SFD Lite Report

Lakshmipur Municipality Bangladesh

This SFD Lite Report was prepared by

CWIS-FSM Support Cell, DPHE

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1 The SFD Graphic

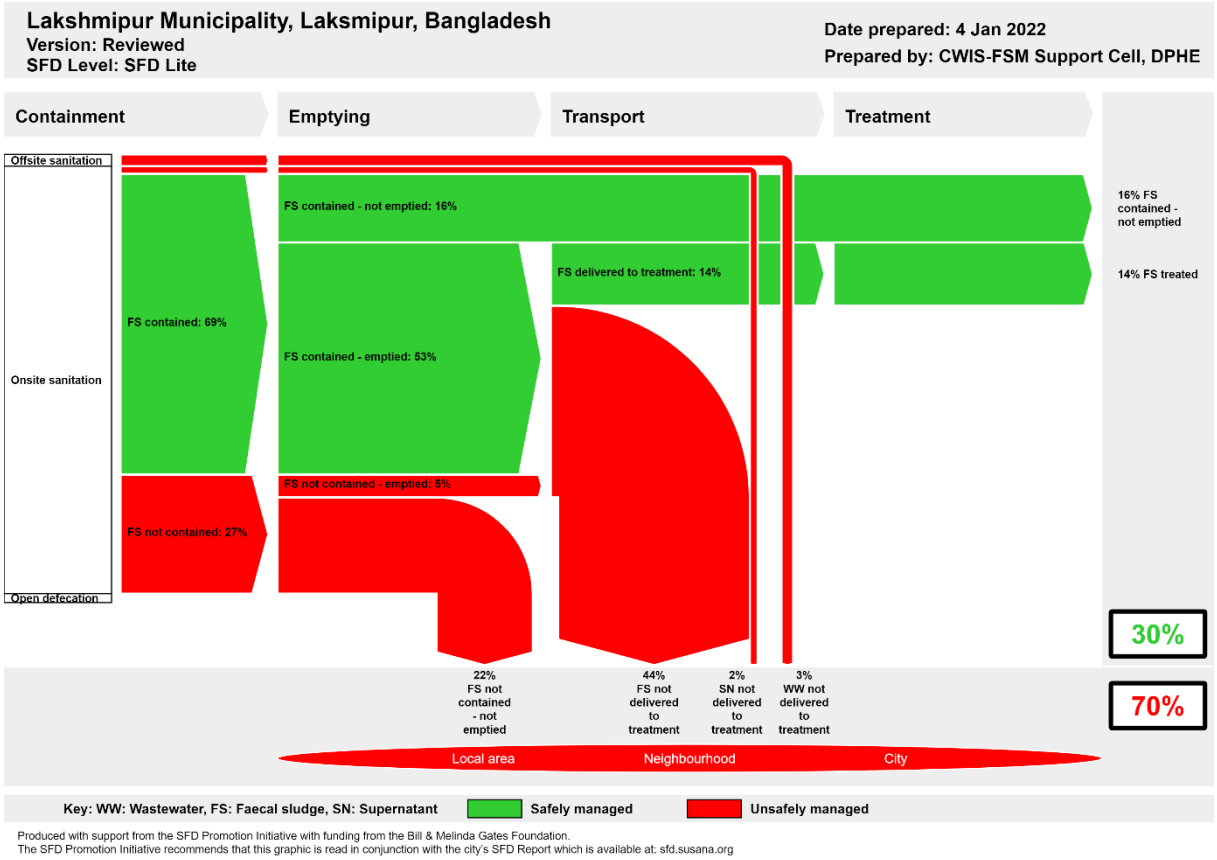

Figure 1: SFD Graphic for Lakshmipur municipality.

