Metrics and Service Level Benchmark For

INTEGRATED WASTE MANAGEMENT PLANT

(Solid Waste and Faceal Sludge)

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CWIS-FSM Support Cell

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Foreword

The Department of Public Health Engineering (DPHE) for the first time brought the " Metrics and Service Level Benchmark for Integrated Waste Management Plant (Solid Waste and Faecal Sludge)" that includes a set of standards following the existing government rules and regulations.

The aim of this documents is to establish performance-based accountability for the Faecal Sludge Treatment Plants/ Integrated Waste Management Plant across Bangladesh. The government has made urban sanitation a priority to enhance faecal sludge management, and as part of this initiative, the National Action Plan 2021-2030 has been endorsed to enforce the Institutional and Regulatory Framework for Faecal Sludge Management (IRF-FSM). A number of Faecal Sludge Treatment plants is being operated by the municipality and city corporations across the country and there is a need to established performance based accountability. The department of Public Health Engineering has already established Integrated Waste Management (IWM) plants that will treat faecal sludge and solid waste at the same treatment plant. To ensure performance a set of standards and accountability mechanisms is very essential. Therefore, this Metrics and Service Level Benchmark (SBL) document will serve as a guidance tool for ensuring performance efficiency of Faecal Sludge Treatment plants/ Integrated Waste Management Plants (IWM) through a minimum standard set of parameters commonly understood and used by all stakeholders.

An evaluation framework and performance monitoring system are also included in this document, enabling a municipality to easily assess their Faecal Sludge Treatment Plants/ Integrated Waste Management plants using specific indicators. This document has also mapped the current locations of existing Faecal Sludge Treatment Plants (FSTP's) in Bangladesh along with their establishment year, treatment capacity, flow rate, design criteria, CapEx and OpEx. The performance report will gauge the effectiveness of Faecal Sludge Treatment plants /Integrated Waste Management Plant(IWM) based on these indicators so that municipalities/city corporations can analyze their performance and set goals for the following year to ensure accountability based on results.

I am grateful to the CWIS FSM Support Cell, DPHE, for developing this timely and essential document that will greatly contribute to the improvement of solid waste and faecal sludge management in Bangladesh. It is expected that the document will be useful for policymakers, researchers, and professionals, reflecting progress in urban service delivery.

(Tushar Mohon Sadhu Khan)
Chief Engineer
Department of Public Health Engineering

Acknowledgement

The Department of Public Health Engineering (DPHE) is glad to introduce the "Metrics and Service Level Benchmark for Integrated Waste Management Plant (Solid Waste and Faecal Sludge)" that includes a set of standards following existing government rules and regulations.

This document aims to set performance standards for Integrated Waste Management (IWM) Plants which treats both faecal sludge and solid waste in Bangladesh. The National Action Plan 2021-2030 prioritizes urban sanitation, endorsing the Institutional and Regulatory Framework for Faecal Sludge Management (IRF-FSM). With various Faecal Sludge Treatment Plants (FSTPs) implemented nationwide, establishing performance-based accountability is crucial. The Department of Public Health Engineering (DPHE) is now implementing Integrated Waste Management (IWM) plants necessitating standardization and accountability for safety of environment. This Metrics and Service Level Benchmark (SLB) document will provide guidance to ensure the efficient performance of FSTPs and IWMs using a common set of parameters understood by all stakeholders.

Included in this document are an evaluation framework and a performance monitoring system, enabling municipalities to easily assess their FSTPs and IWMs using specific indicators. Additionally, the document maps the current locations of existing FSTPs in Bangladesh, detailing their establishment year, treatment capacity, flow rate, design criteria, CapEx, and OpEx. The performance report will gauge the effectiveness of FSTPs and IWMs based on these indicators, allowing municipalities and city corporations to analyze their performance, and set goals for the following year to ensure accountability based on results.

To finalize this document, I would first like to express my deepest gratitude to Mr. Tushar Mohan Sadhu Khan, Chief Engineer of the Department of Public Health Engineering, for his precise guidance. My sincere thanks also go to Mr. Md. Shafiqul Hassan, Co-chair of the CWIS-FSM Support Cell, along with the respected Project Directors and officials of DPHE who provided invaluable feedback and insightful advice throughout the finalization process. Sincere thanks to the partners of the CWIS-FSM Support Cell (ITN-BUET, WaterAid, Practical Action, SNV, Athena Infonomics, Global Water and Sanitation Center-GWSC, AIT, FANSA and Others) for bringing knowledge which are immensely valuable while deliver this document. Lastly, I extend my heartfelt appreciation to all the officials of the CWIS-FSM Support Cell, whose commitment and hard work from the beginning to the end were crucial in bringing this document to completion.

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Contents

ABBREVIATIONS

FSTP	Faecal Sludge Treatment Plants
IWM	Integrated Waste Management
DPHE	Department of Public Health Engineering
LGI	Local Government Institute
SLB	Service Level Benchmark
IRF	Institutional Regulatory Framework
ABR	Anaerobic Baffled Reactor
PDBs	Planted Drying Beds
CW	Constructed Wetland
BOD_5	Biochemical Oxygen Demand
CoD	Chemical Oxygen Demand
TEQ	International Toxic Equivalents
ECR	Environmental Conservention Rule
FS	Faecal Sludge
ECR	Environmental Conservation Rule

Section I

Service Level Benchmarking in the context of performance management of FSTP's

Section I: Service Level Benchmarking in the Context of Performance Management of FSTP's

1.1 Introduction

Bangladesh is one of the fastest urbanizing countries in South Asia, with a population of 160 million . A study has shown that the tendency of people to move from villages to cities for the purpose of livelihood is very high . According to a 2019 estimate, about 37.4% of the total population now lives in cities. If this trend continues, around 50% of the total population will live in cities by 2030. With the increase in population, urbanization and income, the generation of waste (faecal sludge and solid waste) will be much higher than at present. Ensuring civic benefits for such a large number of populations will create challenges for the government. At the same time, being unable to manage such an amount of waste will create environmental pollution and degrade the human-nature ecosystem. The Government of Bangladesh has already prioritized urban sanitation to improve faecal sludge management, and in line with this, the National Action Plan 2021-2030 (Municipalities and City Corporations) has been approved to implement the Institutional and Regulatory Framework for Faecal Sludge Management (IRF-FSM).To improve the urban sanitation system government has already taken initiatives to establish Integrated Waste Management (IWM) plants that will treat faecal waste and solid waste at the same treatment plant. To efficiently manage this infrastructure, a set of performance indicators is essential. Therefore, this Service Level Benchmark (SLB) document will serve as a guidance tool for ensuring performance efficiency of Faecal Sludge Treatment Plants (FSTP's) through a minimum standard set of parameters commonly understood and used by all stakeholders.

1.2 Importance of Service Level Benchmark

Service Level Benchmarking (SLB) is new for Bangladesh, especially for the faecal sludge treatment system. These performance indicators will enable stakeholders to measure the performance, understand the lacunae in the system, and gradually improve the treatment system. This SLB document includes a set of minimum standards for measuring the efficiency of the FSTP's following existing government rules and regulations. This will help monitor the treatment system's inputs and outputs for measuring the efficiency and necessary action after reviewing the scoring. Therefore, SLB will contribute to rationalizing decision-making, strengthening accountability, transparency, resource mobilization & allocation, and prioritizing development activities in line with the City-Wide Inclusive Sanitation (CWIS) principle. In Bangladesh, most FSTPs treat sludge from septic tanks, pit latrines with planted/unplanted drying beds. The wastewater is treated through settler, ABR, Constructed wetlands, and polishing ponds. In every step, there needs to be monitor the performance of the system. In this regard, an evaluation framework and Service Level Benchmark have been developed to measure the efficiency of the FSTP's and improve their performance holistically.

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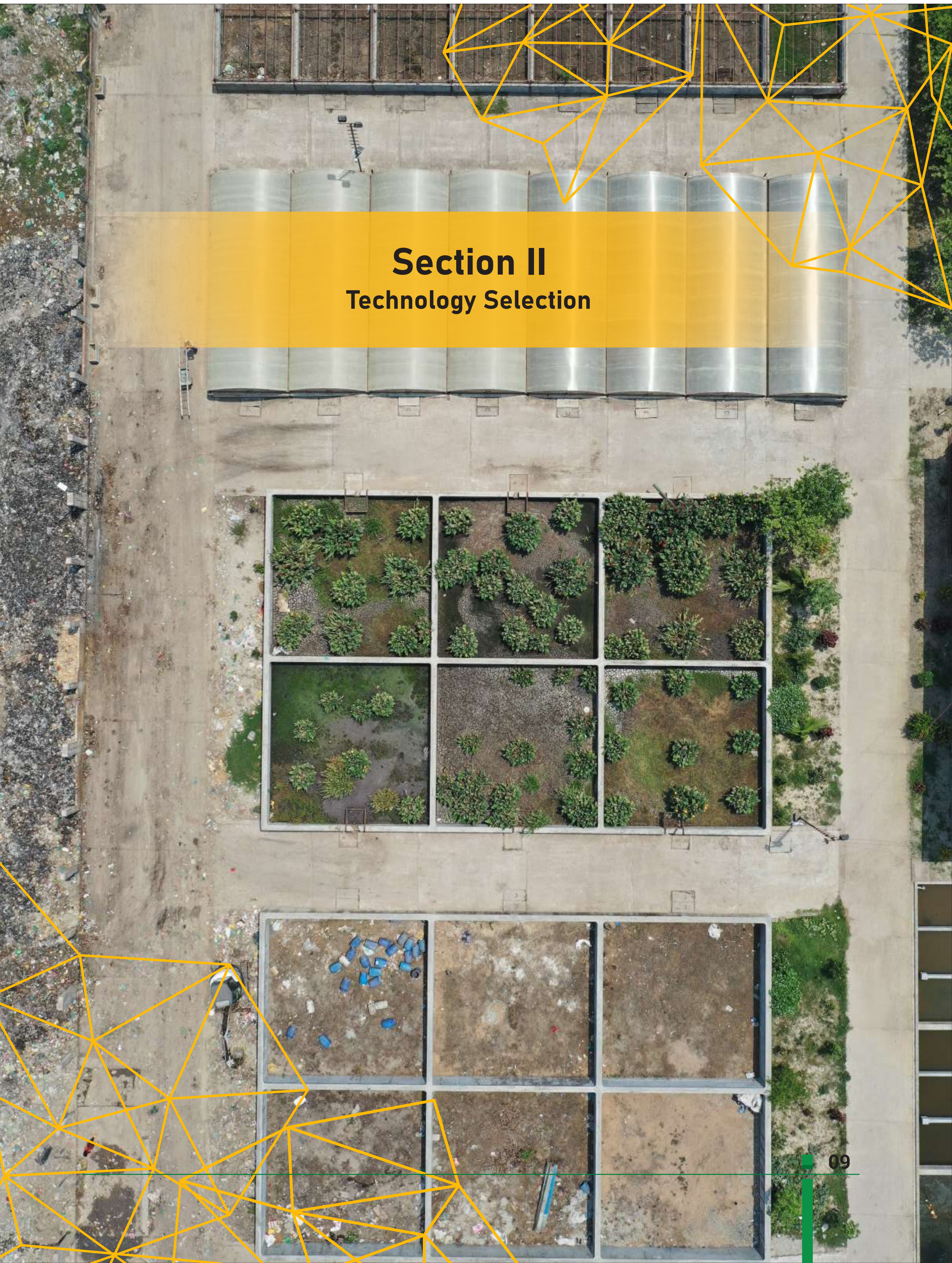
[1] https://data.worldbank.org/indicator/SP.POP.TOTL? locations=BD

[2] Zakir Hossain et al. (2016), Rural-urban Migration in Bangladesh and Its Nexus with Some Socioeconomic Indicators at Origin and Destination, International Journal of Social Relevance & Concern ISSN-2347-9698

Section II
Technology Selection



Section II: Technology Selection

2.1 Technology Selection for Integrated Waste Management

The municipality has primarily two types of waste. One is solid waste, and the other is the faecal sludge. Considering these two types of waste, an integrated approach has been taken to treat both solid waste and faecal waste in one treatment plant. A brief description of Integrated Waste Management is presented below for wider understanding.

A. Treatment of Faecal Sludge

Faecal sludge is collected from different types of containments of residential houses, marketplaces, institutions, public toilets etc. The collection and transportation processes are executed by mechanical vacuum tankers. The tankers discharge the sludge to planted drying beds in the plant.

Planted drying beds (PDBs) are sludge drying beds of porous media (e.g. sand and gravel) that have plants with emergent macrophytes in it. The beds are loaded with layers of sludge that are subsequently dewatered and stabilized through multiple physical and biological mechanisms like evaporation and evapotranspiration. Here, it accumulates for 2-3 years depending on the loading rate. The dried sludge is left here for a longer retention period of 2-3 years to ensure that pathogens are inactivated. After removal, the dried sludge can be used as a soil conditioner (night soil) or raw materials with non-combustible solid waste for co-composting.

The liquid percolated from the dry bed is treated in the Integrated Settler and Anaerobic Filter (ABR). In settler, settleable solids of wastewater are removed by sedimentation. In the ABR, the suspended and dissolved solids present in the wastewater undergo anaerobic degradation. As wastewater flows through the filter, particles are trapped, and organic matter is degraded by the biomass that is attached to the filter material. The wastewater then passes through the Constructed wetland (CW), where the pollutants (mostly nutrients) present in the wastewater are degraded further aerobically. It also reduces the nutrients such as N, P and K present in wastewater. The treated wastewater then goes to the Polishing pond. Pathogens present in wastewater are removed in polishing ponds. Then the treated wastewater can be discharged into the environment, complying with the effluent discharge standards.

For faecal sludge to be safe for re-use (both solid and liquid components), following treatment stages need to be followed:

Table 2.1: Different treatment stages for faecal sludge

Treatment Stages	Treatment Method	Process
Solid Liquid Separation	Screening	- Screener
Dewatering and drying of sludge	Filtration, Evaporation and evapotranspiration	- Gravity Based dewatering using Planted Sludge Drying Beds
Liquid/Effluent Treatment	Settling, Biological stabilization and Filtration	- Settler - Anaerobic Baffled Reactor (ABR) - Constructed Wetland
Disinfection	Solids	- Co-Composting - and/or Sludge Combustion
	Liquid	- UV in Polishing Pond or - Chlorination

B. Treatment of Solid Waste

Solid waste is collected from residential houses, slum areas, hostels, markets and business places, institutions etc and transported to the waste separation area of the plant. The solid waste is categorized as:

- Non-combustible waste, which has a high moisture content, high C/N
- Combustible waste, plastic, textile, commercial

Non-combustible waste: The waste is separated, and the non-combustible waste undergoes composting. A thermophilic, aerobic composting process is maintained, and a mechanical turner is used to ensure uniform turning of the mixture in regular intervals to ensure sufficient aerations. The compost is then kept in the maturation chamber and post-maturation chamber, where it undergoes hot air treatment in a hot chamber to kill pathogens before packaging for agricultural use. The aerobic process of composting does not produce methane because methane-producing microbes are not active in the presence of oxygen.

For non-combustible component solid waste treatment, the following treatment stages will be followed:

Table 2.2: Different treatment stages for Solid Waste

Treatment Stages	Treatment Method	Process
Combustible and non-combustible waste Separation	Screening	- Mechanically and manually separation
Composting	Aerobic Decomposition	- Waste decomposition
Maturation Treatment	Air Drying	- Residual decomposition and moisture reduction
Post Maturation Treatment	Hot Air Drying	- Disinfection (> 45 C)

Combustible waste : The separated portion of combustible waste is sent to the plasma gasification unit. A controlled gasification process converts the combustible waste into gaseous constituents and a relatively incombustible residue as slag/ash satisfies the environmental compliances.

During the combustion process, billions of free-flowing electrons generated via ionization create a state of highly energized and electromagnetically conductive plasma. These energy-rich electrons collide at high speed with the carbonaceous waste, molecularly dissociating and thermally (temperature >800ºC) disintegrating the waste compounds into elemental stable and inert gas and slag/ash residue.

The gases that get generated during the plasma gasification (CO,H_2, CO_2, O_2, CH_2 etc) process needs to go under gas cleaning processes such as Cooling, Scrubbing, Cyclone Separator to finally produce clean gas as CO, H_2 which is safe to release in the atmosphere.

Figure 2.1 shows different treatment streams for treating solid and faecal waste in an integrated way, and Figure 2.2 shows a standard Integrated Waste Management Plant flow for a city.

