SFD Report

Bhola Municipality
Bangladesh

Final Report

This SFD Report - Intermediate - was prepared by
UPM Umwelt-Projekt-Management GmbH.

Date of production: 25/03/2020
Last update: 11/05/2020

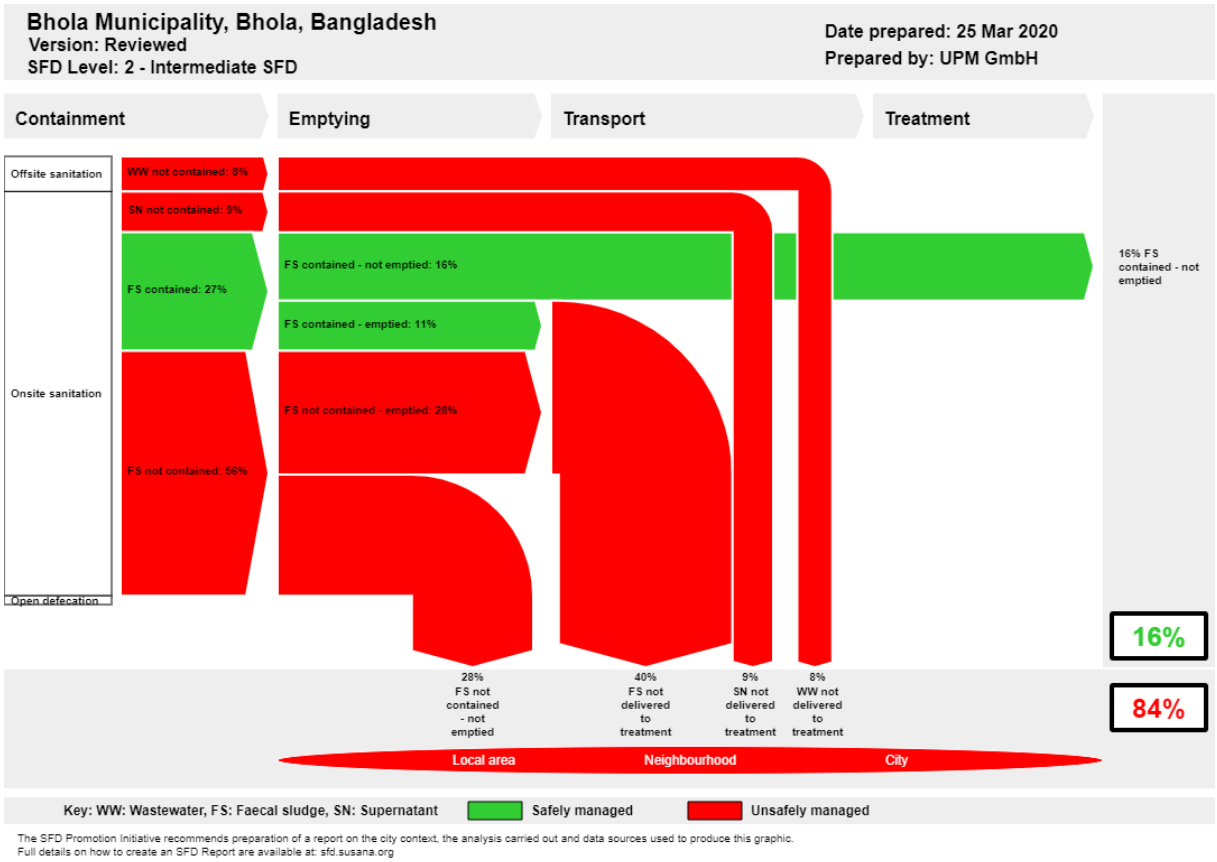
SFD Report Bhola Municipality, Bangladesh, 2020

Produced by: UPM GmbH

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:

Intermediate. Level 2 report.

Produced by: UPM Umwelt-Projekt-Management GmbH (UPM)

UPM is very grateful to all partners & consultants working on the "Development of a Regional Integrated Waste Management Facility in Bhola" under the CTEIP project, who have helped to collect the information used for this report. We also would like to thank all stakeholders for kindly providing their time and information for this work.

Status:

Final SFD report.

Date of production: 25/03/2020

3. General city information

Bhola is one of the administrative districts (Zila) located in south-central Bangladesh with a total area of 3,404km^2 and a population of 1.8 million inhabitants. Part of the district is Bhola island which, despite being the largest island of Bangladesh, only can be accessed by boat at this point. This island of 1,441km^2 is divided into seven Upazila (sub-districts). One of these Upazila is Bhola Sadar, located at the northern end of the island. With an estimated population of 53,775 inhabitants for the year 2020, based on an urban growth rate of 0.54% (BBS, 2013), Bhola Sadar is classified as a municipality called Paurashava in Bangladesh (BBS, 2013). The Paurashava is densely populated with 4,140 inhabitants per km^2. The island of Bhola can be described as levelled, with an average elevation of 2-3m above sea level it is frequently flooded and affected by sever cyclones common for the region (Murshed et al., 2015). Bhola island is very vulnerable to sea level rising and erosion. Housing in the Paurashava includes multi-story apartment houses (multi-pucca = 3%) and single-family houses of lower (kutcha = 48%) and higher qualities called Puccas (5%) and Semi-Puccas (43%).

4. Service outcomes

The Paurashava Bhola Sadar completely relies on onsite sanitation, mainly septic tanks (51%) and pits (41%), locally also called sum pits. Some residential buildings (5%) report to have both options available. In total, 27% of buildings use flush toilets and 73% use pour flush toilets. 82% of non-residential units, such as public buildings and businesses, have septic tanks available. 15% report to have no toilet infrastructure at all and hence use neighbouring facilities or the toilet at home.

Seven public toilets were identified in Bhola Paurashava, of which five are currently operating and on average receive 375 users per toilet per day (UPM Survey, 2019). All public toilets are connected to the septic tanks.

Bangladesh is declared as an open defecation free country (World Bank, 2020) and BRAC NGO reports that in 2016, there were 42 households without a toilet, yet through their engagement program this gap could be fully closed (Stakeholder 2, 2020). Field visits of UPM (2019 and 2020) observed toilets directly discharging in the various canals, called Khals, of Bhola.

Emptying of latrines and septic tanks is provided by the so-called sweepers, who mainly are members of the marginalized Harijan community of Bangladesh. Emptying is mostly done manually (70%) or with pumps (30%). Overall, 49% of containments in Bhola are reported to be emptied. Latrines are more frequently emptied since 64% of them have been emptied at least once. In contrast, only 46% of the septic tanks have been emptied so far (UPM Survey, 2019). Furthermore, offset-latrines with double-pits get promoted by BRAC NGO and a loan is provided by households that want to construct these. Double-pits usually do not get emptied since only one pit is in use while the second one is closed so that the content can infiltrate to the ground.

At this point there is no faecal sludge treatment in Bhola Paurashava and island. Hence emptied faecal sludge from all type of containments is not safely managed. As a common practice, in 58% of the emptying cases the sludge gets discharged into open drains or Khals/ canals, 40% bury the FS in an earthhole, sometimes close by the containment (Stakeholder 1, 2020) and cover it with ash and soil. The groundwater pollution risk in Bhola Sadar is low, as the aquifer is reported to be located in a depth of 300m (Wetlands International, 2019) and the majority of households are connected either to the water grid provided by the city or they use deep-tube wells (UPM Survey, 2019). However, it is worrisome that the Master Plan of Bhola Paurashava reports that even though households have access to water from deep-tube wells, they still use surface water for drinking purposes (Bhola Paurashava Draft, (2018). Statistics are not provided on this, however. Besides the Khals, there are about 2,175 small size ponds and ditches in Bhola (Bhola Paurashava, 2018).

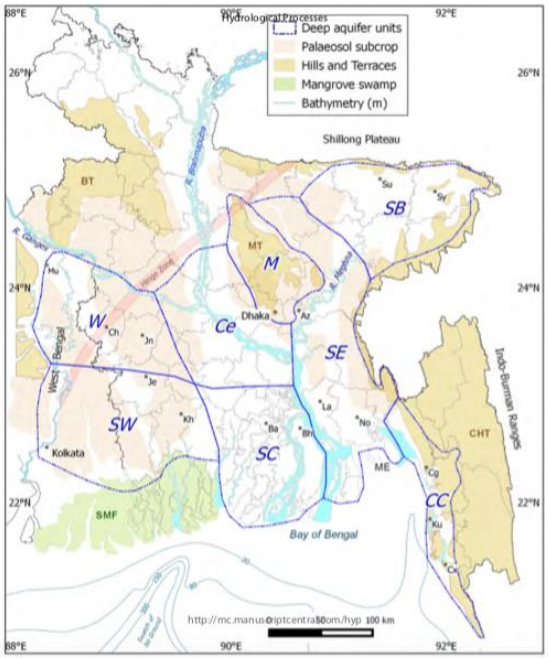


Figure 1: Indication of aquifer units and ground conditions in the Bay of Bengal, Bangladesh (Source: Ravenscroft et al 2018).

5. Service delivery context

In the last three decades large efforts have been made to reduce the open defecation (OD) rate from 34% in 1990, to 1% in 2018, leading to the declaration of Bangladesh as an OD free country (World Bank, 2020). Due to the Bangladesh Environment Conservation Act 1995 (Amendment 2010), management of sludge has become mandatory. In 2015, the Department of Environment (DoE) of the Ministry of Environment and Forests, together with the German Agency for International Cooperation (GIZ) developed the Bangladesh Standards and Guidelines for Sludge Management (GoB, 2015a). These however do not include onsite sanitation and only focus on offsite sanitation. At the same time, besides four major cities, Bangladesh is completely relying on onsite sanitation. The coverage of improved sanitation marks only 61% as the country is

challenged by its an annual national urbanization rate of 3,2% (World Bank, 2020).

Nonetheless, political efforts for facilitating faecal sludge management (FSM) become more present. For instance, the 2014 National Strategy for Water Supply and Sanitation (NSWSS), which is part of the overall Sector Development Plan 2011-25, includes FSM as a sub-strategy needed to achieve the main objectives of the plan. Framework, direction, institutional arrangement and an implementation plan are given, yet the NSWSS lacks a concept for funding of these activities (UPM, 2019).

With the Framework for Faecal Sludge Management (IRF-FSM) of 2017 a second step has been taken towards clearly addressing the need for FSM on all levels from rural areas to large cities. In coherence with the 2009 Local Government Act (amended in 2010), overseeing and developing FSM in line with other water and sanitation services is mandated to the local government, through the Ministry of Local Government, Rural Development and Cooperatives (MLGRDC). The MLGRDC is encouraged to set up a unit dedicated to FSM and to collaborate with the Local Government Engineering Department (LGED), Department of Public Health Engineering (DPHE), as well as the private sector and NGOs (GoB, 2017a).

6. Overview of stakeholders

As mentioned above, the Ministry of Local Government, Rural Development and Cooperatives is in charge of developing and overseeing sanitation services. However, funding to implement sanitation services and FSM is limited in many municipalities. Bhola targets to invest 5% of its annual budget each on the empowerment of women and marginalized groups yet struggles to meet this target (Stakeholder 3, 2020).

