SFD Lite Report

Sirajganj Municipality Bangladesh

This SFD Lite Report was prepared by
CWIS-FSM Support Cell, DPHE

Date of production: 04/01/2022

1 The SFD Graphic

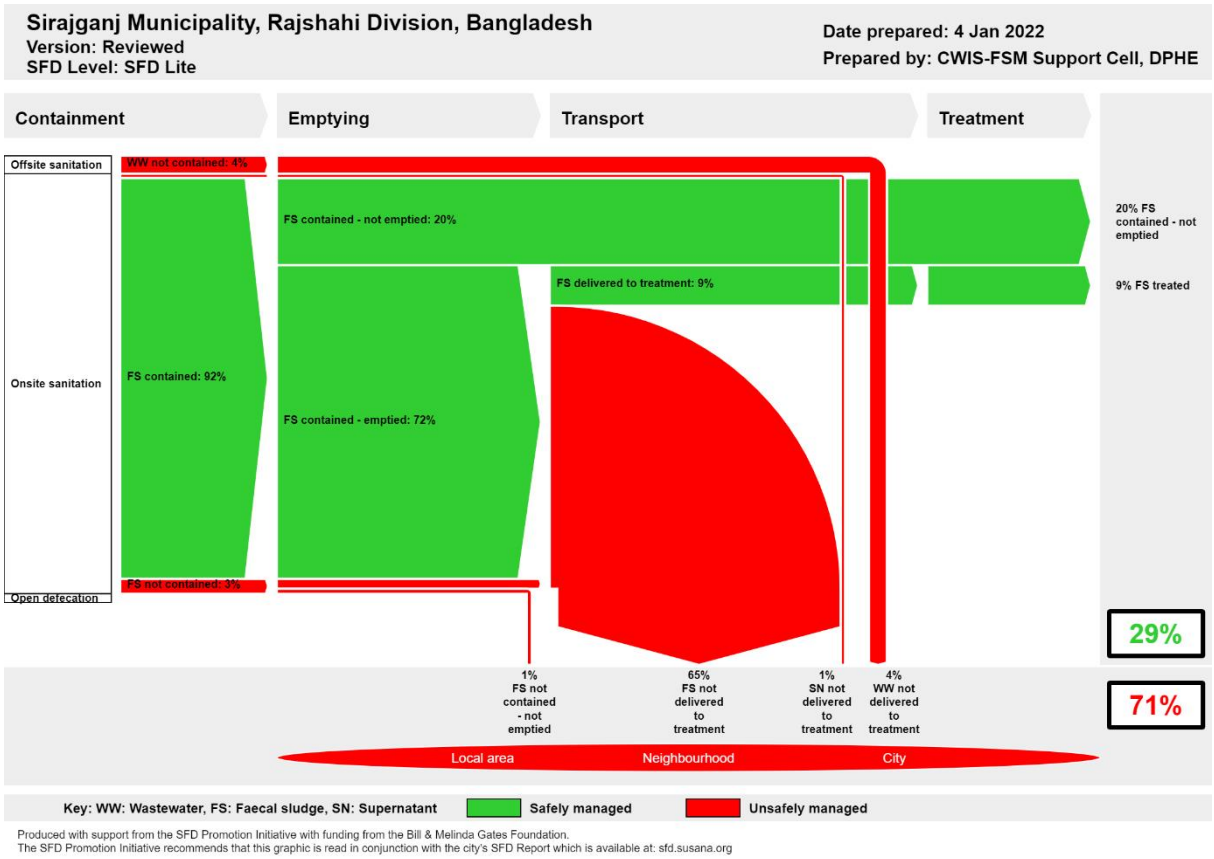

Figure 1: SFD Graphic for Sirajganj municipality.