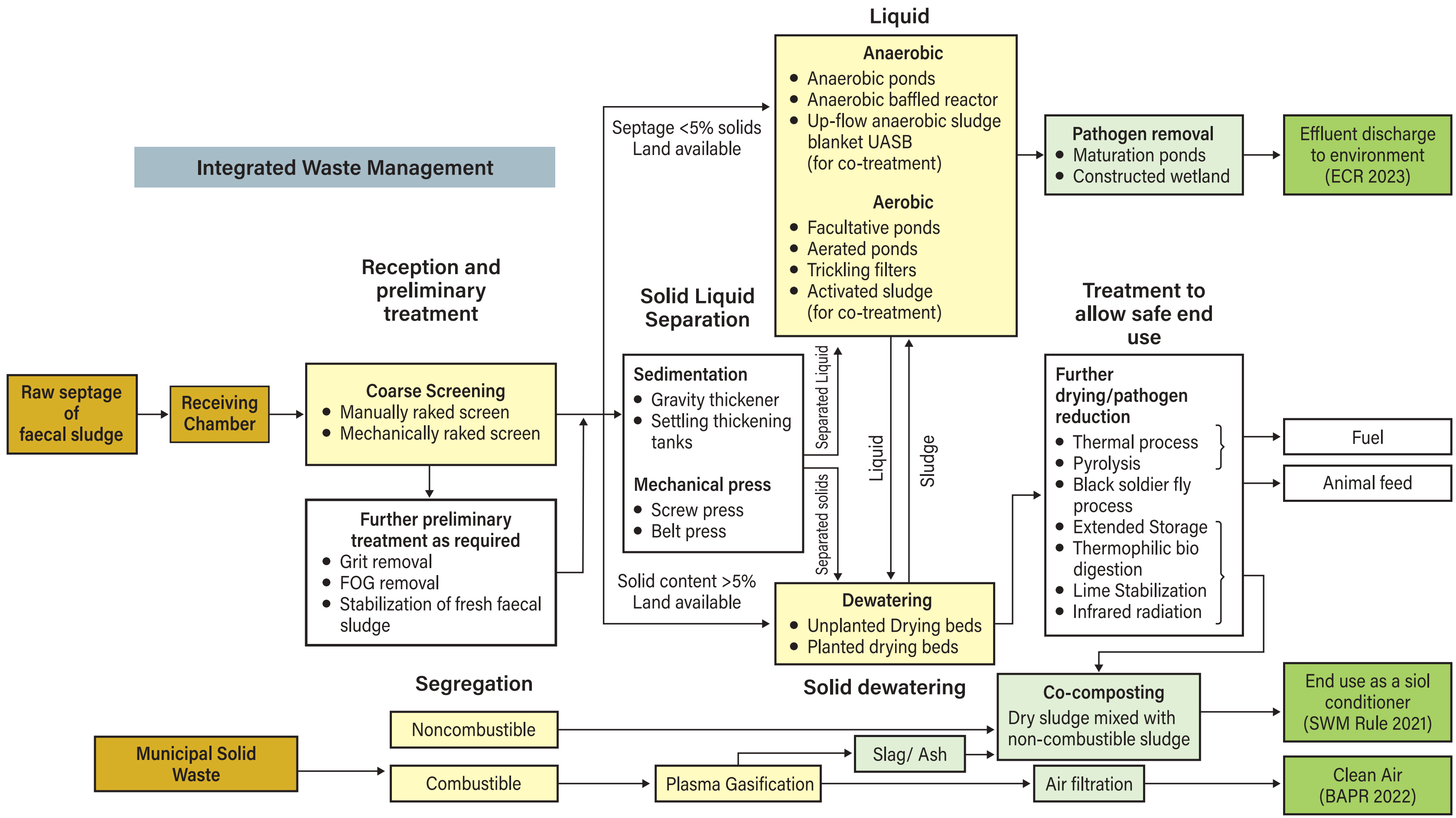


Figure 2.1: Different treatment streams of the Integrated Waste Management System

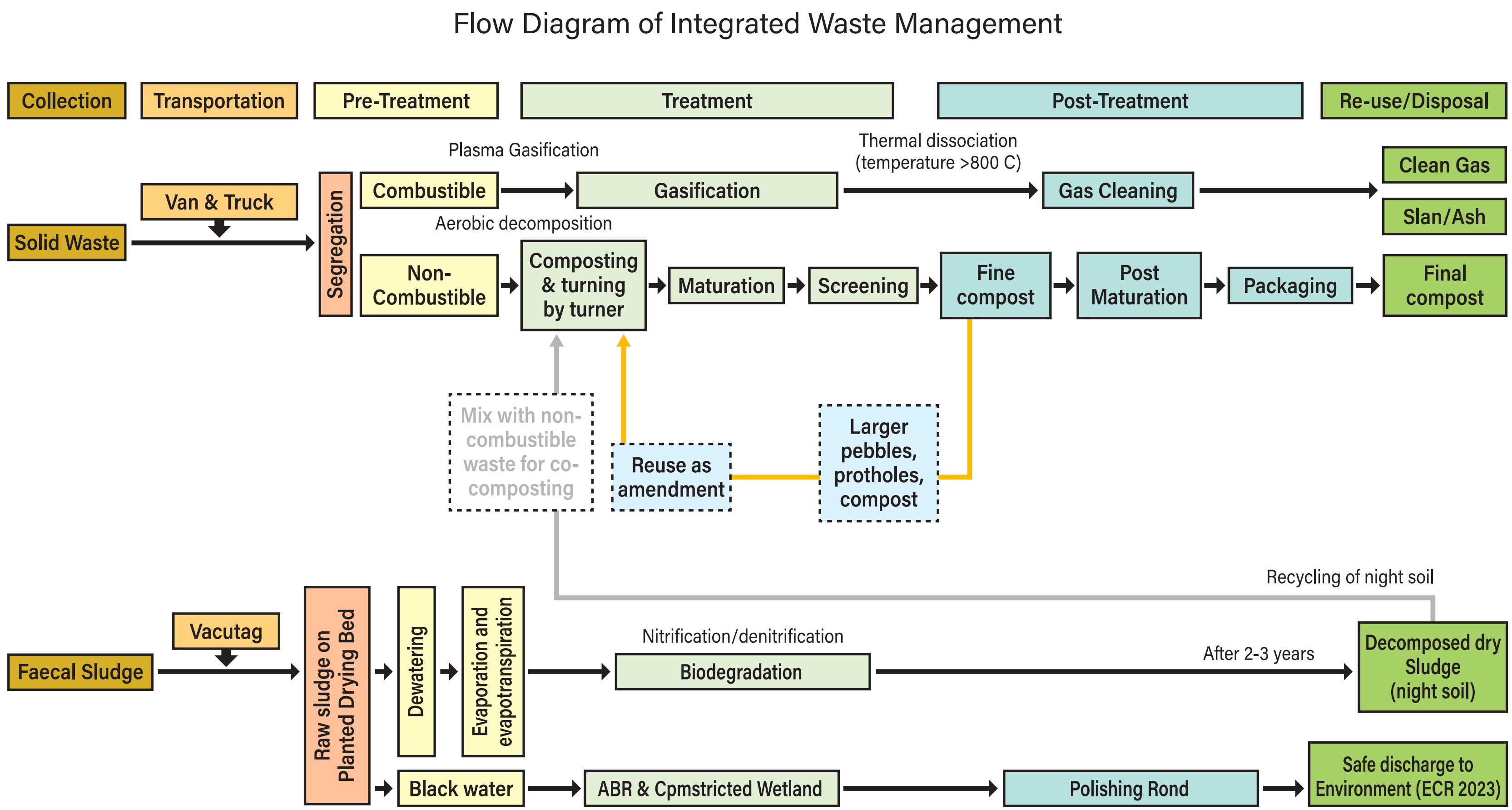


Figure 2.2 : A Standard Flow of Integrated Waste Management System for a city

2.2 FSTP Evaluation Framework for Measuring Treatment Efficiency

The treatment efficiency of the FSTPs/Integrated Waste Management (IWM) plant indicates how efficiently it removes the solid and liquid parts, ensuring national standards in different treatment streams. It is essential to measure the treatment efficiency to ensure consistent quality of any designed FSTPs/IWM. The following frameworks shows how a systemic loop can help to evaluate the FSTP/IWM.

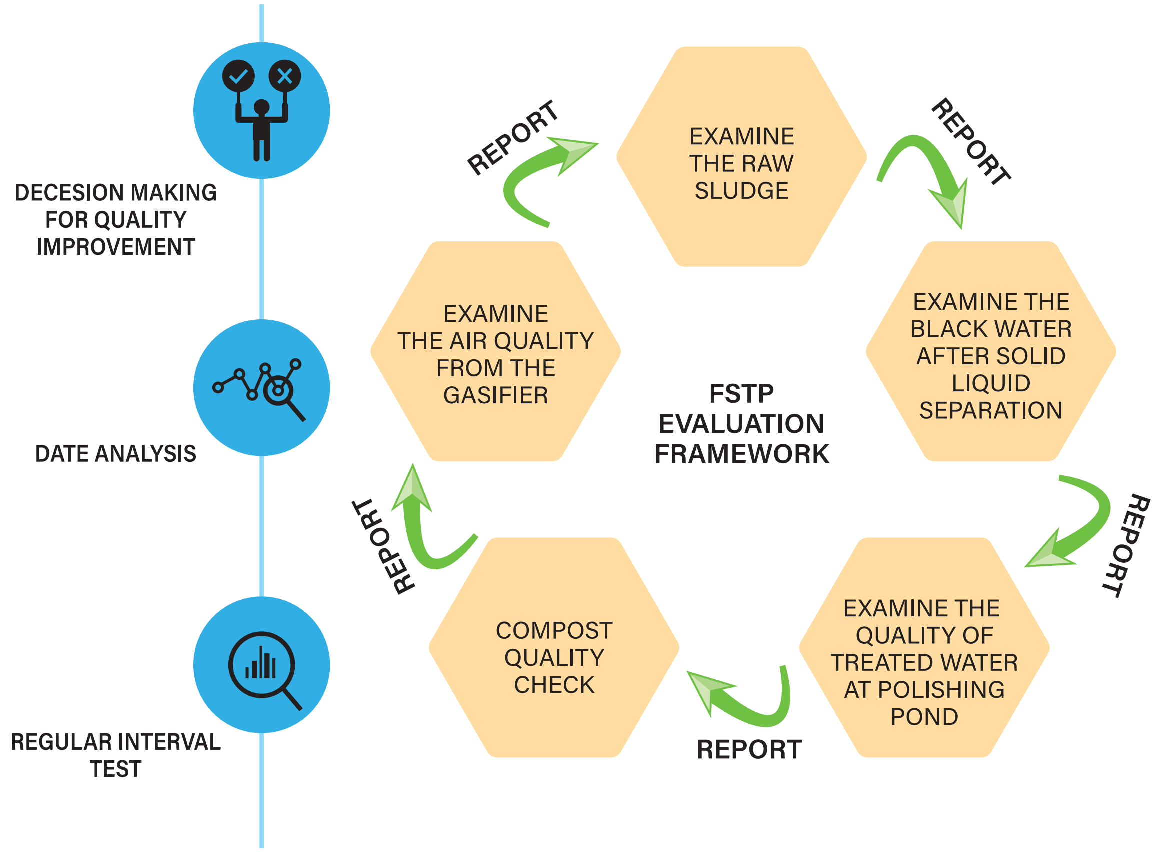


Figure 2.3: FSTP Evaluation Framework

The evaluation process of FSTP/IWM requires checking the quality at different treatment streams. The followings five steps are essential to evaluate the system and need to maintain at regular intervals. Tables 2.3, 2.4, and 2.5 shows the testing interval, testing parameters, and testing points. The evaluation steps are described below,

Step 1: To examine the quality of the raw sludge, sample should be collected from point 1 (Figure 2.4, point 1). A 500 ml sample needs to be collected with a plastic bucket using a handle made of the rod while discharging the sludge from the vacuum truck tanker into the drying bed. At least five samples (500 ml each) need to be collected at 2.5-minute intervals for a composite mixture. The composite mixture will ensure the homogeneity of the raw sludge. Finally, a composite mixture of 500ml raw sludge needs to be tested for the following parameters, such as pH, BOD_5, COD, Suspended Solids (SS), Oil & Grease, Nitrate (NO_3), Phosphate (PO_4) and Total Coliform.The sampling bottle needs to be clean, and the sample number, location, time, and date should be mentioned on each bottle. A logbook should be maintained during the process.

Step 2: In this step, a sample of 500 ml should be collected from the inlet (Figure 2.4, point 2) of the anaerobic baffled reactor. In this case, a cylindrical stainless steel sampler should be used, which can be lowered and raised with the help of a rope. The sampling bottle needs to be clean, and the sample number, location, time, and date should be mentioned on each bottle. A logbook should be maintained during the process.

Step 3: In this step 1000 ml sample needs to be collected from the polishing pond (Figure 2.4, point 3). This should be recorded in a logbook mentioning the sample number, location, time, and date. A pH meter can be a handful of tools at the field level to measure the pH instantly. Also, automatic data loggers can regularly collect information on pH, turbidity, and suspended solids. Personal protective equipment such as gloves, face masks, goggles, gumboots, and hand sanitiser should always be kept in the sample collection box while collecting samples. Specimens must be stored in ice bags prior to shipment to the laboratory, and care must be taken to ensure that the ice bag contains a leakproof frozen ice gel bag.

Step 4: This step will ensure the compost standard according to Solid Waste Management Rules, 2021. In this process (Figure 2.4, point 4), dry sludge and organic waste need to be mixed in a proper ratio for composting. The essential part of the composting process is turning at regular intervals, batching for 45-60 days, and hot air drying (>45°C) in the post-maturation chamber. Standard and measuring intervals mentioned in Table 2.4

Step 5: Inorganic part of the solid waste needs to be separated (Figure 2.4, point 5) and treated at the plasma gasification unit. This process should ensure the Bangladesh Air Pollution Regulations 2022. Standard and measuring intervals mentioned in Table 2.5

Following are the sampling location for measuring the efficiency of the FSTPs/IWM

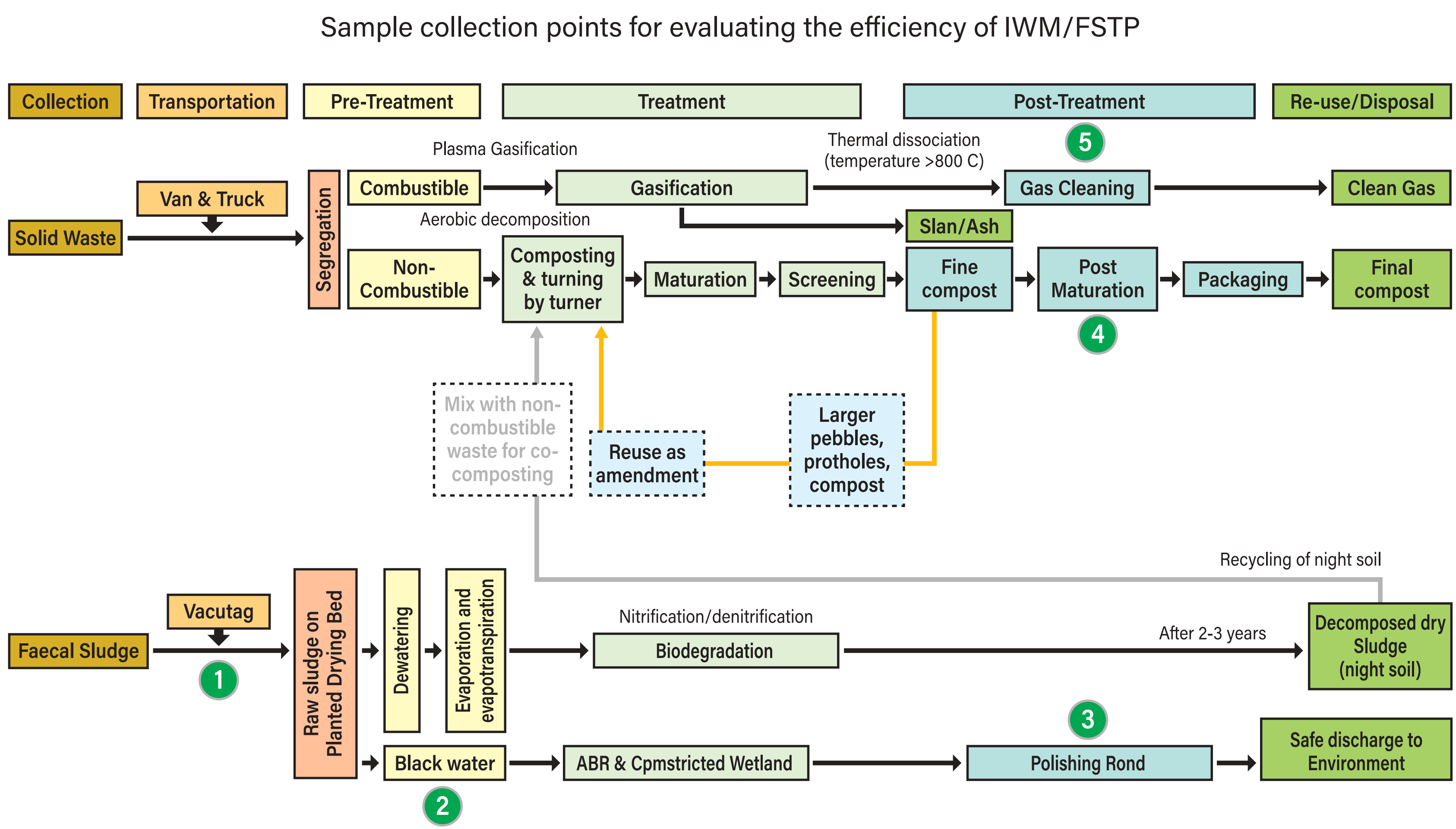


Figure 2.4: Sample collection points for evaluating the efficiency of IWM/FSTP's

Table 2.3: Standards for Sewage Discharge

(Following the Environment Conservation Rules, 2023)

No	Parameter	Unit	Standard Ltd.	Sample collection points	Sample testing intervals
1.	Temperature	Degree Centigrade	30	1,2,3	3-month intervals
2.	pH	--	6-9	"	"
3.	BOD_5 at 20˚ C	milligram/l	30	"	"
4.	COD	milligram/l	125	"	"
5.	Suspended Solids (SS)	milligram/l	100	"	"
6.	Oil & Grease	milligram/l	10	"	"
7.	Nitrate (NO_3)	milligram/l	50	"	"
8.	Phosphate (PO_4)	milligram/l	15	"	"
9.	Total Coliform	CFU per 100 mL	1000	"	"

Table 2.4: Standards for Compost

(Following Solid Waste Management Rule 2021)

