



Federal Ministry
for Economic Cooperation
and Development



A REPORT ON PROJECT ACTIVITIES IMPLEMENTED BY WASTE CONCERN UNDER

**INTEGRATED WATER MANAGEMENT IN URBAN
AREAS AS A CORE TASK OF MUNICIPAL SERVICES
OF GENERAL INTEREST PROJECT (PN-161)**

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Table of Contents

List of Figures	iii
List of Tables	v
List of Acronyms	vi
1 Introduction	1
1.1 Background	2
1.2 Selected Municipalities in Bangladesh	4
1.2.1 Savar Municipality	4
1.2.2 Kushtia Municipality	5
1.3 Relevance with SDGs and National Policies	6
1.4 Objectives of the Report	6
1.5 Organization of the Report	6
2 Baseline Assessment	7
2.1 Purpose	8
2.2 Savar Municipality	8
2.2.1 Water Supply	8
2.2.2 Access to Toilet	8
2.2.3 Wastewater Management	9
2.2.4 Solid Waste Management	10
2.2.5 Condition of Sanitation Workers	11
2.3 Kushtia Municipality	11
2.3.1 Water supply	11
2.3.2 Access to Toilet	12
2.3.3 Wastewater Management	13
2.3.4 Solid Waste Management	13
2.3.5 Condition of Sanitation Workers	14
2.4 Key Findings from Baseline Assessment	15
3 Sanitation Sector Interventions	17
3.1 Design and Implementation Support for Improved Shared Toilets at Bede Para Slum of Savar Municipality	18
3.1.1 Background	18
3.1.2 Objectives	19
3.1.3 Planning and Implementation Process	19
3.1.4 Description of the Intervention	20
3.1.5 Salient Features	22
3.1.6 Operation and Maintenance	25
3.1.7 Lessons Learned	25
3.2 Renovation of Public Toilet at Karnapara in Savar Municipality	26
3.2.1 Background	26
3.2.2 Objectives	27
3.2.3 Description of the Intervention	27
3.2.4 Operation and Maintenance	28
3.2.5 Lessons Learned	29

3.3	Renovation of Three Public Toilets at Kushtia Municipality	29
3.3.1	Background	29
3.3.2	Objectives	30
3.3.3	Description of the Intervention	31
3.3.4	Operation and Maintenance	34
3.3.5	Lessons Learned	35
3.4	Design of Decentralised Wastewater Treatment System (DEWATS) for Savar Cantonment Area	35
3.4.1	Background	35
3.4.2	Description of the Intervention	35
4	Waste Management Sector Interventions	39
4.1	Distribution of Separate-Coloured Bins for Waste Segregation in Savar Municipality	40
4.1.1	Background	40
4.1.2	Distribution of Bins	40
4.1.3	Distribution of Infographic Leaflets on Waste Segregation	43
4.1.4	Impact Survey to Assess the Effectiveness of Bin Distribution	44
4.1.5	Key Takeaways	45
4.2	Distribution of Safety Jackets for Sanitary Workers in Savar Municipality	45
4.2.1	Background	45
4.2.2	Distribution of Jackets	45
4.3	SWM Mobile Transfer Station for Savar Municipality	46
4.3.1	Background	46
4.3.2	Objectives	47
4.3.3	Stakeholder Consultation	47
4.3.4	Description of the Intervention	47
4.3.5	Operation and Maintenance	48
5	Capacity Building Activities	51
5.1	Overview	52
5.2	Training	52
5.2.1	Conversion of Open Landfill to Controlled Landfills in Small and Medium Towns	52
5.2.2	Operation and Maintenance of Public Toilets in Kushtia Municipality	53
5.2.3	Medical Waste Management in Savar Municipality	53
5.2.4	Operation and Maintenance of Public Toilets in Savar Municipality	55
5.2.5	Promotion of 3R and Source Segregation of Waste	56
5.3	Exposure Visit	57
5.3.1	Visit in Kushtia Municipality	57
5.3.2	Visit in Khulna City Corporation	58
5.4	Workshop	60
5.5	Meeting with WATSAN Committee of Kushtia Municipality	61
6	Publications, Manuals, and Guidelines	63
6.1	Overview	64
6.2	WASH Baseline Assessment Reports	64
6.3	SFD Reports and Posters	64
6.4	O&M Manual for Public Toilets	66
6.5	Operational Guideline for FSM	67
7	Way Forward	69
	References	72
	Appendices	73
	Appendix 1: List of Project Personnel from Waste Concern	74
	Appendix 2: List of Concept Notes and DPRs	75
	Appendix 3: Shit Flow Diagram (SFD) of Savar municipality	76
	Appendix 4: Shit Flow Diagram (SFD) of Kushtia municipality	77

List of Figures

Figure 1.1:	An Overview of project activities implemented by Waste Concern during 2021-2023	3
Figure 1.2:	Map of Savar Municipality with municipal wards	4
Figure 1.3:	Map of Kushtia Municipality with municipal wards	5
Figure 2.1:	A typical pit latrine in Savar municipality	9
Figure 2.2:	A shared toilet in a slum in Savar municipality	9
Figure 2.3:	Discharging grey water in open area	10
Figure 2.4:	A household discharging wastewater in drain	10
Figure 2.5:	Pile of waste alongside a stream near Bank Town in Savar Municipality	11
Figure 2.6:	Condition of Public toilets in Kushtia Municipality	12
Figure 2.7:	A vacutug for collecting faecal sludge in Kushtia municipality	13
Figure 2.8:	Faecal sludge drying beds of FSTP in Kushtia municipality	13
Figure 2.9:	A view of the existing landfill site of Kushtia Municipality	14
Figure 3.1:	Map showing the location of Bede Para and the selected cluster for proposed intervention	18
Figure 3.2:	Condition of some of the toilets in Bede Para before intervention	19
Figure 3.3:	Flow Diagram of the planning and implementation process for shared toilets in Bede Para	19
Figure 3.4:	Plan of the selected cluster of Bede Para with locations of shared toilets and water pumps	20
Figure 3.5:	Plan of a Shared Toilet at Bede Para	21
Figure 3.6:	Section of a Shared Toilet at Bede Para	21
Figure 3.7:	Improved Shared Toilets constructed at Bede Para	22
Figure 3.8:	Overhead Water Tank (left) and user obtaining water from pump (right)	22
Figure 3.9:	Gender-sensitive and Child -friendly design with easy-to-maintain features	23
Figure 3.10:	Slurry Pump emptying a pit (left) and Vacuum Truck of municipality (right)	24
Figure 3.11:	Paintings of Meena Cartoon on the walls of shared toilets with educative message	24
Figure 3.12:	Location of the Public Toilet in Karnapara area of Savar Municipality	26
Figure 3.13:	Condition of exterior and interior of Public Toilet at Karnapara before renovation	27
Figure 3.14:	Stakeholder consultation with community and municipal officials	27
Figure 3.15:	The exterior and the interior of the public toilet after renovation	28
Figure 3.16:	Handover of the renovated public toilet to the Mayor of Savar Municipality during the inauguration ceremony	28
Figure 3.17:	Male and female users of the public toilet at Karnapara	29
Figure 3.18:	Map showing Locations of Selected Public Toilets for Renovation in Kushtia Municipality	30
Figure 3.19:	External and Internal Condition of the Public Toilet at Hospital Road before Renovation	31
Figure 3.20:	Exterior of the Public Toilet at Hospital Road after Renovation	31
Figure 3.21:	Interior of the Public Toilet at Hospital Road after Renovation	32
Figure 3.22:	Internal Condition of Public Toilet at M. A. Rahim Market before Renovation	32

Figure 3.23: Public Toilet at M. A. Rahim Market after Renovation	33
Figure 3.24: Hand washing facility (left) and Nameplate (right) of the Public Toilet at M. A. Rahim Market	33
Figure 3.25: Internal Condition of Public Toilet at Kobi Azizur Rahman Road before Renovation	33
Figure 3.26: Public Toilet at Kobi Azizur Rahman Road after Renovation	34
Figure 3.27: Outfall of wastewater in a nearby waterbody (pond) inside Savar Cantonment area shown in plan (left) and a photograph (right)	35
Figure 3.28: Schematic Diagram of Proposed DEWATS	36
Figure 3.29: Section of Anaerobic Baffle Reactor (ABR) and Filter Drain of proposed DEWATS	36
Figure 3.30: 3D View of Anaerobic Baffle Reactor (ABR) and Filter Drain of proposed DEWATS	36
Figure 4.1: Map showing locations of bin distribution in Savar Municipality	41
Figure 4.2: Three different coloured bins distributed for segregating biodegradable, non-biodegradable, and household hazardous wastes	42
Figure 4.3: Handover of the bins to the Mayor of Savar Municipality and to the Councillor of Ward-1	42
Figure 4.4: A local resident using the distributed bins	42
Figure 4.5: Two sides of the infographic leaflet (English Version) distributed to raise awareness in favour of waste segregation using three different colour bins	43
Figure 4.6: Distribution of infographic leaflets in Bede Para (left) and Municipal Supermarket (right)	43
Figure 4.7: Questionnaire survey on effectiveness of distributed bins for waste segregation	44
Figure 4.8: Handover of safety jackets to the Mayor of Savar Municipality (left), a staff wearing the jacket (right)	45
Figure 4.9: Temporary dumping of solid waste on roadside (left) and collection by garbage trucks from roadside (right) in Savar municipality	46
Figure 4.10: Interaction of the project team with Savar municipality	47
Figure 4.11: Proposed Mobile STS unit consisting of a tractor and a hydraulic trailer/trolley	48
Figure 4.12: Possible locations for operation of mobile STS unit as proposed by Savar municipality	49
Figure 5.1: Participants of training sessions on conversion of landfill and O&M of public toilets in Kushtia Municipality	53
Figure 5.2: Training on medical waste management in Savar Municipality	54
Figure 5.3: Participants of training on medical waste management in Savar Municipality	54
Figure 5.4: Some moments from training on O&M of public toilet in Savar Municipality	55
Figure 5.5: Participants of training on O&M of public toilet in Savar Municipality	55
Figure 5.6: Training on Promotion of 3R at the Conference Room of Savar municipality office	56
Figure 5.7: Training on Source Segregation of Waste at the Auditorium of Savar municipality office	57
Figure 5.8: The exposure visit team meeting the Mayor of Kushtia municipality	58
Figure 5.9: Demonstration of faecal sludge collection during the exposure visit in Kushtia municipality	58
Figure 5.10: The exposure visit team meeting the Mayor of Khulna City Corporation	59
Figure 5.11: The members of exposure visit team visiting the FSTP of Khulna City Corporation	59
Figure 5.12: Participants of the online workshop on decentralized wastewater solutions in small and medium towns in Bangladesh	61
Figure 5.13: Waste Concern presentation during the meeting with WATSAN Committee of Kushtia Municipality	62
Figure 5.14: Discussion session with members of WATSAN Committee of Kushtia Municipality	62
Figure 6.1: WASH Baseline Assessment reports for Savar and Kushtia municipalities	64
Figure 6.2: SFD Report for Savar municipality	65
Figure 6.3: SFD Report for Kushtia municipality	65
Figure 6.4: Cover of O&M Manual for public toilets in Savar and Kushtia municipalities	66
Figure 6.5: Cover of Operational Guideline for Faecal Sludge Management	67

List of Tables

Table 2.1:	Existing condition of surface water bodies in Savar municipality	8
Table 2.2:	Different types of latrines in Savar municipality	9
Table 2.3:	List and Condition of public toilets in Kushtia municipality	12
Table 4.1:	Number of Respondents for Each Location of Bin Distribution	44
Table 4.2:	Locations of mobile STS operation as proposed by Savar Municipality	48

List of Acronyms

BBS	Bangladesh Bureau of Statistics
BDT	Bangladeshi Taka
BMZ	Bundesministerium für wirtschaftliche Zusammenarbeit und Entwicklung
BORDA	Bremen Overseas Research and Development Association
DEWATS	Decentralised Wastewater Treatment System
DPHE	Department of Public Health Engineering
DPR	Detailed Project Report
FHTC	Functional Household Tap Connection
FS	Faecal Sludge
FSM	Faecal Sludge Management
FSTP	Faecal Sludge Treatment Plant
GoB	Government of Bangladesh
KLD	Kilo Litres per Day
LGED	Local Government Engineering Department
LIC	Low Income Community
LPCD	Litres per Capita per Day
MRF	Materials Recovery Facility
O&M	Operation and Maintenance
PPE	Personal Protective Equipment
SDG	Sustainable Development Goals
SFD	Shit Flow Diagram
STS	Secondary Transfer Station
SWM	Solid Waste Management
WASH	Water, Sanitation and Hygiene
WATSAN	Water and Sanitation

1. Introduction



1.1 Background

The *“Integrated Water Management in Urban Areas as a Core Task of Municipal Services of General Interest”* is a project conceived and formulated by Bremen Overseas Research and Development Association (BORDA) with funding from German Federal Ministry for Economic Cooperation and Development (BMZ). The focus of this project is on promoting integrated and decentralised water and sanitation solutions for small municipalities in South Asian region. Eight municipalities from three countries in this region, namely India, Bangladesh, and Nepal, were selected for interventions under this project. The core issue addressed by this project is that small municipalities in global south have severe lacking of water and sanitation service delivery of acceptable quality to their citizens, especially to areas with high concentration of disadvantaged population groups. Therefore, the goal of the project is to contribute to improving the living conditions of people in small towns and reduce the health and environmental risks associated with inadequate water supply and sanitation in this region. However, the meso/micro level project objective is to enable provision of improved municipal water and sanitation services for the disadvantaged population of small towns.

This project focused on water and sanitation solutions in small municipalities for several reasons. Although there was a considerable improvement in access to water and sanitation services in India, Bangladesh and Nepal during the last few decades, these three countries still face overwhelming challenges in this sector. Besides, the benefits of water and sanitation improvement schemes do not reach all sphere of population equitably. The major share of urban water and sanitation improvement grants in these countries are channeled to major cities, largely neglecting the agenda of small municipalities. National policies and strategies in this sector too tend to have more inclinations towards large cities and rural areas than small municipalities. The municipalities suffer from inadequate personnel and institutional capacities, weak revenue base, and often weak leadership. The coverage of piped water supply in these municipalities is very limited, existing in some selected areas and excluding the disadvantaged segment of population. They also lack systematic sewer disposal and treatment system, and are unable to upgrade from rudimentary waste management system. Weak institutional capacity and vicious cycle of poor service delivery and poor tax and revenue collection result in perennial budget deficits for small municipalities. The limited grant they receive is mostly spent on construction without long-term arrangement for operation and maintenance. Consequently, sustainability of water and sanitation services in these municipalities is at stake. Therefore, the project’s approach is to focus on strengthening municipal capacity for planning and management of integrated and decentralised solutions for water and sanitation challenges faced by small municipalities.

The activities of this project in Bangladesh started in January 2021 for a three-year project phase, with Waste Concern as the local implementation and management partner. Waste Concern is a non-government organization that has been engaged in waste management, environmental management, and water and sanitation sectors since its establishment in 1995. Two municipalities were selected in Bangladesh for this project, namely Savar municipality and Kushtia municipality. A number of activities were planned and executed under this project, such as planning, design and implementation of various interventions, capacity building, and information dissemination or public awareness raising. It was also planned to implement some demonstrative interventions in selected municipalities. An overview of project activities implemented by Waste Concern has been presented in Figure 1.1. The activities have been described in detail in the following chapters of this report.

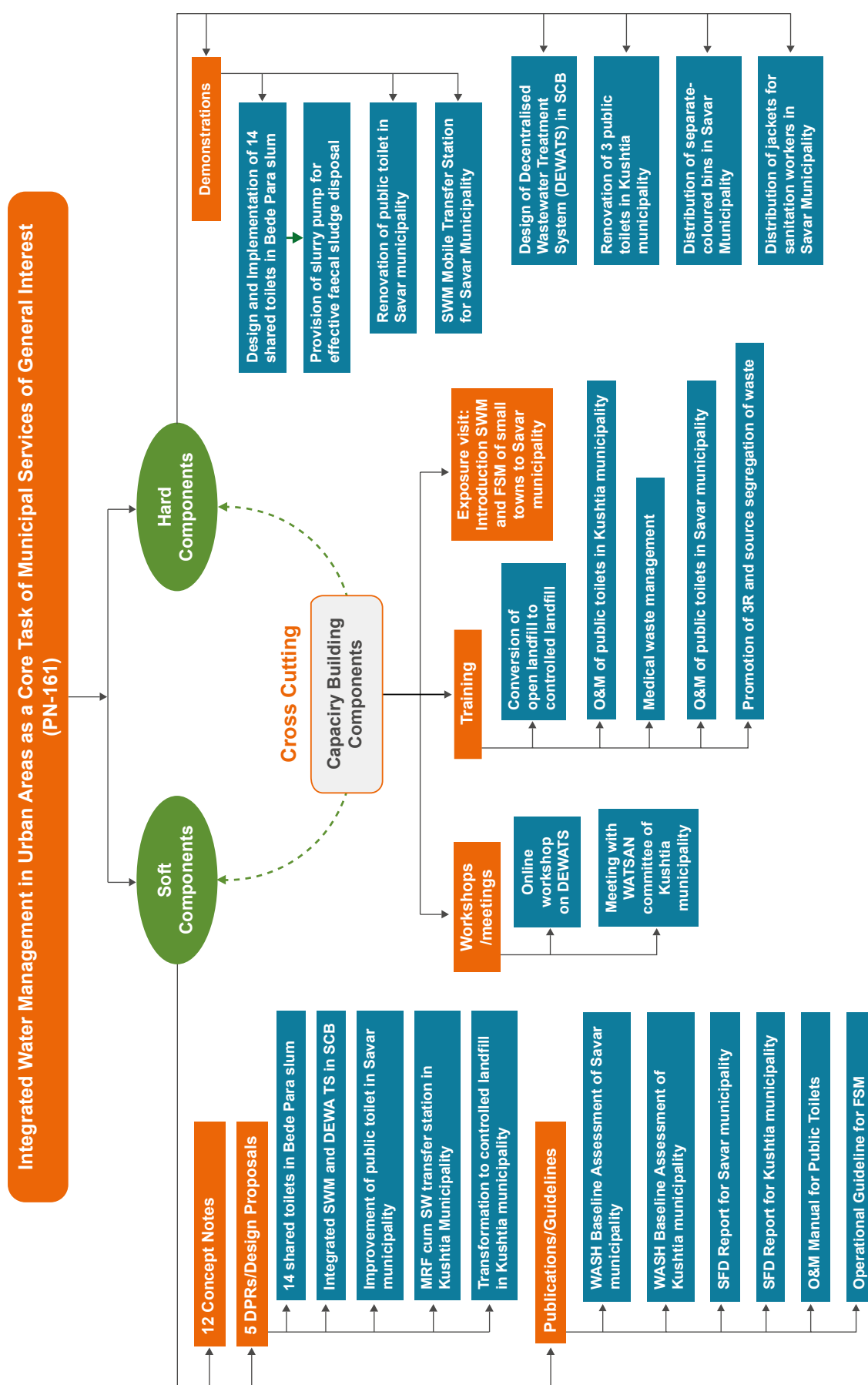


Figure 1.1: An Overview of project activities implemented by Waste Concern during 2021-2023

1.2 Selected Municipalities in Bangladesh

Savar municipality and Kushtia municipality were selected for interventions under this project through careful consideration. This project set off a number of activities in these municipalities, such as design and construction of water and sanitation facilities, renovation of defunct municipal facilities, promoting source segregation of solid waste, distribution of jackets for sanitation workers, conducting training and workshops on various topics related to operation and maintenance of municipal facilities and effective municipal waste management, and other capacity building activities (such as exposure visit of municipal officials). Three demonstrative interventions were implemented under this project, all of which took place in Savar municipality. A brief overview of these municipalities have been provided in following sections.

