some minor referral support from ESWAMA, ECTDA and LGA WASH Unit officials. The VTOs are not organised except for some level of price regulation (similar to a cartel) and considering how infrequently users evacuate (usually once every 18 months), they have very irregular patronage. Manual emptiers are independent odd-job entrepreneurs who perform this role as a bit part of their income-generating activities with negotiable rates depending on bargaining with users.

3.1.3 Service targets

Despite several water-focused interventions that prioritise service delivery, and to a lesser extent, WASH sector governance improvement programmes implemented in Enugu city, sanitation in the city has not received the same attention as in the rural areas of Enugu state, where UNICEF and WaterAid have been implementing various sanitation interventions. In 2018, WaterAid began a project that is seeking to draw attention to the sanitation issues in the city and create public awareness of the risks many residents face due to the poor sanitation situation. The project is also pioneering sanitation marketing in urban areas targeting low-income areas to stimulate increased ownership of toilets, climbing up the sanitation ladder and improve participation of women and youths (between 18-25 years) in the sanitation market. Another aim of the project is reforming the institutional frameworks governing water supply and sanitation in the state and building the capacity of key institutional actors to influence higher level decision makers to prioritise WASH. The state government has also entered into an agreement with a private firm – Serene Greenfields to convert the enormous waste generated in the state for the production of electricity and fertilizers.

3.2 Equity

3.2.1 Plans and measures to reduce inequity

According to Enugu Capital Territory Development Authority, identified slums in Enugu City include Ugbo Okonkwo Layout, a high-density settlement in Upper New Haven area; Ugbo Chime, a former farm settlement; and the densely populated Obiagu, Ikilike, and Iva Valley areas. The Enugu state government is laying new pipes to give these slums access to potable water to improve hygiene and discourage people from fetching water from polluted streams (Enugu State Ministry of Environment, 2018). Also, some slum areas with severe sanitary and hygiene problems may be relocated or demolished. The Ministry of Environment has also procured some mobile toilets (Figure 7) that will be sold at subsidised prices to these slum households and which can be evacuated (for a specified fee) easily when filled up with sewage and faecal matter to discourage open defecation in nearby streams, gutters or houses.

Figure 7: Mobile toilets procured by the Enugu State Ministry of Environment for slum households (Photo credit: Chinedum Igwe)

Modern public toilets are also available across the city to cater for low income people in the metropolis and discourage open defecation. One is the ultra-modern public flush toilet in Ogbete Main Market, which has overhead water facility installed (Figure 8). The facility is managed by the Enugu City Chapter of the Enugu State Amalgamated Market Traders Association (ESAMATA), and users are charged N50 (US$0.14) per use. The toilet has a sealed septic tank without soakaway, and is emptied by motorised vacuum tanker operators (VTOs) when full. The risk of groundwater contamination is high because although the tanks are fully lined and sealed, there is still a strong likelihood of seepage into the groundwater.

Figure 8: Inside and back view of the Ogbete Main Market Public Toilet (Photo credit: Chinedum Igwe)

4 Stakeholder Engagement

The proportions shown in the SFD graphic were developed on the basis of estimates, informed by interviews with a range of key informants in July and August 2018. A major source of data for this work was through key informant interviews. Fifteen KIIs were carried out together with observations and monitoring of relevant sites mentioned by the interviewees to verify and validate the data. The time-frame of the study did not give room for Focus Group Discussions.

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KII 11, 2018. Interview with the Public Toilet workers at Ogbete Main Market.

KII 12, 2018. Interview with 5 Households at New Haven.

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