No	Parameter	Standard Ltd.	Sample collection points	Sample testing intervals
1.	Color	Dark brown to black	4	6-month intervals
2.	Physical Condition	Non-granular form	"	"
3.	Odor	Absence of foul odor	"	"
4.	Moisture Content	Maximum 20%	"	"
5.	Inert materials	Maximum 1 %	"	"

Chemical Properties

No	Parameter	Standard Ltd.	Sample collection points	Sample testing intervals
1.	pH	6.0-8.5	4	6-month intervals
2.	Organic Carbon	10-25%	"	"
3.	Nitrogen, N	0.5-4.0%	"	"
4.	C:N	Max 20:1	"	"
5.	Phosphorus, P	0.5-3.0%	"	"
6.	Potassium, K	0.5-3.0%	"	"
7.	Sulfur, S	0.1-0.5%	"	"
8.	Zinc, Zn	Max 0.1%	"	"
9.	Copper, Cu	Max 0.05%	"	"
10.	Chromium, Cr	Max 50 ppm	"	"
11.	Cadmium, Cd	Max 5 ppm	"	"
12.	Lead, Pb	Max 30 ppm	"	"
13.	Nickel, Ni	Max 30 ppm	"	"

Table 2.5: Municipal Solid Waste Incinerator Standard
(Following Bangladesh Air Pollution Rules 2022)

No	Parameter	Avg time	Max limit (mg/Nm^3)	Sample collection points	Sample testing intervals
1.	Particulate matter (PM)	1 hr	30	5	Yearly
2.		24 hr	20	"	"
3.	carbon monoxide (CO)	1 hr	100	"	"
4.		24 hr	80	"	"
5.	nitrogen oxide (NO_X)	1 hr	300	"	"
6.		24 hr	250	"	"
7.	sulphur dioxide (SO_2)	1 hr	100	"	"
8.		24 hr	80	"	"
9.	hydrogen chloride (HCL)	1 hr	60	"	"

No	Parameter	Avg time	Max limit (mg/Nm³)	Sample collection points	Sample testing intervals
10.		24 hr	50	"	"
11.	mercury (Hg)	0.5-8 hr	0.05	"	"
12.	Cadmium and thallasium	0.5-8 hr	0.1	"	"
13.	antimony, arsenic, lead, chromium, cobalt, copper, manganese and nickel	0.5-8 hr	0.5	"	"
14.	hydrogen fluoride	0.5-8 hr	1.0	"	"
15.	Dioxin and furan	0.5-8 h	0.1 ng TEQ/Nm²	"	"

2.3 Pathogen Inactivation Chart for Co-Composting

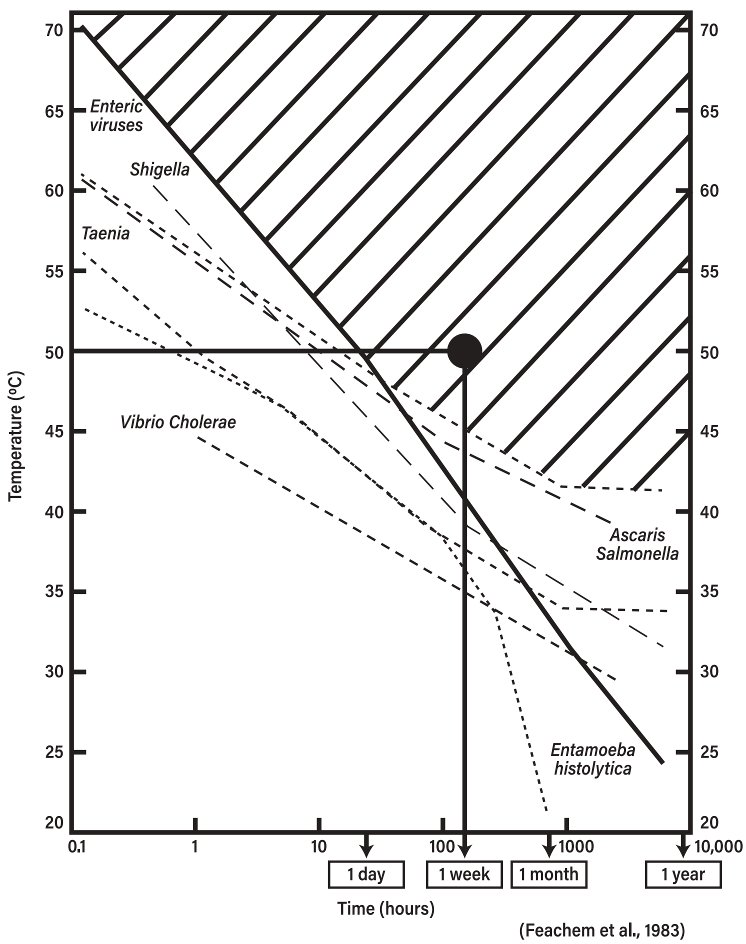
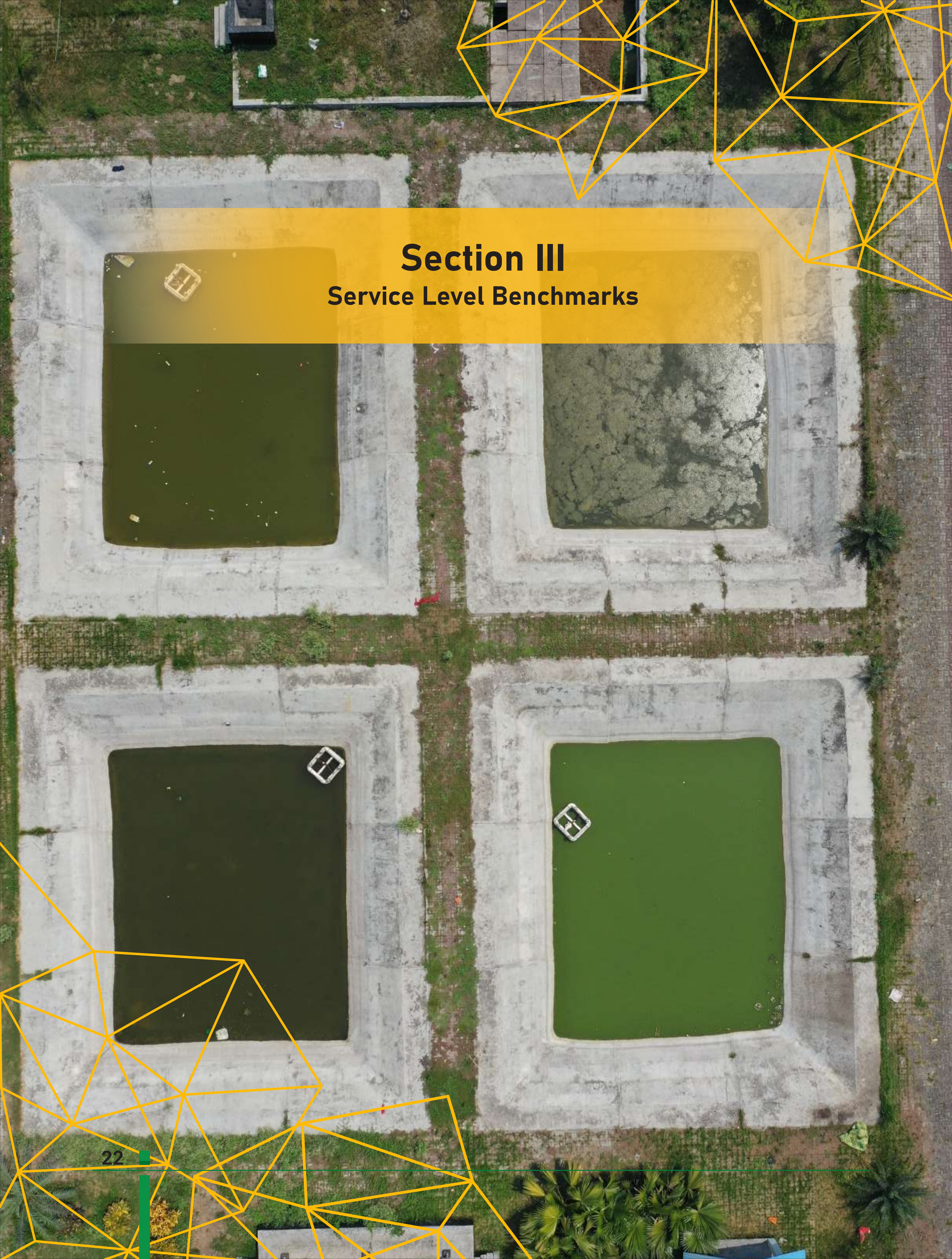


Figure 2.5 : Pathogen Inactivation chart for Co-Composting
(Following WHO Guideline for the Safe use of Wastewater, Excreta, and Graywater 2006)

Most pathogens are deactivated at temperatures above 60˚C, causing denaturation of cell proteins and nucleic acids. Processes like thermophilic co-composting and lime treatment achieve this. Higher temperatures require less time for pathogen inactivation. Treatment duration or storage of treated sludge can lead to pathogen reduction due to limited survival time in adverse conditions. Bacteria in faeces typically survive for one week to two months, with Salmonella spp. surviving, on average, for 30 days and faecal coliforms for 50 days. Meanwhile, helminth eggs are highly persistent and can remain viable for several months to years.The necessary storage duration for pathogen reduction also relies on ambient temperature; recommended durations include up to one year at an ambient temperature of 35°C or two years at 20°C while storing FS (fecal sludge). Storage below 10°C does not result in sufficient inactivation.A controlled hot air drying (>45°C) combined with a post-maturation chamber is a favorable option for pathogen inactivation during co-composting process.

Section III
Service Level Benchmarks



Section III: Service Level Benchmarks

3.1 Adequacy of capacity for treatment of Faecal Sludge

Performance Indicator		
Indicator	**Unit**	**Definition**
Adequacy of capacity for treatment of Faecal Sludge	%	Adequacy is expressed as treatment. (separating solid and liquid parts from the faecal sludge; whereas removing oxygen demand, Suspended Solids, Oil & Grease, Nitrate,Phosphate, and Total Coliform from the liquid part is essential as per government ECR 2023 standard) capacity of the plant with respect to the faecal sludge generation for the same time period
Data Requirements		
Data required for calculating the indicator	**Unit**	**Remarks**
a. Total faecal sludge generation		Data on the total faecal sludge generation from the municipality service boundary can be calculated by multiplying the per person average faecal sludge(FS) generation by number of population living in that area. If a baseline study is available for the municipality, FS generation can be taken as a valid source of data.
b. Treatment plant capacity	(m^3/day)	The total functional capacity of the treatment plant can be taken from the municipality engineering department as per the design.
Faecal Sludge treatment capacity	**%**	**Adequacy of the treatment capacity= [b/a]x100**

Rationale for the indicator
In recent years, most municipality/city corporations have operational/planned FSTP's for serving the residents. The capacity of the FSTP is designed in response to the city population, availability of land and allocated government budget. This indicator will highlight the adequacy of the treatment of faecal sludge. The benchmark value for this indicator is 100 percent.

Reliability of Measurement	
Reliability	**Description of method**
Lowest level of reliability (D)	No available information. Calculations are based on assumptions.
Intermediate level (C)	The information on the treatment capacity of the FSTPs is based on secondary data. If secondary data is not available, capacity can be calculated based on the size of the planted drying bed/ unplanted drying bed/ sludge receiving system.
Intermediate level (B)	The treatment capacity is well documented, and sludge generation is calculated based on primary data.
Highest/preferred level of reliability (A)	The treatment capacity is well documented, and sludge generation is calculated based on the recent baseline/survey data.

3.2 Adequacy of capacity for treatment of Solid Waste

Performance Indicator		
Indicator	**Unit**	**Definition**
Adequacy of capacity for treatment of Solid Waste	%	Adequacy is expressed as the capacity to separate the organic and inorganic parts from the collection system and deliver them to the composting/incineration /gasification/landfill site for the same time period.

Data Requirements		
Data required for calculating the indicator	**Unit**	**Remarks**
a. Total solid waste generation	(m^3/day)	Data on the total solid waste generation from the municipality service boundary can be calculated by multiplying the average solid waste generation per person by the number of populations in that area. If there a baseline data is available, it can be used as a valid source for the data on waste generation.
b. Treatment plant capacity/ Landfill capacity	(m^3/day)	Total functional capacity of the treatment plant/Landfill can be taken from the municipality engineering department as per the design. Otherwise, the total capacity can be calculated based on the size of the solid waste receiving chamber/landfill site.
Solid Waste treatment capacity	**%**	**Adequacy of the treatment capacity = [b/a]x100**

Rationale for the indicator

There are a number of FSTP's / Integrated Waste Management Plants (IWM) which also have the facility to co-treat the solid waste. In addition, few of them have the facility for sanitary landfill. In both cases, the adequacy of capacity for solid waste treatment/storage in landfill sites needs to be measured regarding the total solid waste generation.

This indicator will highlight the adequacy of the treatment of solid waste. The benchmark value for this indicator is 100 percent.

Reliability of Measurement	
Reliability	**Description of method**
Lowest level of reliability (D)	No available information. Calculations are based on assumptions.
Intermediate level (C)	There is no estimate of treatment capacity that is actually functional and in operation but secondary information is present to extrapolate the treatment information.

Reliability of Measurement	
Reliability	**Description of method**
Intermediate level (B)	The treatment capacity is well documented, and solid waste generation is calculated based on secondary reference.
Highest/preferred level of reliability (A)	The treatment capacity is well documented, and solid waste generation is calculated based on the updated baseline/ survey data.

3.3 Efficiency of the drying bed to separate the solid part from the faecal sludge

Performance Indicator		
Indicator	**Unit**	**Definition**
Efficiency of the drying bed to separate the solid part from the faecal sludge	%	Efficiency of the drying bed is expressed as the capacity to retain/store solid parts from the faecal sludge considering all weathering conditions with respect to its design capacity.
Data Requirements		
Data required for calculating the indicator	**Unit**	**Remarks**
a. Design capacity of the treatment beds	(m^3/day)	Design capacity can be collected from the design document/ field measurement.
b. Total faecal sludge delivered to treatment beds	(m^3/day)	Total fecal sludge volume can be determined using information from the treatment plant logbook. If such a logbook is not available, the total amount can be calculated by multiplying the average daily number of trips and the capacity of vacuum trucks arriving at the treatment plant.
Planted drying beds/unplanted drying beds capacity	**%**	**Efficiency of the drying bed = [b/a]x100**

Rationale for the indicator
For sustainable FSTP's / Integrated Waste Management Plants (IWM) management, it is not just enough to have the infrastructure for collection and treatment purposes. It is important that the infrastructure has the capacity to treat/retain the solid part efficiently. Monitoring this indicator is essential, with a benchmark value of 100 percent.

Reliability of Measurement	
Reliability	**Description of method**
Lowest level of reliability (D)	No available information. Calculations are based on assumptions.
Intermediate level (C)	There is no available information on drying beds, but the capacity is calculated based on secondary information or extrapolated based on the same type of system.
Intermediate level (B)	The drying bed capacity is well documented, and the delivered faecal sludge amount is roughly calculated by secondary data.
Highest/preferred level of reliability (A)	The drying bed capacity is well documented, and the delivered faecal sludge amount is calculated from the logbook/primary data.

3.4 Efficiency of the liquid treatment unit

Performance Indicator		
Indicator	**Unit**	**Definition**
Efficiency of the liquid treatment unit	%	Efficiency is expressed as the capacity to treat the wastewater from the solid-liquid separation unit. This treatment unit usually comprises a settler, ABR, Constructed wetland/ coco pit filter and polishing pond. The treatment efficiency is calculated by the wastewater sample passing the unit, and treated samples from the outlet are equal to or better than the standard laid down by the government of Bangladesh according to Environmental Conservation Rule 2023.

Data Requirements		
Data required for calculating the indicator	Unit	Remarks
a. Total number of parameters tested	Number per quarter	Sampling (quality, periodicity, point of sample collection etc.) should be taken as per mentioned in Chapter 2 (FSTP Evaluation Framework for Measuring Treatment Efficiency), and parameters should be tested mentioned in Environmental Conservation Rule (ECR 2023) by the Government of Bangladesh.
b. Number of parameters pass the treatment standard	Number per quarter	Within the total valid samples, the number of samples that pass the specific standard, along with all key parameter
Secondary treatment unit (settler, ABR, Constructed wetland/ coco pit filter and polishing pond) capacity	**%**	**Efficiency of the liquid treatment unit = [b/a]x100**

Rationale for the indicator
For effective management of Sustainable FSTP's/ Integrated Waste Management Plants, it is essential to have more than just the infrastructure for collecting and treating waste. The treated water should be released into water bodies or utilized for purposes like irrigation to comply with environmental standards. Therefore, monitoring this aspect is crucial. The established benchmark value for this measure stands at 100 percent.

Reliability of Measurement	
Reliability	Description of method
Lowest level of reliability (D)	No available information or not all parameters are tested
Intermediate level (C)	Not applicable
Intermediate level (B)	The sampling regimen is well-documented and practiced on most occasions. The treatment plant has its own laboratory equipment or have regular access to accredited testing centers. Only a few parameters are assessed.

