SFD Lite Report

Saint Mary
Jamaica

This SFD Lite Report was prepared by

CSE, GWP-Caribbean and Saint Mary and Global Environment (GE)

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1 The SFD Graphic

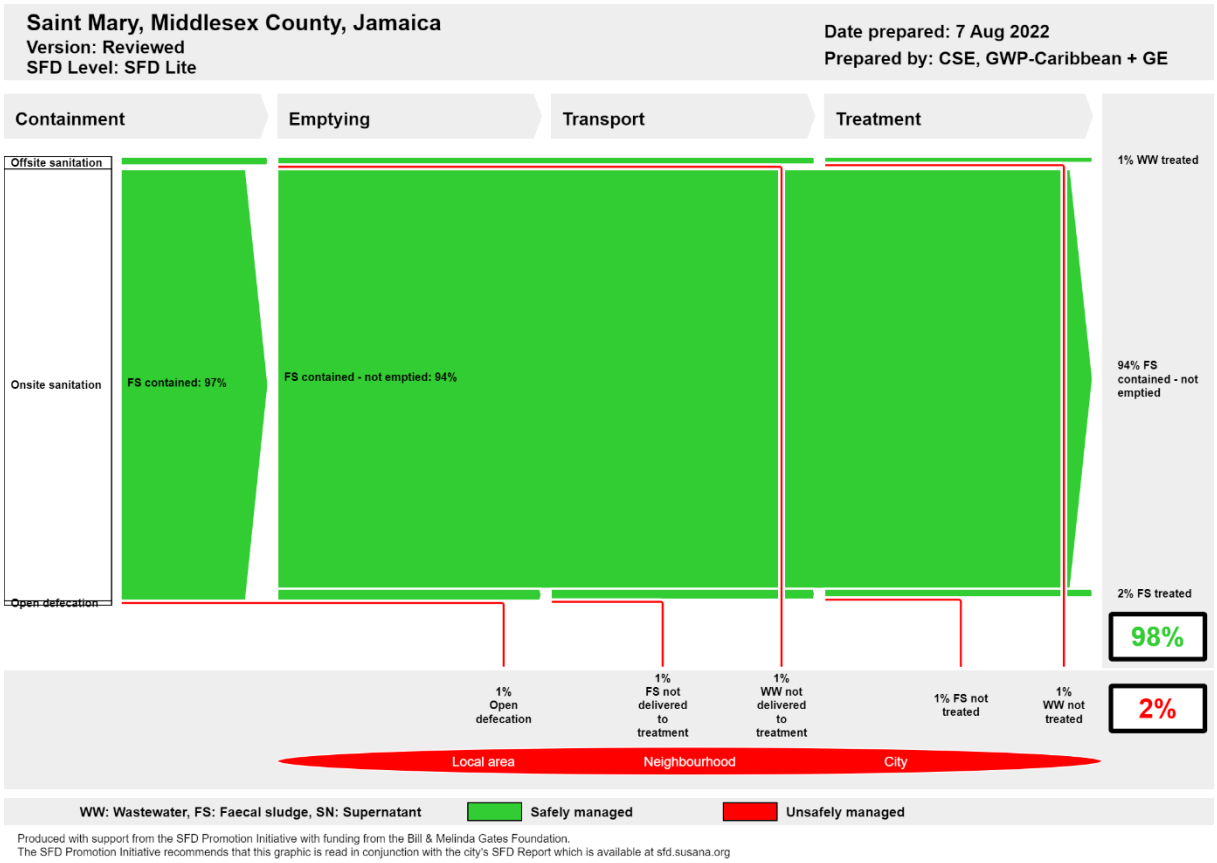

Figure 1: SFD Graphic for Saint Mary.

2 SFD Lite information

Produced by:

-This report has been made as part of an International Online Training on Preparation of Shit Flow Diagram (SFD) for Caribbean Countries conducted by Centre for Science and Environment (CSE) from 21/03/2022 to 2/04/2022 and compiled as part of SFD Promotion Initiative (SFD-PI) Project (Phase 3) funded by Bill and Melinda Gates Foundation (BMGF). Further, the report has compiled by Ms. Jodian Pinder.

-Special thanks to all the persons who participated in key informant interviews (KIIs) and surveys and special thanks to Mr. Harsh Yadava (CSE) for his invaluable inputs and support while preparing the SFD graphic.