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 (December 2020)'*, 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. Alhaj Abu Taher, Mayor, Lakshmipur Municipality, Mr. Alauddin, Secretary, Lakshmipur Municipality; Mr. Md. Abul Bashar, Executive Engineer, Mr. A.K.M. Shams Uddin, Sub-assistant Engineer (Superintendent), Mr. Fayez Ahmed, Conservancy Inspector, Lakshmipur 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. Alhaj Abu Taher, Mayor, Lakshmipur 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 Lakshmipur 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

Lakshmipur was originally a sub-division of Lakshmipur district and the municipality was established in 1976. The town stands on the bank of the Rahmatkhali and is located 137 km south-east of Dhaka (Figure 2). The city is sub divided into 12 wards and 22 mahallas. Lakshmipur is one of the 53 district-level municipalities in the country.

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

Population parameters	
Estimated population, 2021	146,525
Households, 2021	30,654
Area, sq.km	27
Total roads, km	156.32
Total drains, km	64.45

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

According to the population census in 2011 by the Bangladesh Bureau of Statistics (BBS), the Lakshmipur city population was 115,793. The urban population growth in Lakshmipur is considered 2.65% 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 146,525. The density of population is 3,874 per km².

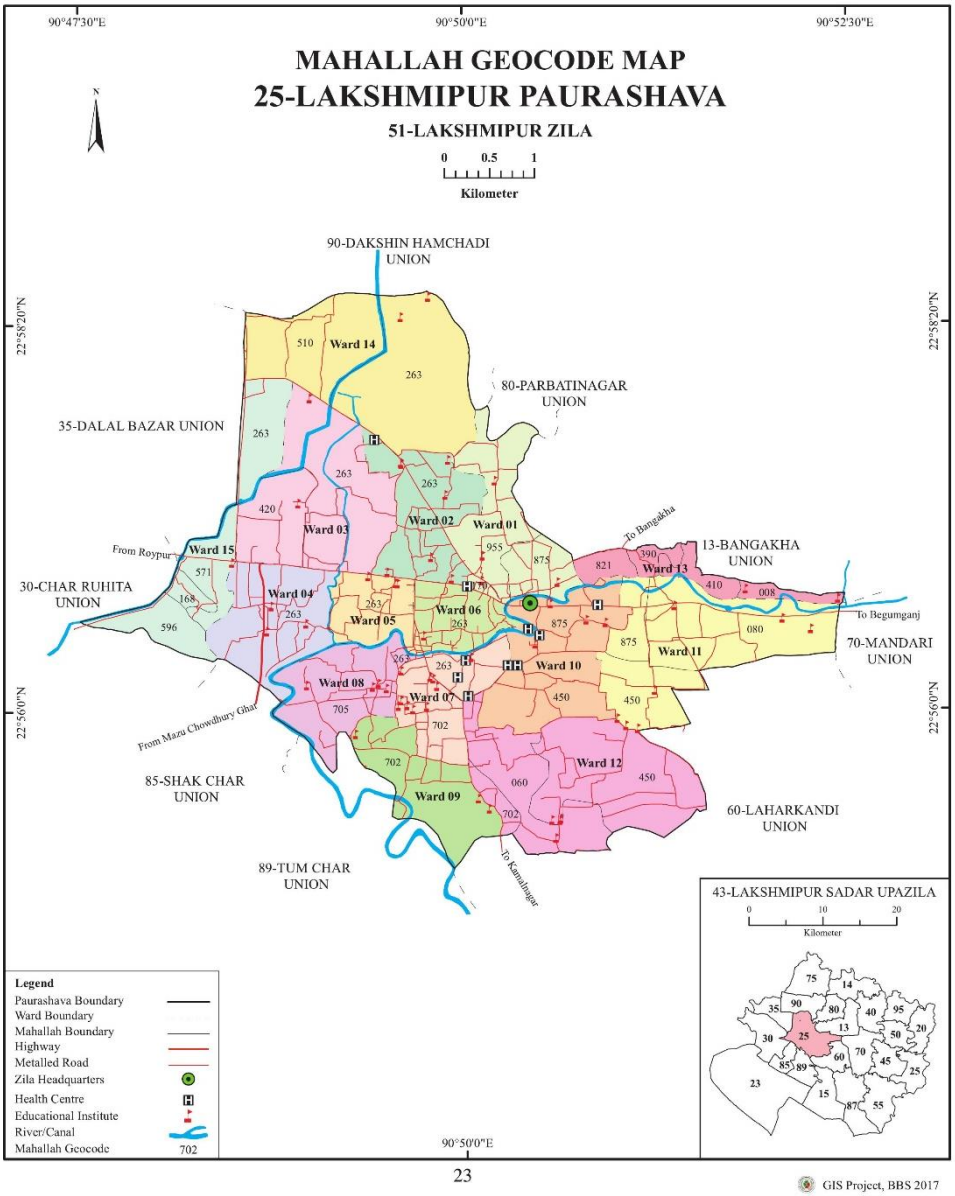

Figure 3 : Lakshmipur Municipality ward boundary map (BBS/ GIS report 2017).