1.2.1 Savar Municipality

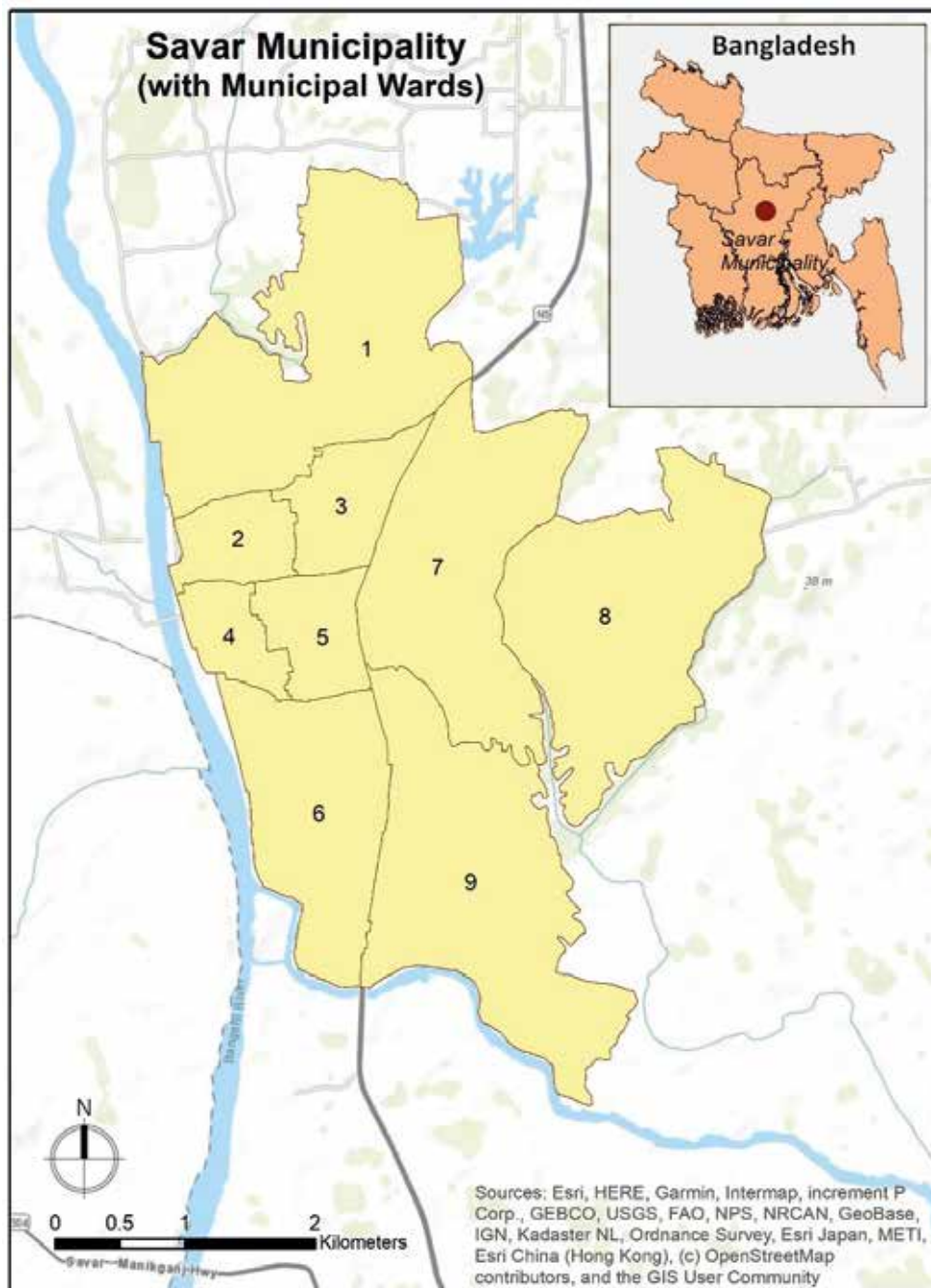


Figure 1.2: Map of Savar Municipality with municipal wards

Savar municipality is a small municipality in Dhaka District, situated just 12 kilometers away from Dhaka city. It has an estimated population of around 665,000, with a Male-to-Female ratio of 1.09. The municipality comprises an area of 14.08 sq. km. The whole municipal area is divided into 9 wards. More than half of the land within the municipal boundary is used for residential purpose. But this is also a rapidly industrialising municipality, hence there is a rapid influx of population migrating for job opportunities. This is resulting in rapid increase of slum population – currently 4.4% of the total population live in 10 designated slums of the municipality (Baseline Survey, 2021). Already laden with inadequate institutional and financial capacity, the municipality is under mounting pressure for improving the quality of water and sanitation service provision. The municipality has no facility for wastewater or faecal sludge treatment, and almost 80% of wastewater generated from toilets ends up in open environment due to no or improper containment system. The urgent need for improved and well-maintained public toilets, faecal sludge management system, waste treatment and disposal facilities, secondary waste transfer stations, etc. made the municipality a suitable candidate for introducing multiple interventions under this project.

1.2.2 Kushtia Municipality

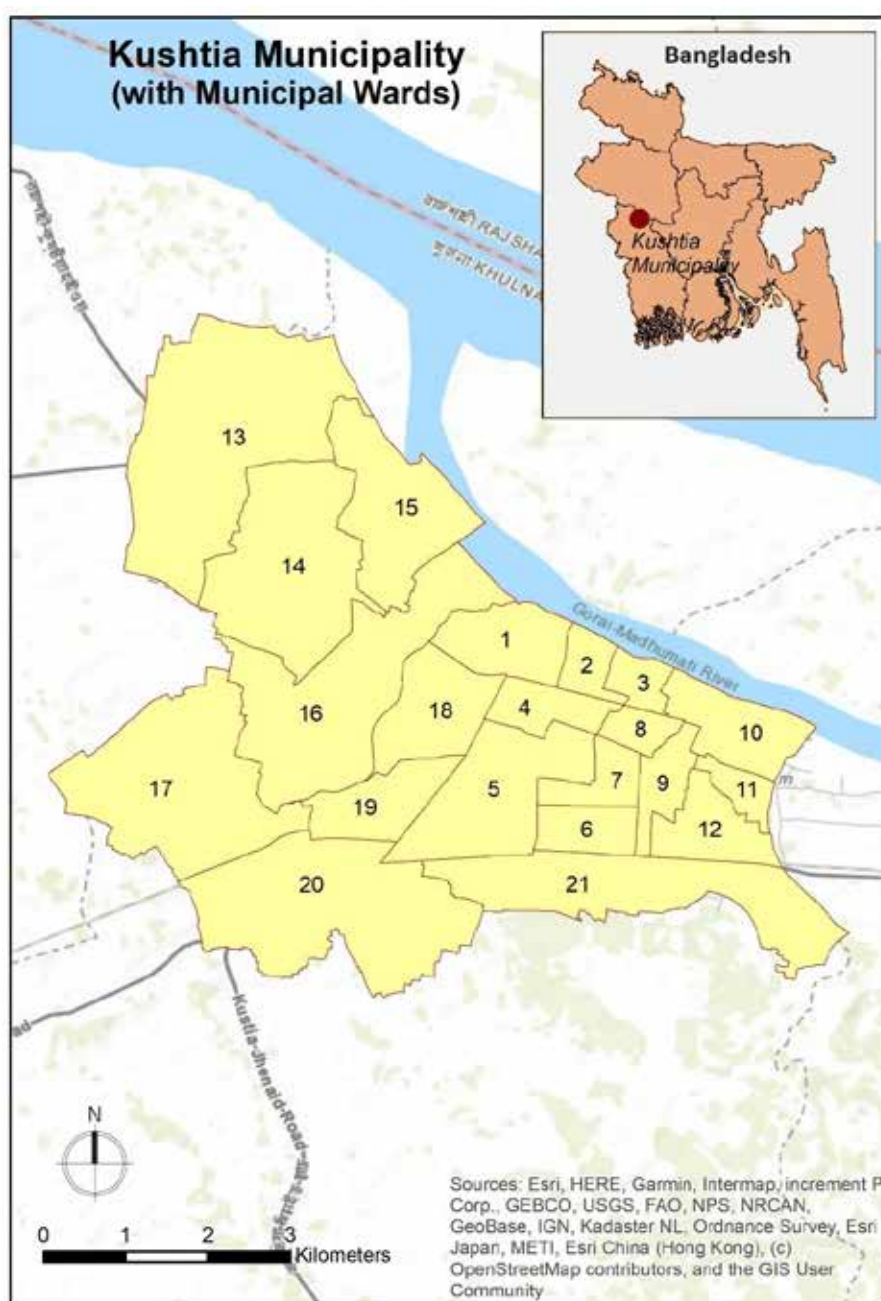


Figure 1.3: Map of Kushtia Municipality with municipal wards

Another municipality selected from Bangladesh for this project is Kushtia municipality. Situated in the south-western region of the country, it developed as a significant urban centre because of its easy access by waterway through Padma river and railway connection with Kolkata (Calcutta), the then Capital of British India. Established as a municipality in 1869, it is one of the earliest municipalities in Bangladesh. The current estimated population of Kushtia municipality is around 250,000. It has an area of 42.79 sq. km., and consists of 21 municipal wards. This municipality has been struggling with municipal waste management and effective operation and maintenance of municipal facilities. The only landfill of the municipality has already exceeded its capacity and overflowing with waste. The condition of existing public toilets was deplorable and few of these were completely dysfunctional. Although the municipality has a faecal sludge treatment facility (FSTP), it operates at only 67% of its capacity due to inadequate containment and collection of faecal sludge. Only 32% of wastewater is safely managed in this municipality. Therefore, achieving adequate sanitation and waste management is still a huge challenge for this municipality.

1.3 Relevance with SDGs and National Policies

This project is attuned to Sustainable Development Goal (SDG) 6, which aims at achieving access to safe and adequate water and sanitation for all. The project is also compatible with SDG 1 (End poverty in all its forms everywhere), SDG 3 (Ensure healthy lives and promote well beings for all at all ages), SDG 11 (Make cities and human settlements inclusive, safe, resilient and sustainable), and SDG 17 (Strengthen the means of implementation and revitalize the global partnership for sustainable development). It is relevant with national development plans/policies of Bangladesh as well, especially 8th Five Year Plan, Perspective Plan of Bangladesh 2021-2041, and National Strategy for Water Supply and Sanitation (Revised and Updated in 2021).

1.4 Objectives of the Report

The main objectives of this report are as follows:

- 1) To document and describe various activities that were planned and implemented by Waste Concern under this project.
- 2) To outline the methods of planning and implementation as well as operation and maintenance for major interventions under this project.
- 3) To identify key lessons/insights from major interventions under this project.

1.5 Organization of the Report

The contents of this report has been organised in seven chapters. *Chapter 1* provides an introduction to the project and the municipalities selected in Bangladesh for interventions under this project. *Chapter 2* discusses the main aspects of baseline assessment of WASH in Savar and Kushtia municipalities as well as major findings from this assessment. *Chapter 3* describes WASH sector interventions under this project and key lessons learned from these activities. Waste management related interventions have been described in *Chapter 4*. Various capacity building activities that took place under this project, such as training, workshops, exposure visit, etc. have been discussed in *Chapter 5*. The publications (e.g., WASH Reports, SFD Reports) and manuals/guidelines (e.g., O&M for public toilets, FSM Operation) prepared under this project have been presented in *Chapter 6*. Finally, *Chapter 7* provides a prospective look for WASH and waste sector interventions in the light of the experiences and insights gained from various activities implemented under this project.

2. Baseline Assessment



2.1 Purpose

The *National Strategy for Water Supply and Sanitation* of Bangladesh necessitates that baseline survey on the status of WASH in each local government body (Upazila, town or city) to be carried out for the purpose of acquiring information on the condition of containment, treatment, and disposal of excreta, management of solid waste and wastewater, surface drainage, etc (GoB, 2021a). Accordingly, a baseline assessment of WASH sector in Savar and Kushtia municipalities was conducted in 2021 under this project. This includes assessment of existing situation of water supply, access to toilets, wastewater management, solid waste management, condition of sanitation workers, etc. This study revealed overall condition of various aspects of WASH in these municipalities and identified gaps and issues pertaining to each aspect discussed. The outcomes from baseline study paved the way for formulation of proposed actions in the form of Concept Notes and later some of these were realised as demonstrations and other activities under this project. The insights from baseline assessment also helped determining the topics for training and other capacity building activities in the selected municipalities. The following sections provide an overview of significant findings from WASH baseline assessments of these municipalities.

2.2 Savar Municipality

2.2.1 Water Supply

The estimated water demand in Savar municipality is 119,824 cubic meters per day. But piped water supply is non-existent in Savar municipality. As a result, the residents are almost entirely dependent on tube wells and electric water pumps to obtain water. The survey found 300 shallow tube wells and 125 deep tube wells (operated with pumps) in the municipality – all were installed through private initiatives.

The fitness of surface water bodies as sources of water supply is largely poor, as can be seen in the following table.

Table 2.1: Existing condition of surface water bodies in Savar municipality

Type of water resource	Rivers	Canals	Ponds	Marshland/Ditches	Khal
Approximate area (acres)	71.11	41.28	53.24	79.88	46.59
Present condition (visual observation)	Poor	Poor	Poor	Poor	Poor
Quality of water	Poor	Moderate	Moderate	Poor	Poor
Identified problems	Industries dump waste	Nearby residents dump waste	Filling up of ponds and lakes	Filling and development activities in the marshland causing water logging	Nearby residents dump waste
Any initiative taken for conservation of water resources	No	No	No	No	No

Source: WASH Baseline Assessment, 2021

2.2.2 Access to Toilet

In the absence of a sewerage network, people in Savar municipality mostly use either pit latrines or septic tank-based latrines. However, a few people use hanging latrines too, which is a very unhygienic option. Table 2.2 shows the percentage distribution of different types of latrines in Savar municipality. Some households in the municipality have access to shared toilets only. These toilets can be found particularly in slum areas.

Table 2.2: Different types of latrines in Savar municipality

Type	Percentage
Single pit latrine	32
Twin pit latrine	22
Septic tank	45
Unsanitary	1

Source: Field survey, 2021

The state of containment and treatment of wastewater is quite miserable. Almost 80% of the wastewater (sewage or faecal sludge) generated in the municipality ends up in drains, water bodies, and open fields due to inadequate containment and disposal system.

The baseline survey revealed the following issues regarding the sanitation scenario of the municipality:

- Most of the toilets were found to be directly connected with drains.
- There is a huge scarcity of public toilets due to unavailability of land.
- Toilets in the slums were mostly found unhygienic.



Figure 2.1: A typical pit latrine in Savar municipality



Figure 2.2: A shared toilet in a slum in Savar municipality

2.2.3 Wastewater Management

Since the municipality lacks a sewerage system, the residents are entirely dependent on on-site sanitation system. Based on the population of the municipality, it was estimated that 46,598 KL of faecal sludge was generated per year. But the municipality does not have any faecal sludge treatment facility (i.e. FSTP), because a suitable land could not be located for construction of such facility. When required, local sanitation workers are hired for manually emptying sludge from pits or septic tanks. The emptied sludge is disposed in nearby drains or water bodies or low-lying areas, contributing to the problem of rampant environmental pollution in the municipality. However, according to the sanitation baseline survey, only 46% of the residents expressed requirement for desludging of their containment units (Waste Concern, 2021a). The municipality received a vacuum truck for desludging from Local Government Engineering Department (LGED) through City Region Development Project (CRDP) funded by Asian Development Bank (ADB). Because the demand for faecal sludge removal was low, the vacuum truck remained mostly unused. The majority of toilets in the municipality do not have proper containment system designed according to the National Building Code

(BNBC) – most of these are connected to an open drain or storm sewer, and some have unlined pits without any outlet, posing significant risk of groundwater pollution.

There is no proper greywater management system in the municipality too. Most households discharge greywater directly into open municipal drains, some of which are already blocked because of indiscriminate disposal of solid waste. In some areas of the municipality, greywater is discharged in nearby waterbodies and open fields. Neither the households nor municipal officials have any concern for systematic management of this greywater.



Figure 2.3: Discharging grey water in open area



Figure 2.4: A household discharging wastewater in drain

2.2.4 Solid Waste Management

Savar municipality lacks an efficient solid waste collection and management system. Every day around 185 tons of solid waste is generated in the town. Most of the waste generated in the municipality is dumped in low-lying areas, water bodies, and on roadsides. The municipality is able to collect only 36% of the waste. The coverage of door-to-door waste collection is 45%. There are only 24 community bins available for secondary collection. During the time of baseline survey, the municipality had only 10 waste collection vehicles – varying from 1-ton to 3-ton capacity – for carrying waste to the dumping site. The municipality does not have a designated landfill site. The collected waste is dumped in an unofficial landfill at Komlapur, Birulia Union, which is located outside the municipal area. There is no composting plant or any other resource recovery facility in the municipality.

The municipality has long been suffering from unsystematic waste management. There is no practice of source segregation of waste. The door-to-door collection exists partially in the town. Secondary storage facility is inadequate. Waste collection and transportation system is characterised by inadequate number and capacity of vehicles as well as inefficient routing plan. Physical composition analysis indicates that more than 80% of the waste is organic in nature. Yet there is no facility for processing the biodegradable portion of waste. In fact, there is huge gap of knowledge and lack of awareness among the municipal staff regarding resource recovery from municipal waste. There is no proper guideline for health and safety of waste workers. The waste collectors lack adequate knowledge of proper handling of the waste and operation and maintenance of waste collection equipment.

The indiscriminate open dumping of the waste leads to pollution and induces ill effects on public health.



Figure 2.5: Pile of waste alongside a stream near Bank Town in Savar Municipality

2.2.5 Condition of Sanitation Workers

There are 250 contractual municipal sanitation workers and another 100 workers are working privately in the solid waste management sector. In case of wastewater management, there are 50 contractual municipal sanitation workers, and 25-30 privately serving workers. The municipality provides WASH facilities to the sanitation workers, but this is not adequate due to shortage of municipal fund. Personal protective equipments (PPE) such as gloves, apron, gumboots, etc. are provided to the workers once a year, which is inadequate too. Besides, there is no specialized training for these workers on proper handling of waste and equipments.

There is no provision of housing facility from the municipality for sanitation workers. They reside in slums under poor living conditions, where they are deprived of adequate basic services needed for maintaining a decent life. Also, there is no provision of insurance for these sanitation workers.

2.3 Kushtia Municipality

2.3.1 Water supply

The municipality provides piped water supply to the households in the town. According to the statistics provided by the municipality, 10,400 KL water is supplied by the municipality per day through its 135 kilometers long network of water pipes. The total number of households with functional connection is 9215. The municipality is dependent almost entirely on groundwater for potable water supply. There are 3 water treatment plants in the municipality for Iron and Arsenic removal. Department of Public Health Engineering (DPHE) at times undertakes maintenance and extension programmes of the water supply system of the municipality.

However, the extent and quantity of municipal water supply is far from adequate. Only 33% of the households is covered by piped water supply. The rest of the households are dependent on tubewells (shallow and deep) for obtaining water. Current per capita water supply is 120 litres per day, whereas the government recommended amount is 180 litres per capita per day. Moreover, water is available at high pressure only for 2-3 hours per day. According to Bangladesh

Bureau of Statistics (BBS, 2015), there are 38 notified slums in the municipality – none of which has piped water supply or communal water collection points. Residents of these slums depend on public stand posts.

2.3.2 Access to Toilet

According to a study conducted by DPHE (2020), Kushtia municipality has 96% sanitation coverage as per SDG standard. No open defecation (0%) was reported in the municipality. The study shows that 44% of the toilets are connected to septic tanks and 54% are pit latrines (single pit or twin-pit).

In the public realm, however, the scenario of access to toilets is quite poor. The municipality has insufficient number of public toilets - only 6 in total. To make matters worse, two of these toilets were completely dysfunctional during the time of baseline survey. The remaining toilets were either in poor or moderate conditions (Table 2.3). Only two of the four operational toilets had dedicated units for female users.

Table 2.3: List and Condition of public toilets in Kushtia municipality

Sl. No.	Location	Operational Status	Overall Physical Condition
1	M. A. Rahim Market	Operational	Poor
2	Kobi Azizur Rahman Road	Operational	Moderate
3	Bus Terminal	Operational	Moderate
4	DC Office	Closed	Poor
5	Rajar Hat Bazar	Operational	Moderate
6	Hospital Road	Closed	Poor

Source: Baseline Assessment, 2021



Figure 2.6: Condition of Public toilets in Kushtia Municipality

2.3.3 Wastewater Management

Kushtia municipality does not have any sewerage network for collecting wastewater. Almost all households resort to on-site sanitation options (septic tanks, pits, etc.). But only 32% of wastewater generated in these toilets is contained and safely managed. Two types of septic tank/pit emptying system is practiced in Kushtia municipality. Mechanical emptying system is practiced in areas that can be accessed by vacuum trucks or vacutugs. The municipality has a vacutug service for sludge collection and transportation from on-site sanitation spots to the faecal sludge treatment plant (FSTP). The municipality had been providing the vacutug service since 2004. This was outsourced to a private-sector entity – AID Foundation – in February 2021. Currently, 6 vacutug units of 1000L, 1500L, 2000L, and 4000L capacities are under operation, conducting 60-90 desludging trips in a month. The municipality has one faecal sludge treatment plant (FSTP) that can treat 18 KL of sludge per day. The plant includes sludge drying beds, a trickling filter for treatment of percolates from the drying beds, and a co-composting facility.

In the areas where vacutugs cannot access due to narrow streets, pit emptying is performed manually by sanitation workers using buckets and sometimes pumps. The sludge emptied in this manner is discharged in drains or low lying areas.

Most of the toilets in the municipality do not have proper containment units designed following the standards of Bangladesh National Building Code. Faecal sludge and/or supernatant from 68% of toilets find their way to drains or waterbodies or open grounds without treatment. Even for toilets that have proper containment units, demand for desludging is low since the emptying of existing septic tanks is not carried out on a regular basis (once every 2-3 years). The amount of faecal sludge collected every day is 12 KL, which is 67% of the total capacity of FSTP. Therefore, the FSTP of the municipality is not operating at full capacity.

Kushtia Municipality does not have any separate collection and management system for greywater. Greywater is directly discharged into open drains and low-lying areas. No initiative was proposed to set up a grey water management system as there is lack of awareness and technical knowledge on this issue.



Figure 2.7: A vacutug for collecting faecal sludge in Kushtia municipality



Figure 2.8: Faecal sludge drying beds of FSTP in Kushtia municipality

2.3.4 Solid Waste Management

Every day around 76 metric tons of solid waste is generated in Kushtia municipality. The average amount of waste collected per day is 27 metric tons, which is only 35% of the total waste generated. Door-to-door waste collection exists in two-third of municipal wards (14 out of 21 wards). Rickshaw vans are used for door-to-door waste collection. There are 2 formal Secondary Transfer Stations (STS) in the municipality along with some informal ones, where waste collected by rickshaw vans is temporarily kept before transferring to municipal waste-carrying trucks. The municipality has 10 such trucks – varying in capacities from 1.5 tons to 5 tons. These trucks carry municipal solid waste from STS to the dumping site. The municipality has only one formally designated landfill site for dumping waste. There is also a co-composting plant of 4 tons/day capacity near the landfill site, where organic solid waste and dewatered faecal sludge are processed together to produce compost (Waste Concern, 2021b).

The solid waste collection and management system in Kushtia municipality is quite inadequate and inefficient. Almost 65% of the total waste generated remains uncollected by the municipality. This waste is being thrown into open drains, vacant lands, and roadside spaces, causing clogging of drains and environmental degradation. Clogging of drains due to indiscriminate dumping of waste therein results in water logging. Besides, open dumping of waste causes air, water, and land contamination. According to the Department of Environment (DoE), 67% of air pollution in the municipality happens due to inefficient management of solid waste.