Collaborating partners:

Partnership:

- Centre for Science and Environment, New Delhi, GWP-Caribbean, Saint Mary Municipal Corporation (SMMC). Financed by: Global Environment (GE)

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3 General City Information

Saint Mary is a rural parish[1] located on the Caribbean island of Jamaica. The geographical coordinates of Saint Mary are latitude 18°09' north and longitude 77°03' west. Saint Mary is the fifth smallest parish on the island and its capital is Port Maria. The parish is located on the north eastern coast of the island and has an area of 611.3 km^2. Jamaica is divided into three counties namely Cornwall, Middlesex and Surrey. Saint Mary is situated in the county of Middlesex and is separated into three constituencies; specifically Western, Central and South Western Saint Mary (Figure 2).

Figure 2: Map of Saint Mary[7].

The parish is bordered by the parish of Portland in the East, Saint Ann parish in the West, and parts of Saint Catherine and Saint Andrew parishes in the South. The topography is primarily mountainous, rising up to almost 4,000 feet at the highest point with 13% of its area having slopes below 10 degrees[2]. The average rainfall for the parish is 2,057.4 mm per year. Saint Mary has warm temperatures year round ranging between 30°C and 32°C[3].

The soil types that are found in the parish are predominately limestone on the western side and shale rock on the eastern side. The Rio Nuevo River, Wag Water and White Rivers are the three (3) main rivers in Saint Mary[2].

The National Water Commission (NWC) is the main supplier of water in Saint Mary. The NWC supplies approximately 139 million gallons (526 million litres) of water per month in Saint Mary. NWC currently has 26,000 accounts in the parish. Thus, 71% of the parish's water is supplied by the NWC (KII-4, 2022)[4]. Other suppliers includes the Saint Mary Municipal Corporation (stand pipes, storage tanks and distribution into homes), private supplies and community supplies (open streams, wells, entombment). The amount of water supplied by 'other suppliers' is unknown (KII-2, 3, 2022)[5].

Table 1 shows the population growth of Saint Mary in the past three decades.

Table 1: Population growth rate.

Census Year	Population	Growth Rate (%)	Source
1991	108780	2.6	Census 1991
2001	111466	1.89	Census 2001
2011	113615	1.9	Census 2011
2019	115090	1.28	STATIN
2022	146120	-	Estimated

As per the population and housing census conducted by the statistical institute of Jamaica (STATIN) 2011, Saint Mary had a population of 113,615 persons living in 36,530 dwelling with an average of 3.1 persons per household[6].

According to STATIN post censual data collected in 2019, the total population increased to 115,090 (based on the number of births and deaths that occurred during that period)[6].The year 2021 was slated to be census year in Jamaica but due to the COVID-19 pandemic this was postponed until September 2022. It is against this background that the researcher estimated the population in 2022 based on cross examination of information received during Key Informant Interviews (KIIs) to be 146,120 persons with an average of 4 persons per household.

[1] Parish is the smallest unit of a local government constituted in rural area.
[2] The Jamaica Information Service (JIS); https://jis.gov.jm/information/parish-profiles/parish-profile-st-mary/
[3] Climate and average monthly weather in St. Mary, Jamaica; weather-and-climate.com)
[4] KII Mr. Richard Williams (Regional Director North East NWC) and Mr. Neville Braham, North East NWC
[5] KII with Mrs. Patricia. Smith-Warren Water and waste water quality Public Health Inspector and Mr. Brandon Myles, SMMC
[6] The Statistical Institute of Jamaica (STATIN);https://statinja.gov.jm/Demo_SocialStats/PopulationStats.aspx
[7] Map of Saint Mary sourced from https://www.jamaica-land-we-love.com/st-mary-jamaica.html

4 Service outcomes

Saint Mary , Parish, Jamaica, 7 Aug 2022. SFD Level: SFD Lite
Population: 146120
Proportion of tanks: septic tanks: 100%, fully lined tanks: 100%, lined, open bottom tanks: 100%

Containment						
System type	Population	WW transport	WW treatment	FS emptying	FS transport	FS treatment
	Pop	W4b	W5b	F3	F4	F5
System label and description	Proportion of population using this type of system (p)	Proportion of wastewater in sewer system, which is delivered to decentralised treatment plants	Proportion of wastewater delivered to decentralised treatment plants, which is treated	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
T1A1C4 Toilet discharges directly to a decentralised foul/separate sewer	2.0	90.0	80.0			
T1A2C5 Septic tank connected to soak pit	3.0			90.0	90.0	80.0
T1B11 C7 TO C9 Open defecation	1.0					
T1B7C10 Pit (all types), never emptied but abandoned when full and covered with soil, no outlet or overflow	94.0					

Table 2 : SFD Matrix.