The LGED as well as the DPHE are major governmental stakeholders participating in the Coastal Towns Environmental Infrastructure Project (CTEIP), a project which aims to strengthen climate resilience and disaster preparedness. CTEIP is financed by loans and grants, in particular from the ADB and the Bill and Melinda Gates Foundation Integrated solid waste management including FSM structures are part of the CTEIP.

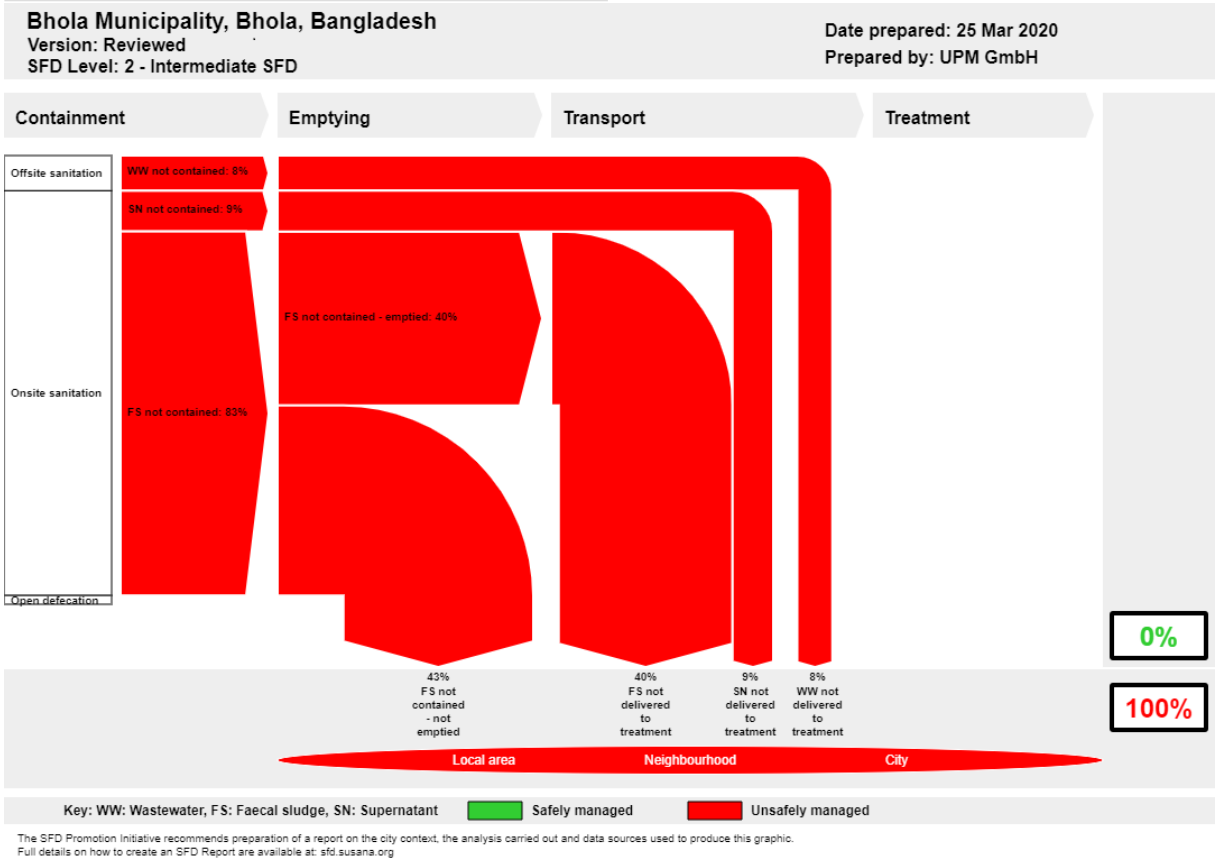
Furthermore, there are nine private manufacturers of materials for sanitation facilities (rings, slabs, siphons) as this has become a lucrative market in Bhola (Stakeholder 8, 2020). NGOs such as BRAC and the Development Organization of the Rural Poor (DORP) actively work on sanitation issues: on the one hand the provision of sanitation facilities and materials, and on the other hand on advocacy matters collaborating with the local government as well as citizen committees (Stakeholder 3, 2020).

Despite the institutional focus on local government in this regard, the national government is reported to be in charge for sanitation programming (WSUP, 2018).

Table 1: Key Sanitation/Solid Waste Management Stakeholders in Bhola (Source: UPM 2020).

Key Stakeholders	Institutions / Organizations /
Public Institutions	Bhola Paurashava, Ministry of Local Government, Rural Development and Cooperatives (MLGRDC), Local Government Engineering Department (LGED), Department of Public Health Engineering (DPHE)
Non-governmental Organizations	BRAC, DORP, Bhola Citizen Council
Private Sector	sweepers, (mason) toilet manufacturers
Development Partners, Donors	ADB, BMGF

7. Context-adapted SFD Graphic



8. Description of context-adapted SFD graphic

The context-adapted SFD graphic does not significantly vary in the data input given. The main difference is the classification of a high groundwater pollution risk, leading to a result of 100% of the faecal sludge as unsafely managed.

Given that the aquifer in Bhola island is located in a depth of about 300m (Wetlands International, 2019), there is no direct risk for a groundwater pollution. The context-adapted SFD graphic is included to address the public and environmental health hazards caused by pollution in the various canals and open drains as well as the over two thousand small ponds and water bodies in Bhola. These are used for household water purposes such as washing and the Master Plan for Bhola municipality (draft 2018) even states that surface water in Bhola is being used for drinking water purposes. The survey by UPM (2019), in contrast has shown that households either have access to private deep-tube wells or are connected to the municipal water supply network.

9. Process of SFD development

The data for this SFD graphic have been collected in several steps from 2019 to 2020. UPM is part of the Coastal Towns Environmental Infrastructure Project (CTEIP) which is implemented in eight vulnerable towns in Bangladesh and aims, amongst other things, to develop an integrated solid waste management system for Bhola, including faecal sludge management. As part of this, UPM in collaboration with its local partners, conducted a survey on water and sanitation for households and non-residential buildings in 2019 (n=96). Various stakeholder meetings were held in 2019, including municipality departments, NGOs, technical experts as well as community members. Moreover, sweepers working in cleaning and sanitation services were consulted. These data then were collected into a project inception report which additionally includes a literature study and a synthesis of the enabling political environment. This inception report is used as the base for data material and the context description for this SFD graphic. Sources drawn from the report are marked (as UPM 2019) and observations or field visits during this time are indicated with the year

2019. In a second step the main author of this report, who was not part of the initial data collection team, visited Bhola for three days in March 2020 in order to get a personal understanding of the context and follow up with some stakeholders to close data gaps.

10. Credibility of data

As described above, the data for this SFD graphic have been collected by UPM team members as part of the CTEIP project which stands in high interests of the Bhola Paurashava, especially the DPHE department, which has been consulted several times. Therefore, the overall credibility of the data collected is evaluated as high.

The level of stakeholder consultation and information collected are appropriate for an Intermediate Level SFD graphic. The household survey of 100 participants gives very useful insights to the access to water and sanitation services in Bhola, as well options for emptying of containment. The results of this survey as well as data collected from the literature review were cross-checked with various key stakeholders in Bhola and additional field observations. During the 3-day field visit in 2020 the author interrogated a stakeholder from the municipality as well as from NGOs and a private household on this.

Moreover, the author of the SFD graphic did not again consult the same officers of the Bhola municipality (Paurashava) who had been part of previous interrogations already, in order to not overload them with questions and surveys which bears the risk of creating a negative impact on the success and working relation of the CTEIP project.

11. List of data sources

Abbreviated list of data sources:

- Bhola Sadar Paurashava (2018). Draft Masterplan Report 2018-2038. Preparation of Master Plan for Bhola Paurashava, Bhola District. Submitted by Troyee associates, Dhaka.
- Government of the People's Republic of Bangladesh (2013). Economic Census. Bangladesh Bureau of Statistics. Available from: http://bbs.dhaka.gov.bd/
- Government of the People's Republic of Bangladesh (2015a). Bangladesh Standards and Guidelines for Sludge Management. Ministry of Environment and Forests Department of Environment. Available from: http://bsa.com.bd/ [last accessed 22.03.2020].
- Government of the People's Republic of Bangladesh (2017a). Institutional and Regulatory Framework for Fecal Sludge Management (FSM) in Bangladesh. Ministry of Local Government, Rural Development and Cooperatives. Local Government Division.
- Murshed, M. A., Islam, M., and Hossain, M. (2015). 'Assessment of Coastal Vulnerability Due to Sea Level Change at Bhola Island, Bangladesh: Using Geospatial Techniques'. Journal of the Indian Society of Remote Sensing.
- UPM (2019) Survey on WASH and FSM Services in Bhola for households and non-residential buildings.
- UPM Umwelt-Projekt-Management GmbH (2019). Technical Assistance Consultant's Inception Report. For: Government of Bangladesh. Development of a Regional Integrated Waste Management Facility in Bhola. Bangladesh (Internal Document).
- Water and Sanitation for the Urban Poor 2018. The Urban Sanitation Research Initiative is a 2017–2020. Driving sector change in urban sanitation. Available from: https://www.wsup.com/content/ [last accessed 22.03.2020].
- Wetlands International (2019). Securing Wetlands for Sustainable WASH: A dialogue on Bhola Island, Bangladesh. Available from: https://south-asia.wetlands.org/blog/ [last accessed 22.03.202].
- World Bank 2020. People practicing open defecation (% of population). Available from: https://data.worldbank.org/indicator/ [last accessed 22.03.2020].

Stakeholders:

- Stakeholder 1, 2, 3 and 8, (2020). For a full description of the stakeholder engagement and responsibilities, please refer to the Appendix 1 and 2 from the main report.

SFD Bhola, Bangladesh, 2020

Produced by:

UPM GmbH

This Executive Summary and the SFD Report are available from: www.sfd.susana.org

Table of Content

List of tables

List of figures

Abbreviations

ADB	Asian Development Bank
BAU	Bangladesh Agricultural University
BMGF	Bill and Melinda Gates Foundation
BSERT	Bureau of Socioeconomic Research and Training
CSES	Centre for Sustainable Environmental Sanitation
CTEIP	Coastal Towns Environmental Infrastructure Project
CETPs	Central Effluent Treatment Plants
DoE	Department of Environment
DORP	Development Organization for the Rural Poor
DPHE	Department of Public Health Engineering
FSM	Faecal Sludge Management
GIZ	The German Agency for International Cooperation
GoB	Government of Bangladesh
IRF	Integrated Regulatory Framework
LGED	Local Government Engineering Department
MLGRDC	Ministry of Local Government, Rural Development and Cooperatives
NBCB	National Building Code of Bangladesh
NGO	Non-Governmental Organizations
NWSS	National Water and Sanitation Strategy
NPSWSS	National Policy for Safe Water and Sanitation
OD	Open Defecation
PSU	Policy Support Unit
SDP	SDP Sector Development Plan
SDG	Sustainable Development Goal
SFD	Shit Flow Diagram
UPM	UPM Umwelt-Projekt-Management GmbH
USD	US Dollar
USTB	University of Science and Technology Beijing
WASAs	Water Supply and Sewage Authorities
WASH	Water Sanitation and Hygiene
WSUP	Water and Sanitation for the Urban Poor

1 City context

Bangladesh, located in South Asia is covering an area with 147,500 km^2 and is the ranking number 10 of the most densely populated countries in the world with a total population of 163 million and a population density of 1,253 inhabitants per km^2 (UN , 2019). About 37% of Bangladesh's population live in urban areas, with the average annual urban population growth rate of 3.5% (UN , 2019). With an absolute number of over 42 million people, Bangladesh has one of the largest urban population (WSUP, 2018, p.10).