One-third of municipal wards are outside the coverage of door-to-door waste collection. The number of primary waste collection vans is inadequate. Lack of properly designed secondary transfer stations affects systematic handling of the waste in the municipality. Furthermore, the number and capacity of trucks for carrying waste is insufficient too. Open trucks are used for carrying waste and most trucks do not have hydraulic tipping system. The current landfill site had already reached its capacity. Resource recovery from solid waste is very negligible – only 6% of biodegradable waste is brought under composting.



Figure 2.9: A view of the existing landfill site of Kushtia Municipality

2.3.5 Condition of Sanitation Workers

The municipality has a total of 326 employees as sanitation workers. These workers are living in Sweepers' Colony where the condition of basic facilities are very poor. Municipality provides WASH facilities to the workers, but water supply and toilet facilities are inadequate and the colony lacks proper drainage facility. The shortage of fund prohibits adequate supply of WASH facilities.

Municipality provides PPE (hand gloves, apron, gumboots, etc.) to sanitation workers twice a year. Also, the municipality imparts training to sanitation workers on occupational safety and health, and operation and maintenance of vacutug. However, there was no provision for training on waste segregation and other aspects of solid waste collection and disposal.

2.4 Key Findings from Baseline Assessment

Key findings from baseline assessment in Savar municipality:

- Since there is no piped water supply in Savar municipality, the dependence is entirely on groundwater which is obtained by means of tube wells and electric water pumps.
- Most latrines in Savar municipality are either pit latrines or septic tank-based latrines. The toilets in slum, often used in shared basis, are in the most deplorable condition.
- Almost 80% of the wastewater (sewage or faecal sludge) is not properly contained or disposed of, and ends up in drains, water bodies, and open fields.
- There is no facility for sewage or faecal sludge treatment in the municipality.
- The waste collection rate of the municipality is very low - only 36% of the solid waste generated is collected by the municipality.
- There is no formal facility for resource recovery from waste in the municipality. There is lack of awareness among the municipal staff regarding resource recovery from municipal waste.
- The waste collectors are not aware of source separation of the waste and proper handling of waste collection equipment.

Key findings from baseline assessment in Kushtia municipality:

- Only 33% of the households in Kushtia municipality is covered by piped water supply. The rest of the households are dependent on tubewells (shallow and deep) for obtaining water.
- Kushtia municipality has 96% sanitation coverage as per SDG standard.
- There are only 6 public toilets in the municipality. Two of these toilets were completely dysfunctional during the time of baseline survey.
- Only 32% of wastewater generated in the municipality is contained and safely managed.
- There is only one Faecal Sludge Treatment Plant (FSTP) in the municipality. But the FSTP of the municipality is not operating at full capacity, because the amount of sludge collected by vacutugs is only 67% of the total capacity of FSTP.
- The municipality can collect only 35% of the total waste generated.
- The municipality has only one landfill site, which had already reached its capacity.
- Resource recovery from solid waste is very negligible. Only 6% of biodegradable waste is processed through composting.

3. Sanitation Sector Interventions



3.1 Design and Implementation Support for Improved Shared Toilets at Bede Para Slum of Savar Municipality

3.1.1 Background

A prime objective of this project is to provide improved municipal water and sanitation services for the disadvantaged population of small towns. The baseline assessment conducted in 2021 identified ten notified slums within the municipal area of Savar. Among these slums, Bede Para slum is in the most deplorable condition considering access to urban basic services such as water supply, sanitation, and solid waste management. The inhabitants of this slum belong to a marginalised ethnic group, known as Bede. Bede people are typically used to a nomadic lifestyle, moving from place to place by rivers on their boats. Their traditional profession has been snake charming and catching, traditional medicines, and selling trinkets and jewelry. However, advances in medicinal healing and changes in people's beliefs have made many traditional professions of Bedes no longer profitable. This has affected their overall way of life. Previously, Bedes were almost exclusively living on boats, but nowadays many Bede families have settled on lands nearby rivers and have given up the life as boat-dwellers. Bede Para in Savar is one such settlement of Bede community, which is situated in Ward 1 of the municipality. This slum settlement encompasses an area of 20 acres, and is inhabited by 1234 households with a total population of 5047. A great number of people in this slum area are living in extreme poverty and they are a vulnerable group of the society.

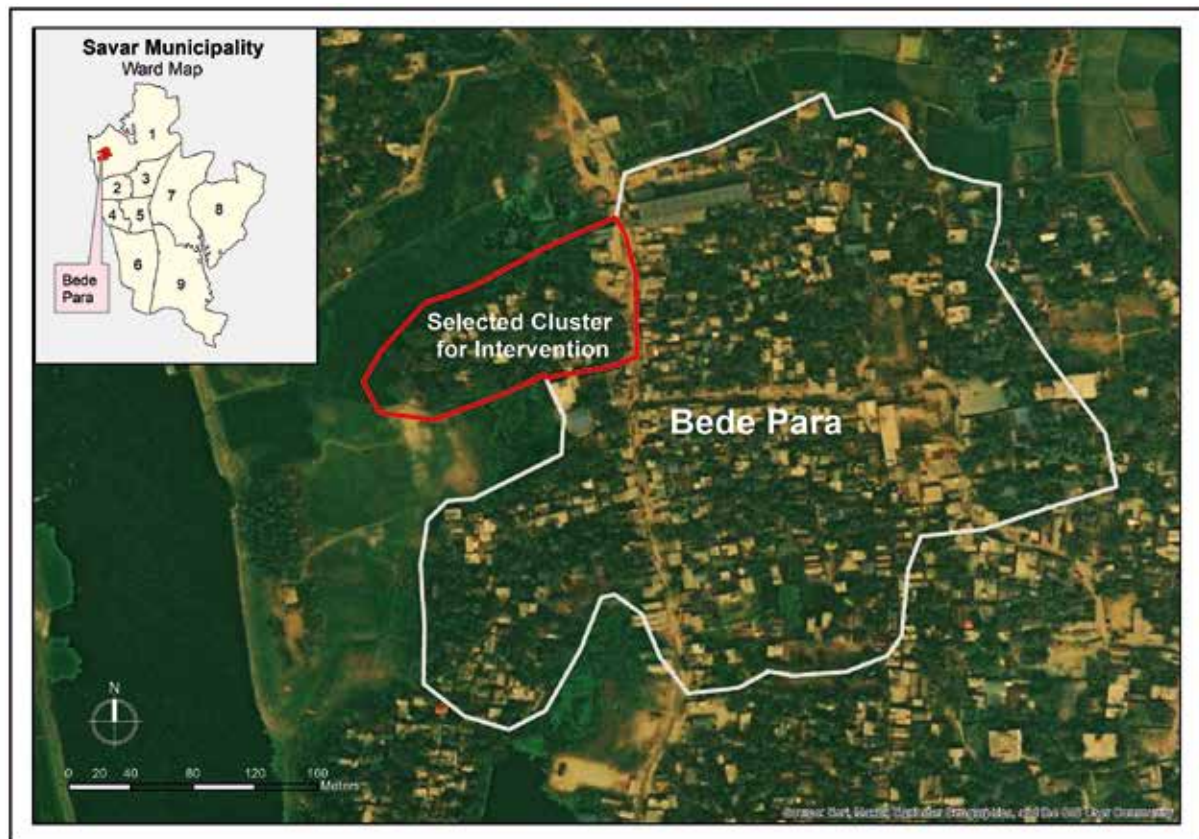


Figure 3.1: Map showing the location of Bede Para and the selected cluster for proposed intervention

The sanitation condition in one particular cluster of the slum was extremely deplorable. Around 360 people are living in this cluster, which comprises an area of only 1.65 acres. All toilets were unimproved and unhygienic, lacking a proper containment structure, roofs, walls, and doors. Some were made with temporary materials, with some curtain-like features instead of doors, and without any roof. These toilets were very uncomfortable to use, especially for women and children. The condition might be aggravated if flood water enters into the locality during a severe flooding event. Considering this miserable sanitation scenario of this particular cluster, it was selected for a demonstrative intervention for sanitation improvement in a low-income community. By improving the existing conditions of toilets

in this cluster, this intervention aims to move up the sanitation ladder as per *National Strategy for Water Supply and Sanitation (Revised and Updated in 2021)* (GoB, 2021a).



Figure 3.2: Condition of some of the toilets in Bede Para before intervention

3.1.2 Objectives

- The main objective of this intervention was to convert the unhygienic toilets in the slum into shared improved toilets with a proper containment system, roof, walls, and access to water sources.
- Another objective of this intervention was to make the toilets safe and hygienic for use by women and children.

3.1.3 Planning and Implementation Process

The need for improvement of toilets in Bede Para was identified during baseline assessment. A bottom-up approach was followed for planning and design of shared toilets in Bede Para. Stakeholder consultation was conducted with the community and elected ward councillor to understand the requirements of the residents of Bede Para and to adopt the most suitable approach for implementation of this activity. Based on this consultation, one particular cluster of the slum was selected for intervention. Bede Para is a high-density settlement and there is scarcity of suitable land to build on. Hence, the locations of the improved toilets were identified by the residents of the cluster themselves. A topographical survey and soil test was carried out in the intervention cluster. This was followed by the preparation of detailed design and cost estimates of the toilets. The residents also highlighted the need for ensuring adequate water supply and proper lighting inside the toilets. Therefore, provision of pumps with overhead water tanks and solar panels were included in this activity. After completion of the construction of the shared toilets, these were handed over to the community. The entire process of planning and implementation of shared toilets in Bede Para has been depicted through a flow diagram in Figure 3.3.

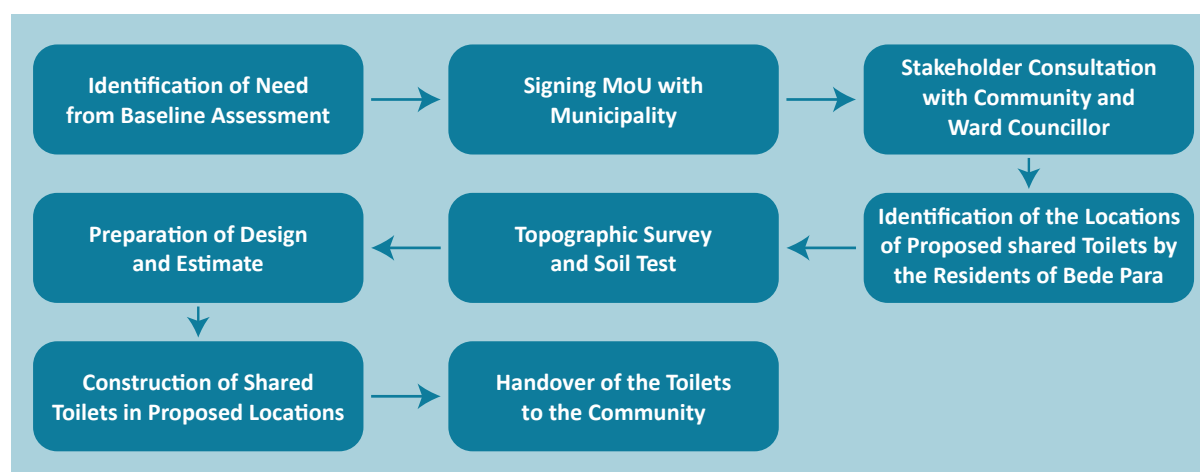


Figure 3.3: Flow Diagram of the planning and implementation process for shared toilets in Bede Para

3.1.4 Description of the Intervention

Under this intervention, all the existing unimproved toilets were replaced with improved ones. A total of 14 improved toilets were constructed that would serve 70 families consisting of 360 users. Each facility would be used and maintained by 4-6 families on a shared basis. The super-structure of these shared toilets consisted of brick walls, CGI sheet roofs, and permanent plastic doors. The plinths were raised 0.3 m (1 ft) above ground level in order to keep the facilities functional even during high flooding events. Good quality squatting pans were installed and the floors were covered with tiles for ease of cleaning. Vent pipe was provided for reducing odour and nuisance. There was also provision for adequate ventilation.

These improved toilets were fitted with single pit type of containment system. Each pit is 1500 mm deep with a diameter of 750 mm. Capacity of each pit is 0.66 m³. Considering a sludge accumulation rate of 0.04 m³/person/year, each pit would be capable of containment for 5-6 months.

In order to make these toilets functional all day long, lights were provided to illuminate the toilets at night. Solar panels with storage batteries were installed in each toilet to power these lights.

Also, 3 submersible water pumps with overhead plastic tanks were provided for water extraction and storage. This would ensure year-round water supply to the community and, thereby, help enhance overall sanitation situation and hygiene.

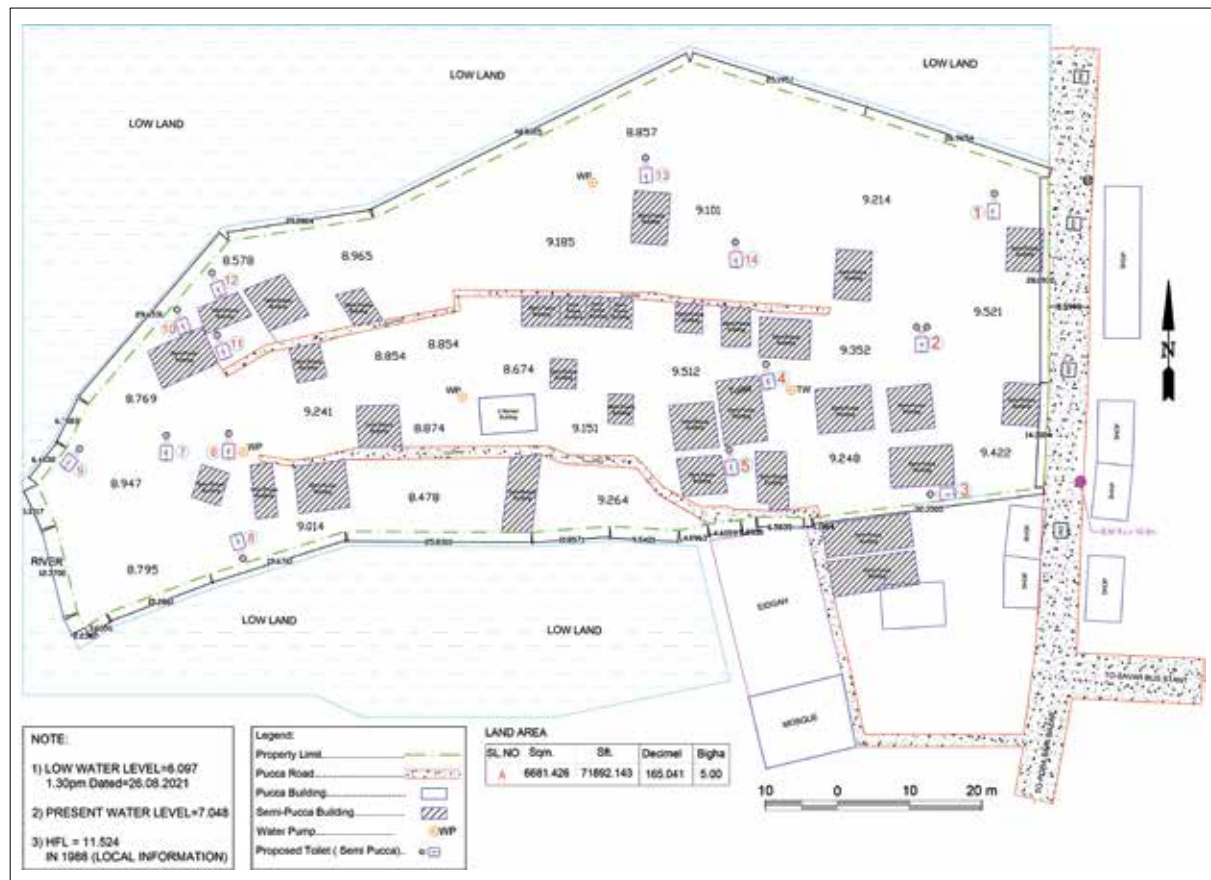


Figure 3.4: Plan of the selected cluster of Bede Para with locations of shared toilets and water pumps

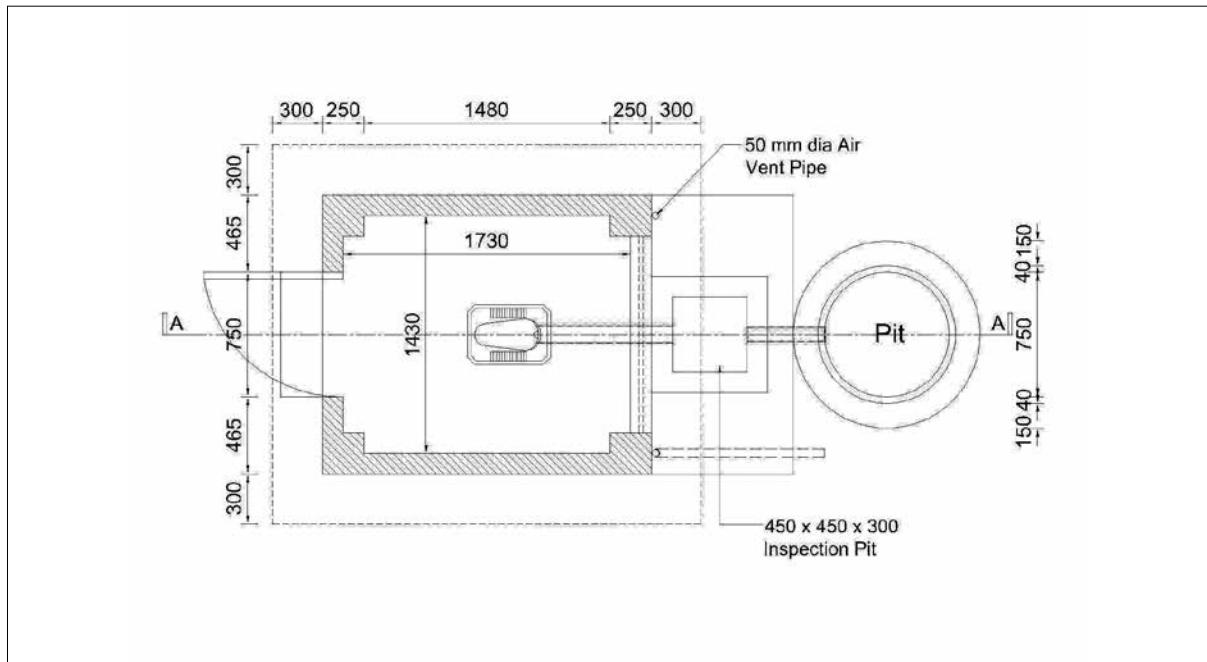


Figure 3.5: Plan of a Shared Toilet at Bede Para

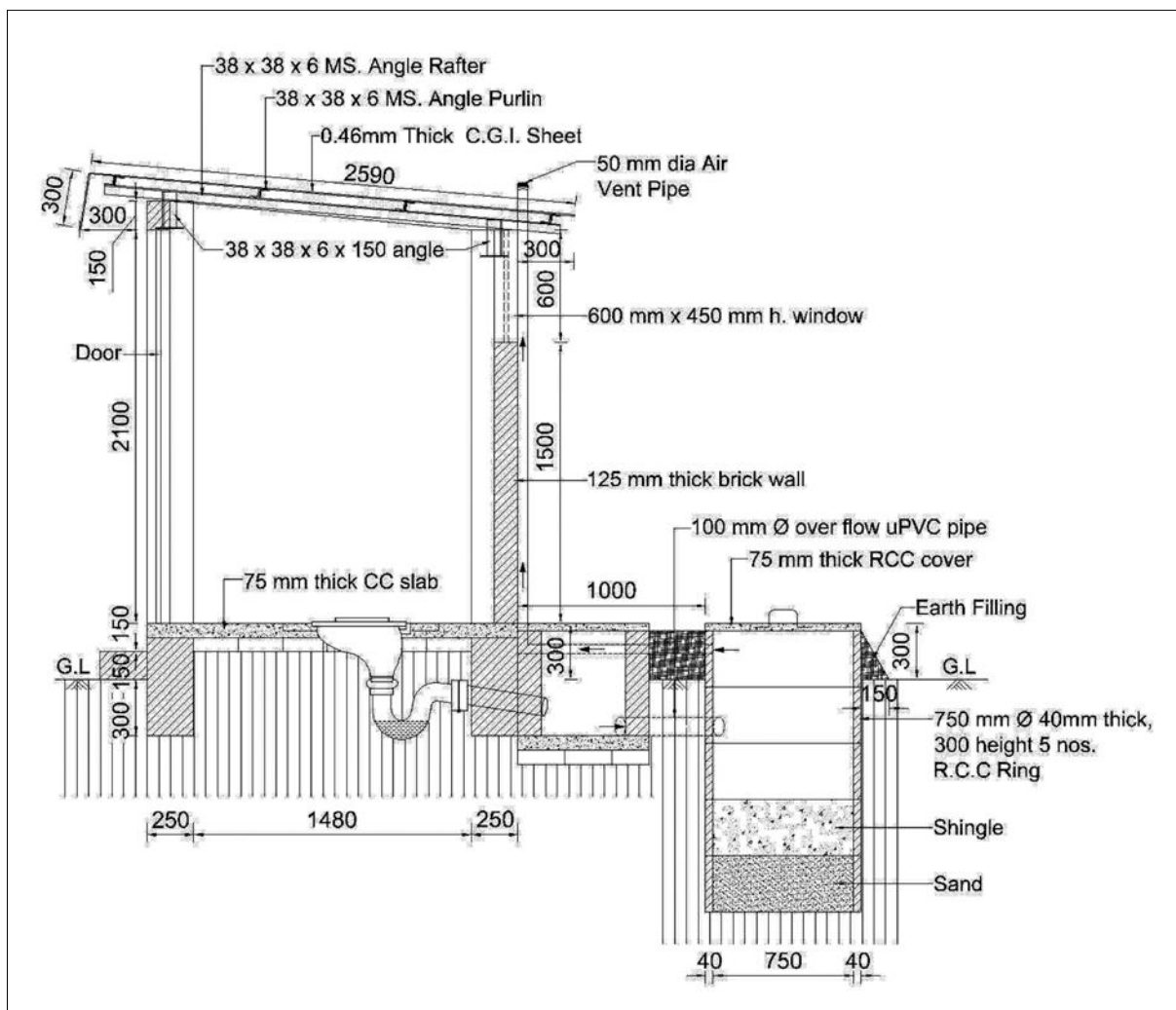


Figure 3.6: Section of a Shared Toilet at Bede Para



Figure 3.7: Improved Shared Toilets constructed at Bede Para

3.1.5 Salient Features

a) Proper Containment of Wastewater

Initially it was planned to provide twin-pit containment system for each toilet. The advantage of twin-pit system is that the pits can be used and emptied alternately. However, due to lack of adequate space, it was not possible to arrange for twin-pit except for one toilet. The remaining 13 toilets were provided with single pit. In order to avoid any risk of contamination of groundwater, the depth of each pit was limited to 1500 mm.

b) Uninterrupted Electricity and Water Supply

Since there was no electricity supply in the unimproved toilets of Bede Para, it was quite inconvenient to use these toilets in the evening and at night. Through this intervention, solar panels with storage batteries were provided in the improved shared toilets, thus ensuring day-long usage of these facilities through adequate lighting at night.