The SFD matrix (Table 2) was used to generate the SFD graphic shown in Figure 1. It was recognised that 98% of the excreta and wastewater (WW) is classified as safely managed while the remaining 2% is classified as unsafely managed. The safely managed excreta comprises 1% wastewater from the sewer system which is delivered to treatment and treated, 2% faecal sludge from septic tanks which is delivered to treatment and treated, and 94% faecal sludge in pits of various types, which are not emptied but safely abandoned, covered and replaced when full. While the latter method is considered safe (assuming groundwater used for drinking is not polluted), it is only safe while there is space for households to cover old pits and replace with new ones. In areas where housing density is increasing, alternative safe solutions will need to be found that may include safe emptying, transport and treatment before reuse or disposal.

The unsafely managed excreta generated from Onsite Sanitation Sytems (OSS) and offsite systems is determined to be 2%, consisting of wastewater delivered to treatment but not treated (1%); wastewater not delivered to treatment (1%); FS not delivered to treatment (1%), FS delivered to treatment but not treated (1%) and people practising open defecation (1%).

Overview on technologies and methods used for different sanitation systems through the sanitation service chain is as follows:

4.1. Offsite systems

Sewerage network and conveyance systems:

Based on field observations, KIIs-1, 2, 6, 8, 2022 and records from the Saint Mary Health Department (SMHD) it was determined that 2% of the population is connected to offsite systems (decentralised sewerage systems, T1A1C4). The National Water Commission (NWC) has primary responsibility for sewerage services in Saint Mary. The excreta generated from the households (HHs) in the parish reaches the Sewage Treatment Plants (STPs) via gravity feed (through sewer laterals). There are two sewage treatment plants that are operated by the NWC in Saint Mary (Figure 3 and Figure 4). These sewage treatment plants are located in Stockholm Park, Highgate and Boscobel (KIIs-2, 4).

The STPs have a capacity of approximately 189,270,590 Million Litres per Day (MLD) each and treats between 189,270,590 to 264,978,826 MLD of wastewater. Mechanical technology, which includes oxidation ditches, mound and aeration tanks are being utilized at these sewage treatment plants. Chlorine and liquid alum are used in the treatment process. For the purpose of this research, it was assumed that 90% of wastewater is delivered to the sewage treatment plants of which 80% is treated.

Treatment:

It was assumed that 80% of wastewater received is treated at the national effluent standards. This assumption was based on information received during the interview with parish official who mentioned that the status of the effluent discharged fluctuates periodically because the plants are old, not being properly maintained and are being overloaded (KII-2, 2022). Thus, compliance with the country's effluent discharge standards are not always achieved by the operators. With regards to Faecal Sludge (FS), after treatment, drying beds are used to store FS. Some of the treated FS is also trucked to dumpsites (not sanitary landfills) outside of the parish.

Figure 3: Treatment (Source: Jodian/Org./2022).

Figure 4: STP, operated by NWC (Source: Jodian/Org./2022)

4.2. Onsite Sanitation Systems (OSS)

Containment:

The majority of the parish is non-sewered. Based on KIIs-1, 2, 6, 8, 2022, sample Household (HH) surveys records from the Saint Mary Health Department and field observations, 94% of the population is dependent on OSS. Most of the HHs have water carriage system attached to soak pits (*locally called as absorption pits*) while others have conventional pit latrines, pour flush and Ventilated Improved Pit latrines. Therefore, the most popular type of OSS utilized by HHs are pits, used by 94% of he population, that have never been emptied but abandoned when full and covered with soil (T1B7C10) . These pits have no outlet or overflow. It must be noted that all the pits have open bottoms. Currently lined pits with semi-permeable walls are in prevalent practice compared to unlined pits which were more prevalent about 30 years ago (KII-8). The pits currently used are 6-12 feet (1.8 - 3.6 metres) deep and constructed with reinforced walls. Masons line the pits with stones and create a ring beam to ensure that the walls do not collapse.