Reliability of Measurement	
Reliability	**Description of method**
Highest/preferred level of reliability (A)	The sampling regimen is well documented and practiced completely. The treatment plant has its own laboratory equipment or have regular access to accredited testing centers. There is a periodic monitoring of wastewater quality and all parameters are assessed according to ECR 2023

3.5 Quality of Co-Composting

Performance Indicator		
Indicator	**Unit**	**Definition**
Quality of Co-Composting	%	Quality of the Co-compost is expressed as per the national standards mentioned in Solid Waste Management Rule 2021.
Data Requirements		
Data required for calculating the indicator	**Unit**	**Remarks**
a. Total number of parameters tested half yearly	Number half yearly	For Co-Composting, there is a guideline provided by the Solid Waste Management Rule 2021. Additionally, Bangladesh Standards and Guidelines for Sludge Management 2015 also provide more details on agricultural use purposes.
b. Number of parameters pass the quality standard	Number half yearly	The Co-Composting standard parameters should be compared with the Solid Waste Management Rule 2021 set by the Government of Bangladesh.
Quality of Composting	**%**	**Satisfactory level as per standard = [b/a]x100**

Rationale for the indicator
It is crucial to ensure that the processed dry sludge from FSTPs/ Integrated Waste Management Plants is repurposed as a material for resource recovery without adversely impacting the environment when placed on open ground or landfill sites. Therefore, monitoring this parameter is of great importance. The target value set for this indicator stands at 100 percent.

Reliability of Measurement	
Reliability	**Description of method**
Lowest level of reliability (D)	No available information or not all parameters are tested.
Intermediate level (C)	Not applicable
Intermediate level (B)	The composting process and turning schedule are well documented. The treatment plant can measure daily composting temperature, ensure hot air drying (>45°C), and conduct post-maturation to remove pathogens. Compost quality data is sent at regular intervals, with only a few parameters being assessed.
Highest/preferred level of reliability (A)	The composting procedure and turning schedule are thoroughly documented. The facility can monitor the daily temperature of the compost, ensuring hot air drying (>45°C) and post-maturation to eliminate pathogens. Information on the quality of the compost is regularly provided, with all factors being evaluated, and the standard for composing batches is available for confirmation.

Section IV

Making Service Level Benchmarking Operational

Section IV : Making Service Level Benchmarking Operational

4.1 Initiating performance reporting

This guideline provides an outline for the performance management system with the SLBs as the basis for monitoring and managing the performance of the FSTP's. For operationalized the performance few points need to be considered. Following are the points that needs to be ensured before reporting the performance of the FSTP's.

Keep the system simple : All the data formats and process for measuring the performance measurement should be kept very simple to start with. A gradual step should be maintained to make the system robust.

Leadership role of the city authority : To make the system operational, municipality/city corporations mayors should lead this initiative of making the Service Level Benchmarking successful.

Training and orientation : Staff at all municipality/city corporation levels will need to undergo training and orientations on Service Level Benchmarking to enable them to play their roles in the overall performance management system. Officers at the heads of the department level should take the lead in orienting their respective staff.

4.2 Performance Report Cards

The minimum frequency of computation of the performance indicator is specified in table 4.1. The municipality/city corporation is advised to follow the framework suggested below. However, they may make minor changes in the reporting frequency considering the operation modality of the FTSP plant.

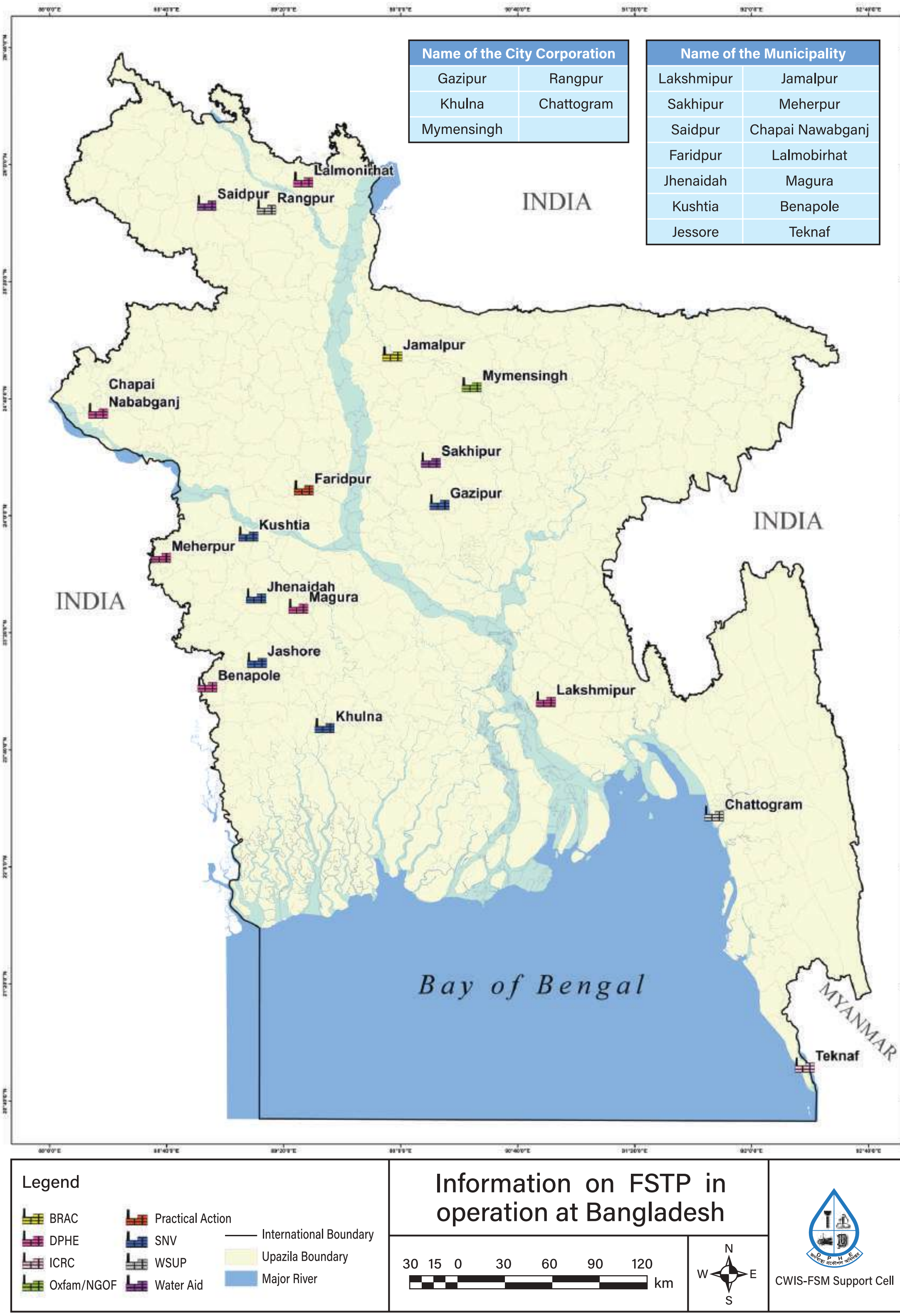
Table 4.1 : Minimum frequency of computation of the performance indicator

SLB No.	Indicators	Frequency of Measurement by the Plant Operator	Frequency of reporting with the municipality/city corporation authority	Frequency of reporting with local government division
1.	Adequacy of capacity for treatment of Faecal Sludge	Quarterly	Half-yearly	Annually
2.	Adequacy of capacity for treatment of Solid Waste	Quarterly	Half-yearly	Annually

SLB No.	Indicators	Frequency of Measurement by the Plant Operator	Frequency of reporting with the municipality/city corporation authority	Frequency of reporting with local government division
3.	Efficiency of the drying bed to separation the solid part from the faecal sludge	Quarterly	Half-yearly	Annually
4.	Efficiency of the liquid treatment unit	Quarterly	Half-yearly	Annually
5.	Quality of Co-Composting	Quarterly	Half-yearly	Annually

Section V
FSTP Mapping Bangladesh

Section IV : FSTP Mapping Bangladesh



Name of the City Corporation	
Gazipur	Rangpur
Khulna	Chattogram
Mymensingh	

Name of the Municipality	
Lakshmipur	Jamalpur
Sakhipur	Meherpur
Saidpur	Chapai Nawabganj
Faridpur	Lalmobirhat
Jhenaidah	Magura
Kushtia	Benapole
Jessore	Teknaf


INDIA
INDIA
INDIA
Bay of Bengal
MYANMAR
88°0'0"E
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Panchagarh
Thakurgaon
Birganj
Nilphamari
Lalmonirhat
Nageshwari
Kurigram
Saidpur
Rangpur
Ulipur
Dinajpur
Sundarganj
Gaibandha
Dewanganj
Hakimpur
Gobindoganj
Joypurhat
Sherpur
Jamalpur
Nakla
Netrokona
Sunamganj
Chhatak
Kanaighat
Bogura
Chapai Nawabganj
Naogaon
Muktagacha
Mymensingh
Jagannathpur
Shibganj
Ajmiriganj
Moulvibazar
Godagari
Sirajganj
Ghatail
Kishoreganj
Habiganj
Natore
Charghat
Arani
Belkuchi
Kalihati
Sakhipur
Shayestaganj
Shahjadpur
Tangail
Sreepur
Ishwardi
Pabna
Bera
Gazipur
Kushtia
Dhamrai
Narsingdi
Nabinagar
Meherpur
Rajbari
Alomdanga
Chuadanga
Faridpur
Dohar
Jhenaidah
Cumilla
Magura
Boalmari
Shibchar
Shariatpur
Laksam
Madaripur
Jashore
Chandpur
Chatkhil
Khagrachari
Benapole
Manirampur
Gopalganj
Lakshmipur
Sonaimuri
Feni
Muladi
Khulna
Noakhali
Bashurhat
Satkhira
Jhalokathi
Bagerhat
Betagi
Patuakhali
Chattogram
Satkania
Teknaf
Project
23 Municipalities Water Supply and Sanitation Project, DPHE
25 Town AIIB Project, DPHE
25 Town AIIB Project, DPHE/DPHE
25 Town AIIB Project, DPHE/UGIIP III
32 Municipalities Water Supply, Faecal Sludge Management and Environmental Sanitation, DPHE
Shibchar municipality and upazila safe water supply and sanitation system extention and development project, DPHE
Lives and Livelihoods Fund (LLF), DPHE
SNV/UGIIP-III, DPHE
BRAC\
DPHE
ICRC
Oxfax/NGOF
Practical Action
SNV
UGIIP-III, DPHE
WSUP
WaterAid
Legend
International Boundary
Upazila Boundary
Major River
Information on FSTP in different projects at Bangladesh
40 20 0 40 80 120 160
km
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W
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CWIS-FSM Support Cell


88°0'0"E
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21°0'0"N
INDIA
INDIA
INDIA
MYANMAR
Bay of Bengal
Panchagarh
Thakurgaon
Birganj
Nilphamari
Lalmonirhat
Nageshwari
Kurigram
Saidpur
Rangpur
Ulipur
Dinajpur
Sundarganj
Gaibandha
Dewanganj
Hakimpur
Gobindoganj
Joypurhat
Sherpur
Jamalpur
Nakla
Netrokona
Sunamganj
Chhatak
Kanaighat
Bogura
Chapai Nawabganj
Shibganj
Naogaon
Muktagacha
Mymensingh
Jagannathpur
Godagari
Natore
Sirajganj
Ghatail
Kishoreganj
Ajmiriganj
Moulvibazar
Habiganj
Charghat
Arani
Belkuchi
Kalihati
Sakhipur
Shayestaganj
Shahjadpur
Tangail
Sreepur
Ishwardi
Pabna
Bera
Gazipur
Kushtia
Dhamrai
Narsingdi
Nabinagar
Meherpur
Rajbari
Alomdanga
Chuadanga
Faridpur
Dohar
Jhenaidah
Cumilla
Magura
Boalmari
Shibchar
Shariatpur
Laksam
Madaripur
Jashore
Chandpur
Chatkhil
Khagrachari
Benapole
Manirampur
Gopalganj
Lakshmipur
Sonaimuri
Feni
Muladi
Khulna
Noakhali
Bashurhat
Satkhira
Bagerhat
Jhalokathi
Betagi
Patuakhali
Chattogram
Satkania
Teknaf
Legend
Construction completed
Consruction ongoing
FSTP in operation
Yet to start construction
International Boundary
Upazila Boundary
Major River
Information on FSTP in different locations at Bangladesh
30 15 0 30 60 90 120
km
N
W
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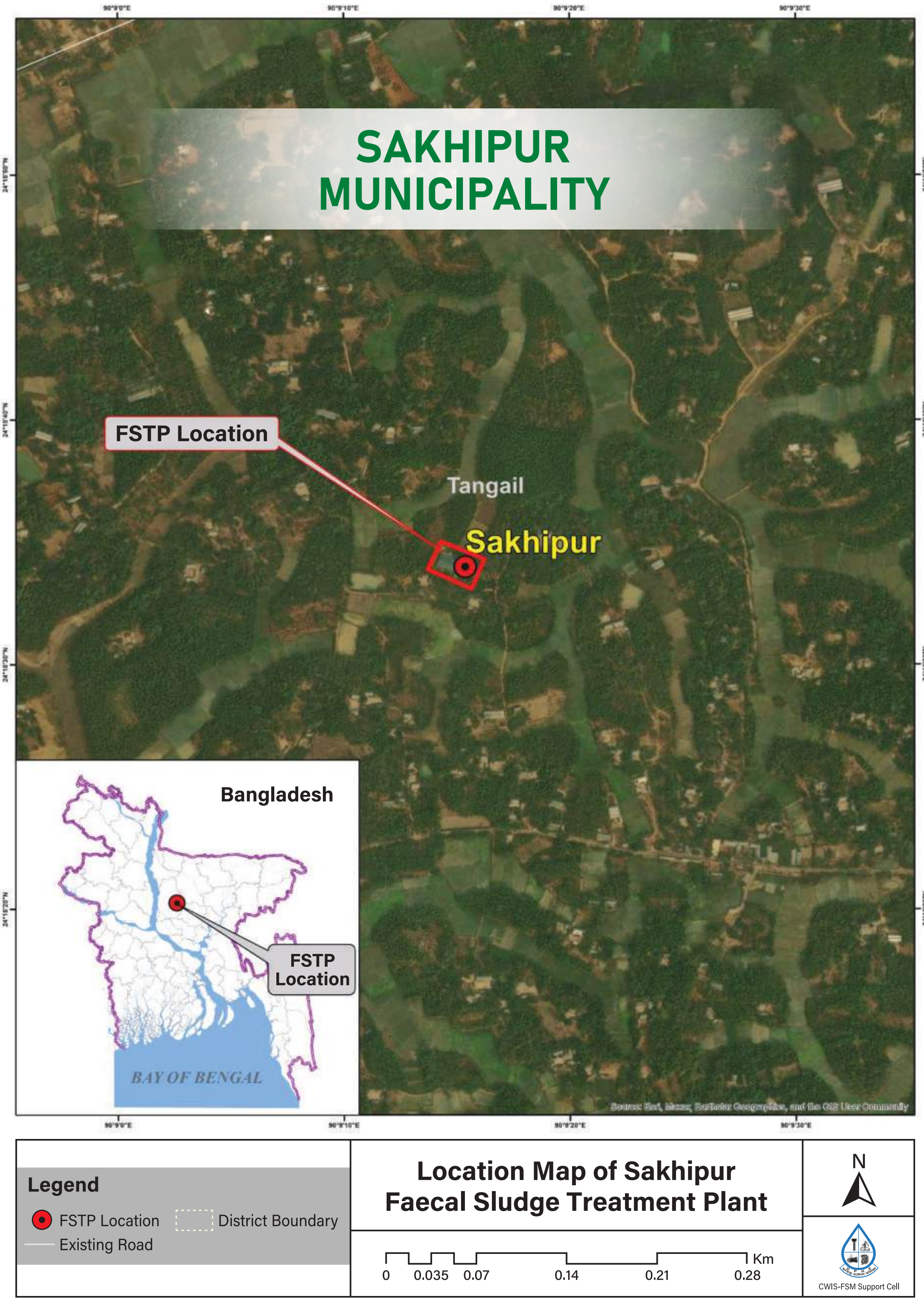
S
CWIS-FSM Support Cell