Figure 3.8: Overhead Water Tank (left) and user obtaining water from pump (right)

The lack of piped water supply in the area posed a challenge in ensuring proper sanitation. The main sources of water in the area were some shallow tubewells which are operated manually. But during dry season the water table lowers and it becomes difficult to obtain ample water from these tubewells for daily use. Addressing this issue, three submersible pumps with overhead water tanks were installed in the area in order to ensure year-round uninterrupted water supply, and thereby help improve overall sanitation.

c) Disaster Risk and Climate Sensitivity

Bede Para slum is situated near Bangshi River. The normal water level of the river was recorded at around 6 meters. However, the river water level rises to 7 meters during monsoon season, flooding the low-lying lands surrounding Bede Para area. The average elevation of the selected cluster in Bede Para slum is 9 meters. As the climate changes, the risk of severe flooding events may increase. Addressing this issue, the plinths of toilets were raised 0.3 m (1 feet) above ground level. Thus an average safety height of 2.3 meters was obtained as a climate adaptation measure in the design.

This intervention also has a climate mitigation aspect. Instead of tapping on conventional electricity supply sources – most of which use fossil fuels for electricity production – the toilets were provided with solar panels to supply electricity. Therefore, the climate footprint of this intervention is reduced by means of cutting down the emission of greenhouse gases. Thus this intervention is aligned with the *Paris Agreement*'s mitigation goals.

d) Gender-sensitive and Child-friendly Design

Previously, many toilets in Bede Para slum did not have roofs and proper walls. Also, many toilets had some curtain-like features instead of permanent doors. These toilets were very much uncomfortable for women. This intervention turned the unimproved toilets into improved shared toilets with permanent walls, roof, and doors. Also, these toilets were not convenient for children, especially during the evening. Now, the shared toilets are built to be safe for both women and children, with properly designed steps, squatting pans and other features. Also, hygiene of these facilities were ensured through enhancing access to water and laying easy-to-clean tiles on the floor. Overall, these toilets were built to be gender-sensitive and child-friendly facilities.



Figure 3.9: Gender-sensitive and Child -friendly design with easy-to-maintain features

e) Innovative Desludging Technique

The pits of shared toilets have to be emptied by means of vacuum truck of the municipality. However, since the lanes of Bede Para are too narrow and the length of suction pipe of this truck is 100m, it is possible for the vacuum trucks to directly empty the pits of only seven toilets, i.e. half of all the toilets in the cluster. To overcome this challenge, two slurry pumps were procured and provided to the municipality. The function of these pumps is to transfer the sludge of toilet pits that are beyond the reach of suction pipes into some intermediary pits, which would then be emptied by vacuum trucks. This relay method of desludging is an innovative approach introduced in this project.



Figure 3.10: Slurry Pump emptying a pit (left) and Vacuum Truck of municipality (right)

f) Wall Paintings

Addressing the need to create awareness regarding usage and cleanliness of toilets as well as maintaining proper hygiene and sanitation among the people of Bede Para, the walls of the toilets were painted with educational cartoons. These are based on a popular cartoon “Meena”, which was produced with the support of UNICEF during the 1990s with the purpose of raising awareness regarding various social issues in South Asian countries, particularly educating young viewers. The central character is Meena – a girl who along with her younger brother Raju and pet parrot Mithu conveys important messages to the viewers. In case of shared toilets at Bede Para, they demonstrate how to use toilet and maintain hygiene with such messages as “wash hands with soap properly after using toilet”.



Figure 3.11: Paintings of Meena Cartoon on the walls of shared toilets with educative message

3.1.6 Operation and Maintenance

The responsibility of operation and maintenance of the shared toilets lies with the community. The costs of O&M are equally shared by the families that use a specific toilet. Each shared toilet has an operator identified from the user community (nearby 4-6 households) who is in charge of the operation and maintenance activities. In order to facilitate the operation and maintenance (O&M) of the shared toilets, a Standard Operating Procedure (SOP) was prepared. This SOP provides guidelines on the effective use of shared toilets as well as instructions for operators engaged in O&M of these toilets. These include ensuring hygiene and cleanliness of toilets and floors, ensuring that electrical fittings and solar panels are functional, using environmentally harmless and hygienic liquids and chemicals in cleaning work, ensuring timely cleaning of the water tanks, and regular monitoring and emptying of pits.

According to the Standard Operating Procedure, the pits have to be emptied once in 3 months or as per the requirement. Desludging of these pits is done with assistance from municipality. The vacuum truck of the municipality is used for this purpose. For those toilets that are located beyond the reach of vacuum truck's suction pipe (100m length), a combination of slurry pump and vacuum suction is used. Two slurry pumps had been handed over to Savar Municipality to facilitate this process. Thus the pits of all the shared toilets can be emptied effectively.

3.1.7 Lessons Learned

- The identification of intervention on the basis of need of the community is essential, because it garners a sense of ownership among the users.
- Construction of infrastructure alone is not sufficient to meet the need of people. Sometimes additional facilities are required in order to sustain it. In case of shared toilets at Bede Para, provision of three water pumps and two slurry pumps improved the overall functionality of the shared toilets.
- The functionality of a WASH facility can also be improved by Involving the community in the O&M process. This was reflected in the O&M of the shared toilets, which have been maintained well and kept clean by the users.

3.2 Renovation of Public Toilet at Karnapara in Savar Municipality

3.2.1 Background

As the second demonstrative intervention under this project, a defunct public toilet at Karnapara area in Ward no. 6 of Savar Municipality was chosen for restoration. The toilet is situated beside Karnatali River, which is a branch of Dhaleshwari River. The location of the public toilet site is next to a ghat or landing place for boats carrying people and goods between the municipality and nearby areas across Dhaleshwari River. A good number of people use the ghat to cross the river every day. There is a mosque beside the ghat too. Because of its riverside location, this place attracts many local people who come here to take a stroll and spend some time for refreshment and fresh air, especially in the morning and late afternoon.



Figure 3.12: Location of the Public Toilet in Karnapara area of Savar Municipality

It was observed during initial inspection that the structure of the public toilet was sound and stable. However, due to lack of reliable electricity connection to the public toilet, the submersible pump that had been installed to supply water to the toilet could not be operated. Because the toilet was lying non-operational for a long time, the fixtures were mostly degraded and the existing pump was no longer functional. As a result, the public toilet turned into a dysfunctional facility despite being situated in a strategic location.

In order to operationalize this public toilet, it was planned to renovate this facility along with provision for consistent electricity supply. There was also a plan for landscaping the immediately surrounding area. This would be done by providing seats, pergola, surface pavement, planters, etc. and incorporating a tea stall in this place. These arrangements would be targeted at attracting and retaining more people in this place, therefore enhancing the number of users of this facility. This was also expected to change the perception of general people about public toilets – these can be sociable places with necessary amenities, as opposed to the popular image of public toilets as dirty, unhygienic places.



Figure 3.13: Condition of exterior and interior of Public Toilet at Karnapara before renovation

3.2.2 Objectives

- Renovation of the public toilet by repairing and replacing the internal and external features.
- Installation of solar panels for ensuring a regular supply of electricity and water.
- Improvement of the surrounding area of public toilet with better landscaping.

3.2.3 Description of the Intervention

With a view to turn the site of public toilet into a convenient place for sitting and interacting, a landscaping plan for the site was prepared. The main theme of the design was mingling three major elements, namely the public toilet, ghat (riverfront), and people visiting this place by creating visual connections, sense of enclosures, and providing a variety of functions and usages. The initial plan, which was prepared in consultation with the municipality, included renovation of existing toilet, repairing of existing riverside stairs (ghat), installation of solar panels for lighting and pumping water, tea stall, sitting arrangements, paved walkway, pergola roof, plantation, etc. Repairing of ghat was later omitted from the plan and the entire demonstration activity was divided into two phases. First phase included repair of the toilet, and installation of solar panels and a pump. Second phase included landscaping with ancillary civil works. The first phase of the work was completed in December 2022. However, due to considerable time required in obtaining approval from NGOAB and consequent delays in receiving funds from donor, the second phase of this intervention was not possible to implement.



Figure 3.14: Stakeholder consultation with community and municipal officials

The toilet had facilities for both male and female users. It included three units with squatting pans, two urinals, and a wash basin in Male section; and one unit with a commode and a wash basin in **Female** section. As part of this intervention, the interior and exterior walls of the toilet were painted. The fittings of the toilet, such as taps, basins, and lights were replaced. Solar panels with a total capacity of 3 KWp were installed to ensure a sustainable and reliable supply of electricity to the toilet. Initially, the solar panels were planned to be placed on the ground near the toilet. But addressing the demand of local people to use this site for extension of nearby graveyard, the solar panels were installed on the rooftop of the toilet after consultation with community and municipal officials. Also, a submersible pump of 1 HP capacity and an overhead tank **were** installed for pumping and storage of water.

After the renovation work was complete, the public toilet was formally handed over to the municipality. The Mayor of Savar Municipality, Haji Md. Abdul Goni, accepted the renovated facility on behalf of the municipality and formally inaugurated it for public use. Md. Shariful Imam (Executive Engineer of Savar Municipality), Mr. Abdus Sattar (Councillor of Ward 6), Mohammad Aminul Quaium (Project Manager of Waste Concern), and Syed Zubaer Ahmed (Event and Logistics Officer, Waste Concern) were present during the inauguration.



Figure 3.15: The exterior and the interior of the public toilet after renovation

3.2.4 Operation and Maintenance

For the purpose of operation and maintenance, the municipality leased out the public toilet to a private operator. A caretaker was hired by the leaseholder to look after the public toilet. He is responsible for regular cleaning and maintenance of the facility. A small amount of money is being charged from the users of this facility (5 BDT for urination, 10 BDT for defecation, and 15 BDT for shower), which is used to meet the O&M expenses. The operation hours of the toilet are from 6 AM to 11 PM.



Figure 3.16: Handover of the renovated public toilet to the Mayor of Savar Municipality during the inauguration ceremony

An O&M survey conducted in 2023 revealed that 15-20 people use this facility every day. Around 4000-5000 BDT worth of revenue is generated from the users per month. The monthly expense for maintenance is around 200-300 BDT, which

is mainly spent for purchasing cleaning items such as toilet cleaning liquid/powder, brooms, brushes, bucket, etc. The frequency of toilet cleaning is usually twice a week, but the sweeping of the floor is done every day. The latest O&M check indicates that all units are functional and clean. The solar panels and pump are functioning properly, and the toilet fittings such as flush and taps are operational too. The interior lighting condition and ventilation are satisfactory.



Figure 3.17: Male and female users of the public toilet at Karnapara

3.2.5 Lessons Learned

- It is essential to ensure availability of supporting infrastructure in order to keep a public facility functional. Absence of electricity rendered the submersible pump useless, which hindered water supply to the toilet. This caused the facility lying useless after its construction. Only after ensuring consistent electricity supply by means of solar panels the toilet became operational.
- Stakeholder consultation with local people must be conducted during the early phases of a project activity. For instance, the fact that the land planned for installation of solar panels had already been earmarked for expansion of nearby graveyard was known only during the time of implementation, when the members of local graveyard committee raised objection against development on that land. This interruption during implementation could have been avoided if the community were consulted during the planning phase of this activity.
- Involvement of the public authority/municipality from the onset of the work increases the possibility of cooperation from these authorities. For instance, when local people expressed their objection regarding the planned site for solar panels, the municipality took prompt action to resolve the issue shifting the location of solar panels in consultation with local people.

3.3 Renovation of Three Public Toilets at Kushtia Municipality

3.3.1 Background

Public Toilets in municipal areas are valuable assets that, if maintained and operated properly, can play critical roles in promoting sanitation and hygiene in public sphere. In Bangladesh, however, these municipal assets are very often undermined, resulting in a common image of public toilets as dirty, shabby, and stinky facilities that one might not be encouraged to use. Negligence of municipalities in proper maintenance of public toilets often turns these into derelict and defunct facilities that otherwise could have been assets of both social and financial values.

One of the oldest municipalities in Bangladesh, Kushtia Municipality is a 'Class A' municipality with a population of around 250,000. It is one of the fastest growing municipalities in Bangladesh with a good potential for economic development. Yet almost all public toilets in the municipality were suffering from poor maintenance and poor cost recovery. Baseline assessment conducted in 2021 shows that the municipality does not have an adequate number of public toilets considering its growing population and social and economic activities. There are only 6 (six) public toilets in the Municipality, out of which two facilities were completely dysfunctional and closed. The physical conditions of these public toilets varied greatly. There was lack of proper lighting and ventilation in these toilets. Commode/pan

flush were found to be broken, basin pipe and taps were missing in some toilets. The interiors of some toilets did not receive ample daylight, therefore the plaster on the inner walls and roofs was affected with dampness and became damaged.

These public toilets were not gender-friendly either. Three of the toilets didn't have dedicated ladies' facilities. As a result, the number of female users was observed to be very low. Moreover, most toilets did not include any high commode. This made the toilets largely unusable for physically challenged people. There was poor collection of user charges and record keeping too, resulting in very poor revenue generation from these facilities. Observing the deplorable conditions of public toilets in Kushtia Municipality, an initiative was taken to renovate some of these toilets under this project. The municipality identified three toilets for renovation that are situated at Hospital Road, M. A. Rahim Super Market, and Kobi Azizur Rahman Road. The first one was completely derelict and closed, hence a complete overhaul of this facility was necessary. The other two toilets were operational, but in somewhat subpar condition.

3.3.2 Objectives

- To assess the existing conditions of the defunct or subpar public toilets identified by Kushtia Municipality and identify the necessary improvements to be made in these facilities.
- To improve the existing conditions of these public toilets through necessary renovation works and make these facilities operational again.



Figure 3.18: Map showing Locations of Selected Public Toilets for Renovation in Kushtia Municipality

3.3.3 Description of the Intervention

a) Public Toilet at Hospital Road

The public toilet at Hospital Road had been completely abandoned before the renovation work began. The total area of this toilet is 351 sq. ft. It had 9 LWCs, 1 shower unit, no urinals and no wash basins before renovation. The Defunct Facility Assessment study conducted by Waste Concern in 2021 revealed that the toilet was in a very poor condition. The entrance gate was severely damaged and unusable. The entrance of the toilet was damp and there was not enough daylight coming inside. The roof was damaged and plasters on the wall became damp and loose. The corridor was degraded too. It did not have provision for separate female units.

Through this intervention, the toilet was transformed into a usable facility that can address the needs of both male and female users. After renovation, there are 3 units and 3 urinals for male users and 1 unit for female users now. Also, 3 basins for male users and 2 basins for female users were provided. A shower unit was also provided in this public toilet, thus making it a full-fledged facility serving multiple purposes. One unit in the Male section was furnished with commode considering the need of physically challenged people. From the same consideration, the entry to the toilet was facilitated with a ramp instead of steps. The interior walls were covered with tiles in order to prevent dampness and damage to plasters.



Figure 3.19: External and Internal Condition of the Public Toilet at Hospital Road before Renovation



Figure 3.20: Exterior of the Public Toilet at Hospital Road after Renovation

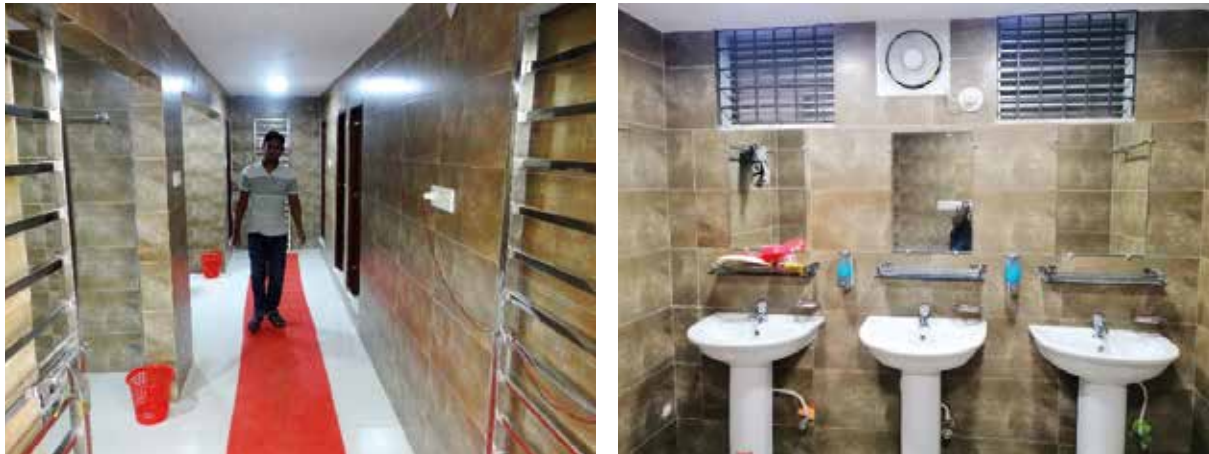


Figure 3.21: Interior of the Public Toilet at Hospital Road after Renovation

b) Public Toilet at M. A. Rahim Market

The public toilet at M. A. Rahim Market is a facility that primarily serves shop-owners, employees, and visitors of the market. The total area of this toilet is 215 sq. ft. It had 4 LWC units, 4 urinals, and no wash basins before renovation. As the baseline assessment indicates, it had already been a heavily used facility despite the condition being very unhygienic. The assessment of this public toilet conducted in 2021 revealed its poor condition. The collapsible gate was broken. A water closet was broken. The windows were covered with polythene sheets and there was not enough daylight. Plaster on the wall was damaged in some places. All the water closets were squatting pans (LWCs), so these were not convenient for physically challenged people.

During renovation work, the collapsible gate was repaired. Exhaust fans were added to improve the internal ventilation. One squatting pan was replaced with a commode in order to facilitate the use of the facility by physically challenged people. Two basins were also added in this public toilet. The interior walls of the water closet units were covered with tiles to save the walls from damage caused by dampness.



Figure 3.22: Internal Condition of Public Toilet at M. A. Rahim Market before Renovation



Figure 3.23: Public Toilet at M. A. Rahim Market after Renovation



Figure 3.24: Hand washing facility (left) and Nameplate (right) of the Public Toilet at M. A. Rahim Market

c) Public Toilet at Kobi Azizur Rahman Road

Among the three public toilets, the toilet at Kobi Azizur Rahman Road was in relatively better physical condition. But many fittings and fixtures were either missing or broken, so some units and basins were not functional. It is a relatively spacious facility, with a total area of 428 sq. ft. and separate Male and Female sections. Male section has 3 LWC units, one wash basin and one shower. The female section includes 2 LWC units and one wash basin.

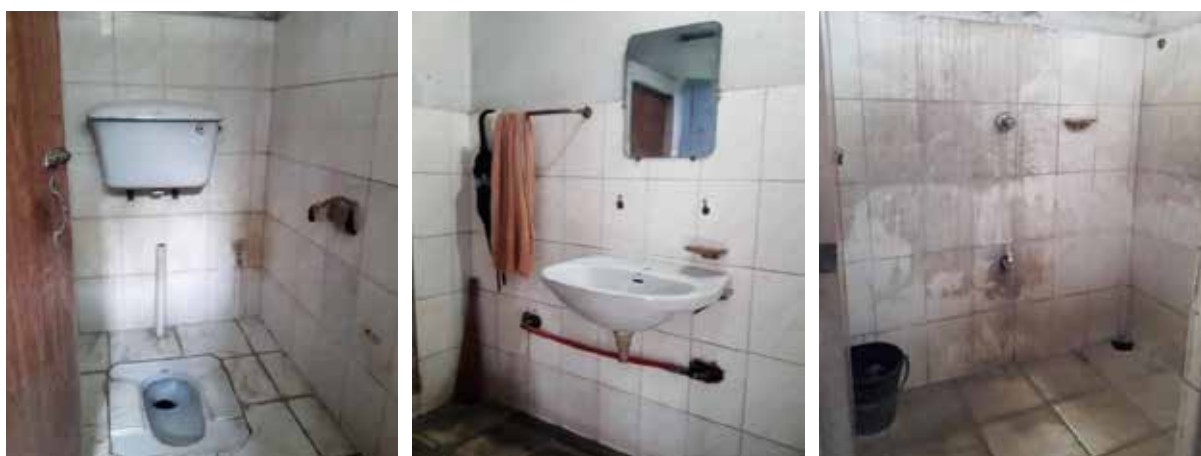


Figure 3.25: Internal Condition of Public Toilet at Kobi Azizur Rahman Road before Renovation

During the assessment of the condition of this toilet, it was found that the flush of a unit had been broken. Some basin pipes and tap fittings were missing. Some light bulbs and shower fittings were missing too. During renovation, all the shower and tap fittings were replaced. Lighting fixtures were replaced and light bulbs were added. Colouring and finishing works were done on both the interior and exterior surfaces.