The use of 45 gallon (170 litre) drums to line pits is steadily gaining popularity among the lower socio economic class. Persons use both plastic and metallic drums (KII-2, 8).

Figures 5, 6, 7 and 8 show examples of OSS in Saint Mary.

Figure 5: Pour flush latrine (Source:Jodian/Org./2022).

Figure 6: Soak pit (Source: Jodian/Org./2022).

Figure 7: Broken sewer pipe leading to soak pit (Source: Jodian/Org./2022).

Figure 8: Pit latrine (Source: Jodian/Org./2022).

More Septic Tanks (ST) are being constructed in Saint Mary because under the law only building plans that have proposal to construct secondary and tertiary systems to manage excreta are being approved. This is observed especially in the coastal areas and areas with very a high water table. It was determined that septic tanks connected to soak pits (T1A2C5) is being utilised by 3% of HHs in Saint Mary (Figure 9 and Figure 10). These septic tanks typically have two chambers and are built from concrete or sold as plastic precasted. The dimension varies for septic tanks constructed with cement while the precasted STs have standardised sizes. HH surveys revealed that septic tanks are emptied on average every two years but this is heavily dependent on the size of the household and septic tank. Septic tanks observed in Saint Mary are mostly connected to tile fields and reed beds. For the purpose of this SFD graphic, all such types of infiltration systems are categorized as soak pits (KII-2, 5, 7, 8).

Figure 9: STs connected to soak pit (Source: Jodian/Org./2022).

Figure 10: Precasted plastic ST (Source:Jodian/Org./2022).

Public Toilets (PTs):

The Saint Mary Municipal Corporation (SMMC) operates eight public toilet facilities throughout the parish (markets and transportation centres) that are non-sewered (Figure 11). The PTs includes system tanks connected to soak pits. Most of the buildings are in need of minor to moderate repairs (field observation, 2022). There are twenty nine seats and three urinals in all PTs. Separate seats are available for both men and women. Fees ranging from $30 to $50 Jamaican dollars (USD 0.20 - 0.33) are charged at public toilets facilities located in transportation centre and markets while some of the sanitary conveniences are utilized for free. The FS from septic tanks is removed by private operator's mechanical desludging vehicle which are emptied daily at a co-treatment plant in St. Ann (KII-3, 2022).

Figure 11: Public toilet operated by SMMC (Source: Jodian/Org./2022).

Emptying:

OSS as mentioned before are emptied only if the containment is a septic tank. These tanks are mechanically and manually emptied by private desludging vehicles and workers. There is only one registered private desludging company that is based within Saint Mary. However, during field observation and KIIs, it was noted that other private cesspool operators are contracted to empty FS from HHs, restaurants, institutions and hotels in the parish. An operator receives on average 15 requests per month for emptying of septage. The cost to clean a septic tank varies and is based on the distance of the HH, the number loads and whether or not the workers have to manually clean the septic tanks (due to sanitary napkins disposed of inside the tanks, etc.). As per septic tank cleaner survey, it was stated that Personal Protective Equipment (PPE) is provided. The frequency of emptying septic tanks depends on the size of the tanks and the size of the HH. Based on KIIs, it was estimated that on average septic tanks are desludged between18 months and 2 years. However, it can be less. Hence, variable F3 was set to 90%. The SMMC does not own a desludging vehicle and so PT, HHs and other entities hire private operators to remove FS (KII-1, 3,5,7,8, 2022).

Transport and Disposal:

Subsequent to emptying the septic tanks, the desludging vehicles discharge the septage at a sewage treatment plant in Saint Ann. Since FS/WW is transported and disposed of outside of the city, it is hard to monitor these private operators (Figure 12). However, it must be noted that the last report of an operator discharging FS in an unauthorized manner in Saint Mary was 10 years ago (KII-2, 5, 2022). As per the septic tank cleaner survey, it was established that operators log their daily activities, showing some form of accountability. It was also noted that these operators are aware of the law and try their best to obey the law as they do not wish to tarnish their company's name. Hence, variable F4 was set to 90% and F5 was set to 80% as it is being co-treated at the sewage treatment plant.