The municipality covers an area of 27 square kilometres. At present Lakshmipur municipality has 156.32 km of road out of which 84.35 km is bituminous road, 10.68 km is Cement Concrete (CC) road, 4.98 km is Herring-Bone-Bond (HBB) road, 17.50 km is brick flat soling road and 38.82 km is earthen road. The municipality has about 64.45 km of drain which includes 8.5 km of brick drain, 12.5 km of Reinforced Cement Concrete drain, 28.45 km of earthen drain and 15 km of natural drain[1] (Source: KII with the Secretary, Lakshmipur Municipality).

The geographical coordinates of Lakshmipur are 22°56′39″ N and 90°49′48″ E[2]. In the context of Bangladesh, the municipality area is undulated but flat. The elevation of the land varies from 1.32 – 5.39

[1] *Source: 'At a Glance: Lakshmipur Municipality', by municipal office*

[2] *Source: https://www.gps-latitude-longitude.com/gps-coordinates*

m (Public Works Datum, PWD). Mainly the centre part of the municipality is high land and the rest of the area is medium to low land.

According to the Bangladesh Meteorological Department (1981-2017)[3], the municipality area and the surrounding area have 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 (BMD) is located in Maijdee Court, Noakhali. 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 30.4-32.3°C between May-August, with the minimum temperatures found to be between 12-13.5°C in January. The annual average rainfall is about 3,155 mm, according to BMD (1981-2017).

The Meghna River passed by the south-western corner (outside) of the municipality. Coralia Khal flows through the municipality. The drainage system of the town is inadequate[4]. According to the flood zoning map of Bangladesh, the municipality is in a flood-free zone (in the last 12 years no flooding event happened) However, the drainage network of the city is not adequate. 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 centre of the municipality, with more than 7,000 per sq km. The population density in the South and south-eastern is lower, with less than 2,000 per sq km[5].