Figure 3.26: Public Toilet at Kobi Azizur Rahman Road after Renovation

3.3.4 Operation and Maintenance

Public Toilet at Hospital Road

The municipality contracted out the public toilet at Hospital Road to a private operator for the purpose of operation and maintenance of this facility. The operation hours of the toilet are from 5 AM to 9 PM. Some fee is charged for using this facility – 5 BDT for urination, 10 BDT for defecation, and 15 BDT for shower. A caretaker was hired to collect the user fees and look after the cleanliness and maintenance of this toilet. According to the maintenance staff, 70-100 people use the public toilet every day. A revenue of 15000-16000 BDT is generated from this facility per month. The expense for maintenance is around 6000-6500 BDT per month, out of which 5000 BDT is spent as the wage of the caretaker, 500 BDT is spent for cleaning agents, and 500-1000 BDT for other purposes (such as utility bills, etc.). All the operation and maintenance expenses are met from collected revenue. The toilets are cleaned very frequently, and the floor is swept 2-3 times a day. During the O&M check, the overall condition was observed to be neat and clean and the toilet fittings were found to be operational. The interior lighting condition and ventilation were satisfactory.

Public Toilet at M. A. Rahim Market

The responsibility for the operation and maintenance of the public toilet at M. A. Rahim Market is vested in the market committee. The market committee assigned two staff on a daily wage basis for maintenance and collection of fees. A cleaning staff was also assigned for regular cleaning of the toilet. The facility is open for 24 hours every day. The user fees for this facility are 2 BDT for urination and 5 BDT for defecation. During an O&M monitoring survey, the maintenance staff informed that 300-400 users use the facility every day. Roughly 1000 BDT is earned from users per day. The total daily wage of the maintenance and cleaning staff is 700 BDT. Additionally, there is an expenditure of 1500-2000 BDT per month for cleaning materials and utility bills. Every day the toilet is cleaned at least 3 times by the cleaning staff. The maintenance staff report any breakage or need for replacement or repair to the market committee immediately.

Public Toilet at Kobi Azizur Rahman Road

The public toilet at Kobi Azizur Rahman Road was leased to a local operator for operation and maintenance. The toilet is operational from 10 AM to 7 PM every day. The user fees for this facility are 5 BDT for urination, 10 BDT for defecation, and 15 BDT for shower. According to the operator, around 20-25 people use this facility per day and the daily income from this is roughly 200 BDT. The monthly expenses for cleaning materials and utility bills are 500-800 BDT. The operator looks after the maintenance and cleanliness of this facility, which is cleaned on a daily basis.

3.3.5 Lessons Learned

- The helpful attitude from the municipality indicates that the local government entities often appreciate such improvement of existing dilapidated or under-utilized facilities.
- Municipalities often do not have ample funds to carry out the necessary repairs or renovations. Therefore, such interventions can significantly help the local governments to renovate and operationalize these facilities.

3.4 Design of Decentralised Wastewater Treatment System (DEWATS) for Savar Cantonment Area

3.4.1 Background

Savar Cantonment is an around 1000-acre military administered area situated to the north of Savar municipality. It is characterised by an undulated topography, with frequent depressions and mounds, which makes it difficult and costly for provision of a conventional sewerage network to collect and transport wastewater. Therefore, the wastewater generated within this area has been discharged in the natural depressions or low-lying lands and waterbodies (Figure 3.27). This has been terribly deteriorating the environmental quality of the area. Addressing this issue, the Waste Concern team decided to help the Cantonment Board by designing a decentralised solution under this project for proper management of wastewater in this area. The idea was to propose a decentralised wastewater treatment system (DEWATS) solution for a cluster of around 2000 population within the area as a pilot phase. This initiative echoes the project objective of introducing integrated/decentralised water and sanitation solutions as pilot demonstrations.

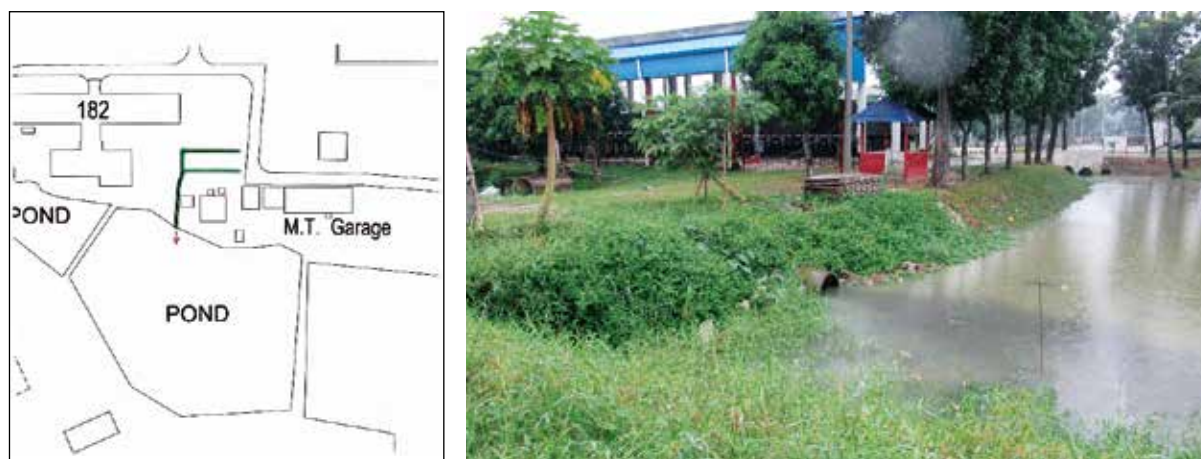


Figure 3.27: Outfall of wastewater in a nearby waterbody (pond) inside Savar Cantonment area shown in plan (left) and a photograph (right)

3.4.2 Description of the Intervention

Before designing the facility, it is important to estimate the quantity of wastewater generated. For this purpose, five small clusters in Savar Cantonment area were surveyed. On the basis of outcomes of this survey, a design for decentralised wastewater treatment system (DEWATS) of 120 m³/day treatment capacity was proposed. A schematic diagram of the proposed system has been given in Figure 3.28.

A detailed design proposal was prepared for treatment of black water, which is generated from the Water Closets (WC) of toilets. The wastewater first enters a Screen and Grit Chamber, which is a basin to trap large solids (rags, paper, plastics, and metals) using screens of different sizes and for settling of grits (sand, gravel, cinder). The solids collected in this chamber have to be removed regularly and disposed safely. From this chamber the wastewater moves to the Settler – a device which separates the liquid from the solid. Pre-treatment takes place in Settler, where around 30% pollutants can be reduced.

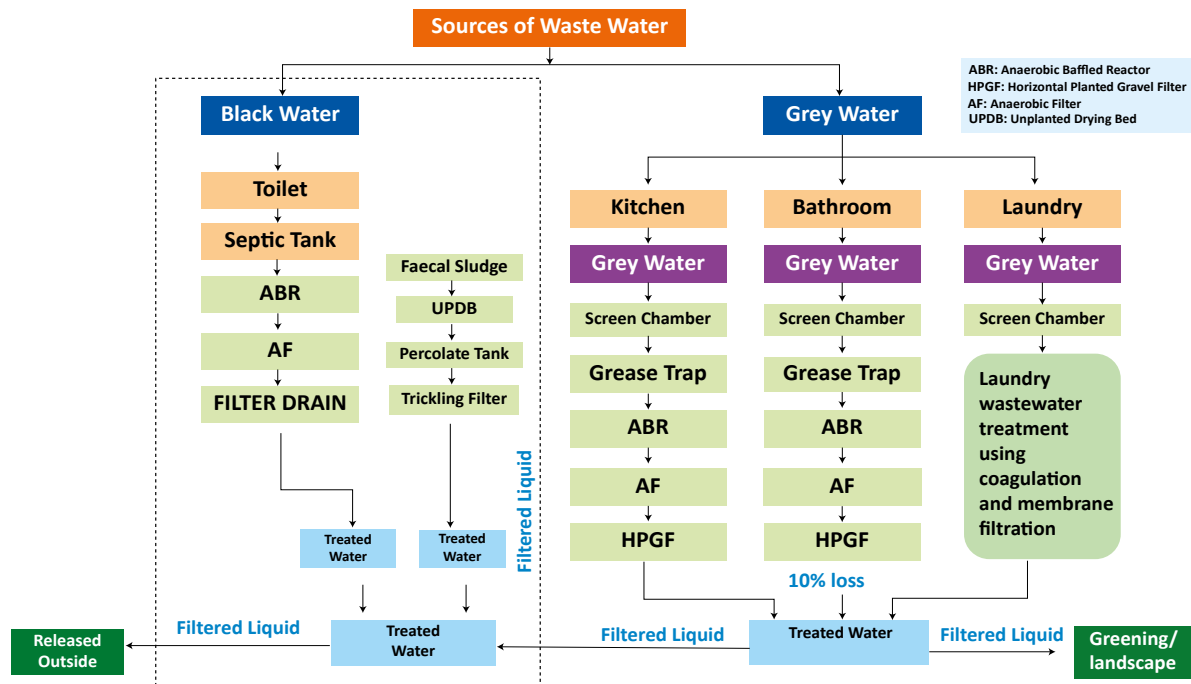


Figure 3.28: Schematic Diagram of Proposed DEWATS

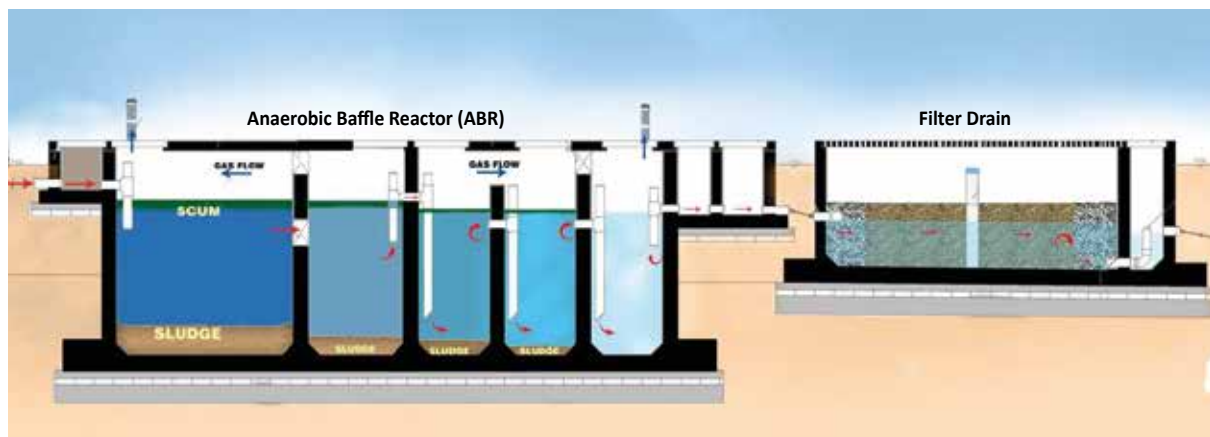


Figure 3.29: Section of Anaerobic Baffle Reactor (ABR) and Filter Drain of proposed DEWATS

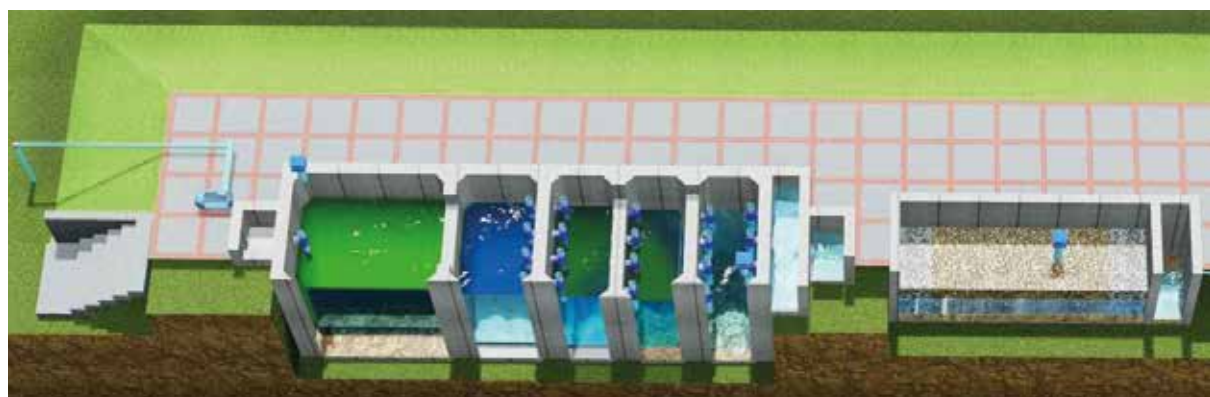


Figure 3.30: 3D View of Anaerobic Baffle Reactor (ABR) and Filter Drain of proposed DEWATS

The effluent from Settler passes through a Grease Trap, the purpose of which is to trap oil and grease so that it can be easily collected and removed. These are chambers made out of brick, concrete or plastic, with an odour tight cover. Floating components are thus separated from the effluent. Then the effluent enters an Anaerobic Baffle Reactor (ABR) – a device with several identical chambers through which the effluent moves from top to bottom for another round of pre-treatment. Here the retention time is 24 hours. Next treatment takes place in an Anaerobic Filter (AF). This is a device filled with filter material through which the effluent moves from top to bottom. Retention time of AF is around 8 hours. Total pollution reduction is around 90%. Then the effluent moves to Filter Drain, where gravel filters are used and hydraulic residence time is 12 hours. Here too substantial pollution reduction is achieved. Filtered water from the filter drain directly comes to a Filter Pit (FP) filled with gravels. Horizontal Planted Gravel Filter (HPGF) can also be used in this system. Eventually, filtered water moves from Filter Pit or HPGF to a Filtered Water Storage Tank (FWST). The FWST is connected to a Soak Pit built with normal bricks to absorb overflowing treated water.

Treated wastewater can be utilized for greening, agriculture, or landscaping using drip method. This will reduce dependence on freshwater for these purposes and will help conservation of water. Successful piloting can be replicated in other cantonments and similar areas in Bangladesh.

4. Waste Management Sector Interventions



4.1 Distribution of Separate-Coloured Bins for Waste Segregation in Savar Municipality

4.1.1 Background

With a view to facilitate the resource recovery process from solid wastes and thereby start the transition towards a circular economy, the *Solid Waste Management Rules, 2021* mandated that three categories of solid waste, namely biodegradable, non-biodegradable, and hazardous wastes must be segregated at source, stored in different bins/containers, and then transferred to relevant collection facilities of municipal authority (GoB, 2021b). Such obligations were expressed for households, businesses and institutions. The rules also emphasize the adoption of 3R strategy by local government bodies or relevant authorities as well as other stakeholders, outlining approaches for waste reduction, reuse, and recycling. Waste segregation at source would be the portal to successful implementation of this strategy.

Under this project, an initiative was taken to promote source segregation of waste by distributing bins of different colours to store specific types of wastes. It was implemented as a pilot scheme in Savar Municipality, which is a small town on the periphery of Dhaka metropolitan area. Over the decades, it had grown into a significant industrial centre with a population of around 650,000. But the waste management scenario of the municipality is grim. A great amount of waste is dumped in random places, especially beside the roads. There is virtually no practice of waste segregation by the households and businesses who generate these, persisting the missed opportunity of turning huge amount of municipal waste into resources. As a first step to promote the behavior of waste segregation at source, it was planned to distribute bins of three different colours in some selected localities and marketplaces. Accordingly, *green* bins were distributed for keeping biodegradable wastes, *yellow* bins for non-biodegradable wastes, and *red* bins for household hazardous waste materials. The wastes are to be segregated in these categories at the place of generation and must be kept in appropriate bins. This intervention was followed up by circulation of educational leaflets for raising awareness with respect to segregation of waste at source.

This intervention aligns with SDG 12 (Responsible Consumption and Production), especially target 12.5, which pertains to substantial reduction in waste generation through prevention, reduction, recycling and reuse. This has implications for SDG 11 (Sustainable Cities and Communities) and SDG 3 (Good Health and Well-being) also.

4.1.2 Distribution of Bins

In order to understand the effectiveness of source segregation of wastes in diverse contexts, the bins were planned to be distributed in some residential and commercial locations. As for residential settings, a low-income community (Bede Para) and a middle-income community (areas around the councillor's office in Ward no. 1) were chosen for bin distribution. Two marketplaces, namely Municipal Supermarket and Kacha Bazar (Kitchen Market), were selected as commercial locations for this intervention. A total of 92 bins were distributed through this initiative. Among these, 59 bins (29 green, 22 yellow and 8 red bins) were handed over to Savar Municipality. Out of these bins, 12 (5 green, 5 yellow, and 2 red) bins were of 140 litres capacity which were provided for distribution in municipal bazar. The remaining bins had a capacity of 70 litres each. In case of residential areas, 15 bins (10 green and 5 yellow) were given out to Bede Para, and 18 bins (12 green and 6 yellow) were provided to Ward-1 councillor's office for distribution in surrounding areas. All bins were distributed in March 2022.

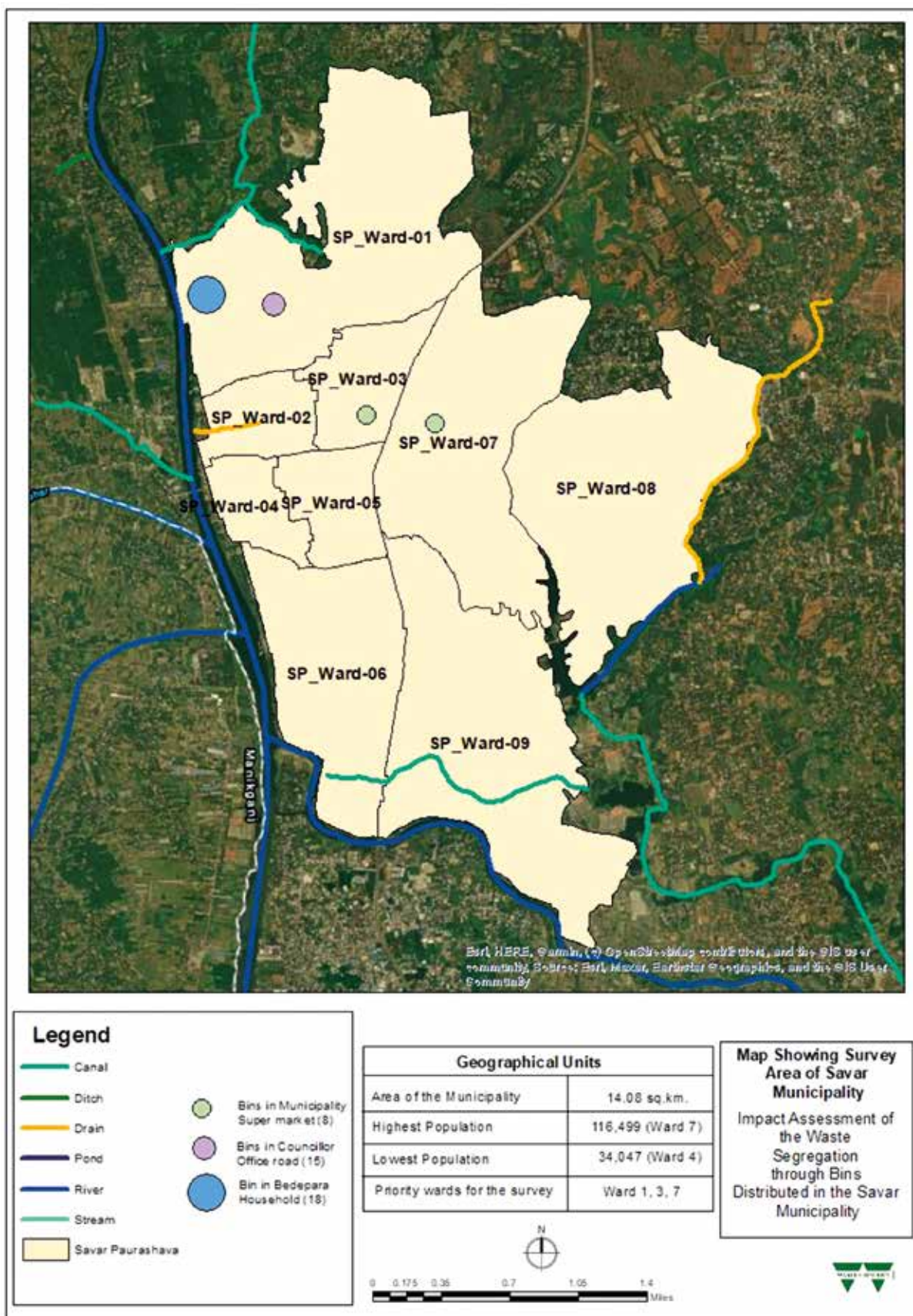


Figure 4.1: Map showing locations of bin distribution in Savar Municipality



Figure 4.2: Three different coloured bins distributed for segregating biodegradable, non-biodegradable, and household hazardous wastes



Figure 4.3: Handover of the bins to the Mayor of Savar Municipality and to the Councillor of Ward-1



Figure 4.4: A local resident using the distributed bins

4.1.3 Distribution of Infographic Leaflets on Waste Segregation

As a follow up activity of segregated waste bin distribution, an educational leaflet was circulated in the locations where the bins were distributed. The purpose was to raise awareness in favour of waste segregation at source of generation. The leaflet had two sides, with relevant information conveyed by means of infographics on each side. One side depicted the problems occurring due to absence of waste segregation practice, and the other side portrayed waste segregation using bins of three different colours as had been distributed in these communities and marketplaces.