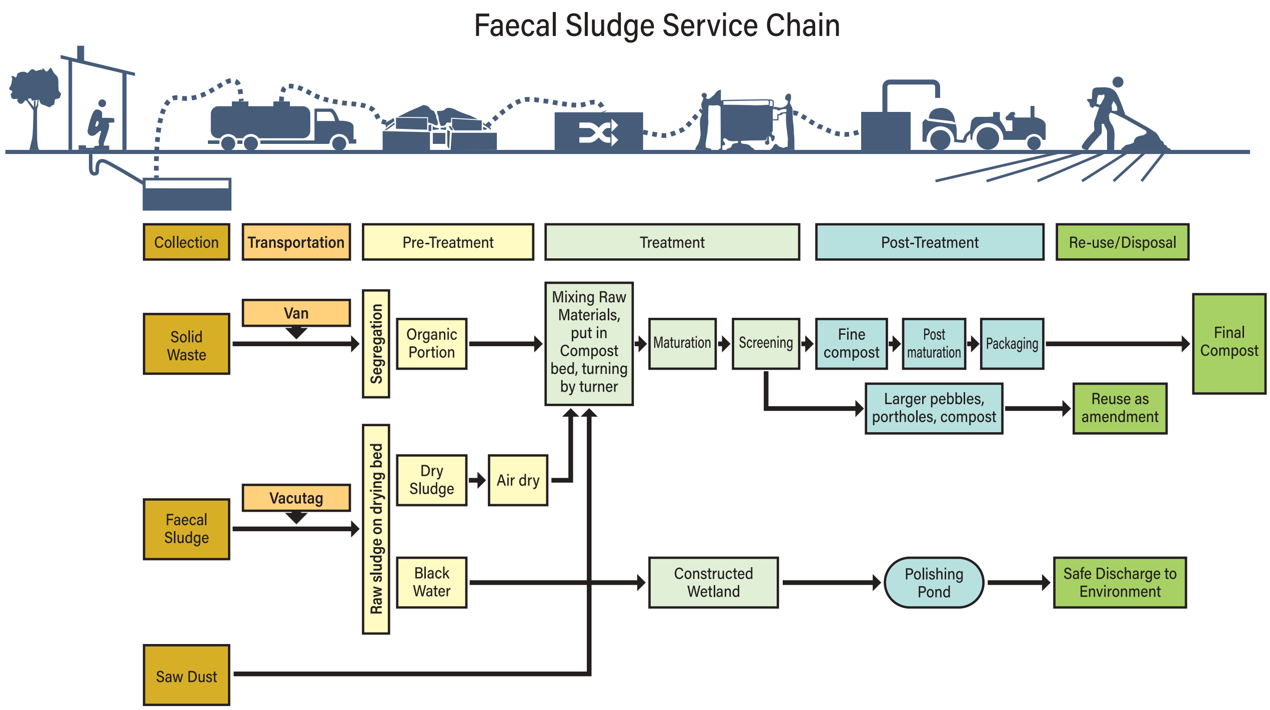


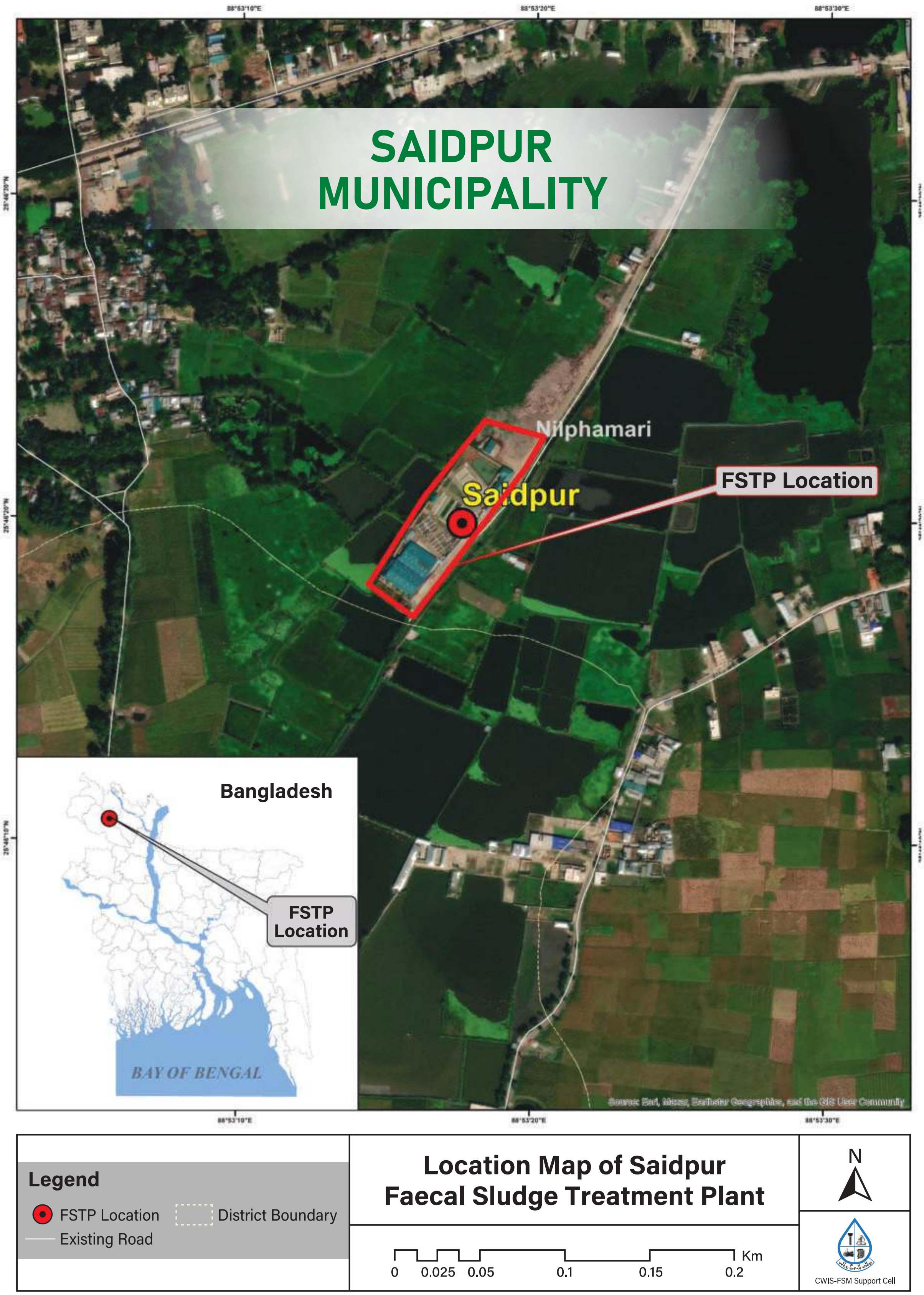
90°9'0"E
90°9'10"E
90°9'20"E
90°9'30"E
SAKHIPUR
MUNICIPALITY
FSTP Location
Tangail
Sakhipur
Bangladesh
FSTP Location
BAY OF BENGAL
Legend
FSTP Location
District Boundary
Existing Road
Location Map of Sakhipur
Faecal Sludge Treatment Plant
0
0.035
0.07
0.14
0.21
0.28
Km
N
CWIS-FSM Support Cell

Plant Summary

No	Item	Description
1.	Plant Location	24.30944°, 90.154272°
2.	Area Name	Selami Chala, Gargobindpur mouza, 06 no ward, Sakhipur Municipality
3.	Installation Year	11 April 2015
4.	Treatment Capacity: Design and (Actual)	Design = 120000 m^3/y Actual = 61000 m^3/y
5.	Type of end user served	Households (primary)/Others
6.	Type of on-site containment system	Septic Tank= 9 % Single Pit= 91%
7.	Received Sludge/Septage Characteristics (Updated)	Total solids (TS)= FC= 27000 CFU/100mL BOD= 50 mg/L NO^3= 134.35 mg/L PO_4^{3-} = 25.40 mg/L TSS=51 mg/L
8.	Treatment levels, liquid effluent Standard (reported)	FC= 600 CFU/100mL BOD= 5.2 mg/L NO^3= 9.4 mg/L PO_4^{3-} = 1.48 mg/L TSS= 10 mg/L
9.	Footprint of system/ Plant Area (ha)	0.0157 ha
10.	Designed energy requirements (actual usage) kW	Minimum 200 kw
11.	Collection Unit	No of Vacuum tanker- 01, capacity 1000L/ others
12.	Emptying fee	1000 BDT per 1000 Litter/ 01 trip
13.	Tipping fee at FSTP (per m^3)	Tripping fee at FSTP 01 BDT per m^3
14.	CapEx (Total)	1.25 core (Approximate)
15.	Land cost	25,00,000 BDT (As per present market value)
16.	OpEx(annual costs)	The average annual cost of operation of the treatment project (per year) is 15,96966

Treatment Plant Flow Diagram :




SAIDPUR
MUNICIPALITY
Nilphamari
Saidpur
FSTP Location
Bangladesh
FSTP
Location
BAY OF BENGAL
Legend
FSTP Location
District Boundary
Existing Road
Location Map of Saidpur
Faecal Sludge Treatment Plant
0
0.025
0.05
0.1
0.15
0.2
Km
N
CWIS-FSM Support Cell

Plant Summary

No	Item	Description
1.	Plant Location	25.772193°, 88.888247 °
2.	Area Name	Shurkimoholla, Vagar, Ward No: 11 Saidpur, Nilphamari.
3.	Installation Year	April 2018 (Construction Starting Period)
4.	Treatment Capacity: Design and (Actual)	Design = 26 m^3/day Actual = 12 m^3/day (Average)
5.	Type of end user served	Households (primary)/Others
6.	Type of on-site containment system	Septic Tank= 43.5 % Single Pit= 38.2 % Double Pit= 11.5 % Others= 6.8 %
7.	Received Sludge/Septage Characteristics (Updated)	Total Coliforms= 7800 CFU/100ml BOD= 416.0 mg/L Nitrate (NO_3)= 589.82 mg/L Phosphate (PO_4^{3-})= 33.4 mg/L TSS= 33.0 mg/L
8.	Treatment levels, liquid effluent Standard (reported)	Total Coliforms= 200 CFU/100ml BOD= 23.0 mg/L Nitrate (NO^3)= 42.17 mg/L Phosphate (PO_4^{3-})= 4.0 mg/L TSS= 12.0 mg/L
9.	Footprint of system/ Plant Area (ha)	0.688 ha
10.	Designed energy requirements (actual usage) kW	Minimum: 40.0 Kw (average)
11.	Collection Unit	No of 04 Vacuum tanker 500 liters, 1000 liters, 2000 liters, 3500 liters
12.	Emptying fee	1000 liters: 800.00 BDT, 3500 liters: 2500.00 BDT (Per trip fee) Two Vacuum tanker are operated now.
13.	Tipping fee at FSTP (per m^3)	800.00 BDT
14.	CapEx (Total)	Total BDT in: 7 core(Approximate)
15.	Land cost	2,55,00,000.00 BDT(As per present market value)
16.	OpEx(annual costs)	Average annual cost of operation of the FSTP (per year) BDT : 26,13,800.00

No	Item	Description
17.	Design Criteria:	Land Area: 1.70 Drying Bed: Number= Unplanted Drying Bed : 20 Nos, Planted Drying Bed: 04 Nos Size= Unplanted Drying Bed : 5.40m X 2.64m X 0.15m Planted Drying Bed: 10.06mX 7.32m X 0.46m
18.	Wastewater treatment:	Biological treatment through constructed wetland, pre-polishing and polishing pond

Treatment Plant Flow Diagram:

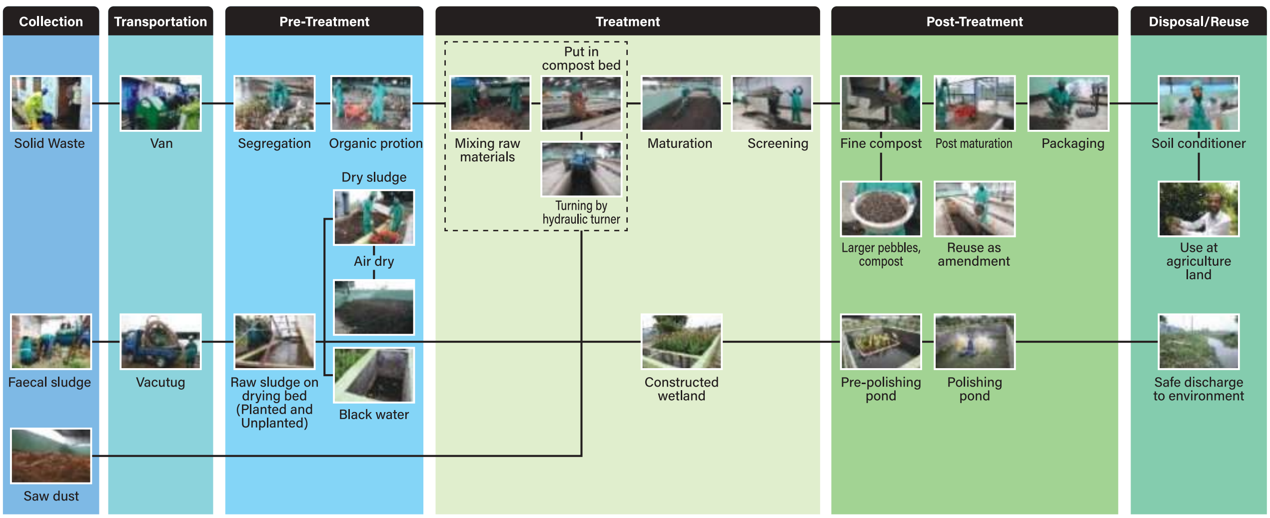


Figure 5.1: Birds Eye View of the Saidpur Farcal Sludge Treatment Plant

Legend

- FSTP Location
- District Boundary
- Existing Road

Location Map of Lakshmipur Faecal Sludge Treatment Plant

N

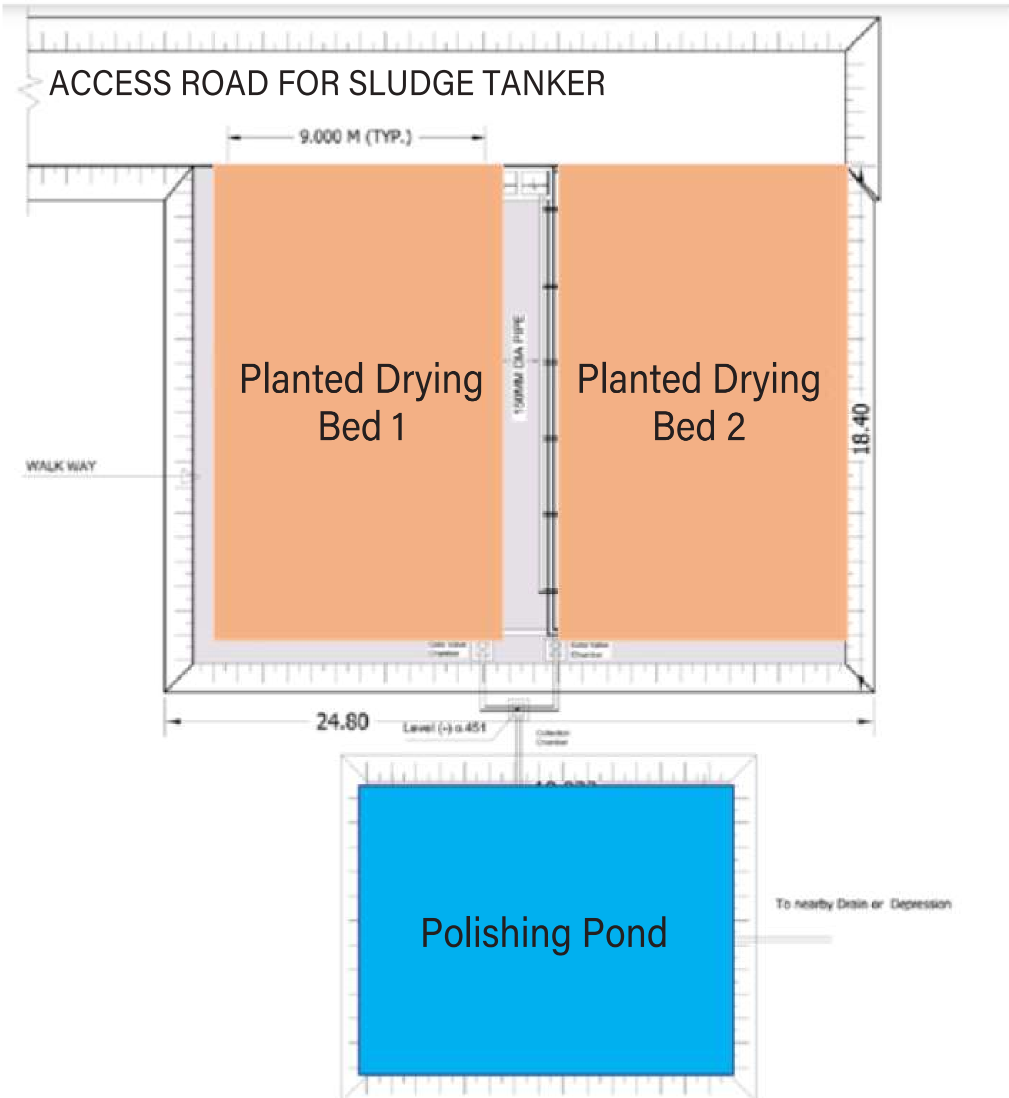
Scale: 0 | 0.045 | 0.09 | 0.18 | 0.27 | 0.36 Km