2 SFD Lite information

Produced by:

- Dr. Abdullah Al-Muyeed, Chief Operating Officer, CWIS-FSM Support Cell, Shishir Kumar Biswas, Project Director, *'Feasibility for Implementing of Solid Waste and Faecal Sludge Management System in 53 District Level Municipalities and 8 City Corporations'*, Department of Public Health Engineering (DPHE) and Suman Kanti Nath, Technical Expert, CWIS-FSM Support Cell, Department of Public Health Engineering (DPHE), Bangladesh.
- We would like to thank Mr. Syed Abdur Rauf Mukta, Mayor, Sirajganj Municipality, Mr.Luthfur Rahman, Secretary, Municipality; Mr. Md. Masud Hossen, Chief Executive Officer; Mr. Md. Shahjahan Ali, Executive Engineer, Ms. Kawsar Akter Dewan, Sanitary Inspector, Sirajganj Municipality for providing all the required primary and secondary data and cooperating for Key Informant Interviews (KIIs) & Focussed Group Discussions (FGDs). This report would not have been possible to produce without the constant support of Mr. Syed Abdur Rauf Mukta, Mayor, Sirajganj Municipality, who helped in conducting sample surveys and FGDs in the field.
- We also acknowledge the support of the Centre for Science and Environment, India for the promotion of SFD in Bangladesh.

Collaborating partners:

- DevCon, Tiller and Sirajganj municipality played vital roles in collecting and sharing data, and producing this SFD graphic and SFD lite report.

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3 General city information

Sirajganj municipality is one of the oldest municipalities in the north-central region of Bangladesh, established in 1869, it is now recognized as a first-class municipality, consisting of 15 wards and 52 mohallas. It is lying on the west of the Jamuna River, about 141 km north-west of the capital city Dhaka (Figure 2). It was once considered a principal jute trade centre. In modern days, it is still an important place for trading as it is located in a very convenient geographical location having well-developed connectivity via road, rail and river with rest of the country. Sirajganj is one of the 53 district-level municipalities in the country.

Table 1: City profile (Source: KII with the Secretary, Sirajganj Municipality).

Population parameters	
Estimated population, 2020	218,307
Households, 2020	49615
Area, sq.km	28.49
Total roads, km	565
Total drains, km	275

Figure 2: Sirajganj municipality location map (BBS/ GIS report 2017).

According to the population census in 2011 by the Bangladesh Bureau of Statistics (BBS), the Sirajganj city population was 158,913. The urban population growth in Sirajganj is considered 1.5% per year. Considering the floating population, such as farmers and traders, comes to the city every day, the present (2020) population is estimated to be around 218,307 with a density of 10,446 per sq. km (Source: KII with the Secretary, Sirajganj Municipality).

The municipality covers an area of 28.49 square kilometres. At present Sirajganj municipality has 565 km of road out of which 365 km is Reinforced Cement Concrete (RCC) road, and 200 km is earthen road. The city has about 275 km of drain[1].