Bhola is one of the administrative districts (Zila) located in south-central Bangladesh with a total area of 3,404km^2, populated by 1.8 million inhabitants and a density of 600 inhabitants per km^2, according to the last census in 2011 (BBS, 2013). Bhola district is located in a river delta and also includes Bhola Island which has an area of 1,441km^2. Despite being the largest island in Bangladesh, Bhola only be can accessed by boat due to the lack of bridge and road connection to the mainland at this point. The economy of Bhola is mainly agricultural with 64% of holdings. The main sources of household incomes are based on fishery, livestock and agricultural production (BBS, 2013).

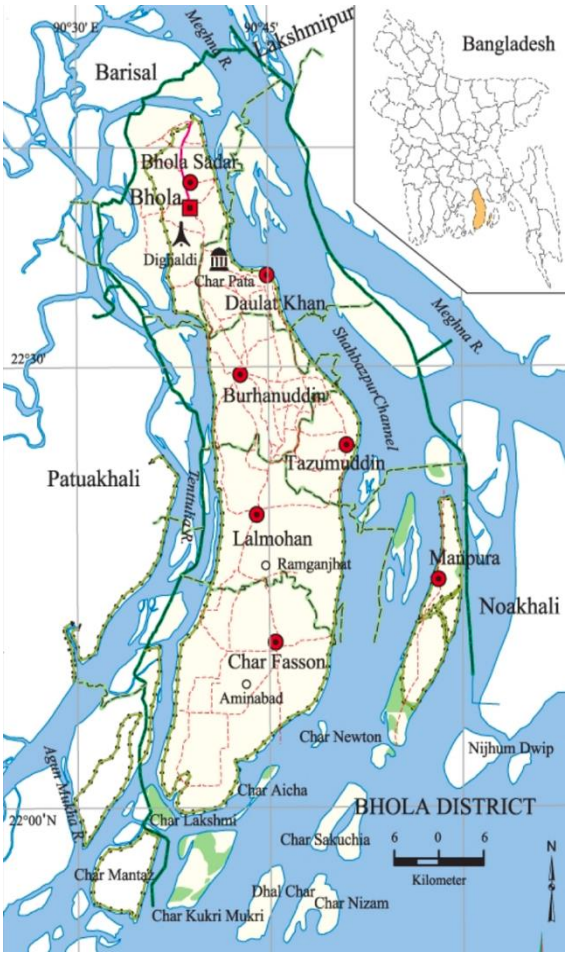


Figure 1: Map of Bhola district

(Source: Banglapedia.org 2020).

Bhola island lies in the physiographical region of the Young Meghna Estuarine Floodplain, an area that is almost levelled (Imamul Huq and Uddin, 2013). The elongated arc-shaped of the island, curved from north to south, is approximately 90 km long and about 13 km wide in the north, 9 km wide in the middle and 20km wide in the south (Kamrul Ahsan, 2013). With an average elevation of 2 – 3m above sea level, Bhola is flooded frequently due to spring tides or tidal surges during the frequent and sever cyclones common for the region (Murshed et al., 2015). Additionally, Bhola island is very vulnerable to sea level rising and erosion: Around 51% of the area of Bhola Sadar Upazila is reported to be under great threat of flooding (Murshed et al., 2015) and the average estimated erosion rate of Bhola Island is 3.85km^2/year (Islam, 2017).

Bhola Sadar is one out of seven Upazila (sub-districts) on the island, which is also classified as Paurashava (municipality) under the Paurashava Ordinance, 1977 and administered by local government (BBS, 2013).

Bhola Sadar has a total estimated population of 53,775 for the year of 2020; this estimation is based on a historical urban growth rate of 1.5% for Bhola (BBS, 2013). There are 4,140 inhabitants per km^2 in an area of 12.7km^2 resulting in a high population density (BBS, 2012).

The climate in Bhola is tropical, with hot humid summers and mild winters: The maximum temperature is 33.9°C and the lowest is 11.5°C (BBS, 2013). The average annual rainfall between the years of 2008-2011 was of 1,623 mm and generally rainfalls peak between May and September. Cyclone seasons in the Bay of Bengal mainly occur pre- and post-monsoon season, which is namely between April-May and October-November.

2 Service Outcomes

2.1 Overview

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		T1A1C7			Not Applicable
Septic tank					Significant risk of GW pollution T1A2C5	T1A2C8			T1A2C9	
Fully lined tank (sealed)					Significant risk of GW pollution Low risk of GW pollution					
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	T1A4C6				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 T1A5C10
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									Not Applicable

Figure 2: Selection grid.

Figure 2 shows the SFD selection grid for the city. The data used for the SFD matrix are exclusively taken from the survey conducted by UPM with 65 households/ residential buildings and 31 non-residential buildings (n=96). With a confidence level of 90% and with a marginal error of +/- 8.4 %, the dataset gives good and relevant insights into the situation in Bhola (Appendix 3). Results of the UPM survey are considered trustworthy and participants from five different types of housing have been interrogated in ratio to their actual distribution in Bhola. These are so called Jhuprie (1%) which is shacks made from branches, bags, tarpaulin, jute, or other materials and Kutchas (ca 48%) made of earth, bamboo, wood and corrugated iron latter. Both are common in Bhola and can be considered as low-quality housing. There are Semi-Puccas (43%) which are middle-quality one- or two-family units; Puccas (5%) which are higher quality one-family units; and Multi-Puccas (3%) which are multi-story units. Since the population number is based on the estimations of the census from 2011, deviations to the actual population and its distribution in 2020 are possible.

Furthermore, a variety of non-residential buildings owners/users was interviewed: governmental institutions including police stations, the public hospital and a medical station,

four schools as well as business such as restaurants, hotels, a bakery and two slaughterhouses.

2.2 SFD Matrix

Bhola Municipality, Bhola, Bangladesh, 25 Mar 2020. SFD Level: 2 - Intermediate SFD
Population: 53755
Proportion of tanks: septic tanks: 77%, fully lined tanks: 100%, lined, open bottom tanks: 78%

System label	Pop	F3	F4	F5	S4e	S5e
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	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
T1A1C7 Toilet discharges directly to water body	8.0					
T1A2C5 Septic tank connected to soak pit	4.0	50.0	0.0	0.0		
T1A2C6 Septic tank connected to open drain or storm sewer	23.0	35.0	0.0	0.0	0.0	0.0
T1A2C9 Septic tank connected to 'don't know where'	24.0	52.0	0.0	0.0		
T1A4C6 Lined tank with impermeable walls and open bottom, connected to an open drain or storm sewer	18.0	88.0	0.0	0.0	0.0	0.0
T1A5C10 Lined pit with semi-permeable walls and open bottom, no outlet or overflow	23.0	55.0	0.0	0.0		

Figure 3: SFD matrix.

The UPM survey of 2019 investigated topics related to the user-interface, collection/ containment and the output of effluents (i.e. if the respondents would know where the effluents would discharge to and/ or where they would be disposed when emptied from the containment). All these answers were organized accordingly to the housing groups mentioned above. Moreover, it was also questioned about the frequency and of emptying and the procedure manual vs. Mechanical (Appendixes 4 and 5). Results of the survey on households and non-residential buildings display in the SFD Matrix (Figure 3):

- 8% of toilets do not have a containment available but discharge directly into surface water (T1A1C7).
- In total, 51% of the population rely on septic tanks:
  - 4% of septic tanks are connected to a soak pit (T1A2C5).

- 23% of septic tanks are connected to open drains or storm sewers (T1A2C6).
- 24% of septic tanks are connected to 'don´t know where' (T1A2C9).

- 41% of the population have a sum-pit, locally also called off-set pit, as containment available:
  - 18% of these are sump-pits that reported to have an overflow to the municipal drain and are therefore considered as lined tanks with impermeable walls and open bottom with an outflow to an open drain or storm sewer (T1A4C6).
  - Off set-pits and pit latrines without outflow but open bottoms are used by 23% of population. They are considered as lined pits with semi-permeable walls and open bottom (T1A5C10).

Figure 4: Illustration of an off-set toilet with one pit (Source: (SNV Nepal, Jawalakhel, Lalitpur, 2017)).

2.2.1 Onsite Sanitation Technologies

In Bhola Paurashava no centralized sewer system or (semi-) centralized faecal sludge/wastewater treatment is present to this moment and the town is completely relying on onsite sanitation. The distribution between septic tanks (46%) and sump pits (44%) is similar for residential building, however, varies among the different building type. For i.e. 51% of Kutchas rely on sump pits and only 31% use septic tanks, also the proportion of toilets directly connected to waterbodies (15%) is higher than the average for Bhola Paurashava (10%). In contrast, for single-Pucca and multi-Pucca type of buildings, the majority 88% and 84% respectively rely on septic tanks. In case of semi-Pucca, most of the buildings also rely on septic tank (56%), a proportion which is lower compared with pucca type of building.

Figure 5: Rings used for pit containment and siphons made in Bhola and backside of toilet witch a double pit (Source: UPM 2020).

All septic tanks are reported to be sealed, of which 44% are constructed in past 10 years, 24% of the septic tanks are reported to be between 10 – 20 years old and 22% are reported to be older than 20 years. The majority, 43%, of septic tanks are reported to have an overflow directly to the municipal drain channel/canal or open waterbody, and only 4% are connected to a soak pit.

53% of sump pits (off-set pits) are built in the past 10 years and 39% of pits are older than this. 26% of pits have an overflow pipe connected to the nearby canals, to prevent overflowing. It was observed that buildings located next to channels use the location to discharge their effluent directly into those channels.

Figure 6: Pour-flush toilets in Bhola (Source: UPM 2019). The picture of the right corresponds to a household pour-flush toilet, partly funded by loan from BRAC (Source: UPM 2020).