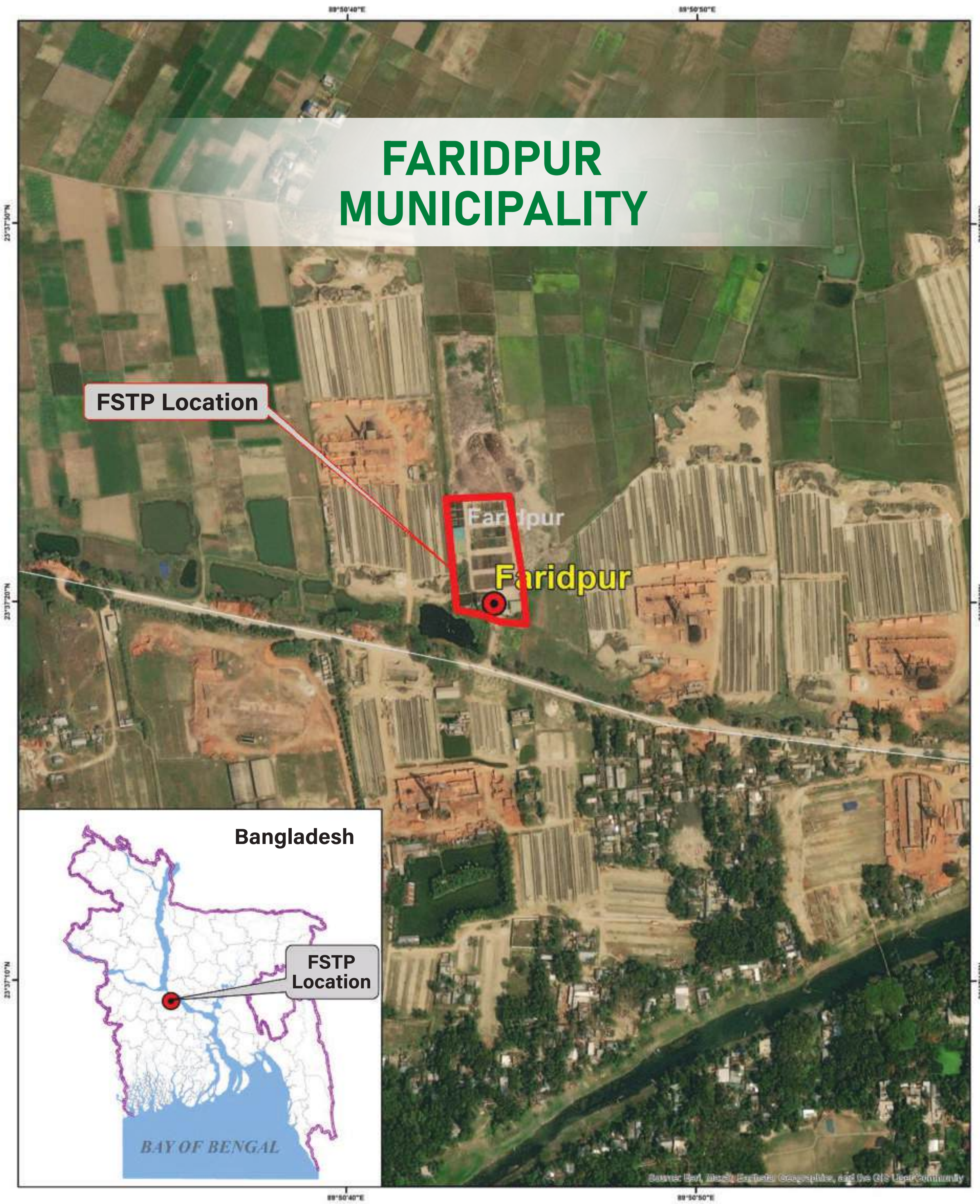
CWIS-FSM Support Cell

Plant Summary

No	Item	Description
1.	Plant Location	22.93501°, 90.807822 °
2.	Area Name	Kacharibag
3.	Installation Year	2013
4.	Treatment Capacity: Design and (Actual)	Design = Actual = 10.8 m3/d
5.	Type of end user served	
6.	Type of on-site containment system	Septic Tank= Pit Latrine= Others=
7.	Received Sludge/Septage Characteristics (Updated)	Total solids (TS)= BOD= 5,000 COD= 28,100 TSS=59,036
8.	Treatment levels, liquid effluent Standard (reported)	Total solids (TS)= BOD= 12.5 COD= 148 TSS=57
9.	Footprint of system/ Plant Area (ha)	0.39 Acres
10.	Designed energy requirements (actual usage) kW	N/A
11.	Collection Unit	03 active vaccum tankers (1,500 L)
12.	Emptying fee	Residential= BDT 1.00/Liter Institution= BDT 1.20/Liter For Low Income Community= BDT 0.60/Liter
13.	Tipping fee at FSTP (per m^3)	
14.	CapEx (Total)	N/A
15.	Land cost	
16.	OpEx(annual costs)	
17.	Design Criteria:	Land Area: Planted Drying Bed/ Reed beds Number= 2 nos (Each Bed=144 m^2)
18.	Wastewater treatment:	Planted Drying bed/ Reed beds-----→ Polishing pond

Treatment Plant Flow Diagram:





Legend

- FSTP Location
- District Boundary
- Existing Road

Location Map of Faridpur Faecal Sludge Treatment Plant

N

0 0.025 0.05 0.1 0.15 0.2 Km

CWIS-FSM Support Cell

Plant Summary

No	Item	Description
1.	Plant Location	23.622673°, 89.845568° https://goo.gl/maps/ukF33aJadbj9Hrc39
2.	Area Name	Adompur
3.	Installation Year	2016
4.	Treatment Capacity: Design and (Actual)	Design = 24 m^3/d Actual = 24 m^3/d
5.	Type of end user served	Others – flowering plant culture
6.	Type of on-site containment system	Septic Tank= 59 % Pit Latrine= 40% Others= 1%
7.	Received Sludge/Septage Characteristics (Updated)	Total solids (TS)= BOD= COD= TSS=
8.	Treatment levels, liquid effluent Standard (reported)	Total solids (TS)= BOD= COD= TSS=
9.	Footprint of system/ Plant Area (ha)	1.5 Acres / 0.607 hectare
10.	Designed energy requirements (actual usage) kW	N/A
11.	Collection Unit	06 vaccum tankers
12.	Emptying fee	1000 ~ 1200 tk/ per trip For LIC- 700 tk/trip
13.	Tipping fee at FSTP (per m^3)	Same as above
14.	CapEx (Total)	N/A
15.	Land cost	Land is leased by SDC
16.	OpEx(annual costs)	2 lakh BDT/year
17.	Design Criteria:	Land Area: Drying Bed: Number= UPDB- 16 nos PDB – 12 nos Size= UDB (10.72m x 3.75m) – each bed PDB (8m x 8m) – each bed
18.	Wastewater treatment:	Treatment method= Combined treatment method (Nitrification, de-nitrification, filtration, aeration)

Treatment Plant Flow Diagram:

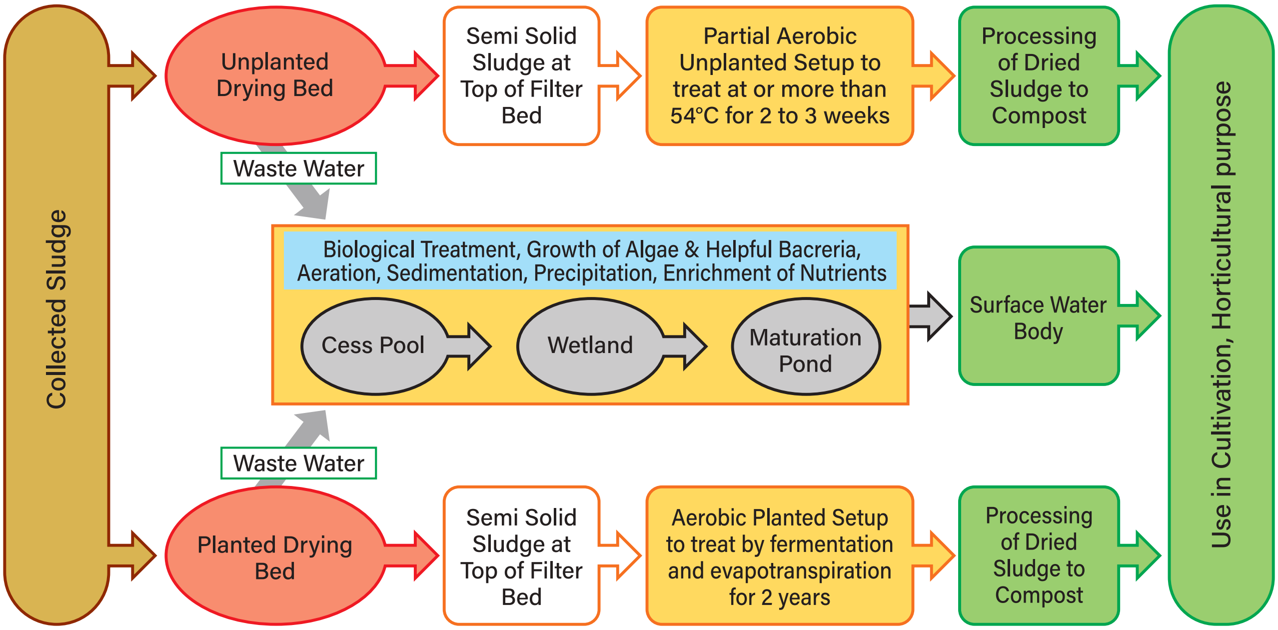
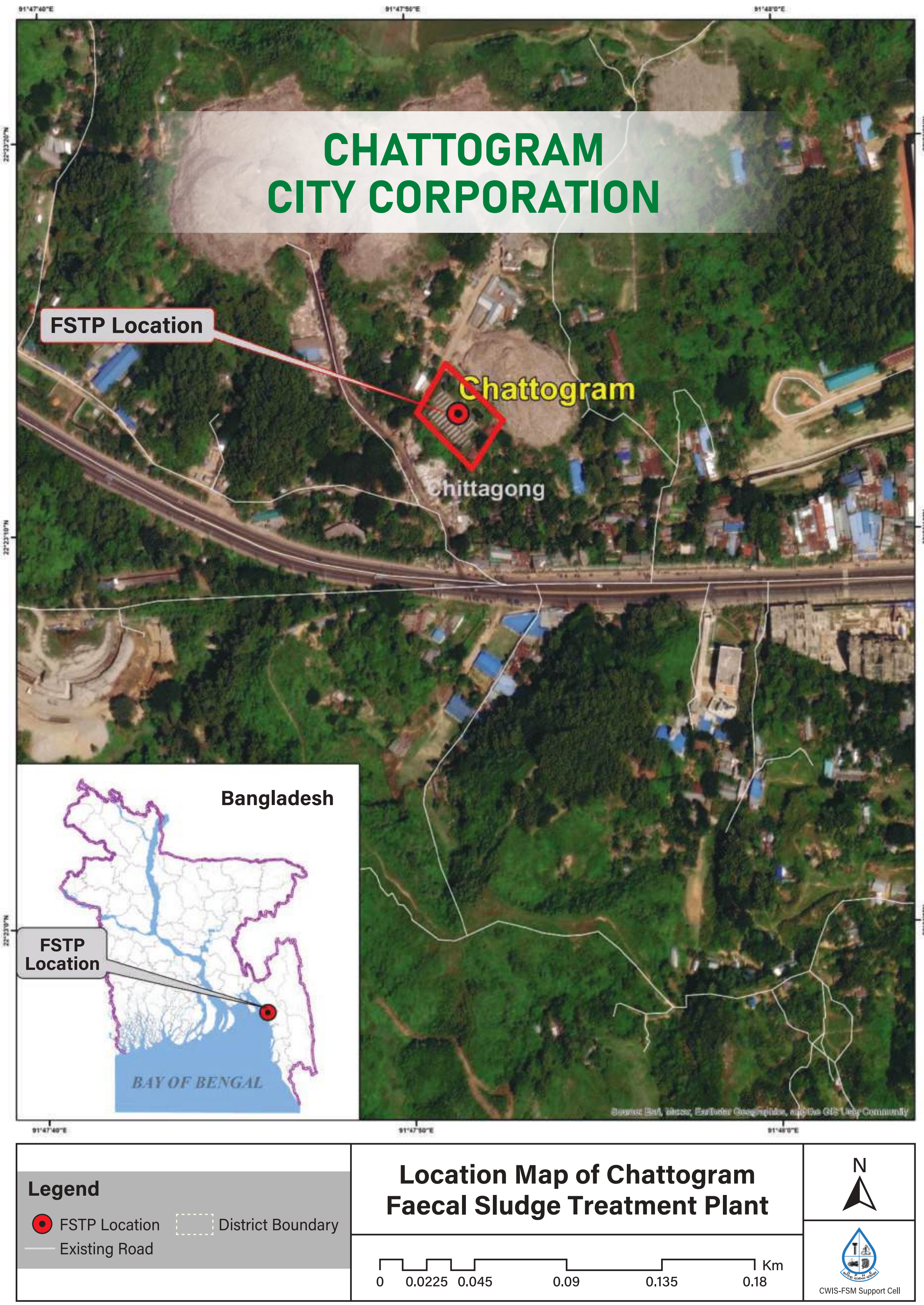


Figure 5.2: Birds eye view of the Faridpur Farcal Sludge Treatment Plant


CHATTOGRAM
CITY CORPORATION
FSTP Location
Chattogram
Chittagong
Bangladesh
FSTP Location
BAY OF BENGAL
Legend
FSTP Location
District Boundary
Existing Road
Location Map of Chattogram Faecal Sludge Treatment Plant
0 0.0225 0.045 0.09 0.135 0.18 Km
N
CWIS-FSM Support Cell

Plant Summary

No	Item	Description
1.	Plant Location	22.386945°, 91.797595°
2.	Area Name	Arefin Nagar
3.	Installation Year	2019
4.	Treatment Capacity: Design and (Actual)	Design = 33.6 m^3/d Actual = 21 m^3/d
5.	Type of end user served	
6.	Type of on-site containment system	Septic Tank= Pit Latrine= Others=
7.	Received Sludge/Septage Characteristics (Updated)	Total solids (TS)= BOD= COD= TSS=
8.	Treatment levels, liquid effluent Standard (reported)	Total solids (TS)= BOD= COD= TSS=
9.	Footprint of system/ Plant Area (ha)	0.65 Acres
10.	Designed energy requirements (actual usage) kW	N/A
11.	Collection Unit	05 active vaccum tankers (1,500 L,2,000 L and 4,000 L)
12.	Emptying fee	Residential= BDT 1.00/Liter Institution= BDT 2.00/Liter For Low Income Community= BDT 0.60/Liter
13.	Tipping fee at FSTP (per m^3)	
14.	CapEx (Total)	N/A
15.	Land cost	
16.	OpEx(annual costs)	
17.	Design Criteria:	Unplanted Drying bed followed by Settler, ABR and polishing pond Tota Number of Unplanted Drying bed = 21 nos (Capacity of each bed = 12 m^3) ABR= 13 Chamber
18.	Wastewater treatment:	Unplanted Drying bed-----→Settler -----→ABR--------→Polishing pond

Treatment Plant Flow Diagram:

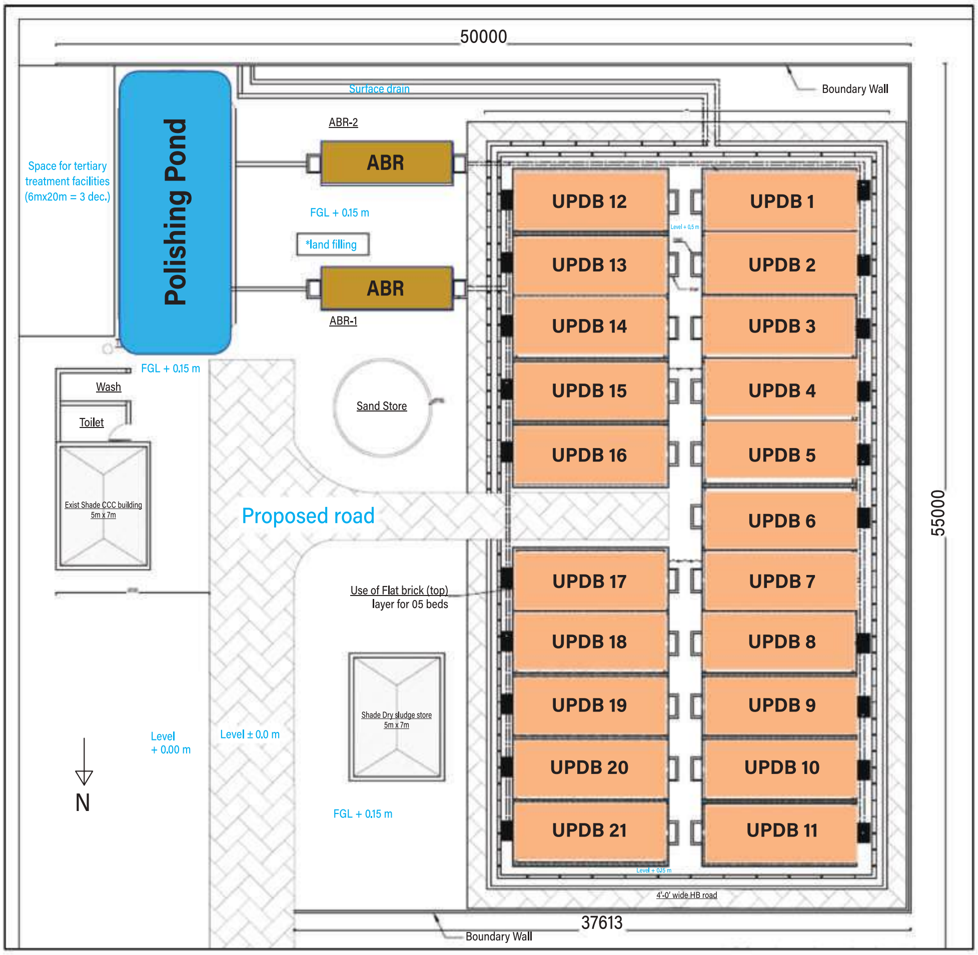
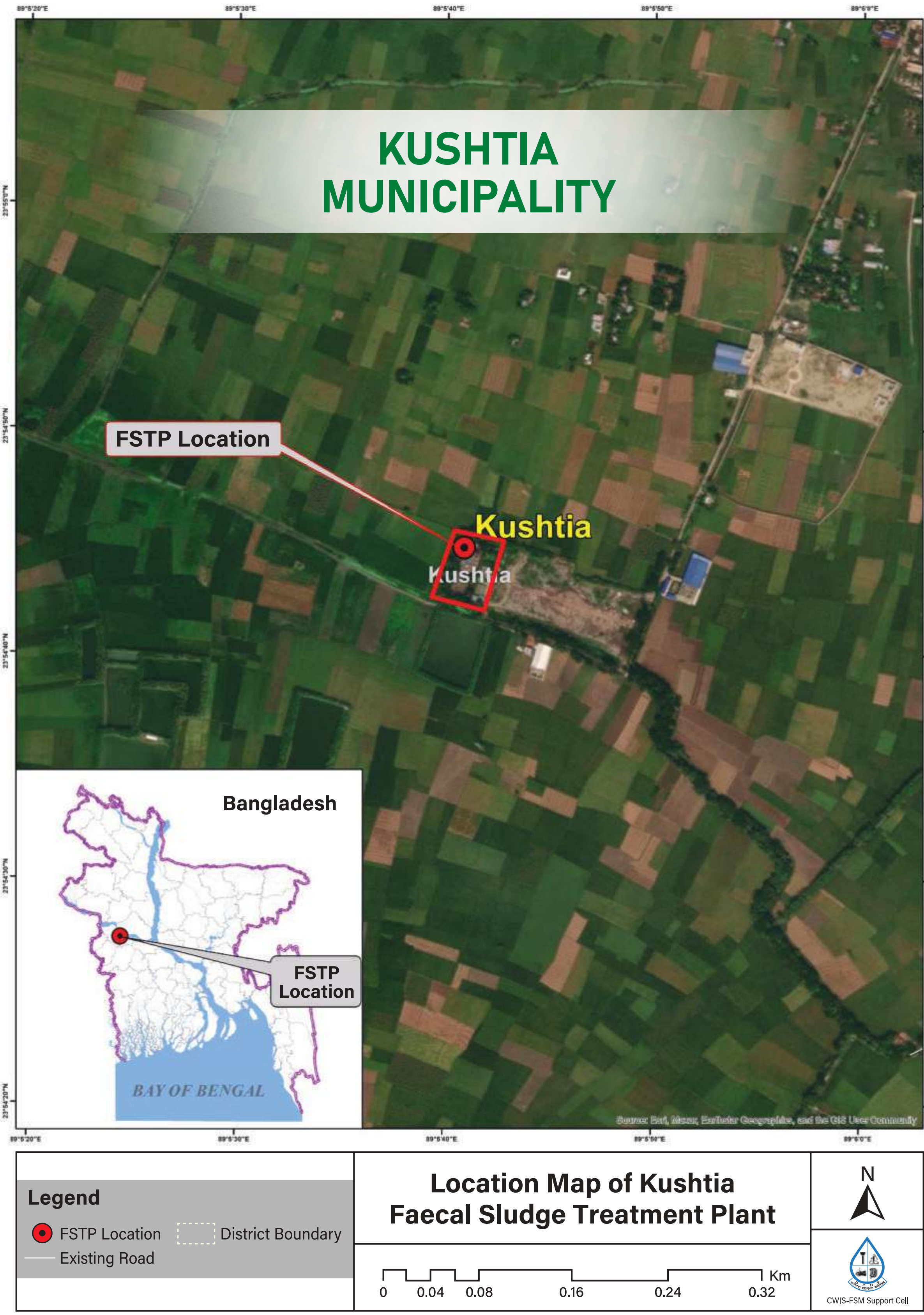