Figure 12: Septage haulage vehicle (Source:Jodian/Org./2022).

4.3 Open Defecation

The area is not open defecation free. It was determined through KIIs and surveys conducted by the Saint Mary Health Department-Environmental Health unit that open defecation is being practised by approximately 1% of residents. Reports (complaints) are still being made at the Saint Mary Health Department and SMMC with regards to residents who practise '*parachuting*' (open defecation). HHs that use sink holes or any other inappropriate method for disposal of their excreta which pollutes the environment are also categorised as open defecation. Lack of funding is a challenge to provide HHs with a latrine facility to marginalized communities.

Informal settlements or squatter settlements are dispersed across Saint Mary. These areas are usually densely populated. Most of these squatter settlements are formed as a result of persons wanting to be close to towns or because they have been displaced. Persons squat on lands that are both government and privately owned. Even though these settlements are informal, most of the HHs have access to potable water and acceptable excreta disposal systems (KII-1, 2022). It must also be noted that efforts are being made to regularise some squatter areas. Some of the HHs that do not have a suitable excreta disposal system were accounted for in the percentage that practice open defecation.

4.4 Ongoing and proposed sanitation projects

As mentioned before, the NWC has primary responsibility for sewerage services in Saint Mary[5]. The sewage treatment plant operator survey revealed that plans have been made for the total rehabilitation of Stockholm Park Sewage Treatment plant. Numerous housing developments are in the emerging phase and are proposed to have decentralised sewage systems. Recommendations have been made by the SMHD for a central sewerage system to be constructed in Saint Mary, especially for areas where the water table is very high. Some housing developments have incomplete systems and the owners are working persistently to have the systems completed (KII-2, 4, 2022).

4.5 Risk of ground water pollution

Very little data with regards to groundwater pollution were received during this research. The SFD groundwater risk estimation tool was used to assist in determining the risk for groundwater pollution in Saint Mary as being low. Based on field observations and information gathered from KII sources, it was estimated that less than 25% of the sanitation facilities are located <10m from groundwater sources and less than 25% of the sanitation facilities are located uphill of the groundwater source.

A percentage greater than 25% of drinking water is produced from groundwater sources. However, currently, soak pits construction are only permitted by the competent authorities where the highest groundwater level is 1.2 m from the bottom of the pit. Soak pits are also not allowed in areas whose landscape is underlain by limestone which has been eroded by dissolution, producing ridges, towers, fissures, sinkholes and other characteristic landforms[8].

The parish has mostly surface water sources which includes rivers above and underground resurfacing as springs. Numerous underground caverns also facilitate springs. Therefore, because of the geological structure of Saint Mary groundwater sources are very few. Areas along the coast or in river valleys are the only places where the sinking of wells for groundwater is allowed (KII-1, 2, 2022). Thus, Saint Mary is categorized as low risk for groundwater pollution.

[8]Ministry of Health and Wellness Minimum Requirements for Waste Water Treatment Systems and Excreta Disposal Management in Jamaica, Volume 3 Section 4, 2007.

5 Data and assumptions

Some of the data required to complete this SFD graphic were not readily available. However, triangulation of data collected from the different authorities, field visit, KIIs, published and unpublished reports aided with the final SFD graphic and report. Some of the data were not up to date, so assumptions were made based on information received from the primary survey.

- Assumptions were made about the percentage of the population that use both onsite and offsite sanitation systems based on records kept by Public Health Officers in each district, field visits and the data collected from the census 2011.
- It was assumed that 90% of WW was transported to STPs and 80% of WW was treated in order to get a true picture of the SFD graphic for the parish.
- It was assumed that the risk for groundwater pollution is low because of the topography of the parish, soil type and the fact that most of the population live below the top of the water source. Laboratory results also showed low levels of sodium and nitrate in water. Low cases of gastrointestinal diseases have been reported in the parish.
- It was assumed that desludgers transport faecal sludge outside of the parish to be treated even though there is no monitoring system. No reports have been made about FS being disposed of improperly.
- Due to the age of the system, leakage and poor maintenance of STP, it was assumed that some WW escapes treatment.