The majority of non-residential units in Bhola Paurashava (82%) relies on septic tanks and only one unit was found using pit latrines (UPM survey, 2019). 15% of all local businesses report to have no toilette at all available, instead public toilets nearby or the ones at household level are used. All of these septic tanks are reported to be sealed, and 43% of the businesses report to have more than one septic tank available, i.e. Bhola Police (13), the general hospital (18) and the district prison (20). Most of the containments/ tanks (57%) are reported to be installed

more than 20 years ago, 32% in the last 10 years, and 7% between 10 – 20 years. The majority, 61% of the septic tanks, are connected to soak pits, which is a distinctly higher share compared to residential buildings were only 9% are connected to soak pits. 39% of septic tanks of non-residential units are directly connected to waterbodies or drain channels (UPM Survey, 2019).

Figure 7: Septic tank in Bhola (Source: UPM 2019).

Seven public toilets were identified in Bhola Paurashava, thereof five currently operating, with average 375 reported users per toilet daily. All public toilets are connected to septic tanks, which are partly connected to the drainage system in order to prevent overflows. Only two of the septic tanks are reported to be desludged.

2.2.2 Open Defecation

Already in 2017/18 Bangladesh has been declared as an open defecation (OD) free country (World Bank, 2020). Rates dropped from nearly 18% in the year 2000 due to strong commitment of the central and local GoB, different NGO's and communities. However, even if not categorized as OD, hanging latrines above waterbodies are still present, 1% of buildings for Bhola were identified with those during the UPM 2019 assessment.

Figure 8. Toilets discharging into water bodies (Source: UPM 2019).

2.2.3 Emptying and Transport

Based on the results of the survey (UPM survey, 2019), it is estimated that 51%[1] of the population in Bhola emptied their containment at least once, corresponding to 44% of all septic tanks and 69% of all pits. It was reported that 29% of the population would empty their pit yearly and 38% in two years intervals. In contrast, only 15% reported to empty their septic tanks on yearly basis, and 30% every second year.

For non-residential buildings, 69% of all containments have been reported to be desludged at least once. The majority of those containments are septic tanks, for which 71% have been reported as emptied at least once, 45% on a yearly basis, and 30% every two years.

Emptying services in Bhola Sadar are performed either manually (70%) or through motorized desludging (30%). According to the Khulna SFD report (Gunawan et al. 2015), customers prefer manual emptying services since it is readily available (75% of answers), it is affordable (23%) and it is flexible in timing (10%). The manual emptying is performed by members of the Harijan community[2] with simple tools and buckets. They usually work at night time in groups of two to six people.

Based on discussions with the Paurashava in 2019, it is reported that 60 Harijan workers (50 male and 10 female) are engaged as so-called sweepers to provide cleaning and emptying services to the community. Some of the sweepers are formally employed by the Paurashava and they are paid 6,000 BDT (70 USD) per month. At a different point in 2019 the number of sweepers was reported to be 129, thus it is understood that this number might be prone to fluctuation and may have to be updated regularly.

The tools for manual emptying i.e. ropes or buckets and personal protective equipment are not provided by the Paurashava administration. Private customers usually call for emptying services informally, yet sometimes a formal contact is made via the Paurashava. For the emptying of septic tanks, the group receives between 1,000 BDT (12 USD) and 8,000 BDT (94 USD), and for pit latrines, they receive from 1,000 BDT (12 USD) up to 4,000 BDT (47 USD). The median costs for desludging a pit latrine by mechanical means (1,500 BDT/18 USD) is 500 BDT (6 USD) higher compared with manual emptying costs (1,000 BDT/12 USD). For septic tanks, the difference appears even higher as the median cost for emptying by mechanical means (6,000 BDT/70 USD) is 4,000 BDT (47 USD) more compared to manual emptying (2,000 BDT/24 USD). In Bhola, 70% of the residents are willing to pay for emptying services. The authorities estimate that around 20 septic tanks and 40 pit latrines are being desludged each month.

Moreover, the Paurashava owns one Chinese vacuum truck of 3,000 litres capacity. The truck is reported to be in working condition and the cost of emptying a septic tank by this vacuum truck is calculated at BDT 1,500 (18 USD) per trip, which is highly competitive compared with services provided by the Harijan community. However, according to the Municipality Sanitation

[1] The overview matrix how the 51% are estimated can be found in the appendix 3.

[2] Harijan (Children of God) is a term describing a marginalized community or low-caste in Hindu societies in Bangladesh as well as India. Harijan are also previously described as the ‘untouchables. The Harijans in Bangladesh are mainly identified with their traditional occupations such as fishermen, sweeper, barber, washer men, blacksmiths, etc. (Parthaand A.R.; Ahmed, S., 2016).

Officer of the Paurashava, the truck has not been used so far, which is aimed to be changed soon (UPM, 2019).

2.2.4 Treatment and Disposal

During the interviews with the Paurashava, it was confirmed that there are no treatment facilities for faecal sludge in Bhola Sadar (UPM, 2019). As a consequence, the FS that is emptied from the containment is either buried into an earthhole, covered with ash and soil or discharged into a drain channel or canals. In Bhola, 46% of the FS emptied ends up inside drains or canals and 52% is buried.

The Public Hospital in Bhola Sadar: Large amount of solid waste can be found behind and around the children ward of the Bhola hospital, mainly from garbage thrown out of the windows (observed in 2019 and 2020). In addition, drains and septic tanks are clogged from solid waste and partly over-flowing; discharge from toilets directed directly into an open drain could be observed. According to discussions with local people present at that time, the situation is not only due to negligence but also to the lack of awareness of the damaging impact of improper waste management to human health and the environment (UPM field visits, 2019). Currently, there are 14 sweepers employed for cleaning and emptying services of the public hospital. As described above, the FS from the septic tanks also gets disposed in holes close by dug particularly for this purpose (Stakeholder 1, 2020).

Figure 9: Open septic tank clogged with solid waste and solid waste disposal at the of Bhola public hospital (Source: UPM 2020).

Figure 10: Discharge into open drain at the backside of Bhola public hospital (Source: UPM 2020).

2.2.5 Groundwater Pollution Risk

The groundwater pollution risk for the island of Bhola is considered low. This is mainly due to the depth of around 300m from which groundwater for drinking and domestic purposes is extracted at this point (Wetlands International, 2019). Wetlands International states that Bhola has completely switched to groundwater usage. Also, a study by the London University College on the depth of aquifers in the Bay of Bengal from 2018 confirms that Bhola is part of a deep aquifer region in Bangladesh (Ravenscroft et al., 2018).

The UPM survey shows that about half of the households are connected to the municipal network, and a quarter each draw water through manual or electrical pumps. Non-residential respondents, such as hospitals or educational institutions too, mainly received water through the public network or electrical pumps. However, it is not clear to what extent and how adequate the well protection is been executed. Additionally, the (Draft) Masterplan of Bhola clearly states that 'Surface water is the main source of drinking water in Bhola Paurashava and deep tube wells are generally used during water collection procedure' (Bhola Paurashava, 2018, p.2-3). Considering this, the public health risk has to be considered high, even though the groundwater pollution risk in itself is ranked lower (as shown in the context-adapted graphic, section 2.4).

According to 'Banglapedia', the National Encyclopedia of Bangladesh, soils in the Meghna floodplain area are mainly silty clays. Despite the lower risk for groundwater pollution according to these sources, it should not be forgotten that a decline of deep groundwater sources may lead to infiltration of polluted surface water to lower ground levels over time.

2.3 SFD Graphic

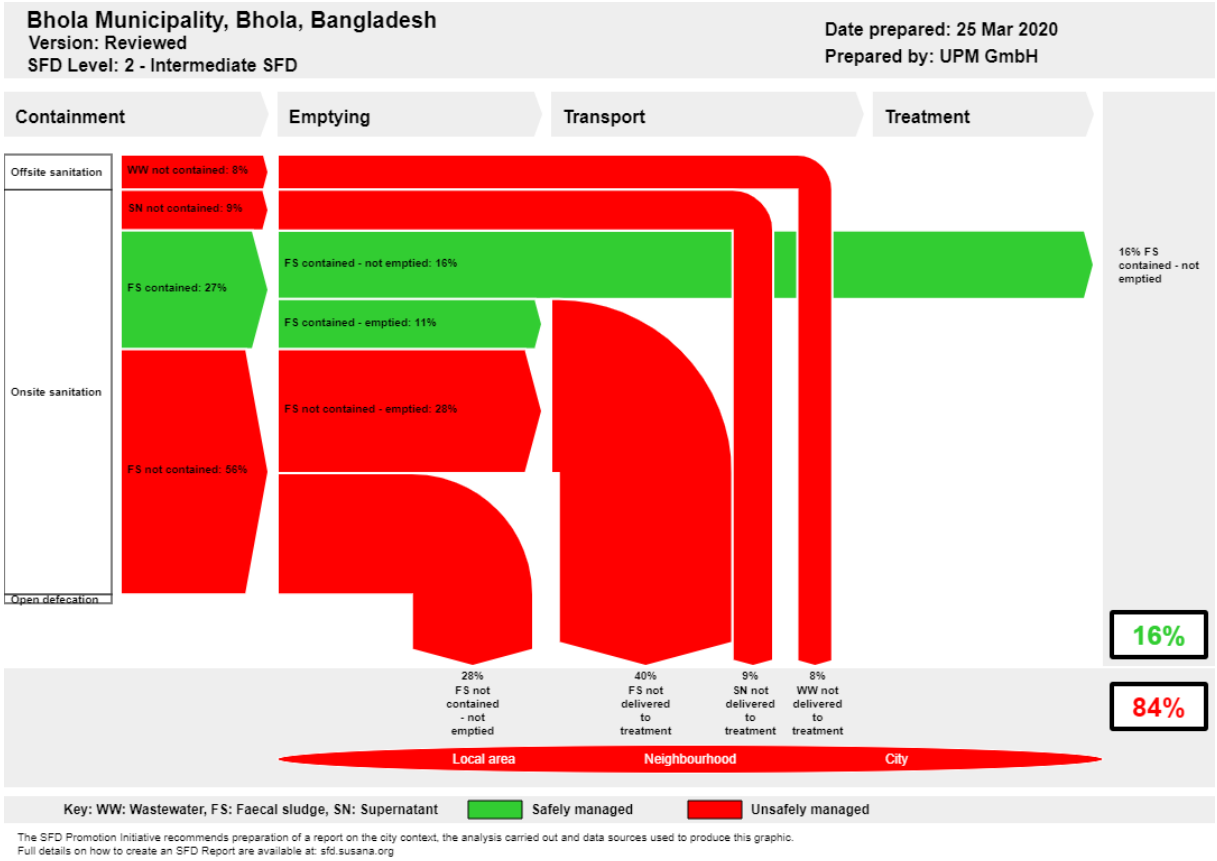


Figure 11: SFD graphic.

Figure 11 shows the SFD graphic for Bhola Paurashava. Overall, the SFD graphic depicts that 16% of excreta is safely managed while 84% is discharged untreated to the environment. The 84% of excreta not properly managed is distributed as: wastewater not contained and not delivered to treatment (8%), supernatant not contained and not delivered to treatment (9%), faecal sludge (contained and not contained) emptied but not delivered to treatment (40%) and faecal sludge not contained and not emptied (28%).