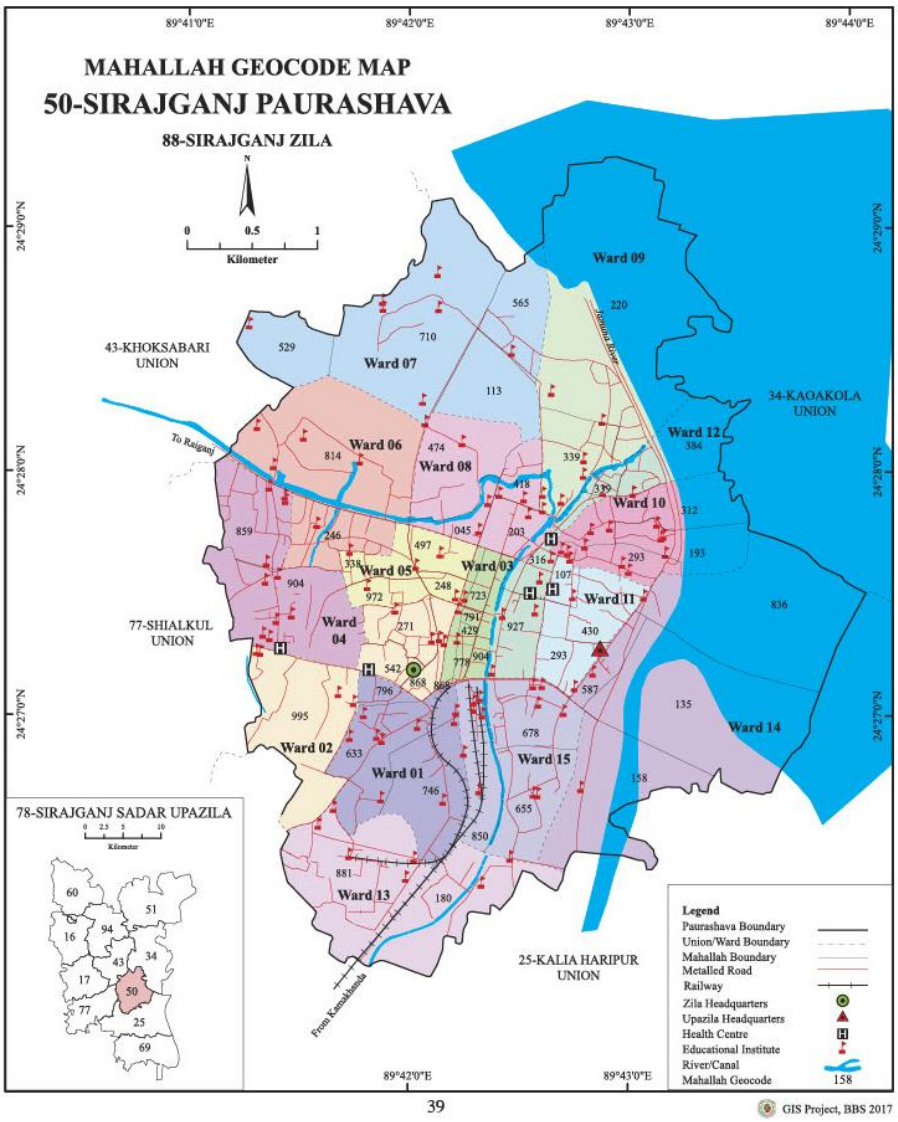

Figure 3: Sirajganj municipality ward boundary map (BBS/ GIS report 2017).

The geographical coordinates of Sirajganj are 24°27'27.76" N 89°42'28.87" E[2]. According to the Bangladesh Meteorological Department (1981-2017), the city area and surrounding area experience a tropical monsoon climate. It is characterized by warm, humid summers and cool, and dry winters. There is no climatological station within the Municipality. The closest meteorological station of Bangladesh Meteorological Department is located in Tangail which is about 32 km away from the Municipality area.

[1] *Source: 'At a Glance: Sirajganj Municipality', by municipal office*
[2] *Source: https://www.gps-latitude-longitude.com/gps-coordinates*

Weather data from this station is collected from 1981 to 2017. About 90% of the total annual rainfall occurs in the period from May through October and the driest months of the years are November to March. The maximum mean temperature observed is 31.6-33.9°C between April-August, with the minimum mean temperatures found to be between 11.4-13.5°C in January. The annual average rainfall is about 1,874 mm, according to BMD (1981-2017)[3].

The Jamuna River passed by the east side of the municipality. Several *khal* passed through the municipality. However, the drainage network of the city is not adequate[4]. There are some secondary drains carrying storm water and domestic wastewater to the outfalls of the rivers and canals.

The ward boundary map and the population density in the 15 wards of the city are shown in Figure 3 and Figure 4. The density is high in the west ranging from 20,001 to 21,270 per sq km. The population density in the North and South is lower, ranging from 3,783 to 5,000 per sq km[5] (KII and field visit during Baseline survey 2020).