Figure 4.5: Two sides of the infographic leaflet (English Version) distributed to raise awareness in favour of waste segregation using three different colour bins



Figure 4.6: Distribution of infographic leaflets in Bede Para (left) and Municipal Supermarket (right)

4.1.4 Impact Survey to Assess the Effectiveness of Bin Distribution

An impact survey was conducted in 2022 to assess the effectiveness of this initiative. The objective of the survey was to assess the extent to which the distribution of the bins had been successful in improving the waste segregation by the users. The survey was carried out by field surveyors using a structured questionnaire. The number of respondents that took part in this survey is 370. The number of respondents from each location has been presented in Table 4.1.

Table 4.1: Number of Respondents for Each Location of Bin Distribution

Location		Number of Respondents	Percent
Bede Para	Residential area	102	27.57
Councillor Office Area	Residential area	83	22.43
Municipal Supermarket	Commercial area	89	24.05
Municipal Kacha bazar	Commercial area	96	25.95
Total		370	100

Source: Waste Concern, 2022



Figure 4.7: Questionnaire survey on effectiveness of distributed bins for waste segregation

The overall survey results indicate that people within the service areas of the waste segregation bins were effectively using these bins. There was a very high rate of successful waste segregation among the users in Bede Para. The waste segregation situation in Councillor's office area and Municipal Supermarket was found to be moderately good. In contrast, there is plenty of room for improvement of the waste segregation practice in Municipal Kacha Bazar area.

4.1.5 Key Takeaways

Although distribution of separate-coloured bins for waste segregation had mostly positive outcomes as per the impact survey, this was comparatively less successful in promoting waste segregation behaviour at Municipal Kacha Bazar area. A total of 12 bins (5 green bins, 5 yellow bins, and 2 red bins) of 140 litres capacity each were provided for the kacha bazar. But given the large volume of wastes generated in this bazar, both number and capacity of bins proved to be inadequate. Apparently, waste segregation at source is much easier to achieve at domestic level than at high volume waste generation areas such as kacha bazar. Special intervention is required in such areas for promoting waste segregation behaviour.

4.2 Distribution of Safety Jackets for Sanitary Workers in Savar Municipality

4.2.1 Background

The sanitary workers involved in solid waste management activities of Savar Municipality used to perform their duties without wearing any safety vests or jackets. Consequently, they were under the risk of being hit by speeding vehicles while removing roadside wastes or sweeping the streets, especially during low visibility conditions such as foggy mornings. Besides, sometimes people did not cooperate with them because they were not recognizable as municipal employees at first appearance. Being aware of these issues from the staff of the municipality, Waste Concern decided to provide some safety vests or jackets to the municipality under this project for distributing among these workers. It was expected that this initiative would help the sanitary workers to be visually distinguishable as well as uplift their morale as municipal professionals.

4.2.2 Distribution of Jackets

A total of 200 safety jackets were handed over to Savar Municipality in February 2022. On behalf of Savar Municipality, the Mayor of the municipality Haji Md. Abdul Goni received the jackets. These were later distributed among the sanitary workers by the municipality. The jackets had light reflecting strips on a neon orange background, making these visible even at low lighting conditions. The name of the project as well as the logos of BMZ, BORDA, Waste Concern, and Savar Municipality were printed on the rear side of the jacket.



Figure 4.8: Handover of safety jackets to the Mayor of Savar Municipality (left), a staff wearing the jacket (right)

4.3 SWM Mobile Transfer Station for Savar Municipality

4.3.1 Background

The third demonstration activity under this project involves provision of a mobile secondary solid waste transfer station (mobile STS) for Savar municipality. The municipality has been suffering severely from unsystematic collection and disposal of huge amount of solid waste generated every day. In the absence of any well-equipped system for waste transfer, the waste gathered from door-to-door collection is temporarily dumped on roadside, which is then collected by municipal garbage trucks for carrying to the site of ultimate disposal. Hence, the municipality is desperate to set up a secondary transfer station (STS) which can act as an intermediary phase between primary collection and eventual disposal phases.

However, there are some challenges in building a permanent STS. The first challenge arises from the scarcity of suitable locations for constructing STS. It is really hard to find such sites in a densely populated municipality like Savar that would be distant enough from existing human settlements not to cause any nuisance, yet easily accessible to both primary collection vans and garbage trucks.

Even though a location for STS could be found, another challenge would arise with respect to obtaining necessary locational and environmental clearances from the relevant authorities. Existing legal provisions necessitate that environmental impact assessment be carried out prior to filing an application for environmental clearance for establishing a waste processing or disposal facility. Conducting environmental assessment and subsequently obtaining environmental clearance would require a considerable amount of time, after which it would not be likely possible to complete the construction of the facility and other ancillary tasks within the remaining time of this project.



Figure 4.9: Temporary dumping of solid waste on roadside (left) and collection by garbage trucks from roadside (right) in Savar municipality

Considering the abovementioned challenges, Waste Concern project team consulted with the municipality over possible solutions, and upon formal request from the municipality, proceeded with a mobile alternative, i.e. a mobile STS. The mobile STS could overcome these challenges in the following manner:

- a) it does not need a permanent site for operation, and can be relocated to another location if there is any objection arising, and
- b) since it is not a permanent structure and only functioning as a mobile facility that is stationed by the municipality at a location temporarily, it does not require obtaining an environmental clearance.

Thus, the idea of a mobile waste transfer station can be useful to help at least partially relieve the existing difficulty of Savar municipality in handling and managing solid waste.

4.3.2 Objectives

- Conducting stakeholder consultation and identification of specific requirements.
- Preparation of procurement documents and technical details required for the mobile transfer station which comprises a tractor and a hydraulic trailer/trolley.
- Proper implementation of the procurement process and handing over to the municipality.

4.3.3 Stakeholder Consultation

The stakeholder consultation was carried out with the municipality to understand the requirement and identify suitable location for a transfer station. Furthermore, interaction was done with the community around the site proposed by the municipality, where the project team observed reluctance towards permanent transfer station as the community perceived that this facility may create nuisance, especially stink, in their vicinity. These consultations helped in arriving at the decision of providing a mobile waste transfer station that can serve multiple wards and overcome the issue of waste accumulation in a single place.



Figure 4.10: Interaction of the project team with Savar municipality

4.3.4 Description of the Intervention

The mobile secondary transfer station unit consists of a tractor and a hydraulic trailer/trolley. This operates as a makeshift arrangement for storing solid waste before transferring to municipal garbage trucks. The tractor is of 2-wheel drive system, with around 40 HP capacity. The hydraulic trailer supports easy transfer of the waste with minimal human interaction. The carrying capacity of this trailer is 150 cu. ft. or 4.25 m³. It consists of an all steel open garbage load body which is operated by hydraulic hoist activated by power take off (PTO) system. Loading of garbage on the load body is manual, but unloading is done by operating hydraulic cylinder to incline the load body at the rear.



Image Courtesy: ACI Motors Limited

Figure 4.11: Proposed Mobile STS unit consisting of a tractor and a hydraulic trailer/trolley

The municipality identified four possible locations for keeping the mobile transfer station unit. The unit can serve in one or more locations per day as per requirement. The proposed locations are situated in Wards 3, 5, 6 and 7 as mentioned in Table 4.2 and shown in the map in Figure 4.12.

Table 4.2: Locations of mobile STS operation as proposed by Savar Municipality

Location No.	Ward no.	Location
MSTS-1	7	In front of Chowrangi Super Market
MSTS-2	6	In front of Karnapara Kacha Bazar
MSTS-3	5	In front of Padma Printers
MSTS-4	3	In front of Razzak Plaza

Source: Savar Municipality, 2023

4.3.5 Operation and Maintenance

The municipality is responsible for operation and maintenance of the mobile STS unit. The unit is expected to serve in any two of the four identified locations per day. The municipality will decide in which of the proposed locations the unit will be stationed every day. Considering the carrying capacity of the trailer, it is expected that this mobile STS unit will serve 10,000 people per day¹.

The municipality will ensure the regular maintenance of this unit. However, the supplier is expected to provide an original Operating Manual along with all necessary accessories. As per technical specifications outlined in the tender document, the supplied items should come with a warranty of up to 5000 hours or 60 months (whichever comes earlier) or as per warranty policy. There must also be several free services (preferably 8-10) available as per Manufacturer/ Authorized Distributor's policy.

¹ Calculation based on a waste density of 350 kg/m³ and an average waste generation rate of 0.3 kg/person/day for Savar municipality

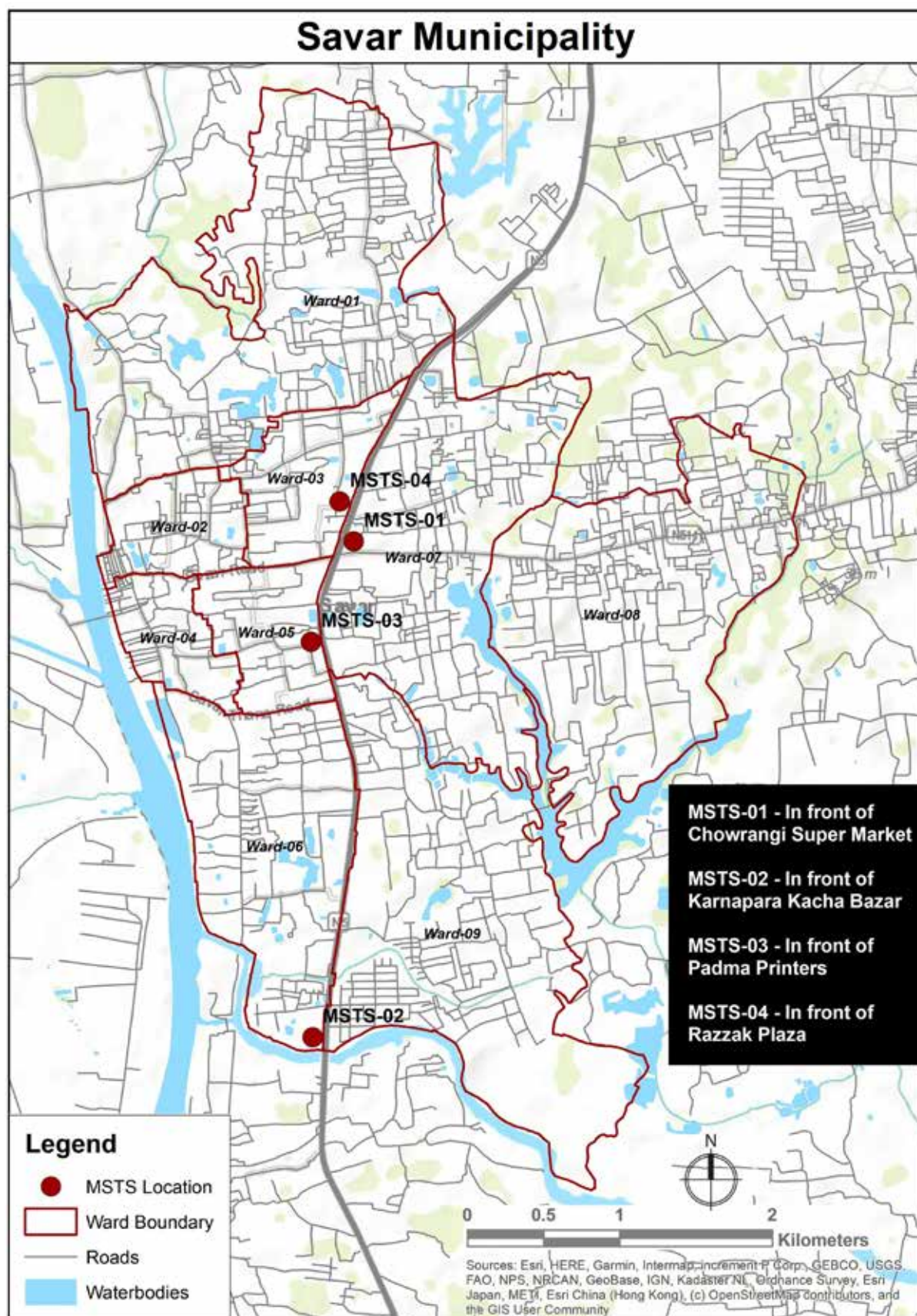


Figure 4.12: Possible locations for operation of mobile STS unit as proposed by Savar municipality

5. Capacity Building Activities



5.1 Overview

An important objective of this project is institutional and personnel capacity strengthening of municipalities. While some interventions took place under this project in Savar and Kushtia municipalities, it is also essential to contribute to the capacity building of these municipalities in order to sustain the functioning of these interventions and help the municipalities to take necessary steps in desired directions. Various types of capacity building/strengthening activities were undertaken during the project period. These included trainings, workshops, and exposure visit, targeting mainly the municipal officials and staff. During the first two years of the project (2021-2022), five training sessions were conducted in two municipalities. Two of these were conducted in Kushtia municipality, which were concerned with conversion of open landfill to controlled landfill, and operation and maintenance of public toilets in the municipality. The remaining three trainings took place in Savar municipality, the topics of which were on medical waste management, operation and maintenance of public toilets, and promotion of 3R and source segregation of waste. A total of 137 personnel from these municipalities received training.

Apart from abovementioned training sessions, a workshop was organized to explore the scope of decentralized solutions for wastewater management in small and medium towns in Bangladesh. Expert practitioners and academics were invited to present and discuss on this subject. It was attended by participants from various national and international organizations.

A two-day exposure visit was organized for officials of Savar municipality in December 2021. The officials were taken to Kushtia and Khulna municipalities under this programme. This visit consisted of lectures and discussions at the respective municipal offices and a day-long site visit to the co-composting plant in Kushtia municipality and FSTP in Khulna municipality.

As a further attempt for enhancing the municipal service delivery capacity of Kushtia municipality, a meeting with WATSAN Committee of Kushtia municipality was arranged in October 2022. During this meeting, the Waste Concern team presented to the committee members and municipal officials various activities undertaken by the project team. The insights and comments of participants on how the municipal services in Kushtia municipality can be improved were pursued and noted.

Brief descriptions of the abovementioned capacity building or strengthening activities under this project have been given in the following sections.

5.2 Training

5.2.1 Conversion of Open Landfill to Controlled Landfills in Small and Medium Towns

The purpose for this training was to improve the current scenario for managing wastes in landfill sites, considering the fact that the current landfill in Kushtia Municipality has been overflowing with wastes which had reached its capacity a long time ago. The training took place on 27th September, 2021 at the Kushtia municipality office. 13 participants joined in this training on the spot and through online platform.

The first part of the training included brief presentations from Waste Concern team on Baseline Situation of WASH in Kushtia municipality and SFD showing current situation of faecal sludge management in the municipality. The next part of the training focused on the transformation of Kushtia municipality's current landfill, presented by Mr. Iftekhar Enayetullah (Director) and Mr. Abu Hasnat Md. Maqsood Sinha (Executive Director and Project Director) from Waste Concern. The current situation of the landfill – which had already been operating beyond its capacity – was demonstrated. Then technical methods on managing more solid waste in the current landfill were presented so that it can sustain till the year 2040.

The next part included Question and Answer (Q&A) and open discussion sessions. The participants expressed their opinions on landfill management too. Some of the feedbacks from the discussion were source segregation of waste, GPS tracking system in the garbage trucks, E-waste and medical waste management, etc.

5.2.2 Operation and Maintenance of Public Toilets in Kushtia Municipality

This training also took place on 27th September, 2021 at the Kushtia municipality office, with 13 participants joining on the spot and through online platform. The main reason for this training was to improve the existing conditions of public toilets in the municipality and develop an understanding of the importance of operation and maintenance (O&M) of these facilities.

The focus of this training session was on transformation of defunct public toilets into operational facilities. The presentation was delivered by Mr. Iftekhar Enayetullah (Director) and Mr. Abu Hasnat Md. Maqsood Sinha (Executive Director and Project Director) from Waste Concern. First, the participants were informed of the conditions of three public toilets of Kushtia Municipality located at Hospital Road, M. A. Rahim Super Market, and Kobi Azizur Rahman Road. Then the proposed interventions for renovation of these toilets were presented to the audience. The proposed improvements were demonstrated through plans and 3-D graphics. Finally, the importance of proper operation and maintenance measures for sustainability of these facilities was explained. Significant proposals were preparation of O&M Manuals to operate public toilets, engaging private sector for operation of these toilets, charging user fees to support maintenance cost, and generate additional income from bill boards/advertisements from private sponsors.

The presentation was followed by Question and Answer (Q&A) and open discussion sessions. Some of the feedbacks from the participants were removal of illegal shops and hawkers at the entrance, improving narrow entrance, interior air and lighting condition, and provision of different entrances for men and women sections in public toilets.



Figure 5.1: Participants of training sessions on conversion of landfill and O&M of public toilets in Kushtia Municipality

5.2.3 Medical Waste Management in Savar Municipality

The training on medical waste management took place in Savar municipality on 23rd November, 2021. It was attended by 40 participants, mostly officials and staff of Savar municipality. The Mayor, CEO, Executive Engineer, and Ward councilors of the municipality were present at the programme. The objective of this training was to improve the condition of medical waste management of Savar Municipality.

The training session was divided into three parts. These were:

1. General aspects and importance of medical waste management
2. Role of waste workers in waste management in the context of COVID-19 pandemic
3. Waste workers' safety and correct use of personal protective equipment (PPE)

The first part was conducted by Dr. Rezaul Hasan. At first, he provided a questionnaire form to get a general idea about the knowledge of municipal waste workers on medical waste management. Then he presented the contemporary medical waste management situation in the context of Bangladesh and the hazardous outcomes because of its mismanagement. He explained the reason for medical waste becoming a major concern in this country. During this session, participants were introduced to the differences between medical waste and hospital waste, and how these wastes should be managed or disposed of properly.

The next part was presented by Dr. Farzana Jahan. She explained to the audience some basic terms such as infectious diseases, hazardous wastes, etc. with examples. She demonstrated the risks of mismanaging the hazardous wastes and who might become victims due to this mismanagement. The short-term and long-term health effects of hazardous wastes were also described by Dr. Jahan.

The third part was a practical session which was demonstrated by Dr. Sharif Hasan. He practically demonstrated to the municipal staff how to use protective gear. He also showed the way of washing hands properly.



Figure 5.2: Training on medical waste management in Savar Municipality



Figure 5.3: Participants of training on medical waste management in Savar Municipality

5.2.4 Operation and Maintenance of Public Toilets in Savar Municipality

This training on operation and maintenance (O&M) of public toilets in Savar municipality was arranged on 1st December, 2021 at the municipality office. This training session was designed to develop an understanding of operation and maintenance activities of public toilet as well as to demonstrate good practices for use and maintenance of these facilities. A total of 17 people participated in this training. Mayor, CEO, Executive Engineer, and other officials of Savar Municipality were present at the training programme.

This training session was conducted by Mr. Shakil Ahmed, an Environmental Specialist in a consulting role for this project. The presentation outlined both operational and maintenance plans for public toilets. In the operational plan, operational arrangements, activities, risk analysis, and operational modalities were discussed. Occupational health and safety, maintenance of structure, timing and frequency of cleaning, basic equipment and supplies, cleaning agents and their correct use, selection of contractors and performance-based contracts, etc. were discussed under the maintenance plan. Overall operational and maintenance arrangements were demonstrated through a flow diagram. Challenges related to maintenance of public toilet were also presented during the session. Besides, the users' responsibilities towards maintaining the public toilet were discussed. Some pictorial examples of good practices for using and maintaining public toilets were demonstrated.

One major takeaway from this training session is that maintenance activities should be kept in motion at all times and all necessary arrangements for maintenance of public toilet should be taken up by the management committee in a timely manner. This would ensure good user experience and sustainability of these facilities.



Figure 5.4: Some moments from training on O&M of public toilet in Savar Municipality



Figure 5.5: Participants of training on O&M of public toilet in Savar Municipality

5.2.5 Promotion of 3R and Source Segregation of Waste

The training took place in Savar municipality on 31st July 2022. It was conducted in two sessions. The first session of the training was given to the officials of the municipality on the promotion of 3R (Reduce, Reuse and Recycle) in Bangladesh. This session was attended by 18 officials of the municipality, including Chief Executive Officer (CEO), Executive Engineer, Town Planner, Assistant Engineer, etc. The second session was on source segregation of waste, which was arranged for the sanitation staff and workers of the municipality. The total number of participants in this session was 41, including waste workers, supervisors, sanitary inspectors and other office staff.

The first session was conducted by Mr. Shakil Ahmed, consultant of Waste Concern. The participants were given an introduction to the 3R, i.e. reduce, reuse, and recycle of waste. The significant aspects of the 'National 3R Strategy' and 'Solid Waste Management Rules 2021' were discussed. The strategies to promote 3R along with the responsibilities of the citizens were explained to the audience. Some examples of activities based on the principles of 3R in Bangladesh were presented too.

Mr. Syed Zubaer Ahmed, Senior Training Officer of Waste Concern and Event and Logistics Officer of this project, conducted the second session of the training. The target audience of this session, i.e. the sanitation staff and workers of the municipality, were mostly unaware of the source segregation of waste. Therefore, the benefits or advantages of source segregation of waste were explained to them. They were trained on how to classify the wastes into three categories (biodegradable, non-biodegradable, and hazardous) and put these into three separate bins. The training officer demonstrated an example of waste segregation that was implemented in Uttara Model Town, an area in Dhaka city.

Although the sanitation workers were mostly satisfied to know about the advantages of waste segregation at source of generation, some of them were a bit worried that such source segregation of waste might affect their income. Currently, they isolate metallic substances, glass materials, broken objects, etc. from waste by themselves, and earn some extra money by selling these items to relevant buyers. So they expressed their concern that, if these items are segregated at source, they may lose this additional income. Also, seeing the Uttara Model Town example, the sanitation workers expressed the need for battery-driven waste collection vehicles, since it would be more convenient for them to collect and transport waste with such vehicles.