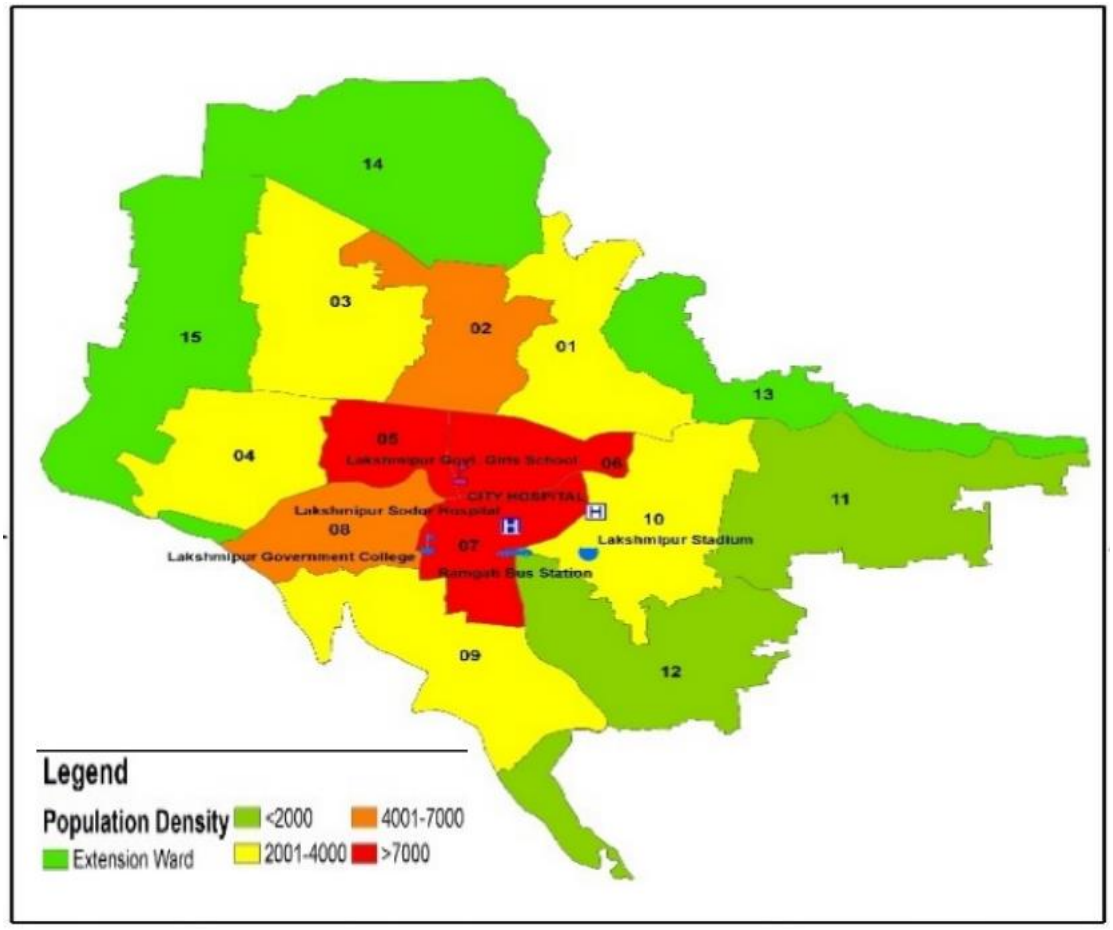

Figure 4: Population density in different Wards of Lakshmipur Municipality(BBS/ GIS report 2017).

[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

Lakshmipur Municipality, Laksmipur, Bangladesh, 4 Jan 2022. SFD Level: SFD Lite
Population: 146525
Proportion of tanks: septic tanks: 83%, 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	2.7	0.0	0.0					
T1A2C5 Septic tank connected to soak pit	2.5			46.0	67.0	100.0		
T1A2C6 Septic tank connected to open drain or storm sewer	10.3			23.0	56.0	100.0	0.0	0.0
T1A2C7 Septic tank connected to open water body	11.6			23.0	56.0	100.0		
T1A2C8 Septic tank connected to open ground	4.1			23.0	56.0	100.0		
T1A2C9 Septic tank connected to 'don't know where'	1.2			23.0	56.0	100.0		
T1A4C10 Lined tank with impermeable walls and open bottom, no outlet or overflow	15.5			19.0	53.0	100.0		
T1A5C10 Lined pit with semi-permeable walls and open bottom, no outlet or overflow	50.5			97.0	19.0	100.0		
T1B10 C7 TO C9 Containment (septic tanks, fully lined tanks, partially lined tanks and pits, and unlined pits) failed, damaged, collapsed or flooded - connected to water bodies, or open ground or 'don't know where'	1.7			0.0	0.0	0.0		

Table 1: SFD Matrix for Lakshmipur municipality.

The outcome of the SFD graphic shows that only thirty percent (30%) of the excreta flow is classified as safely managed, and the remaining seventy (70%) percent is classified as unsafely managed (Figure 1). The unsafely managed excreta originate from wastewater not delivered to treatment (3%), Faecal Sludge (FS) emptied but not delivered to treatment (44%), FS not contained - not emptied (22%) and 2% of supernatant not delivered to treatment. The safely managed excreta originate from Faecal Sludge (FS) contained - not emptied (16%) and FS treated in treatment plant (14%).