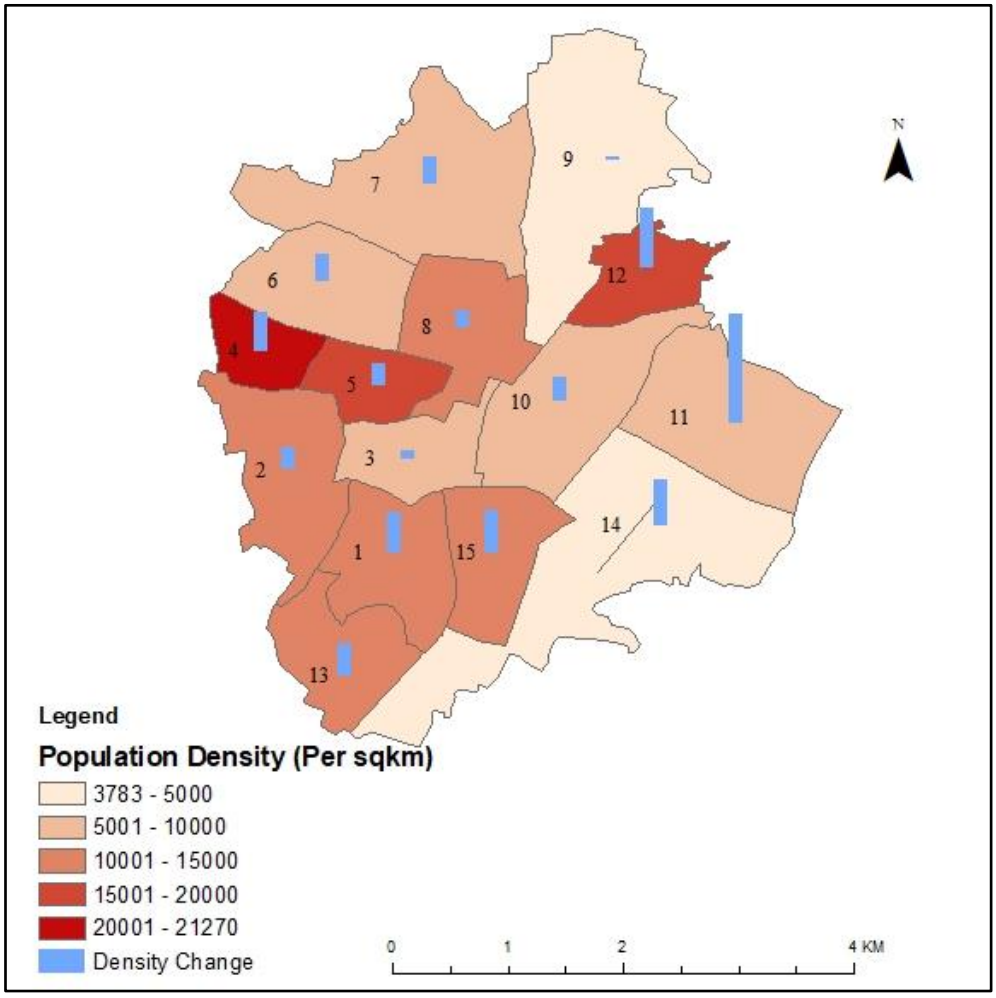

Figure 4: Population density in different wards of Sirajganj city.

[3] *http://bmd.gov.bd/p/Rainfall-Situation-202*
[4] *KII and field visit during Baseline survey 2020*
[5] *KII and field visit during Baseline survey 2020*

4 Service outcomes

Sirajganj Municipality, Sirajganj , Bangladesh , 4 Jan 2022. SFD Level: SFD Lite
Population: 218307
Proportion of tanks: septic tanks: 89%, fully lined tanks: 0%, lined, open bottom tanks: 100%

Containment								
System type	Population	WW transport	WW treatment	FS emptying	FS transport	FS treatment	SN transport	SN treatment
	Pop	W4c	W5c	F3	F4	F5	S4e	S5e
System label and description	Proportion of population using this type of system (p)	Proportion of wastewater in open sewer or storm drain system, which is delivered to treatment plants	Proportion of wastewater delivered to 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	Proportion of supernatant in open drain or storm sewer system, which is delivered to treatment plants	Proportion of supernatant in open drain or storm sewer system that is delivered to treatment plants, which is treated
T1A1C6 Toilet discharges directly to open drain or storm sewer	4.1	0.0	0.0					
T1A2C5 Septic tank connected to soak pit	8.2			59.0	35.0	100.0		
T1A2C6 Septic tank connected to open drain or storm sewer	2.6			69.0	36.0	100.0	0.0	0.0
T1A2C7 Septic tank connected to open water body	0.7			69.0	36.0	100.0		
T1A2C8 Septic tank connected to open ground	0.2			69.0	36.0	100.0		
T1A2C9 Septic tank connected to 'don't know where'	0.2			69.0	36.0	100.0		
T1A4C10 Lined tank with impermeable walls and open bottom, no outlet or overflow	11.5			29.0	36.0	100.0		
T1A5C10 Lined pit with semi-permeable walls and open bottom, no outlet or overflow	72.4			89.0	9.0	100.0		

Table 2: SFD Matrix for Sirajganj municipality.