Figure 5.3 : Faecal Sludge Treatment plant at Arefin Nagar,Chattogram (Photo Courtesy: WSUP)


KUSHTIA
MUNICIPALITY
FSTP Location
Kushtia
Kushtia
Bangladesh
FSTP
Location
BAY OF BENGAL
Legend
FSTP Location
District Boundary
Existing Road
Location Map of Kushtia
Faecal Sludge Treatment Plant
0
0.04
0.08
0.16
0.24
0.32
Km
N
CWIS-FSM Support Cell

Plant Summary

No	Item	Description
1.	Plant Location	23.91242, 89.09473
2.	Area Name	Kanabill road, Kushtia
3.	Installation Year	2012
4.	Treatment Capacity: Design and (Actual)	Design = 18m3/d Actual = 10m3/d
5.	Type of end user served	Households /Institutions/Commercial building
6.	Type of on-site containment system	Septic Tank= 50% Single Pit= 45% Double Pit= Others=5%
7.	Received Sludge/Septage Characteristics (Updated)	Total solids (TS)= 30kg/m3 (Average) BOD= 844mg/l COD= TSS=29052mg/l
8.	Treatment levels, liquid effluent Standard (reported)	Total solids (TS)= BOD= 48 COD= TSS=135
9.	Footprint of system/ Plant Area (ha)	2400 m^2
10.	Designed energy requirements (actual usage) kW	3kwh/day
11.	Collection Unit	5 Vacutugs,1-1m3, 2-1.5m3, 1-2m3, 1-4m3
12.	Emptying fee	1st trip: 1m3-1000tk, 1.5m3-1500tk, 4m3-2000tk, Pit-800tk Every next trip: 1m3-500tk, 1.5m3-600tk, 4m3-1000tk, Pit-400tk
13.	Tipping fee at FSTP (per m^3)	N/A
14.	CapEx (Total)	Around 5000000BDT
15.	Land cost	N/A
16.	OpEx(annual costs)	180000BDT
17.	Design Criteria:	Land Area: Drying Bed: Unplanted Drying Bed Number= 4 Size= 10mX6m
18.	Wastewater treatment:	Cocopeat filter-------→ Polishing Pond

Treatment Plant Flow Diagram:

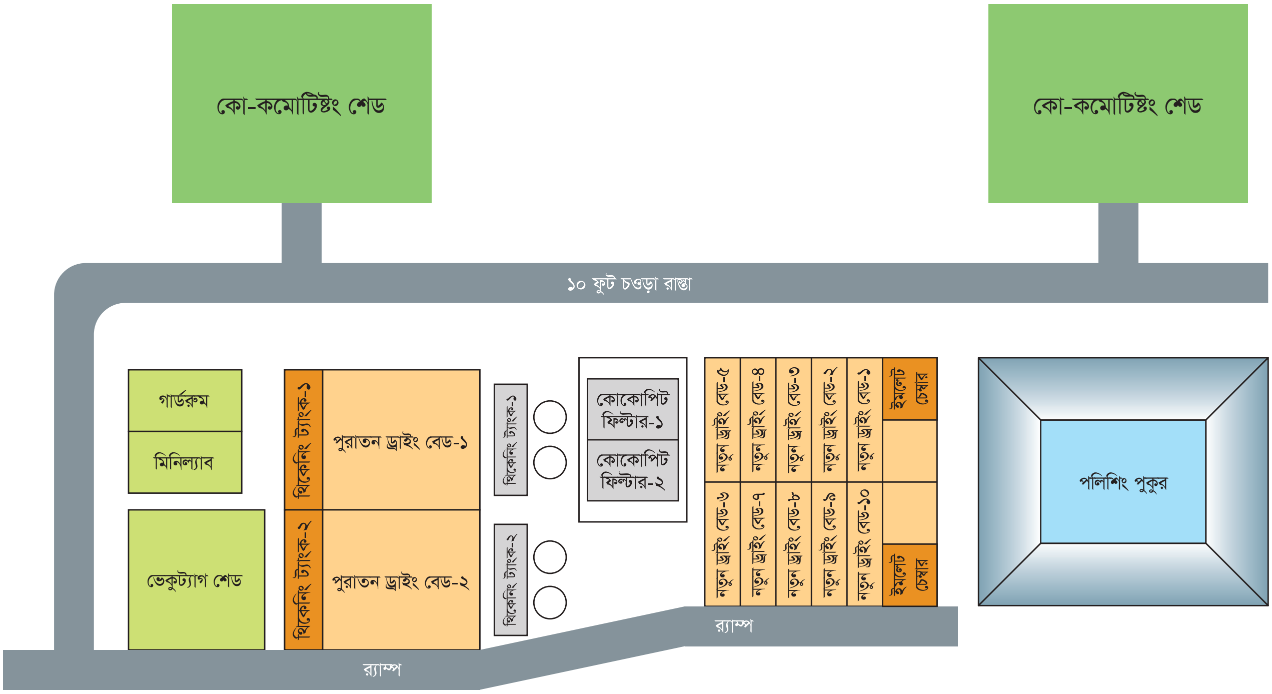
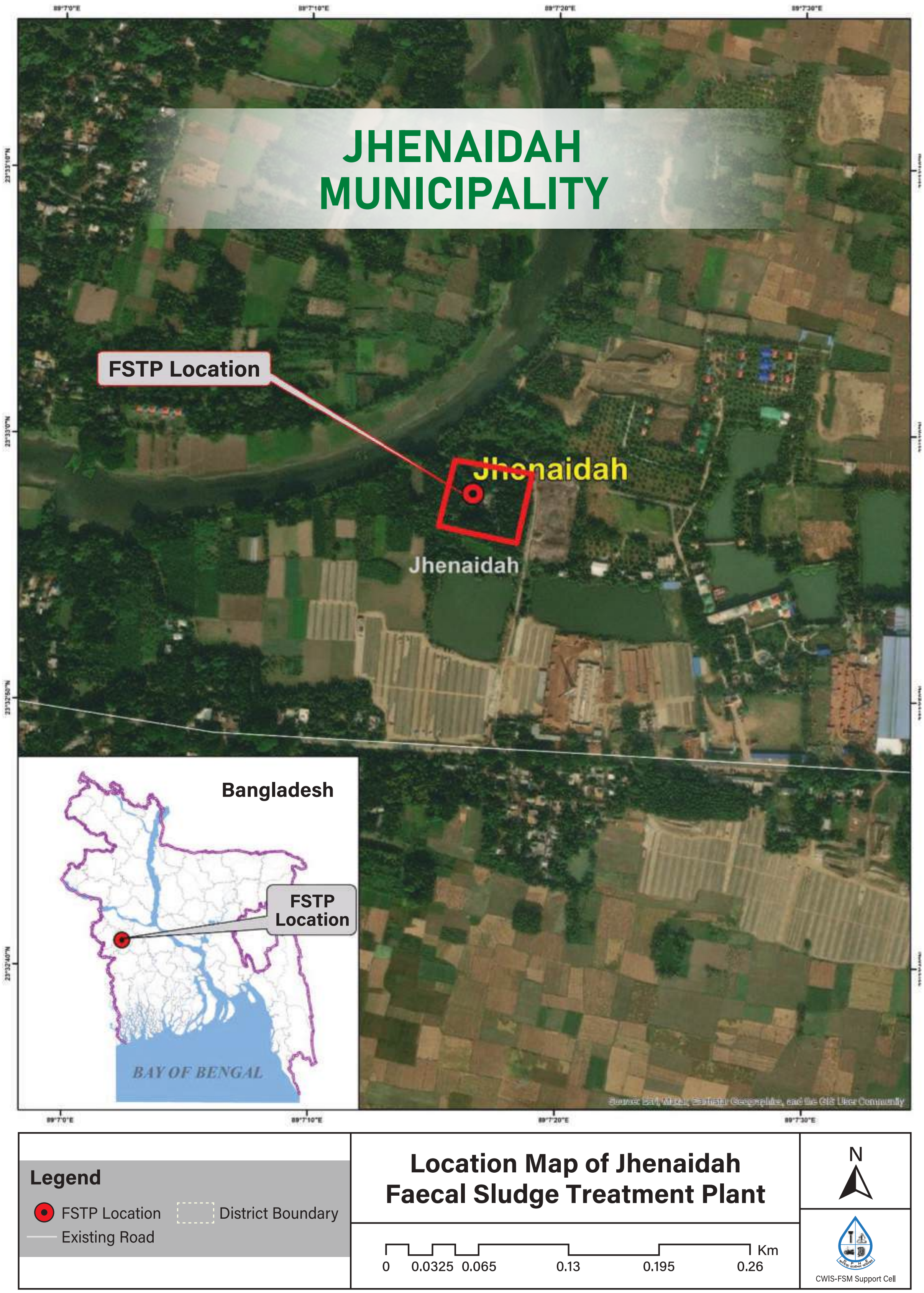


Figure 5.4 : Birds eye view of the Kushtia Farcal Sludge Treatment Plant


JHENAIDAH
MUNICIPALITY
FSTP Location
Jhenaidah
Jhenaidah
Bangladesh
FSTP Location
BAY OF BENGAL
Legend
FSTP Location
District Boundary
Existing Road
Location Map of Jhenaidah
Faecal Sludge Treatment Plant
0 0.0325 0.065 0.13 0.195 0.26 Km
N
CWIS-FSM Support Cell

Plant Summary

No	Item	Description
1.	Plant Location	23.549375, 89.121293
2.	Area Name	Mohishbathan, Jhenaidah
3.	Installation Year	2012
4.	Treatment Capacity: Design and (Actual)	Design = $36m^3/d$ Actual = $12m^3/d$
5.	Type of end user served	Households /Institutions/Commercial building
6.	Type of on-site containment system	Septic Tank= 46% Single Pit= 49% Double Pit= % Others=5%
7.	Received Sludge/Septage Characteristics (Updated)	Total solids (TS)= $30kg/m^3$ (Average) BOD= 895mg/l COD= TSS=28356mg/l
8.	Treatment levels, liquid effluent Standard (reported)	Total solids (TS)= BOD= 32.5 COD= TSS=135
9.	Footprint of system/ Plant Area (ha)	1400 m^2
10.	Designed energy requirements (actual usage) kW	No need any energy for treatment
11.	Collection Unit	2 Vacutugs,1-$1m^3$, 1-$2m^3$
12.	Emptying fee	Residential (non-slum)-$1000BDT/m^3$, Residential (slum)-$500BDT/m^3$, Non-residential (Commercial, institution)-$1500BDT/m^3$
13.	Tipping fee at FSTP (per m^3)	N/A
14.	CapEx (Total) •Breakdown	Around 8000000 BDT
15.	Land cost	N/A
16.	OpEx(annual costs) •Breakdown	120000BDT
17.	Design Criteria:	Land Area: Planted Drying Bed/Constructed Wetland Number= 5 Size= 9.2mX5.2m Unplanted Drying Bed Number= 3 Size= 3.067mX5.2m
18.	Wastewater treatment:	Horizontal Planted filter----→Natural Pond

Treatment Plant Flow Diagram:

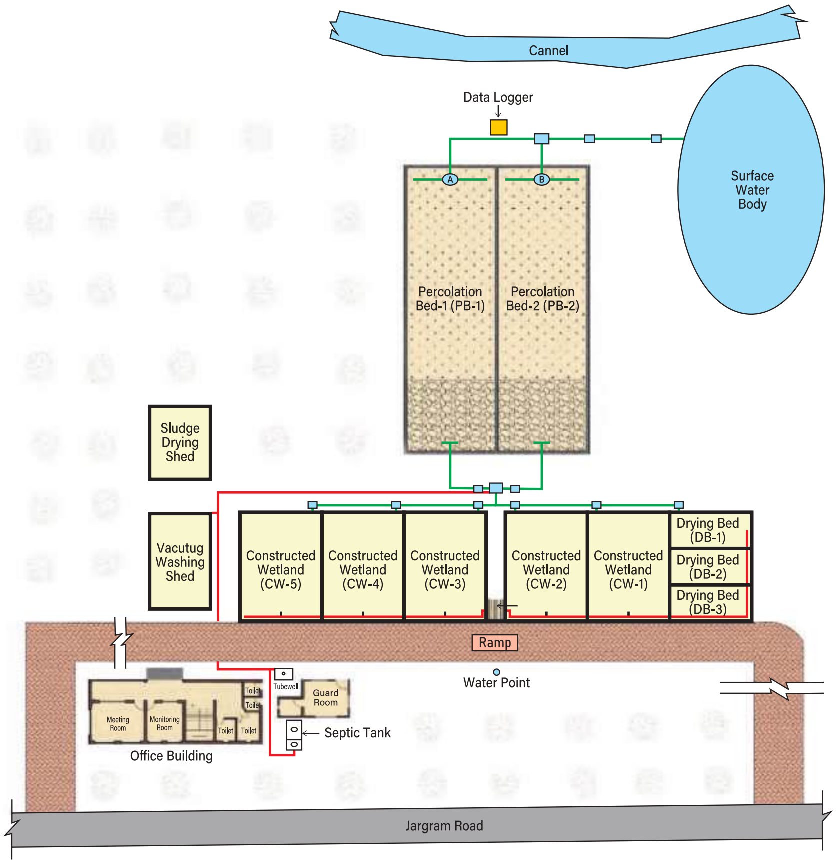
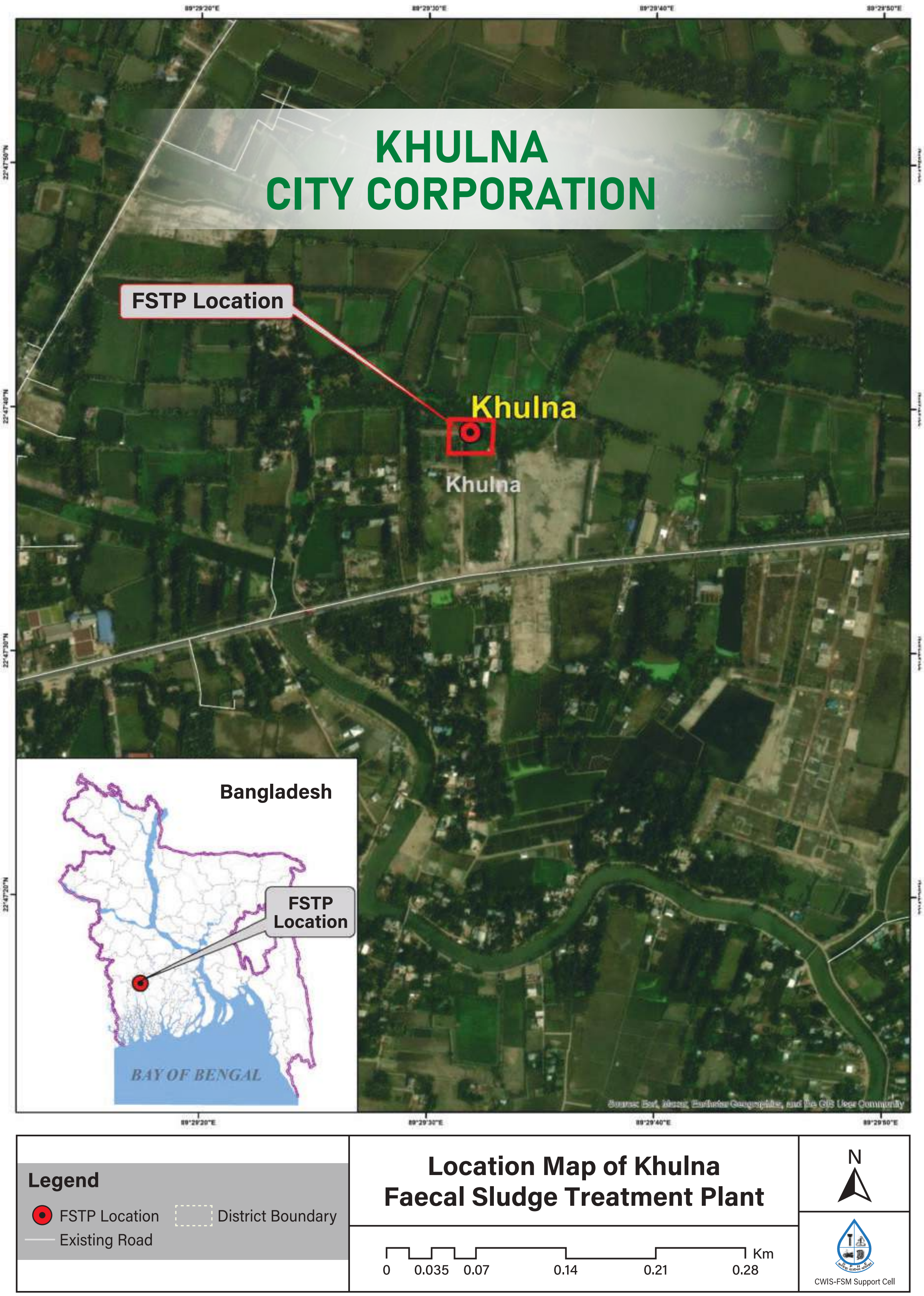