The percentages presented in Table 2 and discussed in the next section are based on data collected through household (HH) surveys, Key Informant Interviews (KIIs) and Focus Group Discussions (FGDs) (Figure 5, Figure 8 and Figure 9).

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 2.7% of the total population of the city to generate the SFD graphic. Similarly, the T1A2C6 system is considered 10.3% 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 (97.87%) 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 (1.74%) and neighbour's toilets (0.39%). From a household survey, it was found that 29.59% of the city population uses septic tanks as the containment system, 50.5 % of the toilets have single pit systems, and 15.5% of people use double pits in the city. About 2.7% 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: 2.5% of the population uses septic tanks connected to soak pits (T1A2C5), 10.3% of the population uses septic tanks connected to open drain (T1A2C6), 11.6% of the population uses septic tanks connected to water bodies (T1A2C7), 4.1% of the population uses septic tanks connected to open ground (T1A2C8), 1.2% of the population uses septic tanks connected to 'don't know where' (T1A2C9), 15.5% of the population uses lined tanks with impermeable walls and open bottom, no outlet or overflow (T1A4C10), 50.5 % of the population relies on the lined pit with semi-permeable walls and open bottom, no outlet or overflow (T1A5C10) and 1.7% of the population use containments (septic tanks, fully lined tanks, partially lined tanks and pits, and unlined pits) that have failed, damaged, collapsed or flooded which are connected to water bodies, or open ground or 'don't know where' (T1B10 C7 TO C9) (KII, FGDs, HH survey, 2020). Thus, at the containment stage, the city's excreta of 68.5% of the population are contained. Figure 6 shows pictures of these technologies in use.

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

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. More than a quarter of the households are supplied with piped water (34%), nearly a quarter of the households use their own tube well (24%), 20% use their own tube well with motor and 22% use other water sources.

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.

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.

However, about 46% of the septic tanks, connected to the soak pit are emptied within 2-5 years. About 23% of the septic tanks connected to open drains, open ground, water bodies or 'don't know where' are emptied within 4-5 years. Almost 19% of double pit latrines and 97% 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 pit is mostly (78.57%) done by private sweepers. Only in a few households desludging is done by municipal sweepers (18.37%) and family members (3.06%). Around 73 % of this withdrawal is done manually using a bucket and rope. About 12% use electric pumps and 14% use mechanical vacuum trucks 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. The municipal authority has three Vacutug, a mechanical sludge emptying and a transportation tanker. There are three mechanical Vacuum trucks available for desludging but presently one vacuum truck is providing the service.

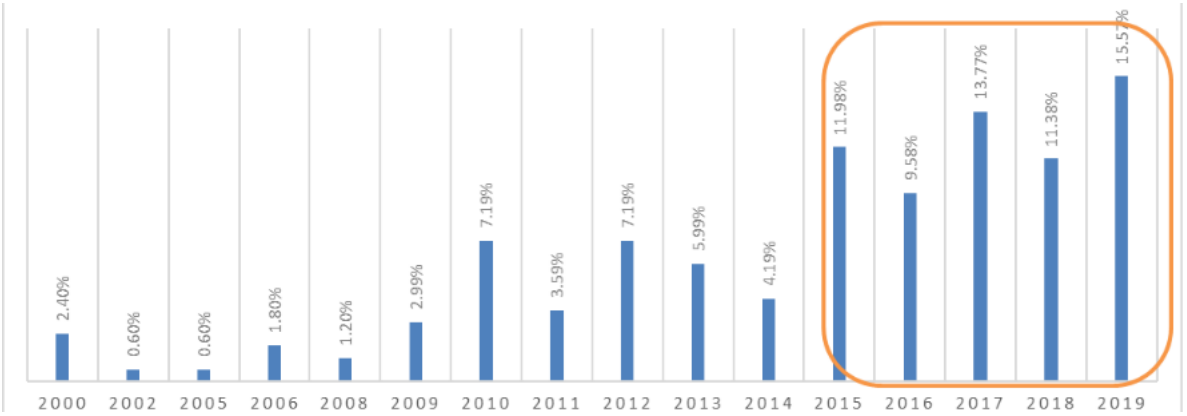

Figure 7: Year of septic tanks construction (Source: *Feasibility study 2020-21/DPHE).*