The outcome of the SFD graphic shows that only twenty-nine percent (29%) of the excreta flow is classified as safely managed, and the remaining seventy-one (71%) percent is classified as unsafely managed (Figure 1). The unsafely managed excreta originate from wastewater not delivered to treatment (4%), Faecal Sludge (FS) emptied but not delivered to treatment (65%), FS not contained - not emptied (1%) and 1% of supernatant not delivered to treatment. The safely managed excreta originate from Faecal Sludge (FS) contained - not emptied (20%) and FS treated in treatment plant (9%).

The percentages presented in Table 2 and discussed in this section are based on data collected through household (HH) surveys, Key Informant Interviews (KIIs) and Focus Group Discussions (FGDs) (Figure 5, Figure 9 and Figure 10).

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

4.1 Offsite Systems

The city does not have a dedicated sewerage system. However, during field observation and HH survey, it was found that there are some certain areas where toilets are directly connected to open drains. Similarly, a portion of septic tanks is directly connected to open drains or storm sewer. Therefore, T1A1C6 system is considered as 4.1% of the total population of the city to generate the SFD graphic. Similarly, the T1A2C6 system is considered 2.6% of the total population of the city to generate the SFD graphic. In the absence of a sewerage system, the faecal sludge in T1A1C6 and the supernatant in T1A2C6 are directly discharged untreated into the river or the environment.

4.2 On-site Sanitation Systems

Figure 5: Household survey and consultations. Left: Household survey. Right: Consultation meeting (Source: *Feasibility study 2020-21/DPHE).*

Containment: Almost all the households (98%) in the city have their latrine which is connected to single pits, twin pits, septic tanks, or discharged directly into the environment (e.g., open-drain or storm sewer). The rest of the households use community latrines (0.24%) and neighbour's toilets (1.68%). From a household survey, it was found that 11.99% of the city population uses septic tanks as the containment system, 72.4% of the toilets have single pit systems, and 11.5% of people use double pits in the city. About 4.1% do not have any type of containment and discharges directly to the environment (KII, FGDs, HH survey, 2020).

According to the type of connectivity and features of containment technologies, the discharging points of the toilets are categorized as: 8.2% of the population uses septic tanks connected to soak pits (T1A2C5), 2.6% of the population uses septic tanks connected to open drain (T1A2C6), 0.7% of the population uses septic tanks connected to water bodies (T1A2C7), 0.2% of the population uses septic tanks connected to open ground (T1A2C8), 0.2% of the population uses septic tanks connected to 'don't know where' (T1A2C9), 11.5% of the population uses lined tanks with impermeable walls and open bottom, no outlet or overflow (T1A4C10) and 72.4% of the population relies on the lined pit with semi-permeable walls and open bottom, no outlet or overflow (T1A5C10) (KII, FGDs, HH survey, 2020). Thus, at the containment stage, the city's excreta of 92.2% of the population are contained. Figure 6 shows pictures of these technologies in use.

Groundwater Pollution: The groundwater level below the ground surface is 6-7 m. The most common drinking water production technology is a borehole with a hand pump or motorized pump. 23% of the households use their own tube well fitted with electric motor and 59% use their own hand pump tube well. 14% of households are supplied with piped water.

Lateral separation between sanitation facilities and water sources varies from one area to another. The main source of drinking water is tube well. Tube wells of different sizes and depths are generally used to pump water from the confined aquifers. During the household visit and FGDs, it was found that less than 25% of sanitation facilities are located within 10 metres from the groundwater source. Besides, due to the geographical situation, sanitation facilities are not located uphill of the groundwater sources. According to a survey report on 'Hydrogeological screening, slug test and geophysical logging on observation well units', conducted by the Department of Public Health Engineering (DPHE), drinking water is collected from the confined aquifer (25 m – 200 m) through pumps. Therefore, a low risk of groundwater contamination is considered in the city.