The 16% of the excreta unsafely managed originates from faecal sludge contained and not emptied from onsite systems (septic tanks and pits) located in areas of low risk of groundwater contamination.

2.4 Context-adapted SFD Graphic

The context-adapted SFD graphic does not substantially vary in the data input given (Figure 12). The main difference is the classification of a high groundwater pollution risk, leading to a result of 100% of the faecal sludge as unsafely managed. The aquifer in Bhola is located in a depth of about 300m (Wetlands International, 2019) and is accessed through protected boreholes. However, it is not clear to what extent and how adequately the protection has been executed. Furthermore, the context-adapted SFD graphic is included to address also the public and environmental health hazards caused by pollution in the various canals and open drains as well as the over two thousand small ponds and water bodies in Bhola Sadar and other parts of the island. These are used for household water purposes such as washing and the Master Plan for Bhola municipality (draft 2018) even states that surface water in Bhola is being used for drinking water purposes, however no statistics are given on this. A survey by UPM (2019) in contrast has shown that households either have access to private deep tube wells or are connected to the municipal water supply network.

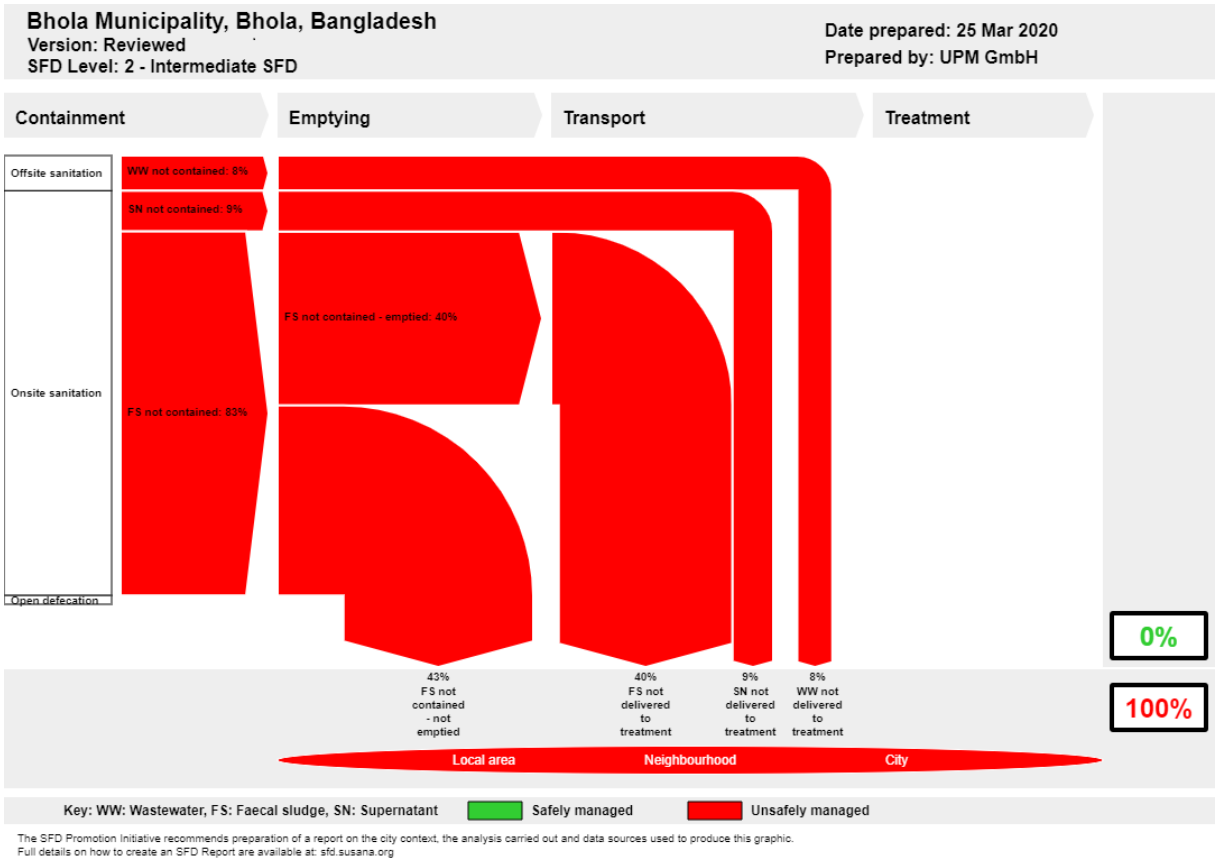


Figure 12: Context-adapted SFD graphic.

3 Service delivery context

3.1 Policy, legislation and regulation

3.1.1 Policy

The year 2021 will mark the 50th anniversary of the independence of Bangladesh, hence its National Development Vision has been set for 2021 and got accompanied with the Perspective Plan 2010-2021, setting targets on how to achieve this vision. The need for water and sanitation services are clearly mentioned, even set as a major focus area (GoB, 2012, p.96), yet remains vaguely formulated: Improved sanitation access and management could be envisioned through 'for example, access to piped water, maintained sewerage systems, environmentally sound hospital and industrial waste disposal' (ibid, p.80).

In the last two decades Bangladesh has indeed made great efforts and improvements towards providing water and sanitation services. Significant progress has been made in reducing open defecation from 34% in 1990 to 1% of the national population in 2018. Nonetheless, improved sanitation remains a major challenge reaching only 61% coverage and a growth rate at 1.1% annually (UPM, 2019).

In 1998, the National Policy for Safe Water and Sanitation (NPSWSS) has been put in place as the main document for regulating water and sanitation. It sets the goal to provide water and sanitation services for all, it regulates roles and responsibilities between government agencies, the private sector and NGOs, yet it lacks a time frame for these goals (WSUP, 2018). In 2014, the supporting National Strategy for Water Supply and Sanitation (NSWSS) replaced the previous version of 2005 which mainly focused on rural development (GoB, 2014b). This strategy was developed in a guided process under the then called Policy Support Unit (PSU) of the Local Government Division (LGD) which is part of the Ministry of Local Government, Rural Development and Co-operatives Government. Moreover, a working group has been formed that remains in a similar constellation still active, including members of the Department of Public Health Engineering (DPHE), Water Supply and Sewage Authorities (WASAs), Non-Governmental Organizations (NGOs) and the Asian Development Bank (ADB) (UPM, 2019). The strategy development process included stakeholder consultation of national and international organizations and representatives from the water and sanitation sector, such as the DPHE, UNICEF, WaterAid and the Bangladeshi NGO BRAC and NGO Forum for Public Health.

The NWSS is s an integral part of the overall Sector Development Plan (SDP) 2011-25 for water and sanitation sector in Bangladesh as it provides objectives, framework, direction, institutional arrangement and implementation plan, also including Faecal Sludge Management as a sub-strategy. The SDP can be grouped into three themes- (a) WASH Interventions- increasing the coverage and improving the quality of WASH interventions, (b) Emerging challenges- addressing the emerging challenges in the sector, and (c) Sector Governance- strengthening sector governance. Despite these qualities, the plan lacks a concept for funding (UPM, 2019).

Since 2017, the Integrated Regulatory Framework for Faecal Sludge Management (IRF-FSM) puts an emphasis on the heavily reliance of the country on onsite sanitation and the need for management of faecal sludge. Hereby it puts the local government in charge of overseeing the development of water and sanitation services as according to the 2009 Local Government Act (GoB, 2017).

3.1.2 Institutional roles

The 2009 Local Government Act (amended in 2010)[3] of Bangladesh defines municipal roles and areas of jurisdiction and the responsibilities of local governments, including those related to water and sanitation. Through the 1996 Water and Sewerage Act, the local government is also enabled to establish Water and Sewerage Authorities (WASAs). However, through the absence of sewerage services in most of the country, WASAs only apply to the cities of Dhaka, Chittagong Khulna and Rajshahi**.** As the rest of the country is heavily relying on onsite sanitation, the above-mentioned Institutional & Regulatory Framework for FSM (IRF-FSM) applies to all four levels of municipal regulation, slightly adjusted to the context of rural areas and smaller to larger cities.

In all cases, the responsibilities of local governments towards overseeing the development of water and sanitation services are enforced through the Ministry of Local Government, Rural Development and Cooperatives (MLGRDC). The MLGRDC is encouraged to set up a unit dedicated to FSM and to collaborate with the Local Government Engineering Department (LGED), Department of Public Health Engineering (DPHE) in the matters, as well as relevant institutions such as the Ministry of Environment and Forest or the Ministry Health and Family Planning. Moreover, collaboration with the private sector and non-government organizations (NGO) are encouraged when planning and implementing services, especially for FSM (GoB, 2017a).

Also, the National Urban Sector Policy (2014), of which the final draft is yet to be officially approved, aims for a decentralized and participatory urban development in which the central government, the local government, the private sector, the civil society, and people all have critical roles to play (UNDP, 2019).

In practice however, the DPHE remains in the lead position in terms of responsibility for sanitation policy and is mandated to monitor and regulate sanitation services on national level. It is reported that Bangladesh is one of the least decentralized countries since only 4% of government expenditure is spent at local level and less than 2% of total revenue is collected at subnational level. Therefore, the local government heavily depends on central government transfers for investments and operating costs (WSUP, 2018, p.10) and often sanitation programs are encouraged by the central government (Gunawan et al., 2015). In the case of Bhola, the Public Works department is reported to be implementing standardized designs and sizes for septic tanks for public buildings following the National Building Code of Bangladesh (NBCB) (2012) (Final Draft 2015).

[3] Applies as the 'Paurashava, City Corporations, Upazila Parishad and Union Parishad Act', according to the population size of the level of government. There are rural areas, secondary cities or so called Paurashavas with a population of 15,000 to 60,000 inhabitants and City Corporation which there are currently nine of and one mega city, Dhaka (GoB 2009).

3.1.3 Service provision

According to the Bangladesh Bureau of Statistics (2011) and in contrast to the Bhola Draft Masterplan, 97% of households in Bhola drink water from tube-wells. Tap water would be used by less than 1% of households for drinking purposes and about 2% would receive their drinking water from other sources. 65% of households have latrines available classified as hygienic latrines and 32% of the population use latrines classified as unhygienic (UPM, 2019). A toilet mapping from 2016 and a following community engagement towards sanitation coverage, BBRAC NGO reports that at least in Bhola Paurashava directly there are no more households without a toilet (Stakeholder 2, 2020). During the field visits of UPM in 2019, it was observed that all households located at the banks of Bhola's channels (khals) discharge their wastewater directly to these khals. The Paurashava has issued a notice to prohibit this practice, yet with little effects so far. A field visit in 2020 confirmed this picture of direct discharge into the khals. The wastewater includes household wastewater and toilet sewage (UPM survey, 2019).

The Public Hospital in Bhola Sadar: Large amount of solid waste can be found behind and around the children ward of the Bhola hospital, mainly from garbage thrown out of the windows (observed in 2019 and 2020). In addition, drains and septic tanks are clogged from solid waste and partly over-flowing; discharge from toilets directly directed into an open drain could be observed. According to discussions with local people present at that time, the situation is not only due to negligence but also to the lack of awareness of the damaging impact of improper waste management to human health and the environment (UPM field visits, 2019). Currently, there are 14 sweepers employed for cleaning and emptying services of the public hospital. As described above, the FS from the septic tanks also gets disposed in holes close by dug particularly for this purpose (Stakeholder 1, 2020).