Figure 5.6: Training on Promotion of 3R at the Conference Room of Savar municipality office



Figure 5.7: Training on Source Segregation of Waste at the Auditorium of Savar municipality office

5.3 Exposure Visit

An exposure visit was arranged under this project for introducing solid waste management (SWM) and faecal sludge management (FSM) of secondary cities and small towns to the officials of Savar municipality. It was designed to provide the municipal officials both theoretical and technical knowledge for developing a co-composting facility in Savar municipality. This two-day exposure visit program took place on the 19th and 20th December, 2021. On the first day, the participants visited Kushtia municipality; and the next day they visited Khulna City Corporation. Five officials from Savar municipality participated in this visit, including the Mayor and CEO (Chief Executive Officer) of the municipality. The remaining participants were Executive Engineer, Assistant Engineer, and Medical Officer of the municipality. Apart from participants from Savar municipality, two representatives from Waste Concern (Project Engineer and Event and Logistics Officer) also joined in this visit.

5.3.1 Visit in Kushtia Municipality

First day of the visit consisted of an introduction and a brief overview of the current system of solid waste management and faecal sludge management in Kushtia municipality, as well as municipality's approach towards waste management with focus on co-composting of faecal sludge with municipal solid waste. A presentation was delivered on this topic by Mr. Ranver Ahmed, Town Planner of Kushtia municipality. The presentation included such items as characteristics of faecal sludge and solid waste in this municipality, average amount of waste generation, management of faecal sludge and solid waste, fertilizer value of human excreta and municipal solid waste, opportunities for co-composting faecal sludge with organic waste, etc.

Later on that day, the participants had the opportunity to observe the process of faecal sludge collection of the municipality on site. The sludge was collected from a residential building with the help of a Vacutug. The operators of Vacutug shared their experiences and challenges of this operation. Afterwards, the team visited the faecal sludge treatment plant (FSTP) which is located beside the landfill site of the municipality. During this visit, sludge collection, drying, and treatment processes were demonstrated to the participants. The plant has a capacity of 18 m³ per day. But currently 12 m³ of FS is collected every day and brought to this facility. There are 6 drying beds and a trickling filter for the treatment of faecal sludge in this plant. The team also observed the process of producing fertilizer in the nearby composting plant. The plant is operated on the basis of a co-composting approach, where 60% organic solid waste is used with 20% faecal sludge, and the rest 20% comes from cow dung for improving the quality of the fertilizer. There are 12 composting boxes in this plant. The whole process is monitored by SNV (An agency from Netherlands), who sell

the fertilizer in the market at a price of 20 BDT per kilogram. SNV gives 50,000 BDT per year to the municipality from the profit they earn by selling the produced fertilizer.



Figure 5.8: The exposure visit team meeting the Mayor of Kushtia municipality



Figure 5.9: Demonstration of faecal sludge collection during the exposure visit in Kushtia municipality

5.3.2 Visit in Khulna City Corporation

On the second day of the exposure visit the team travelled to Khulna City Corporation. After reaching Khulna, the participants visited the City Corporation office. Mr. Md. Abdul Aziz, Chief Waste Management Officer (Executive Engineer) of the City Corporation, delivered an inauguration speech to start the meeting. Then the participants were introduced to the city's solid waste management and faecal sludge management systems. Afterwards, a field visit was arranged for the participants to demonstrate the processes on site.

The first site that was visited by the team was the faecal sludge treatment plant (FSTP) of the city. The team was accompanied by the Executive Engineer of the city corporation. The processes of sludge collection, drying, and

treatment were demonstrated and explained to the participants. The FSTP has an area of 5 acres, with a total capacity of 180 m³ per day. The plant has 6 drying beds for treatment of faecal sludge, each having a capacity of 30m³ per day. The faecal sludge is collected by Vacutugs and emptied in these drying beds. However, only 13% of the total faecal sludge generated in this city is received by the FSTP every day. This plant also has a constructed wetland system for treating wastewater, as operations and maintenance cost for this system is very low compared to drying bed system. A 3-layer system (coarse sand, stone chips, brick chips) was provided at the bottom of the wetland for percolating of liquid portion. For nutrient uptake and oxygen supply *Canna indica* plant was used in the wetland. The polishing pond – provided for improving the quality of effluent – has to maintain proper BOD level (25-40 mg/l), which is being monitored continuously. HDPE sheets of 1.5mm were used in the FSTP to avoid groundwater contamination. There is also a composting plant which consists of two sheds for composting and three storerooms. This plant receives 3 to 4 tons of waste daily through waste collection vehicles and produces about 1.5 to 2 tons of compost per day. The price of the compost is 7 to 8 BDT per kilogram.



Figure 5.10: The exposure visit team meeting the Mayor of Khulna City Corporation



Figure 5.11: The members of exposure visit team visiting the FSTP of Khulna City Corporation

The team also visited the landfill site and observed the solid waste management system of the city. Rickshaw vans are used to collect waste from door to door and transport to nearby Secondary Transfer Station (STS). Then municipal garbage trucks transport solid waste from STS to landfill site. There are 42 such trucks of 3 tons capacity each. Currently, the city corporation has 3 landfill sites that are situated near the city. The overall solid waste composition in the landfill is 87% organic and 13% inorganic. The inorganic portion is sorted out and recycled by the informal sector. About 350 tons of solid waste is collected and transported to landfill every day. But the city is facing problems in handling solid waste in landfill as it practices crude dumping system and there is no leachate treatment system inside the landfill.

5.4 Workshop

Waste Concern along with the project partner BORDA South Asia organized an online consultative workshop on the theme of ‘Decentralized Solutions for Wastewater Management in Small & Medium Towns in Bangladesh’ on 30th March, 2022. The main objective was to improve the understanding of the topic and bring subject experts, academia, and practitioners to discuss it on the same platform. The event was an effort to initiate a dialogue around the necessity to adopt alternative approaches along with conventional approaches, to increase coverage and improve service delivery in the sanitation sector across Bangladesh, building a cohort with like-minded organisations/individuals.

The event was convened by Mr. Abu Hasan Md. Maqsood Sinha, Executive Director, Waste Concern. It was attended by 46 participants from prominent organisations including Department of Public Health Engineering (DPHE), Municipal Association of Bangladesh (MAB), Department of Environment (DOE), National River Conservation Commission, High Commission of Canada, World Bank, Asian Development Bank, United Nations Development Program, etc.

The key speakers were Dr. Md. Mujibur Rahman (Professor, Civil Engineering, Ahsanullah University of Science & Technology (AUST)), Dr. Abdullah Al-Muyeed (Chief Operating Officer, CWIS, FSM Cell, Department of Public Health Engineering (DPHE), Government of Bangladesh), Ms. Gayathri Lalu (Technical Expert, BORDA South Asia), Mr. Jonas Emmanuel L. Maronilla (Managing Director, Basic Needs Services - Philippines Inc.) and Mr. Manas Rath (Senior Advisor, BORDA South Asia).

Key discussion points of this workshop were as follows:

- *High investment needs versus resource limitation:* Conventional systems, being high-investment and operation-intensive, may not be appropriate approach of wastewater solution for small and medium towns that have limited resources in terms of budget and skilled technicians.
- *Limited land resources:* Bangladesh has high population density but very limited developable land. Hence small and medium towns often do not have land available for establishment of full-fledged wastewater treatment infrastructure.
- *Technical and funding support to scale up decentralised systems:* Municipalities struggle with limited technical know-how and have limited funds for trying new approaches. There is a need for technical and financial support for municipalities to step up for these challenges.
- *Formation of regional alliances:* Regional cohorts or alliances should be formed between government representatives, sectoral experts, and other organisations working in the field of wastewater management. This would enable different parties to complement their work to develop sustainable solutions.
- *Promote mutual learnings in South Asia region:* The countries in this region face similar issues and challenges in sanitation sector and have adopted similar technologies and practices to tackle these challenges. The discussants emphasised the need for a structured knowledge exchange in South Asia region to build robust and localised solutions for wastewater management.



Figure 5.12: Participants of the online workshop on decentralized wastewater solutions in small and medium towns in Bangladesh

5.5 Meeting with WATSAN Committee of Kushtia Municipality

A meeting was arranged with WATSAN committee of Kushtia municipality under this project, which took place on 13th October 2022 at the municipality office meeting room. The WATSAN committee was formed to look after the water supply and sanitation-related activities of the municipality. It consists of 5 (five) members; the members had been selected from amongst the municipal Ward councillors and one of them acts as the Chairperson of the committee. Some municipal officials, such as Town Planner, Social Development Officer, and Sanitary Inspector, were also present in the meeting.

The meeting had two parts. In the first part, a presentation was delivered by Mr. Mohammad Aminul Quaium (Project Manager, Waste Concern), introducing the audience to the project and describing the activities that had been performed by Waste Concern in Kushtia municipality under this project. The participants were also briefly informed about the activities in Savar municipality under the same project.

The second part consisted of Q&A and open discussion session with WATSAN committee members and other municipal officials. During the discussion, the members of WATSAN committee were asked to provide their insights and opinions regarding the problems and solutions pertaining to water and sanitation issues in the municipality. They were also asked to express what support they expect from Waste Concern. In response, the members of the committee discussed several issues which are summarised below:

- Although some public toilets had been renovated and improved under this project, no new public toilet had been constructed. Committee members expressed the need for more public toilets in the municipality. They mentioned some important locations in the town where public toilets are necessary, such as BIDC Bazar Mor, Jogoti Rail Station Bazar, Bottoil Bypass Mor, Chowrhas Mor, BTC Gate, etc.
- Because the existing public toilets do not have adequate facilities for female users, the female members of the committee suggested that more units for women have to be provided in public toilets. Also, they informed that some special features in ladies' toilets are necessary, such as places for putting bags and other stuff which are typically carried or used by women.

- Some members appreciated the concept of separate bins for segregation of waste, as had been distributed in some locations of Savar municipality under this project. They proposed to introduce the same approach of waste management in Kushtia municipality, at least as a pilot scheme in some Wards/locations.
- The committee members drew attention to the fact that there is inadequate garbage trucks and vans for waste collection and transport in the municipality. So they requested to address the issue seriously. For instance, the municipality can be provided with some mechanized vans.
- Finally, they proposed to conduct some awareness campaigns to inform public about the interventions under this project.



Figure 5.13: Waste Concern presentation during the meeting with WATSAN Committee of Kushtia Municipality



Figure 5.14: Discussion session with members of WATSAN Committee of Kushtia Municipality

6. Publications, Manuals, and Guidelines



6.1 Overview

In addition to various interventions and capacity building activities, a number of documents were prepared under this project. These include WASH baseline assessment reports, SFD reports, FSM guidelines, O&M manuals, etc. Some of these came out as published materials in printed versions. These documents bear significant value as important project outcomes and can potentially serve as model documents for other projects of similar nature and contexts. This chapter briefly introduces the most noteworthy documents and publications that emerged through this project.

6.2 WASH Baseline Assessment Reports

A baseline survey on WASH sector was conducted in Savar and Kushtia municipalities in March 2021. The outcomes of these surveys were published as two baseline assessment reports – one for each municipality. Each report presents a concise town profile, which includes demography, ward-level data, general land use, and slum information of that town. The baseline status of access to toilets, water supply, local water resources, wastewater management, grey water management, solid waste management, health and hygiene of sanitation workers, institutional arrangement, and municipal finance were presented in these reports. Gaps and issues for each sector were identified too, and explicitly mentioned in the reports. The reports were published in printed form and were circulated in relevant municipalities.



Figure 6.1: WASH Baseline Assessment reports for Savar and Kushtia municipalities

6.3 SFD Reports and Posters

A shit flow diagram (SFD) is a tool to demonstrate how excreta flow from sources of generation to final disposal or treatment in the context of a city or town. It shows what percentage of faecal sludge (FS) generated in a city is contained or not contained. Also, it demonstrates what percentage of FS is emptied and transported to treatment facilities or disposal points. Overall, SFD offers a useful way of visualization of urban sanitation coverage and the ultimate fate of excreta generated in a city. Therefore, this can be a valuable tool for engaging municipal authorities and stakeholders for developing urban sanitation programmes.



Figure 6.2: SFD Report for Savar municipality

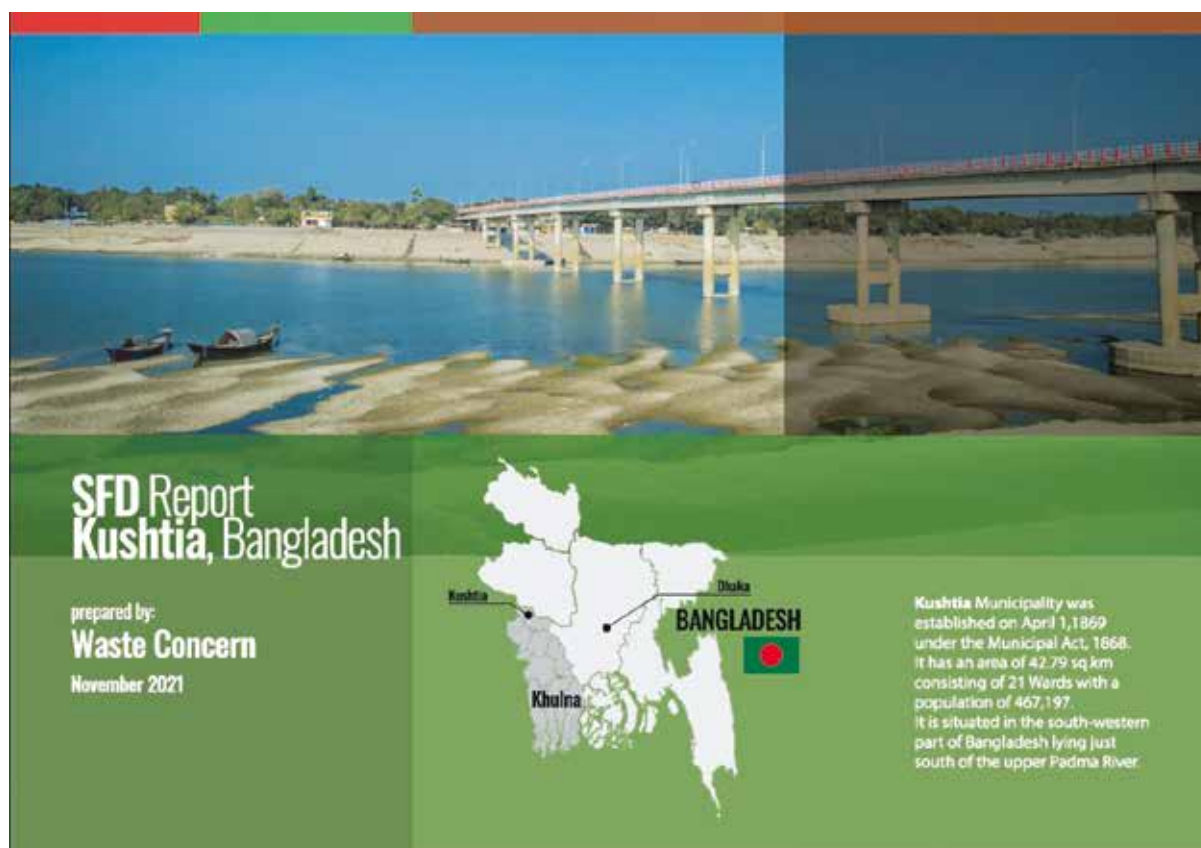


Figure 6.3: SFD Report for Kushtia municipality

Application of proven instruments and conceptual approaches such as SFD is considered as one of the measurable outputs of this project. Accordingly, two SFD reports were prepared for Savar and Kushtia municipalities in August 2021. In each report, the diagram is accompanied with an SFD matrix that provides an overview of FS containment, emptying, transport and treatment. The reports also include some general information of the municipalities and description of their existing sanitation systems. The reports reveal that neither of these municipalities have sewerage network and sewage treatment plants (STP). Kushtia municipality has one FSTP, whereas Savar municipality has no FSTP either. Only 21% and 32% of the wastewater is being safely treated or disposed in Savar and Kushtia municipalities, respectively. The SFD reports also came out in printed form that were circulated in both the municipalities. Additionally, SFD posters were prepared for each municipality, featuring the diagram and relevant information. The shit flow diagrams of Savar and Kushtia municipalities are given in Appendix 3 and 4.

6.4 O&M Manual for Public Toilets

The scope of activities under this project is not just limited to planning, design, and implementation of water and sanitation infrastructure, but it also includes supporting operation and maintenance of these facilities. As part of this effort, an Operation and Maintenance (O&M) Manual was developed for public toilets in Savar and Kushtia municipalities in December 2021. The purpose of this manual was to identify improved operation and maintenance system for public toilets in these municipalities that would be suitable for piloting either by local authority, or an external agency. The manual primarily focuses on adoption and implementation of up-to-date public toilet maintenance practices in order to ensure users' comfort as well as sustainability of these facilities. It also upholds the SDG target of achieving access to adequate and equitable sanitation and hygiene for all (target 6.2) by making public toilets universally accessible with special consideration for women, children, and people with physical challenges.

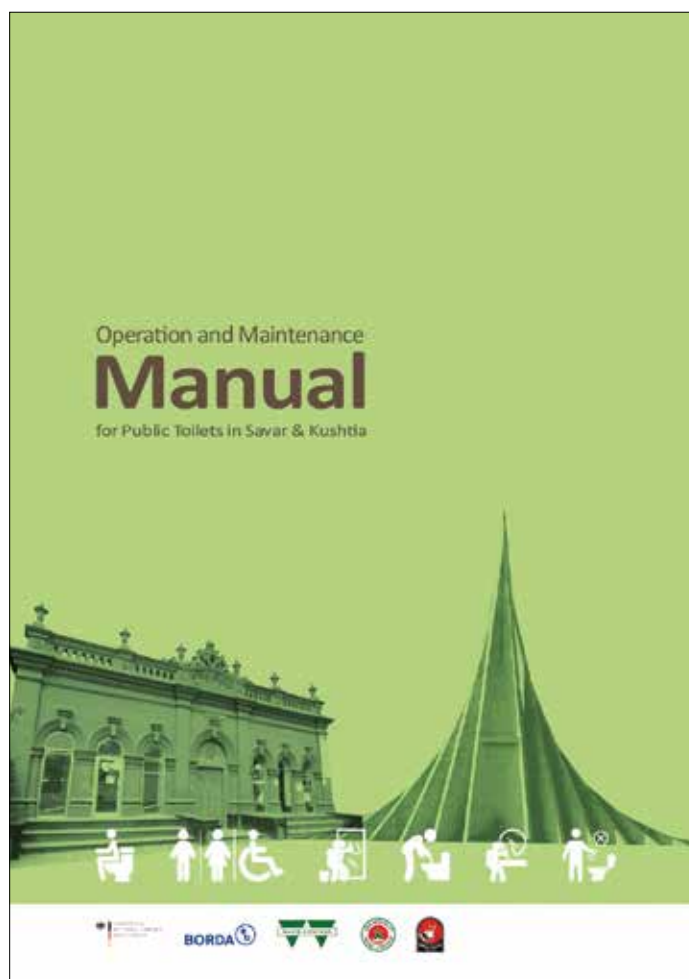


Figure 6.4: Cover of O&M Manual for public toilets in Savar and Kushtia municipalities

As part of proper maintenance and improved management of public toilets, the manual includes such topics as sequence of cleaning, frequency of cleaning, correct use of cleaning equipment, training of maintenance personnel, etc. The manual proposed the formation of a Management Committee In order to perform the overall activities (i.e. regular maintenance, bookkeeping, revenue management, supervision of cleaning agent /company, etc.) for each public toilet; and outlined the duties and responsibilities of this committee. An Advisory Committee was also proposed to play a supervisory role for all public toilets in the municipality. Several operational modalities were suggested in this manual. A section was devoted to user education in order to influence good user behaviour.

6.5 Operational Guideline for FSM

The operational guideline was prepared in December 2021 to efficiently carry out co-composting of faecal sludge (FS) and organic waste in an Integrated Resource Recovery Centre (IRRC). IRRC model was initiated by Waste Concern in Bangladesh in 2004, and it is now being replicated in a number of cities in this country. This guideline focused on the concept as well as detailed operation and maintenance activities which are essential to ensure effective and efficient performance of co-composting process in IRRCs. The ultimate purpose of this document is to transfer knowledge about the functioning of different components of faecal sludge management (FSM) and co- composting to future plant managers and operators, particularly for operation and maintenance of a composting plant having capacity of 3-20 tons per day to process faecal sludge (FS) and source-separated organic waste. The guideline will also be helpful to manage different aspects of quality control and trouble shooting in such facilities.

In this guideline, different technological options for FS treatment has been discussed. Design parameters for treating FS and organic waste has been provided. It also includes the step-by-step process chain of both the FS management and co-composting carried out in IRRC. The technical design (architectural) and operational aspects of an IRRC facility has been discussed in detail. Day-to-day monitoring protocol of both the FSM and co- composting has been outlined too. The guideline includes two case studies to demonstrate and compare experiences of co-composting plants located in different socio-economic, cultural and climatic conditions. All in all, this operational guideline can serve as a useful document for policy-makers, IRRC managers and operators to understand both the theoretical and technical aspects of the operation of an FSM and co-composting facility.