6 List of data sources

Reports and literature

- Climate and average monthly weather in St Mary, Jamaica; weather-and-climate.com
- District Status Registers, SHMD-environmental health unit
- Map of Saint Mary sourced from https://www.jamaica-land-we-love.com/st-mary-jamaica.html
- Ministry of Health and Wellness Minimum Requirements for Waste Water Treatment Systems and Excreta Disposal Management in Jamaica, Volume 3 Section 4, 2007; https://websitearchive2020.nepa.gov.jm/Development-Invest-Man/Volume%203%20-%20Infrastructure,%20Utilities%20and%20Communication/Section%204%20-%20Waste%20Water
- NWC Development Manual, Volume 3 Section 3, 2007; https://w.nwcjamaica.com/uploads/document/Draft%20St.%20Mary%20WS%20PPLan%20-%20October%2012%202011.pdf
- The Jamaica Information Service (JIS); https://jis.gov.jm/information/parish-profiles/parish-profile-st-mary/
- The Statistical Institute of Jamaica (STATIN);https://statinja.gov.jm/Demo_SocialStats/PopulationStats.aspx
- Water Resource Authority, Jamaica, 2022; https://www.wra.gov.jm/
- WRA Water Quality Atlas Jamaica, 2019.

Key informant interviews (KIIs)

- KII-1, 2022; Interview with Mr. A.P Brown (Public Health Expert).
- KII-2, 2022; Interview with Mrs. Patricia Smith-Warren (Water and waste water quality Public Health Inspector.
- KII-3, 2022; Interview with Mr. Myles (SMMC).
- KII-4, 2022; Interview with Mr. Neville Braham and Mr. Richard Williams (NWC).
- KII-5, 2022; Miss Shayna. Lyons/Mr. Mark Lyons (Hydromax).
- KII-6, 2022; Public Health Officers at the local Health Department.
- KII-7, 2022; Hardware operator, Highgate.
- KII-8, 2022; Masons.
- KII-9, 2022; Sewage treatment plant attendant operated by NWC.

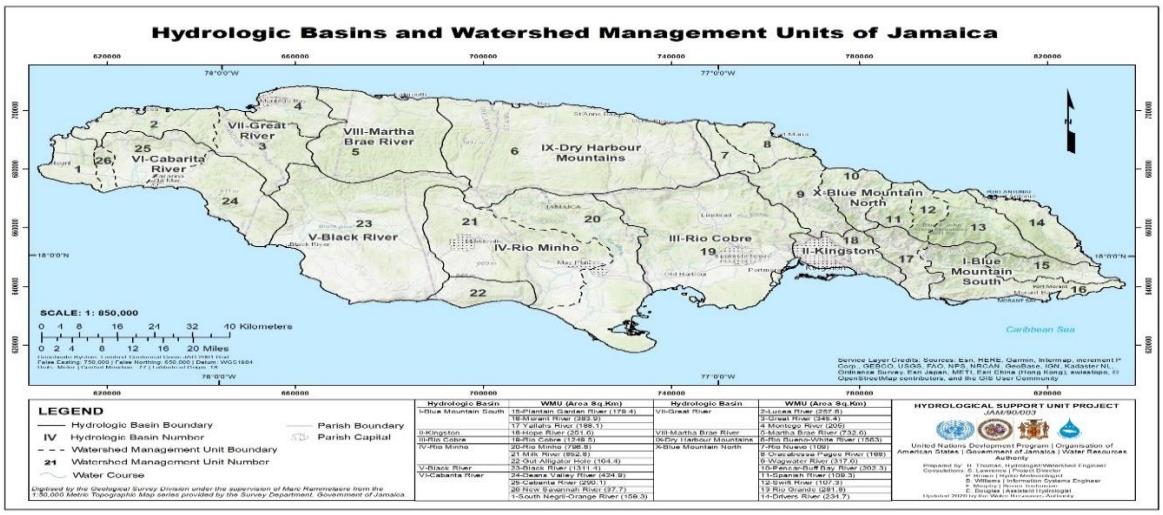
Field observation

- Random households surveys.
- Survey of Public toilets.
- Visit to Sewage Treatment Plants and its outlet/discharge point.
- Observation of septic tanks.
- Observation of desludging trucks on the field.
- Observation of pits (all types if applicable).

Annex-1

Source: WRA Water Quality Atlas Jamaica, 2019

Annex-2



Source: WRA Water Quality Atlas Jamaica, 2019

SFD Promotion Initiative

SFD Saint Mary, Jamaica, 2022

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