3.1.4 Service standards

As per the Bangladesh Environment Conservation Act 1995 (Amendment 2010), management of sludge is mandatory. Since 2015 the 'Bangladesh Standards and Guidelines for Sludge Management' are in place, published by the Department of Environment (DoE) of the Ministry of Environment and Forests and developed with support of GIZ. The guidelines are supposed to be complied by anyone working and operating with wastewater, effluents or sludge in any sort of plant, treating both municipal and industrial waste. Moreover, included are the classification, management, transport, handling, use or disposal of sludge from those plants (GoB, 2015a). Sludge is defined as 'the residual, semi-solid material left from industrial and municipal wastewater and sewage treatment processes' whereas 'Wastewater' means water that has been used for human consumption, domestic purposes, industrial processes or any other purpose that results in a change of the water quality' (Gob, 2015a). Hereby the producer of the sludge, either from municipal or industrial sources is in responsibility for it and is required to submit a sludge management plan to the Department of Environment as part of the environmental clearance information.

Depending on the category of the sludge, to be identified with help of those guidelines, as hazardous or not, it may be treated and managed through anaerobic digestion, land application, thermal incineration, controlled landfill or recycling in making construction materials. Sludge from municipal wastewater or a non-hazardous industry may be composted

and used in agriculture. Sludge from hazardous industries or central effluent treatment plants (CETPs) must exclusively either be treated using thermal incineration or landfilled to protect human health and the environment (GoB, 2015a, p12). The implementation of these guidelines however remains a challenge. Policy briefs in regard to the guidelines point out the need to build capacity of local institutions in planning, design, implementation, operation and maintenance as well as performance monitoring for FSM (Rahman et al., 2015). Bhola Paurashava for instance is lacking an authority to be enforcing the Environment Act 1995/2010 in itself (Bhola Paurashava, 2018, pp.8-7), hence accordingly also the sludge management guidelines.

The National Building Code of Bangladesh (NBCB) (Final Draft 2015) includes onsite sanitation options, for the places where public sewers are not available. Options given are septic tanks and Imhoff tanks in combination with disposal fields and seepage pits (Table 1 and Table 2). Septic tanks shall have a minimum liquid capacity of 2,000 litres and not exceed 300 users per residential building. The liquid retention time of a septic tank shall be at least one day, and the desludging frequency of a septic tank shall be at least a six months interval and maximum once per year. Imhoff tanks are to be used where more than 300 people of residential buildings need to be served. Both types of tanks, septic or Imhoff, will be connected to one or more disposal fields. A distribution box should be placed in-between tank and field in order to receive the effluents and to distribute them equally to the individual entrance pipes of the disposal field(s). No seepage unit, which refers to a seepage pit or disposal field, is allowed be extended into a water table directly (Gob, 2015b, Vol 3, p.8-250). The bottom of seepage units must be at least one meter above the highest water table and pits shall be lined with stone, brick or concrete blocks laid up dry with open joints that are backed up with at least 75 mm coarse aggregate. Soil percolation tests are required before installation of any disposal system (GoB, 2015b, Vol 3; 8 pp.247-250). There is no standard for the disposal or re-use of faecal solids given in the Building Code, however.

Table 1: Standard for locations of Components of Sewage Disposal Systems. (Source: Bangladesh National Building Code; Final Draft 2015).

System Component	Distance (m)				
	Building Foundation	Well	Stream	Seepage Pit	Dry Well
Septic tank	1.5	8	-	1.5	-
Disposal field	3	15	7.5	6	6
Seepage pit	4.5	15	15	6	6
Dry well	3	15	-	6	-

Table 2: Minimum horizontal separation distances for treatment tanks element distance (Source: Bangladesh National Building Code; Final Draft 2015).

Elements	Distance (m)	Elements	Distance (m)
Building	1.5	Reservoir	7.5
Cistern	7.5	Spring	15
Foundation wall	1.5	Stream or watercourse	7.5
Lake, high water mark	7.5	Swimming pool	4.5
Lot line	0.6	Water service	1.5
Pond	7.5	Well	7.5

3.2 Planning

3.2.1 Service targets

According to the Bhola Paurashava Draft Master Plan, integrated provision of environmental infrastructure and the provision of complementary urban services is a major goal. For sanitation, the first target of the plan aims for a sanitary latrine for every household and for public and community latrines which should be leased out to the private sector for maintenance. In general, the Master Plan aims to improve operation of urban services through cost recovery from costumers of these public services.

A second target is the recycling of materials and the prevention of contamination of groundwater by sewerage and drainage. The third target points at the need for social mobilization and behaviour change engagement (Bhola Paurashava, 2018, p.7-6). Moreover, the Paurashava aims to provide the urban poor with access to infrastructure and services, including inhabitants of slum / informal settlements (ibid p.7-3). Evictions of slum dwellers and squatters should be avoided and those dwellers residing in settlements categorized as ‘untenable' are entitled to receive basic minimum services until resettlements.

As part of an integrated public and environmental health approach and to achieve local ecological sustainability, the Master Plan points out the need for the combination of safe and sufficient water supply, sanitation, and storm drainage to improve living conditions (ibid p.7-10). This includes the preservation of natural water bodies, in particular the 2,175 small size ponds and ditches in Bhola Paurashava as well as the rehabilitation of the many khals (canals).

Given the location of Bangladesh and especially Bhola island in an area prone to natural disasters, the Bangladesh Delta Plan 2100 in particular looks into environmental sustainability while effectively coping with natural disasters, climate change and other delta issues. Urban sanitation, wastewater management and applied FSM are listed as integrated issues that need to be addressed. For sanitation management, the strategies mentioned are the *polluter pays principles* (as in the Environment Act 1995 (amended 2010); *NGO engagement* and *PPP encouragement*. For FSM, the sub-strategies to be applied are: *Strengthening sectoral coordination Sub; Targeting financial sustainability Sub-Strategy; Enforce legislative provisions Sub-Strategy and Accelerate implementation of FSM* (GoB, 2017b).

3.2.2 Investments

The Asian Development Bank (ADB) is giving a loan and grant to the People's Republic of Bangladesh for the "Coastal Towns Environmental Infrastructure Project" (CTEIP) which is to strengthen climate resilience and disaster preparedness in eight vulnerable coastal Paurashavas in the country. Bhola is one of them. CTEIP primarily focusses on solid waste management and planning a regional waste management facility in Bhola Sadar, also covering the surrounding municipalities. Beyond this however, faecal sludge management is taken into consideration as part of a holistic approach on urban infrastructure development including measurement on drainage, water supply, sanitation, cyclone shelters, and other municipal infrastructure including emergency access roads and bridges as well as slum improvements, etc. The project states that investments should particularly benefit the poor and female population. Main governmental stakeholder in this project is the Local Government Engineering Department (LGED) (UPM, 2019, p.6-7). Moreover, the Bill & Melinda Gates Foundation is through its two programs 'Urban Sanitation Markets Initiative' and 'Emergency Response' jointly providing the budget for a consultancy team to provide support to LGED and DPHE on 'waste-to-value' options of both faecal sludge and solid waste (UPM, 2019).

3.3 Equity

3.3.1 Current choice of services for the urban poor

The NGO BRAC which has done a toilet monitoring in 2016, reports that of the 9,645 households in Bhola, 42 were without any toilet structure. Through an ongoing behaviour change program and a loan system for the construction of household toilets this number has reportingly been brought down to zero (Stakeholder 2, 2020). Also, previously unimproved direct and unlined pits have been replaced to off-set toilets, meaning a two-pit system and a siphon system which prevents smells, flies and also the desludging process. This is because pits are still unlined leading to infiltration into the soil. Moreover, bamboo covering, and slabs of mud could be replaced through tin and brick constructions. BRAC gives a loan of 10,000 BDT (118 USD) – 50,000 BDT (590 USD) for the construction of toilets, sometimes even more, depending on the income and needs of the client. A loan of this type would generally been given with a 10,5% interest rate by BRAC (BRAC Bank, 2020). A visited household for instance (Stakeholder 7, 2020), invested 20,000 BDT (236 USD) in a toilet structure and received a 15,000 BDT (177 USD) loan from BRAC. If needed, the NGO gives further loans for the fixing of broken structures and beyond this also gives a training on how to repair these.

3.3.2 Plans and measures to reduce inequity

Bangladesh, due to its location in a delta region, vulnerability to cyclones, its population density, growth, urbanization rate and low-income situation, has been identified as one of the key countries in need of climate adaptation and resilience measurements. Hence, there have been several programs in place. For instance, Water and Sanitation for the Urban Poor (WSUP) lead an Urban Sanitation Research Initiative (2017–2020) investigating on opportunities for pro-poor sector change in urban sanitation in three countries. In Bangladesh, collaborating partners are the Centre for Water Supply and Waste Management and the International Centre for Diarrheal Disease Research (UPM, 2019, p.96).

Since 2011, Bhola Paurashava employs an officer for 'Slum Upgrading' (Stakeholder 5, 2020). Even though there are no areas that would be categorized as slums, according to the officer, the activities target the urban poor[4]. In contrast to this, also the Master Plan for Bhola Paurashava, mentions a slum population within the municipality. The activities organized by the 'slum upgrading officer' are partly WASH based, especially around hygiene promotion, yet also include declogging of drainage to prevent overflows. Other activities are based on income generation, such as computer literacy or sewing classes for women, which have created successful businesses. In total 300 people were trained in all activity categories since 2011. Despite the ending of previous funding, the officer continues with these activities through generating funds from the Paurashava whenever possible. Bhola Paurashava targets to spend 5% of their budget on women empowerment and 5% on reducing inequality each, which is according to the officer, based on the national strategies for both of these issues. Furthermore, Bhola itself would aim to integrate these the 5% regulation for these activities in their Masterplan.

3.4 Outputs

3.4.1 Capacity to meet service needs, demands and targets

The director of the public hospital in Bhola (Stakeholder 1, 2020) strongly emphasizes the need for more sweepers in the hospital as well as the need for a special training for them in order to improve cleanliness and hygiene in the hospital. According to him, currently there are 14 sweepers employed who are responsible for the emptying of septic tanks as well as for general cleaning services.

3.4.2 Monitoring and reporting access to services

Monitoring and reporting are very limited in the context of Bhola. NGOs, such as BRAC and Saint follow their internal monitoring program, yet these are rather targeted towards hygiene and behaviour change than to access to FSM services. Within BRAC, one monitoring officer is responsible for 10 households. However, BRAC has monitored toilet access in 2016 and found that 42 of 9,645 households were practising open defecation. Through their behaviour change program they engaged these households to construct pit latrines with three to five rings, as described above.