Figure 6: Containment technologies and their connections in Sirajganj. Left: Toilet pit open to a nearby water body, Right: Toilet pipe connected to open environment (Source: *Feasibility study 2020-21/DPHE).*

Emptying: Households relying on septic tanks have to arrange themselves for emptying of the septic tank. It was observed from the baseline survey that most of the septic tanks have been constructed in the last 4-6 years (Figure 7). According to the survey from 2020, the frequency of emptying of septic tanks or covered pits varies from 1 to 10 years depending upon the size, uses, etc.

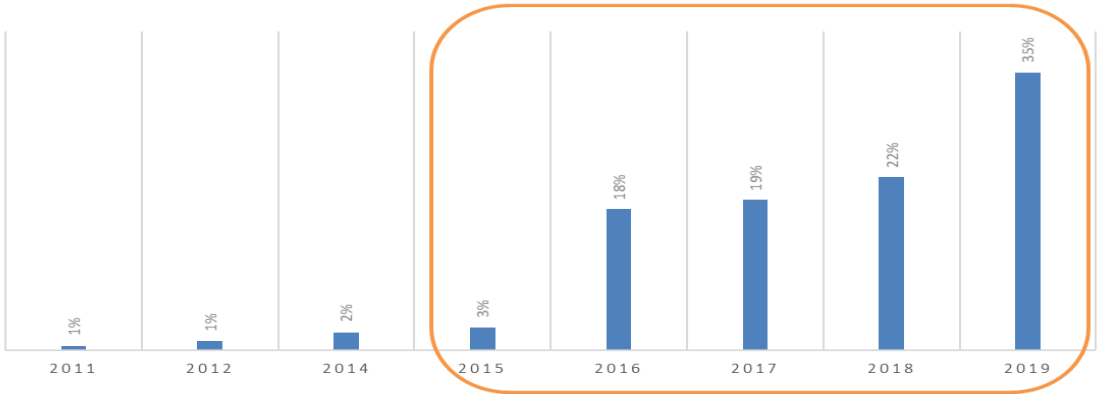

Figure 7: Year of septic tanks construction.

However, about 59% of the septic tanks, connected to the soak pit are emptied within 2-5 years. About 69% of the septic tanks connected to open drains, open ground, water bodies or 'don't know where' are emptied within 2-5 years. Almost 29% of double pit latrines and 89% of single pit latrines are emptied within 1-2 years. Besides the above information, it was also revealed during the discussion in FGDs and household visits, that the demand for desludging septic tanks would increase shortly. Desludging of the septic tanks or pits is mostly (95%) done by private sweepers. Only in a few households desludging is done by municipal sweepers (3%) and family members (3%). Around 92% of this withdrawal is done manually using a bucket and rope. A small number (4%) use manual pumps, 3% use mechanical

vacuum tankers and 1% use an electric pump. The manual method has high risks for the health and safety of the workers. These reflect the absence of safe and improved technologies for sludge emptying. There are two mechanical vacuum tankers in operation in the municipality[6].

Transportation: The sludge withdrawn from the septic tanks and latrine pits by the cleaners is disposed of in various places. Based on the survey from 2020, it was observed that about 59% of the septic tanks, connected to the soak pit are emptied, out of which 35% is FS delivered to the treatment plant. Similarly, 69% of the septic tanks, connected to open drains, open ground, water bodies or 'don't know where' are emptied, out of which 36% is FS delivered to the treatment plant. In the case of lined tanks with impermeable walls and open bottom, no outlet or overflow, 29% are emptied, out of which 36% is FS delivered to the treatment plant. Similarly for lined pits with semi-impermeable walls and open bottom, no outlet or overflow, 89% are emptied, out of which 9% is FS delivered to the treatment plant. In a summary, considering all types of containments, from the 72% of FS contained and emptied, only 13% is FS delivered to the treatment plant. Except for the FS delivered to the treatment plant, 55% is disposed of in a dug hole and covered with soil away from the house and 32% is disposed of in the open environment like a drain, open ground, and water bodies.