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 46% of the septic tanks, connected to the soak pit are emptied, out of which 67% is FS delivered to the treatment plant. Similarly, 23% of the septic tanks, connected to open drains, open ground, water bodies or 'don't know where' are emptied, out of which 56% is FS delivered to the treatment plant. In the case of the lined tank with impermeable walls and open bottom, no outlet or overflow, 19% are emptied, out of which 53% is FS delivered to the treatment plant. Similarly for the lined pit with semi-impermeable walls and open bottom, no outlet or overflow, 97% are emptied, out of which 19% is FS delivered to the treatment plant. In a summary, considering all types of containments, from the 53% of FS contained and emptied, only 26% is FS delivered to the treatment plant. Except for the FS delivered to the treatment plant, 58% of the respondents informed that faecal sludge (sludge from the septic tanks or covered pit latrines) is disposed of in a dug hole covered with soil away from the house and 14% is disposed of in the open environment like a drain, open ground, and water bodies.

Treatment/Disposal: Presently, there is a faecal sludge treatment plant in the town. There are some planted drying beds followed by wastewater treatment facilities. 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[6].

4.3 Open Defecation:

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.

[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.

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.

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

- ✓ The proportion of FS in septic tanks, fully line tanks, and line, open bottom tanks are considered 83%, 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 Lakshmipur city population was 115,793. The urban population growth in Lakshmipur is considered 2.65% 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 146,525.
- ✓ There are around 15.5 % 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, 15.5%). Based on the household survey, variable F3 for system T1A4C10 is set to 19%.
- ✓ There are around 50.5% 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, 50.5%). 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 was set to 97%.
- ✓ 2.5% 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.
- ✓ 1.7% of the population use containments (septic tanks, fully lined tanks, partially lined tanks and pits, and unlined pits) that have failed, damaged, collapsed or flooded which are connected to water bodies, or open ground or 'don't know where' (T1B10 C7 TO C9). These systems are never emptied (variable F3 set to 0% and hence, variables F4 and F5 are also both set to 0%).
- ✓ Around 46% of HHs have emptied their septic tank with a soak pit with a desludging frequency of 2-5 years. Thus, variable F3 for system T1A2C5 is set to 46%.
- ✓ There are 23% of septic tanks connected to the open drain, open ground and water bodies. which are emptied within 2-5 years. Thus, variable F3 for systems T1A2C6, T1A2C7, T1A2C8 and T1A2C9 is set to 23%.
- ✓ Wastewater in T1A1C6 and supernatant in T1A2C6 are directly discharged into the river or the environment untreated. Therefore, variables W4c, W5c, S4e and S5e were set to 0%.
- ✓ Since 67% of emptied sludge from septic tanks (connected to soak pits) is delivered to the treatment plant, variable F4 is considered to be 67%.

- ✓ Since 56% 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 56%.
- ✓ Since 53% of emptied sludge from lined tanks with impermeable walls and open bottom, is delivered to the treatment plant, variable F4 is considered to be 53%.
- ✓ Since 19% of emptied sludge from lined pits with semi-permeable walls and open bottom, is disposed to the treatment plant, variable F4 is considered to be 19%.
- ✓ 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: Lakshmipur Municipality', by municipal office
- https://www.gps-latitude-longitude.com/gps-coordinateshttp://bmd.gov.bd/p/Rainfall-Situation-202

Key Informant Interviews (KIIs) from July 2020 to November 2020

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

Figure 8: KIIs with different stakeholders in Lakshmipur (Source: *Feasibility study 2020-21/DPHE).*

Focus Group Discussions (FGDs) from July 2020 to November 2020

- FSM Cleaner and Service Provider.
- Solid Waste Collector.
- First Stage Solid Waste Collector.
- School representatives.
- Slum Dwellers.
- Mason.


Figure 9: Focus Group Discussions in Lakshmipur (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.

Lakshmipur Municipality, Bangladesh, 2022

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