Also, the NGO Saint (Stakeholder 4, 2020), as the implementing organization of Plan International- Bangladesh, conducts monitoring on behaviour change and sanitation cleanliness as well as overall cleanliness of public service buildings. Even though this activity is targeted towards the rural areas of Bhola district, this is worth mentioning since the monitoring will be implemented by a local committee which involves members of the local government as well. This program however is driven by the NGOs and not by the governmental body.

[4] In Bangladesh slums are defined as a 'cluster of compact settlements of 5 or more households which generally grow very unsystematically and haphazardly in an unhealthy condition and atmosphere on government and private vacant land'. Access to water and sanitation services are defined as 'insufficient, unsafe and inadequate, as defined 15 or more people use one toilet' (GoB, 2014a).

3.5 Expansion

3.5.1 Stimulating the demand for services

Saint (Stakeholder 4, 2020) reports that there will be a one-stop-shop for WASH products opening in Bhola and Daulatkhan municipalities. The shop, implemented by Plan International through Saint, will sell personal hygiene articles but also cleaning materials for toilets.

One mason and manufacturing business owner of toilet sub-structure materials, including concrete rings, slabs and siphons, which is run in the second generation for about 35 years was interviewed (Stakeholder 8, 2020). The owner of this business stated that there are nine further similar businesses. He also stated a great interest in new sanitation technologies as there is a demand and willingness to pay for higher quality services such qualitative and durable concrete rings which are used for construction of so called off-set pits, which are pans connected to a siphon and one or two pits. The mason states to have 25-30 costumers per month for these products; direct pits are neither constructed nor demanded anymore. According to him, this is the same situation for the other nine businesses in Bhola Paurashava. This impression stands in line with the results from UPM (2019), indicating that 70% of households in Bhola are willing to pay for emptying services (see Chapter 2.2.3).

Beyond pit rings, the mason also constructs septic tanks. He stated to construct a number of 3,000 tanks per year, which however is a highly doubtable number since there seemed to be only 4-5 employees working in his business.

The NGO Development Organization for the Rural Poor (DORP) works, despite its name, also in Bhola Paurashava actively in citizen engagement and advocacy. DORP (Stakeholder 3, 2020) helps to support a so-called citizen committee, which includes and targets especially different vulnerable groups in the city such as waste pickers, fishermen, rickshaw drivers or people who are struggling with water supply. This committee started in 2017 with a door-to-door engagement and 17 initial members. Currently there are 38 members of which 22 are males and 16 females. Members get nominated by DORP based on previous engagement and experience. The goal of this committee is to enforce the citizens right to SDG 6.2. (sanitation) and 6.3. (integrated water resource management) for which all members receive trainings on capacity building. Once the committee has identified needs of the local population, DORP will forward these to the local government, on sub-district level/ Paurashava, which is then in charge of finding budget and implementing these demands. DORP describes the working relation from committee to Paurashava as functioning very well. An example is the supply of sanitary napkins and toothbrushes in 48 schools with budget of 300.000 BDT (3,527 USD) based on the activities of the committee. Moreover, DORP states to be advocating to the committee to demand the repairing of toilets by the Mayor of Bhola.

3.5.2 Strengthening service provider roles

BRAC has been working with the engagement of manufacturers on the quality of products and hygienic technologies since 2016 and reports that there is a strong willingness by the target group. The above-mentioned mason (Stakeholder 8, 2020), who was part of the BRAC program, states to be highly interested in trainings or further education on sustainable technologies and he would be willing to invest into these. In previous years he got a loan from BRAC for technical investments, yet he is no longer interested in loans since his business is at a profitable state and he wants to remain independent.

Even though the activities from Saint/ Plan Bangladesh (Stakeholder 4, 2020) do not apply to Bhola municipality directly but the rural areas of the district, it is still worth mentioning that the NGOs equipped ten sweepers with personal protection gear and a barrel for emptying. This has been a one-time project so far, still showing that there are efforts to strengthen the role of sweepers in Bhola which could be taken as a base for extension.

4 Stakeholder Engagement

The data for this SFD report have been collected in the course of over a year, starting in January 2019 with UPM visiting Bhola Island for the first time. Since then, members of the national and international UPM team and its partners have visited Bhola island two more times in February and March 2019. Also, parts of this team have stayed for over eight months from April to December on Bhola for the purpose of data collection including a faecal sludge and solid waste characterization study. Reasons for these visits are UPMs and their partners' engagement as consultants to support the LGED/DPHE in the Coastal Towns Environmental Infrastructure Project (CTEIP). These partners involved are namely the Centre for Sustainable Environmental Sanitation (CSES) of the University of Science and Technology Beijing (USTB), and the Bureau of Socioeconomic Research and Training (BSERT) of the Bangladesh Agricultural University (BAU); funded by the Bill & Melinda Gates Foundation.

During the time period of January 2019 to March 2020 extensive stakeholder engagement has been conducted and data were collected for the UPM consultancy task: In January, February and March 2019, UPM together with ADB and LGED/DPHE undertook various briefings, kick-off and stakeholder meetings and workshops. The purpose of these activities was to introduce the consultant team members to the counterparts, to analyse and outline the need for innovation, and to estimate the range of technical solutions for integrated sustainable environmental sanitation in Bhola. Participants came from local partners of LGED/DPHE, including scientific, technical and advisory support in Bhola, environmental education specialists, and smaller scale technological and environmental behaviour change organizations working with waste and environment in the town. Key informants from NGOs, technology providers, users who work with sanitation, waste and environment protection in Bhola attended as well (UPM, 2019, p.21). Moreover, during field visits and direct observations by the UPM consulting team, interviews were conducted with representatives of local businesses directly at their office/ desk, with representatives of sweepers as well as residents of the marginalized communities in Bhola. Several group discussion meetings were hold on 19 January with local administration, on 24 January 2019 with the governmental authorities and

donors, and on 6 and 7 February 2019 with local stakeholders. The results of this first data were synthesized in an inception report which then was used as the basis for this SFD report.

In March 2020, another field visit of three days was conducted by the main author of this report, a UPM consultant, and a partner from BAU. Purpose of this visit was for the author to better understand the local context and to close remaining data gaps specifically for the purpose of this SFD report. Hereby various stakeholders were interviewed and engaged again, though there were limited capacities to speak with local communities or organize focus groups, since they are not required for an intermediate level SFD graphic.

However, an interview with a family that has been participating in a BRAC loan scheme for improved household sanitation was conducted. Other interviews and field visits were taken with NGOs working in the field of sanitation, a sanitation service provider, the local hospital and an officer from the local government. It was considered to consult the Paurashava once again, yet it was decided against this in order to not overload collaborating officers in order to keep good working relations since they had been interviewed several times before.

5 Acknowledgements

This report was compiled as part of the Technical Assistance for the “Development of a Regional Integrated Waste Management Facility in Bhola” provided to the ADB, Bangladesh Ministry of Local Government, Rural Development and Cooperatives (MLGRDC), the Local Government Engineering Department and the Department of Public Health Engineering, under the framework of the CTEIP, and financed by the Bill and Melinda Gates Foundation (BMGF).

This report does not necessarily reflect the views of ADB, BMGF or the Government concerned. ADB, BMGF and the Government cannot be held liable for its contents.

UPM is very grateful to all partners & consultants working on the “Development of a Regional Integrated Waste Management Facility in Bhola” under the CTEIP project, who have helped to collect the information used for this report. We also would like to thank all stakeholders for kindly providing their time and information for this work.

6 References

Banglapedia. The National Encyclopedia of Bangladesh. Bangladesh Soil. Available from: http://en.banglapedia.org/ [last accessed 22.03.2020].

Bhola Sadar Paurashava (2018). Draft Masterplan Report 2018-2038. Preparation of Master Plan for Bhola Paurashava, Bhola District. Submitted by Troyee associates, Dhaka.

BRAC Bank Home Loan Calculator 2020. Available from: https://www.bracbank.com/en/retail/#loan-products [last accessed 14.04.2020].

Government of the People's Republic of Bangladesh (1995). *The Bangladesh Environment Conservation Act.* (Amendment 2010).

Government of the People's Republic of Bangladesh (2009). Local Government (Paurashava, City Corporations, Upazila Parishad and Union Parishad) Act. (Amendment 2010). Available from: http://bbs.dhaka.gov.bd/

Government of the People's Republic of Bangladesh (2011). Population and Housing Census. Socio Economic and Demographic Report. Bangladesh Bureau of Statistics. Available from: http://bbs.dhaka.gov.bd/ [last accessed 22.03.2020].

Government of the People's Republic of Bangladesh (2012). Perspective Plan of Bangladesh 2010-2021. Making Vision 2021 A Reality (Final Draft). General Economics Division. Planning Commission. Available from: http://bbs.dhaka.gov.bd/ [last accessed 22.03.2020].

Government of the People's Republic of Bangladesh (2013). Economic Census. Bangladesh Bureau of Statistics. Available from: http://bbs.dhaka.gov.bd/

Government of the People's Republic of Bangladesh (2014a). Census of Slum Areas and Floating Population Programme. Bangladesh Bureau of Statistics. Statistics and Informatics Division. Ministry of Planning.

Government of the People's Republic of Bangladesh (2014b). National Strategy for Water Supply and Sanitation. Ministry of Local Government, Rural Development and Cooperatives. Local Government Division. Available from: https://www.who.int/globalchange/ [last accessed 22.03.2020].

Government of the People's Republic of Bangladesh (2015a). Bangladesh Standards and Guidelines for Sludge Management. Ministry of Environment and Forests Department of Environment. Available from: http://bsa.com.bd/ [last accessed 22.03.2020].

Government of the People's Republic of Bangladesh (Final Draft) 2015b. The National Building Code of Bangladesh. Ministry of Works.

Government of the People's Republic of Bangladesh (2017a). Institutional and Regulatory Framework for Faecal Sludge Management (FSM) in Bangladesh. Ministry of Local Government, Rural Development and Cooperatives. Local Government Division.

Government of the People's Republic of Bangladesh (2017b). Bangladesh Delta Plan 2100. Bangladesh Planning Commission. General Economics Division.

Gunawan, A., Schoebitz, L., Strande, L. (2015). SFD Report Khulna, Bangladesh: Eawag/Sandec.

Imamul Huq, S.M., Uddin, J. (2013). 'The Soils of Bangladesh'. Dordrecht, Heidelberg, New York, London: Springer.

Islam, A. B. (2017). 'Coastal Erosion and Accretion on the Island of Bhola, Bangladesh'. Proceedings of Civil and Water Resources Engineering Conference. Dhaka: BIAM Foundation.

Kamrul Ahsan, &. M. (2013). 'Mouth Bar Development Process in The Meghna Estuary of Bangladesh - A Case Study from Bhola Island'. Bangladesh Journal of Geology, pp.31-32.

Murshed, M. A., Islam, M., and Hossain, M. (2015). 'Assessment of Coastal Vulnerability Due to Sea Level Change at Bhola Island, Bangladesh: Using Geospatial Techniques'. Journal of the Indian Society of Remote Sensing.