Treatment/Disposal: The sludge withdrawn from the septic tanks and latrine pits by the cleaners is disposed of in various places. Based on the survey from 2020, it was observed that about 56% of the respondents who use any kind of containment system, informed that faecal sludge (sludge from the septic tank or covered pit latrines) is disposed of in a dug hole covered with soil away from the house. Besides, the sludge disposed into the nearby water bodies is 25%, into the drain is 6%, whereas 13% of sludge is carried away to the Faecal Sludge Treatment Plant (FSTP). There are some planted drying beds followed by composting beds. The survey team found insufficient information about the capacity of the plant. During the visit, it was found that 100% of the faecal sludge delivered to the treatment plant is treated.

Figure 8: Faecal Sludge Treatment Plant, Sirajganj (Source: Feasibility study 2020-21/DPHE).

4.3 Open Defecation:

[6] In the last few years, mechanical vacuum trucks have been provided to several municipal authorities from different government and non-government sources. But municipal authorities have shortage of expert manpower and service delivery mechanism to operate the vehicles. In recent years, the situation is improving. Institutional Regulatory Framework (IRF) and National Action Plan (NAP) have been approved by government. Different service delivery and business models have been developed in few cities. Capacity building program of local government institutions are conducted by governmental institutions and development partners. A significant improvement in Faecal Sludge Management (FSM) will be found within few years.

From HH surveys, KIIs and FGDs, it was found that 100% of citizens use any kind of toilet in the Municipality. Thus, from the sanitation point of view, the town is considered an open defecation-free town.

5 Data and assumptions

The baseline survey conducted in October 2020 contains detailed data on different stages of the sanitation value chain. The SFD matrix is generated from these data, collected during sample household surveys, along with informal interviews, open-ended consultations, key informant interviews and focus group discussions with the municipality officials, town level coordination committee, households, social workers, business persons, pit emptiers and the citizens including women in all the wards of the municipality. The SFD matrix was generated from these data. Finally, data from all these sources were triangulated to produce the SFD matrix, the SFD graphic and the SFD lite report.

The last census was carried out about 10 years ago. So, the actual population, household, and sanitation data are not updated yet. Most of the households with septic tanks do not know the actual type, size, and design desludging periods. Also, a large number of pit users are unaware of the emptying events and frequency of their pit emptying. Due to all these data gaps, some assumptions have been made to produce the SFD graphic. These assumptions were shared with key informants at the municipality and accepted by them.

Following assumptions were made for developing the SFD graphic for Sirajganj municipality:

- ✓ The proportion of FS in septic tanks, fully line tanks, and line, open bottom tanks are considered 89%, 0%, and 100% respectively as per the guidance given in the Frequently Asked Questions (FAQs) in the Sustainable Sanitation Alliance (SuSanA) website.
- ✓ According to the population census in 2011 by the Bangladesh Bureau of Statistics (BBS), the Sirajganj city population was 158,913. The urban population growth in Sirajganj is considered 1.5% per year. Considering the floating population, such as farmers and traders, comes to the city every day, the present (2020) population is estimated to be around 218,307.
- ✓ There are around 11.5 % of twin pit latrines in the containment system. So, it is assumed that all these twin pit containment technologies are defined as lined tanks with impermeable walls and open bottom, no outlet or overflow (system T1A4C10, 11.5%). Based on the household survey, variable F3 for system T1A4C10 is set to 29%.
- ✓ There are around 72.4% of single pit latrines in the containment systems. So, it is assumed that all these single pit containment technologies are defined as lined pits with semi-permeable walls and open bottom, no outlet or overflow (system T1A5C10, 72.4%). Most of the single pit latrines are found to be emptied within 1-2 years. Based on the household survey, variable F3 for system T1A5C10 is set to 89%.
- ✓ 8.2% of septic tanks are connected to soak pits (system T1A2C5). They are well-constructed as per the field visit observation. The risk of groundwater contamination was deemed low, therefore that option was selected in the SFD Matrix. Around 59% of HHs have emptied their septic tank with a soak pit with a desludging frequency of 2-5 years. Based on the household survey, variable F3 for system T1A2C5 is set to 59%.
- ✓ There are 11.9% of septic tanks connected to the open drain, open ground, water bodies and 'don't know where' which are emptied within 2-5 years. Based on the household survey, variable F3 for systems T1A2C6, T1A2C7, T1A2C8 and T1A2C9 is set to 69%.
- ✓ Wastewater in T1A1C6 and supernatant in T1A2C6 are directly discharged into the river or the environment untreated. Therefore, variables W4c, W5c, S4e and S5e are set to 0%.
- ✓ Since 35% of emptied sludge from septic tanks (connected to soak pits) is delivered to the treatment plant, variable F4 is considered to be 35%.
- ✓ Since 36% of emptied sludge from septic tanks (connected to the open drain, open ground, water bodies and ‘don’t know where’) is delivered to the treatment plant, variable F4 is considered to be 36%.