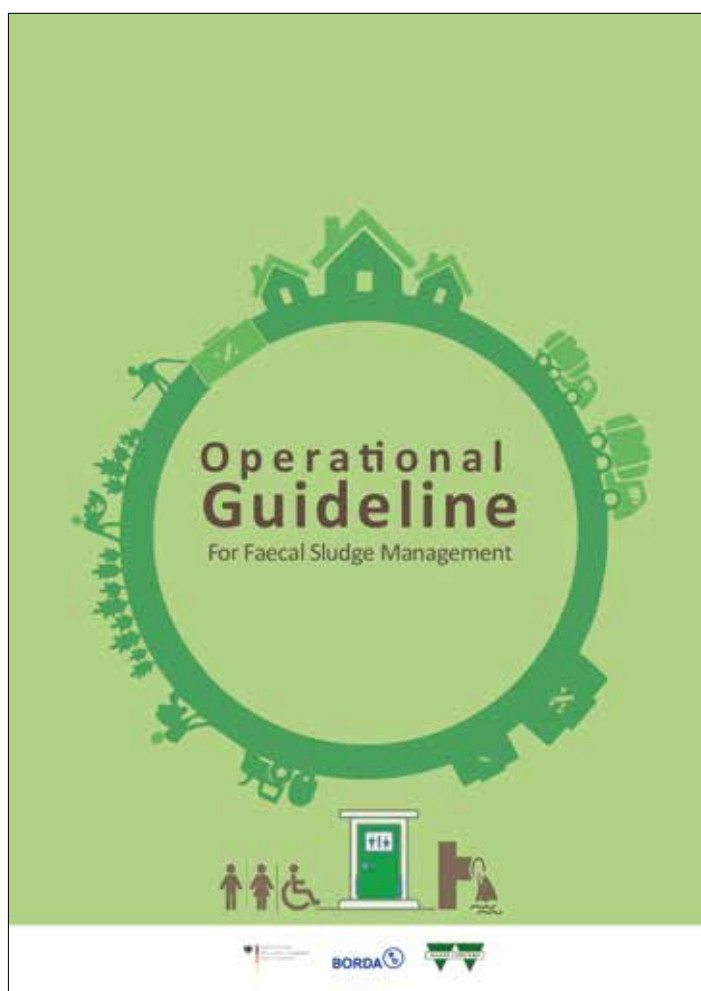
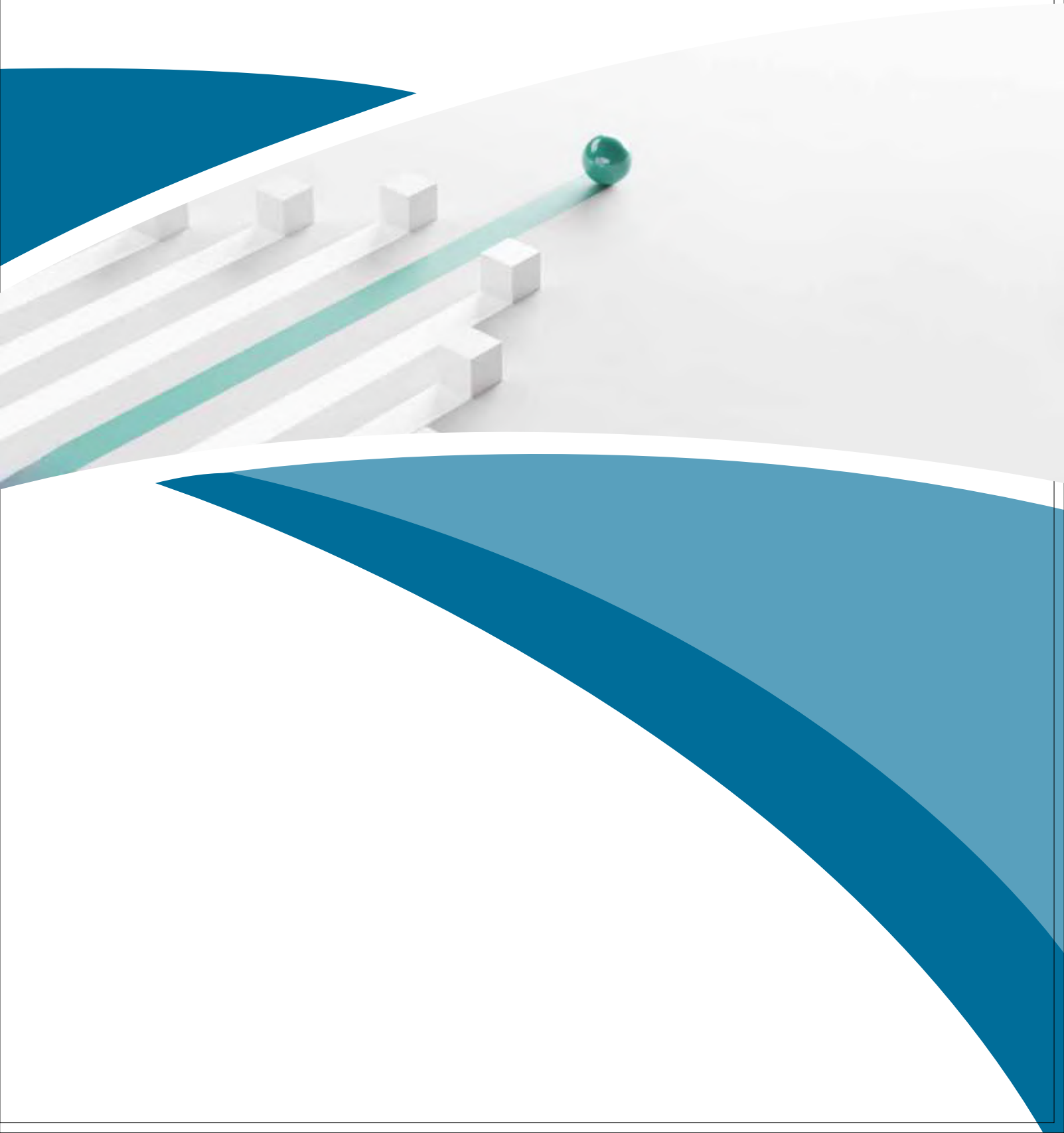


Figure 6.5: Cover of Operational Guideline for Faecal Sludge Management

7. Way Forward



7. Way Forward

This project's particular focus was on promoting decentralised water and sanitation solutions in small urban areas. The physical interventions under this project are mostly demonstrative in nature, which means these are intended to be replicated in other urban areas of the country. The ultimate purpose is to bring more people, especially disadvantaged groups, within the coverage of improved water, sanitation, and waste management services (municipal services of general interest) through adoption of decentralised but integrated solutions. From this perspective, it can be said that most activities implemented under this project, especially activities such as provision of improved shared toilets in urban slum area, renovation and operationalisation of derelict public toilets, distribution of separate coloured bins for source segregation of waste, etc. can easily be replicated in other municipalities of the country in a bigger scale.

Some activities for which Concept Notes/DPRs and designs were prepared under this project, but could not be implemented due to insufficient funds or other limitations, may be realized through some other projects. For instance, a design of a decentralised wastewater treatment system (DEWATS) was prepared for Savar Cantonment area, but the estimated cost for construction of this facility was much greater than the fund available through this project. So, it was not possible to implement this facility right away. However, recently Savar Cantonment Board obtained necessary funding for building the DEWATS facility from the Climate Change Trust Fund of the Government of Bangladesh, because such facility will contribute in reduction of greenhouse gas emission from waste. It is expected that similar DEWATS will be built in other cantonment areas and municipalities in the future. Another initiative for which primary steps were taken under this project is integrated MRF and Solid Waste Transfer Stations in Kushtia municipality. Concept Note, DPR, and initial design were prepared for this activity, but it was not implemented due to insufficient funds. The proposed facility is deemed to be implemented under the *Bangladesh Integrated Solid Waste Management Improvement Project* of Local Government Engineering Department (LGED).

During the first year of this project (2021), two landmark events happened pertaining to WASH and waste management sectors in Bangladesh – revision and update of the National Strategy for Water Supply and Sanitation, and enactment of the Solid Waste Management Rules under the provision of the Environmental Conservation Act of 1995. In the first quarter of 2023, the Environmental Conservation Rules were also updated. These statutory documents are considered as important additions to or upgradations in the legal and policy framework of WASH and waste management sectors of the country, and, therefore, are expected to improve the enabling environment for execution of the aforementioned activities.

Moving forward, the experiences and insights gained from various activities under this project can be instrumental in planning and implementation of similar projects. The most important insights have been summarized below, which can have substantial implications for enhancing feasibility and sustainability of future projects of similar nature:

- 1) New interventions should be planned in alignment with national-level plans and policies in order to increase the chance of their implementation.** The activities under this project were planned in accordance with national and sectoral policies of Bangladesh, such as 8th Five Year Plan, Perspective Plan of Bangladesh 2021-2041, National Strategy for Water Supply and Sanitation, and Solid Waste Management Rules. Because of their conformity with national priorities, some activities that were planned but could not be implemented under this project due to shortage of funds are being able to attract funds from various projects or sources of the government.
- 2) Bottom-up planning approach should be widely promoted for WASH sector interventions, especially for provision of water and sanitation facilities in low-income communities.** Such approach can play a critical role in developing stewardship of the local community for whom the facility is being provided. For example, the residents of Bede Para played an active role in the planning and design of shared toilets. Such involvement propelled a sense of ownership among the residents, ensuring proper care and maintenance of these facilities by the users.

- 3) **Stakeholder consultation should be conducted during the early stages of an intervention, e.g. planning and design stages, rather than leaving it for later stages.** This lesson was learnt during the renovation of public toilet at Savar municipality. Although the planning and design of this activity was carried out in consultation with municipal officials, the local community was not consulted at this early phase due to shortage of time. The municipality agreed to utilize the land adjacent to the existing toilet structure for landscaping and installation of solar panels. However, during implementation of this activity, the members of local graveyard committee protested against any civil work on that land because it had already been earmarked for expansion of nearby graveyard. Had the community been consulted during the planning phase, this interruption during implementation could have been avoided.
- 4) **There must be a solid stewardship for WASH and waste sector improvement activities in concerned local authority.** For instance, mayors of both Savar and Kushtia municipalities demonstrated strong stewardship regarding the interventions under this project. Under their leadership, the municipal officials were always cooperative during planning and implementation of these activities.
- 5) **Involvement of private sector in operation and maintenance can improve the overall performance of municipal services such as public toilets.** However, special attention should be paid to determination of user charges of the facility so that it will be affordable by all and, at the same time, can generate adequate revenue to meet the O&M expenses. The public toilets in Savar and Kushtia municipalities that had been renovated under this project were leased to private sector operators by respective municipalities. As a result, better O&M has been observed in these facilities, and the revenue generated from users is sufficient to meet the O&M expenses.
- 6) **The central and local governments should look for opportunities to scale up the impacts of implemented WASH and waste sector interventions in the future.** A city-wide approach instead of piecemeal interventions will likely have greater impacts in the lives of people.
- 7) **A long-term evaluation of WASH and waste sector interventions is necessary** to identify optimum mode of service delivery and O&M in order to ensure sustainability and maximize effectiveness.

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Appendices



Appendix 1: List of Project Personnel from Waste Concern

Project Director

Abu Hasnat Md. Maqsood Sinha	January 2021 – December 2022
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Project Manager

Iftekhar Enayetullah	January 2021 – June 2021
Md. Humayun Kabir	July 2021 – August 2021
Moushumi Ahmed	September 2021 – December 2021
F. M. Jakariar Kabir	January 2022 – June 2022
Mohammad Aminul Quaium	September 2022 – to date

Project Engineer

Atiar Chowdhury	August 2021 – March 2022
Mehedi Hasan	April 2022 – September 2022
Mahmoud Ibne Sadeque	November 2022 – December 2022
Sangha Mitra Datta Gupta	April 2023 – to date

Urban Planner/Social Mobilizer

Md. Lazim Munim Esti	May 2021 – December 2021
Sangha Mitra Datta Gupta	January 2022 – March 2023

Project Accountant

Merina Afrose	January 2021 – April 2021 (part time)
Ibnul Arat	May 2021 – March 2022
Merina Afrose	April 2022 – to date

Event and Logistic Officer

Syed Zubaer Ahmed	May 2021 – December 2022 (full time)
Syed Zubaer Ahmed	January 2023 – to date (part time)

Appendix 2: List of Concept Notes and DPRs

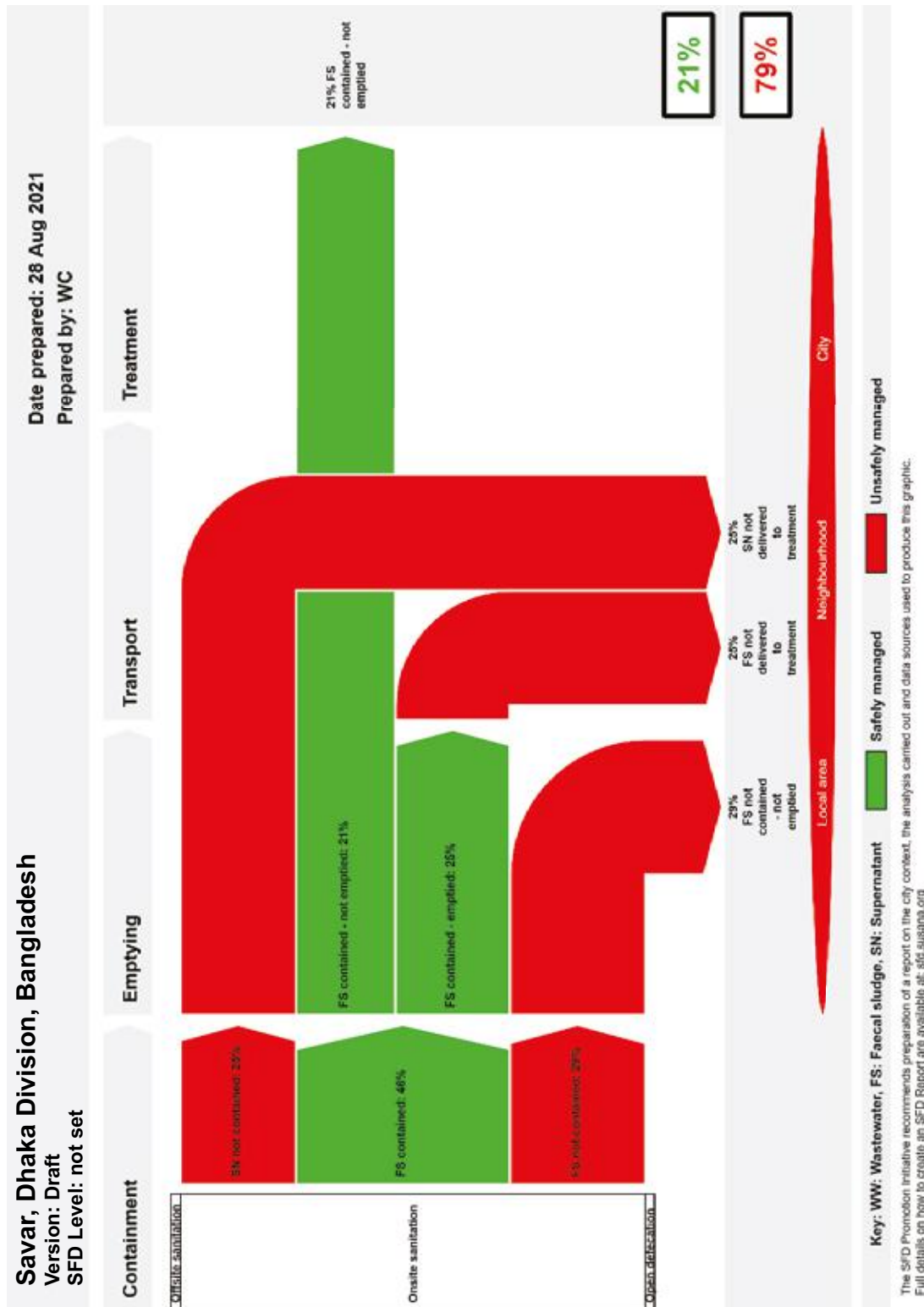
a) List of Concept Notes

Sl. No.	Title	Year	Status
1	Design and Implementation Support for Shared Toilets in the Bede Para Slum of Savar Municipality	2021	Implemented
2	Design and Implementation Support for Integrated MRF and Solid Waste Transfer Station in Ward 5 and Ward 18 of Kushtia Municipality	2021	DPR
3	Design and Implementation Support for Intermediate Treatment Solution for Faecal Sludge in Savar Municipality	2021	Concept Note
4	Design Support for Wastewater Treatment and Reuse in Savar Cantonment Board (SCB) Area	2021	Concept Note
5	Design Support for Wastewater Treatment and Reuse in Low Income Community of Savar Municipality	2021	Concept Note
6	Design and implementation support for transforming the existing landfill site located at Baradi, Kushtia Municipality into an environment-friendly controlled Landfill	2021	DPR
7	Design and implementation support for the construction of compost plant and pilot DEWATS in Savar Cantonment Board (SCB)	2021	DPR
8	Improvement of Existing Bio-Medical Waste Management of Kushtia Municipality	2021	Concept Note
9	Implementing Mobile Transfer Station in Savar Municipality	2021	Concept Note
10	Improvement of Public Toilet in Savar Municipality	2022	Implemented
11	Faecal Sludge Transfer System for Bede Para Slum in Savar Municipality	2022	Concept Note
12	SWM Mobile Transfer Station for Savar Municipality	2023	Under implementation

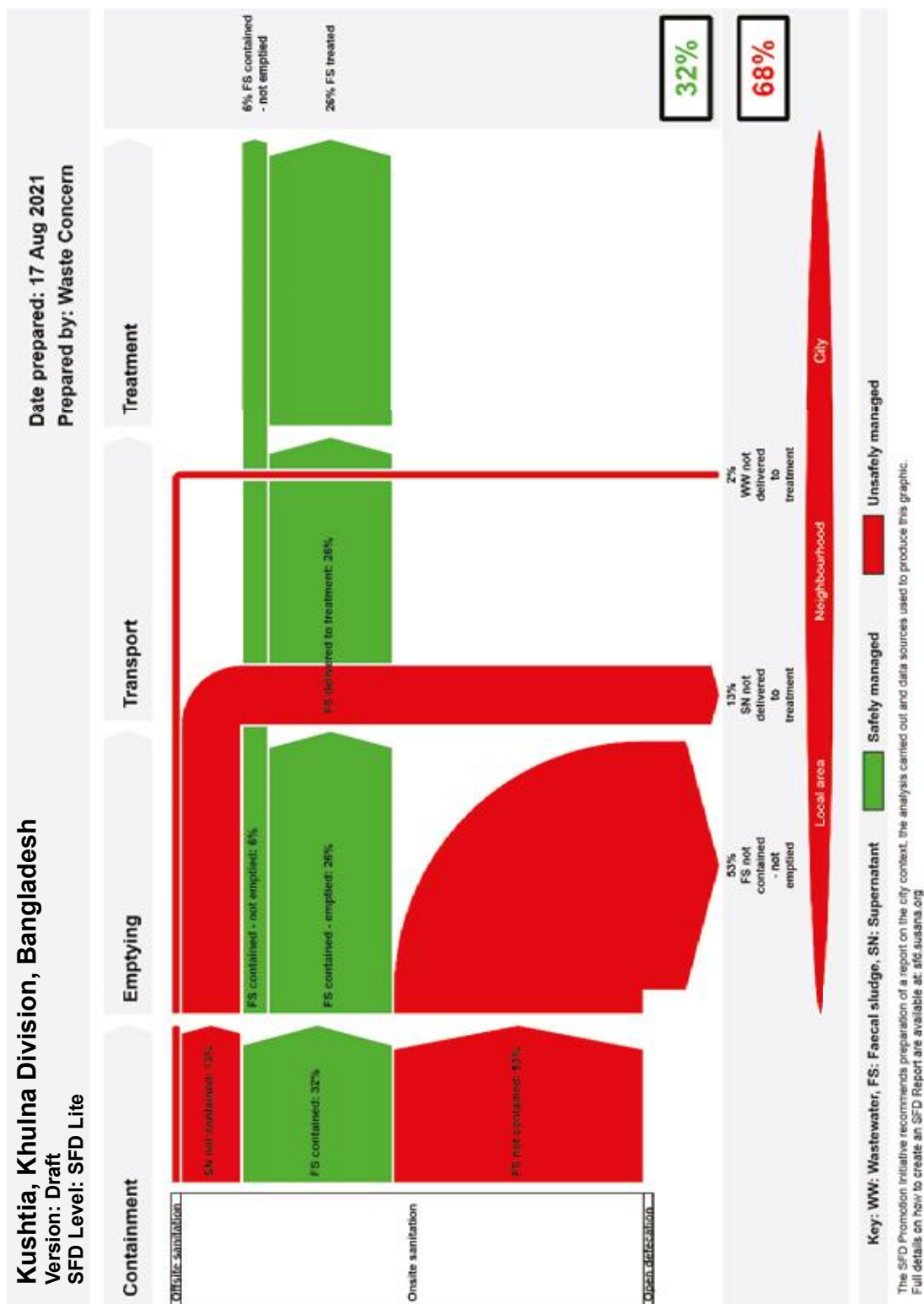
b) List of Detailed Project Reports (DPRs)

Sl. No.	Title	Year	Status
1	Design and Implementation Support for Shared Toilets in the Bede Para Slum of Savar Municipality	2021	Implemented
2	Design and Implementation Support for Integrated MRF and Solid Waste Transfer Station in Ward 5 and Ward 18 of Kushtia Municipality	2021	DPR
3	Design and implementation support for transforming the existing landfill site located at Baradi, Kushtia Municipality into an environment-friendly controlled Landfill	2021	DPR
4	Design and implementation support for the construction of compost plant and pilot DEWATS in Savar Cantonment Board (SCB)	2021	DPR
5	Improvement of Public Toilet in Savar Municipality	2022	Implemented
6	SWM Mobile Transfer Station for Savar Municipality	2023	Under implementation

Appendix 3: Shit Flow Diagram (SFD) of Savar municipality



Appendix 4: Shit Flow Diagram (SFD) of Kushtia municipality



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