Parthaand A.R.; Ahmed, S. (2016). 'Geographical and Social Mapping of the research areas.' In: Ullah, R. (ed.). 'The Harijans of Bangladesh: Living with the Injustice of Untouchability'. Dhaka: Empowerment through Law of the Common People, pp.11-20.

Rahman, M.M., Ashraf Ali, M., Choudhury, M.R. (2015). 'Faecal Sludge Management. A way forward to overcome urban sanitation challenges in Bangladesh'. Department of Civil Engineering, Bangladesh University of Engineering & Technology, BUET, Dhaka.

Ravenscroft, P.; McArthur, J., Rahman, Md. (2018). 'Identifying Multiple Deep Aquifers in the Bengal Basin: Implications for Resource Management.' University College London, Earth Sciences; Department of Public Health Engineering.

Sharma, S. (2017). Toilet Construction Handbook for Masons. Lalitpur: SNV Nepal. Available from: https://snv.org/ [last accessed 22.03.2020].

United Nations (2019). Statistics Pocketbook 2019 edition. Department of Economics and Social Affairs. Series V, No. 43. New York.

United Nations Development Programme (2019). 'Why a national urban policy should be our top priority'. Bangladesh. Available from: https://www.bd.undp.org/ [last accessed 22.03.2020].

UPM (2019) Survey on WASH and FSM Services in Bhola for households and non-residential buildings

UPM Umwelt-Projekt-Management GmbH (2019). Technical Assistance Consultant's Inception Report. For: Government of Bangladesh. Development of a Regional Integrated Waste Management Facility in Bhola. Bangladesh (Internal Document).

Water and Sanitation for the Urban Poor 2018. The Urban Sanitation Research Initiative is a 2017–2020. Driving sector change in urban sanitation. Available from: https://www.wsup.com/content/ [last accessed 22.03.2020].

Wetlands International (2019). Securing Wetlands for Sustainable WASH: A dialogue on Bhola Island, Bangladesh. Available from: https://south-asia.wetlands.org/blog/ [last accessed 22.03.202].

World Bank 2018. Urban population growth (annual %) for Bangladesh. Available from: https://data.worldbank.org/indicator/ [last accessed 22.03.2020].

World Bank 2020. People practicing open defecation (% of population). Available from: https://data.worldbank.org/indicator/ [last accessed 22.03.2020].

7 Appendix

7.1 Appendix 1: Stakeholder identification

	Stakeholder Group	Name of organization	Influence	Interest
Stakeholder 1	Expert Organization	Public Hospital	medium	high
Stakeholder 2	Expert Organization	BRAC	medium	high
Stakeholder 3	Expert Organization	DORP-Development Program of the urban poor	high	high
Stakeholder 4	Expert Organization	Saint NGO	low	medium
Stakeholder 5	Key Institution	Bhola Paurashava	medium	medium
Stakeholder 6	Key Institution	Paurashava - Env. Dept		
Stakeholder 7	Community	Private Household with BRAC loan toilet	medium	medium
Stakeholder 8	Private Sector	Mason in Bhola	low	medium

7.2 Appendix 2: Tracking of Engagement

Tracking of Engagement			
	Date of Engagement	*Purpose of Engagement*	*Summary of outcomes*
Stakeholder 1	2/17/2020	Engagement and Questions	Works for one month in the hospital: engaged and highly interested in medical waste management and cleanness in the hospital. Emphasizes the need for more sweepers.
Stakeholder 2	2/17/2020	Presentation of SFD / Questionnaire	Very engaged and driven WASH Manager: great source of information and connections. Works a lot and successfully on community engagement towards toilet use and waste collection.
Stakeholder 3	2/18/2020	Presentation of SFD / Questionnaire	Very engaged in behaviour change for rural and urban communities. Work with citizen committee since 2017, 34 members by now. Forward citizens' demand directly to the Upazila administrator -who will work on the service delivery. WASH services including unblocking of drainage and demanding to not dispose FS in drains anymore.
Stakeholder 4	2/18/2020	Presentation of SFD / Questionnaire	Now working mainly with rural communities. Similar to DORP, working on behaviour change and community committees. Interesting: 1-stop-shop for WASH articles in Bhola & Daulatkhan Municipality is planned. Did Sweeper engagement: Safety training and handed out protection equipment.
Stakeholder 5	2/18/2020	Slum Upgrading	One-man office, since 2011. There previously was project funding, which ran out. He still runs activities by pulling together Paurashava budget. Mainly on WASH training, livelihoods and computer literacy for women (who need secondary level of education to participate). 300 people have been trained in total. Target: 5% of the municipal budget should be spend on women development and reducing inequality. There is a national strategy for this but not on the local level. This regulation will be included into the Bhola Master Plan though.
Stakeholder 6	2/19/2020		Where not able to meet since he was out of town. Yet showed interested on the phone as he is aware of the CTEIP project and had questions towards UPM activities as well.
Stakeholder 7	2/19/2020	Visit of toilet	Contact works at the local government and has an engineering background. One family household has received loan from BRAC for household toilet: offset latrine with a double-pit. There is a pipe for black water; and one for grey water from a cabin next to the toilet.
Stakeholder 8	2/19/2020	Visit of business production	Mason runs a successful business and constructs concrete rings for latrines and siphons. The demand is high, and costumers are willing to pay for quality. Mason is highly interested in new quality technologies and would like to receive trainings, no further loan (previous from BRAC) is needed.

7.3 Appendix 3: SFD Matrix data

Total Population: 53,755

System	Proportion of population using this type of system	Population using this type of system	Proportion of this type of system from which faecal sludge is been emptied	Population emptied their systems by type of the system	Proportion of population emptied their system	Population using this type of system (Total)	Population emptied their containment by the type (Total)	Proportion of the Population emptied
Toilet discharge directly to water body	8%	4,300				4,300		
Septic tank connected to soak pit	4%	2,150	50%	1,075	2%	27,415	12,111	44%
Septic tank connected to open drain or storm sewer	23%	12,364	35%	4,327	8%			
Septic tank connected to don't know	24%	12,901	52%	6,709	12%			
Lined tank with impermeable walls and open bottom, connected to an open drain or storm water	18%	9,676	88%	8,515	16%	22,040	15,315	69%
Lined pit with semi-permeable walls and open bottom, no outlet or overflow	23%	12,364	55%	6,800	13%			
Total	**100%**	**53,755**		**27,426**	**51%**	**53,755**	**27,426**	

7.4 Appendix 4: Sampling Method

Random sampling method was followed, the sample size calculation was based on reported number of buildings, in total 12,489, provided by the Paurashava.

For sample size calculation following formulas were applied, first to calculate the sample size assuming infinite population:

$$n_1 = Z^2 * p * (1 – p) / ME^2$$

where:

- **Z** is z-value of 1.64, and is associated to the chosen confidence level of 90%
- **p** is initial proportion estimate; conservative value was chosen of 50%
- **ME** is the margin of error of 8.4%
- $\mathbf{n_1}$ required sample size

$$n_1 = 1.64^2 * 0.5 * (1 – 0.5) / 0.084^2$$

$$n_1 = 95{,}29 \text{ --> } n_1 \sim 96$$

Correction due to finite number, N = 12,489

$$n_2 = n_1 / (1 + n_1 / N)$$

$$n_2 = 95{,}26 \text{ --> } n_2 \sim 96^*$$

- **N** is total evaluated number (or population size)
- $\mathbf{n_2}$ required sample to be statistically significant

*Since the confidence interval chosen is 90%, the difference between n_1 and n_2 is minimum and has no final influence when selecting the sample size.

7.5 Appendix 5: Questionnaire used for Survey

To understand the current situation regarding sanitation in Bhola, the following structured questionnaire was applied:

ID (household) and Date

_____

Respondent: Man ___ / Woman ___

Status: Owner ___ Tenant ___

Main income source of household: _____

Address: _____

GPS Coordinates: (example: 41°24'12.2"N 2°10'26.5"E) _____ #

Number Inhabitants of the building: ____

1. Building Type:

- ○ *Single-stored pucca*
- ○ *Multi-stored pucca*
- ○ *Semi-pucca*
- ○ *Kutchas*
- ○ *Jhpur*

2. Water supply

1What source of the water are you using?

- ○ *Municipal pipe network*
- ○ *Ground water (hand pump, manually)*
- ○ *Ground water (electrical pump)*
- ○ *Ponds, channel or river (manually)*
- ○ *Ponds, channel or river (Electrical pump)*
- ○ *Other: _____*

2.1 Do you have a water meter?

- ○ *Yes*
- ○ *No*
- ○ *Don't Know*

3. Fecal Sludge

3.1 What type of toilet is available in the building, and how many?

- ○ *Flush: Number____*
- ○ *Pour-Flush Number____*
- ○ *No Toilet Number____*
- ○ *Others, please specify _____ Number____*

3.2 Do you separate grey & black water?

- ○ *Yes*
- ○ *No*
- ○ *Don't Know*

3.3 Does the building have a septic tank pit, or pit latrine?

- ○ *Pit, How many? ____Do you know how many rings? ____*
- ○ *Pit Latrine, How many? ____ Do you know how many rings? ____*
- ○ *Septic Tank, How many? ____Do you know how many chambers? ____*
- ○ *Others, please specify*

3.4 When was septic tank, pit, or pit latrine constructed?

- ○ *< 5 years*
- ○ *5 - 10 years*
- ○ *10 - 20 years*
- ○ *> 20 years*

3.5 Is the bottom sealed?

- ○ *Yes*
- ○ *No*
- ○ *Don't know*

3.6 Do you know the volume of the containment? _____

3.7 Where is the containment located?

- ○ *Next to the road (house front)*
- ○ *Away from the road (backyard)*
- ○ *Under the building*
- ○ *Partially under the building*

3.8 How is the accessibility to the septic tank or concrete pit for emptying?

- ○ *Easy*
- ○ *Challenging*
- ○ *Not accessible*

3.9 Has the containment been ever emptied?

- ○ *Yes*
- ○ *No*

3.10 If yes, how often (frequent) is the containment being emptied?

- ○ *Yearly*
- ○ *Every two years*
- ○ *2 - 5 years*
- ○ *5 - 10 years*
- ○ *> 10 years*
- ○ *Don't know*

3.11 How is the containment being emptied?

- ○ *Mechanically (pump, vacuum truck)*
- ○ *Manually*

3.12 Do you know what happened with the fecal sludge after the containment is emptied, please explain?

_____

3.13 Does the containment have outflow?

- ○ *Yes*
- ○ *No*

3.14 Does the containment have overflow?

- ○ *Yes*
- ○ *No*
- ○ *Don't know*

- ▪ *If yes, where does the overflow/outflow go?*

- ○ *To nearby ponds/ canals*
- ○ *Municipality drains*
- ○ *Other, please specify* _____

3.15 What is the distance between the containment and next water source? _____

SFD Report Bhola Municipality, Bangladesh, 2020

Produced by:

UPM Umwelt-Projekt-Management GmbH

This Executive Summary and the SFD Report are available from:

www.sfd.susana.org

SFD Promotion Initiative