- ✓ Since 36% of emptied sludge from lined tanks with impermeable walls and open bottom, is delivered to the treatment plant, variable F4 is considered to be 36%.
- ✓ Since 9% of emptied sludge from lined pits with semi-permeable walls and open bottom, is delivered to the treatment plant, variable F4 is considered to be 9%.
- ✓ Since 100% of faecal sludge delivered to the treatment plant is treated, variable F5 for all systems is considered to be 100%.

6 List of Sources

Reports, literature and website

- Bangladesh Bureau of Statistics (BBS), 2011.
- Population and Housing Census, 2011.
- Baseline Survey of the project "Feasibility for Implementing of Solid Waste and Faecal Sludge Management System in 53 District Level Municipalities and 8 City Corporations", Department of Public Health Engineering (DPHE), Dhaka, Bangladesh. (December 2020)
- Report on 'Hydrogeological Screening, Slug Test And Geophysical Logging on Observation Well Units' under *Bangladesh Rural Water Supply And Sanitation Project (BRWSSP),* Arsenic Management Division, Department Of Public Health Engineering (DPHE) (March 2017)
- MANAGING MUNICIPAL WASTE: APPLICATION OF SPATIAL TOOLS AND TECHNIQUES Showmitra Kumar Sarkar* and Md. Esraz-Ul-Zannat; Department of Urban and Regional Planning, Khulna University of Engineering & Technology, Bangladesh; Journal of Engineering Science 10(1), 2019, 113-122
- The revised 'National Strategy for Water Supply and Sanitation, 2021'
- 'At a Glance: Sirajganj Municipality', by municipal office
- https://www.gps-latitude-longitude.com/gps-coordinateshttp://bmd.gov.bd/p/Rainfall-Situation-202

Key Informant Interviews (KIIs) from September 2020 to March 2021

- KII with Mayor, Sirajganj Municipality.
- KII with Secretary, Sirajganj Municipality.
- KII with Conservancy Inspector, Sirajganj Municipality.
- KII with Councilor, Sirajganj Municipality.
- Facilitators: Md. Mynul Islam Hemel, Field Coordinator, Tiller.

Figure 9: KIIs with different stakeholders in Sirajganj (Source: *Feasibility study 2020-21/DPHE).*

Focus Group Discussions (FGDs) from September 2020 to March 2021

- FSM Cleaner and Service Provider.
- First Stage Solid Waste Collector.
- Solid Waste Collector.
- Market People.
- Slum Dwellers
- Mason.

Figure 10: Focus Group Discussions in Sirajganj (Source: *Feasibility study 2020-21/DPHE).*

Additional information

- This report was compiled as part of the Baseline Survey of the project, ***"Feasibility for Implementing of Solid Waste and Faecal Sludge Management System in 53 District Level Municipalities and 8 City Corporations", (December 2020).***
- The project was implemented under the supervision of the Department of Public Health Engineering (DPHE). In-depth information and data were collected for the towns which included project documents, master plans and baseline reports from the municipality and national levels, statistical data like population and household income expenditure, GIS data and other geospatial data and satellite images, and open street maps (OSM). The Field Survey of the project was conducted from 01 January 2020 to 24 March 2020 and from 04 July 2020 to 30 November 2020.
- The field survey includes household surveys, key informant interviews, focus group discussions, and physical feature surveys. A central server has been established to monitor FSM and SWM databases under the project. The results of the study are shared with the municipal authority and are considered as a basis for preparing investment projects by the government and development partners, and sustainable plans for operating and maintaining the systems by the municipal authorities.

SFD Promotion Initiative

Sirajganj Municipality, Bangladesh, 2022

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