Figure 5.5 : Birds eye view of the Jhenaidah Farcal Sludge Treatment Plant



KHULNA
CITY CORPORATION
FSTP Location
Khulna
Khulna
Bangladesh
FSTP Location
BAY OF BENGAL
Legend
FSTP Location
District Boundary
Existing Road
Location Map of Khulna
Faecal Sludge Treatment Plant
N
0
0.035
0.07
0.14
0.21
0.28
Km
CWIS-FSM Support Cell

Plant Summary

No	Item	Description
1.	Plant Location	22.794167, 89.4922
2.	Area Name	Rajbandh, Khulna
3.	Installation Year	2016
4.	Treatment Capacity: Design and (Actual)	Design = 180m^3/d Actual = 90m^3/d
5.	Type of end user served	Households /Institutions/Commercial building
6.	Type of on-site containment system	Septic Tank= 62% Single Pit= 28% Double Pit= % Others=10%
7.	Received Sludge/Septage Characteristics (Updated)	Total solids (TS)= 30kg/m3 (Average) BOD= 615mg/l COD= TSS=29020mg/l
8.	Treatment levels, liquid effluent Standard (reported)	Total solids (TS)= BOD= 42 COD= TSS=95
9.	Footprint of system/ Plant Area (ha)	5200 m^2
10.	Designed energy requirements (actual usage) kW	No need any energy for treatment
11.	Collection Unit	2 Vacutugs,1-1m^3, 1-2m^3
12.	Emptying fee	Residential (non-slum)-700BDT/m3, Residential (slum)-350BDT/m3, Non-residential (Commercial, institution)-1050BDT/m3
13.	Tipping fee at FSTP (per m^3)	N/A
14.	CapEx (Total) •Breakdown	Around 20000000 BDT
15.	Land cost	N/A
16.	OpEx(annual costs) •Breakdown	120000BDT
17.	Design Criteria:	Land Area: Planted Drying Bed/Constructed Wetland Number= 5 Size= 9.2mX5.2m Unplanted Drying Bed Number= 3 Size= 3.067mX5.2m
18.	Wastewater treatment:	Horizontal Planted filter--gPolishing Pond

Treatment Plant Flow Diagram:

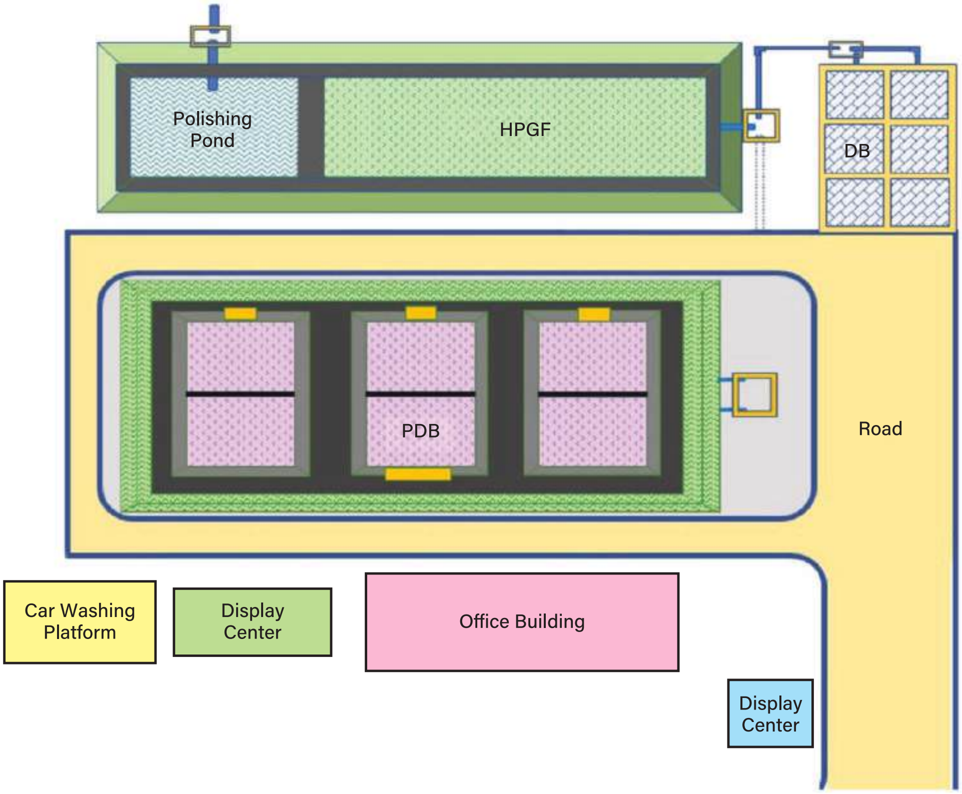
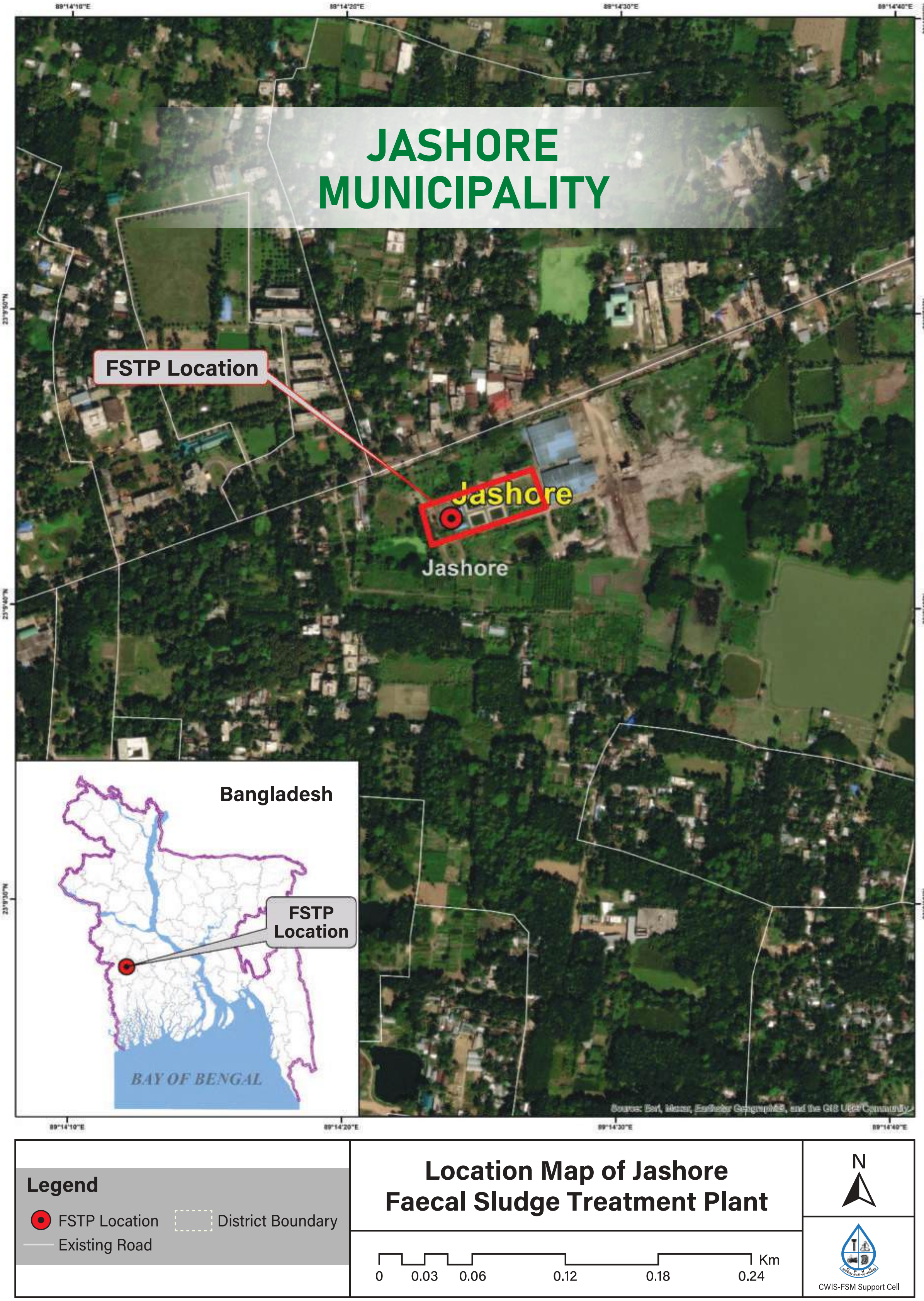


Figure 5.6 : Birds eye view of the Khulna Farcal Sludge Treatment Plant



JASHORE MUNICIPALITY
FSTP Location
Jashore
Jashore
Bangladesh
FSTP Location
BAY OF BENGAL
Legend
FSTP Location
District Boundary
Existing Road
Location Map of Jashore Faecal Sludge Treatment Plant
0 0.03 0.06 0.12 0.18 0.24 Km
N
CWIS-FSM Support Cell

Plant Summary

No	Item	Description
1.	Plant Location	23.161941, 89.239988
2.	Area Name	Jhumjhumpur, Jashore
3.	Installation Year	2018
4.	Treatment Capacity: Design and (Actual)	Design = 9m³/d Actual = 9m³/d
5.	Type of end user served	Households /Institutions/Commercial building
6.	Type of on-site containment system	Septic Tank= 58.5% Single Pit= 6.9% Double Pit=28.62 % Others=5.98%
7.	Received Sludge/Septage Characteristics (Updated)	Total solids (TS)= 30kg/m³ (Average) BOD= Not tested yet COD= TSS= Not tested yet
8.	Treatment levels, liquid effluent Standard (reported)	Total solids (TS)= BOD= Not tested yet COD= TSS= Not tested yet
9.	Footprint of system/ Plant Area (ha)	1400 m²
10.	Designed energy requirements (actual usage) kW	3kwh/day
11.	Collection Unit	5 Vacutugs,3-1.5m³, 1-2m³,1-2.5m³
12.	Emptying fee	1st trip-2300BDT (2.5m³), Every next trip-1500BDT
13.	Tipping fee at FSTP (per m³)	N/A
14.	CapEx (Total)	Around 3000000 BDT
15.	Land cost	N/A
16.	OpEx(annual costs)	180000BDT
17.	Design Criteria:	Land Area: Unplanted Drying Bed Number= 3 Size= 10mX6m
18.	Wastewater treatment:	Cocopeat filter--------→Polishing Pond

Treatment Plant Flow Diagram:

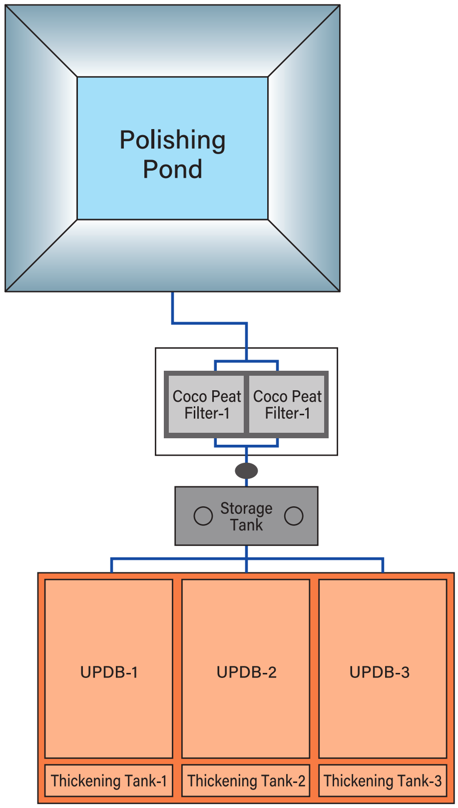
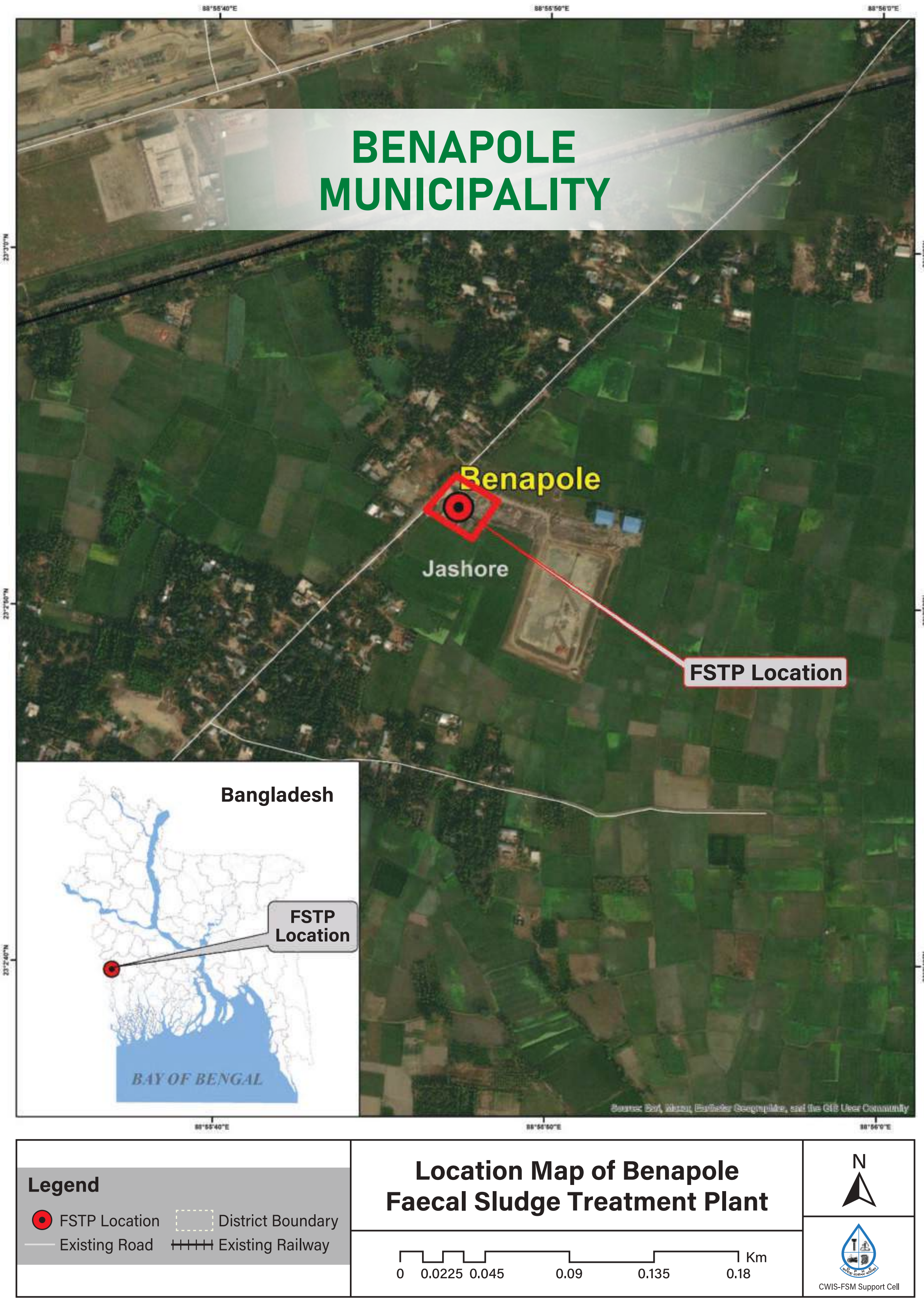


Figure 5.7 : Birds eye view of the Jashore Farcal Sludge Treatment Plant


BENAPOLE
MUNICIPALITY
Benapole
Jashore
FSTP Location
Bangladesh
FSTP Location
BAY OF BENGAL
Legend
FSTP Location
District Boundary
Existing Road
Existing Railway
Location Map of Benapole Faecal Sludge Treatment Plant
0 0.0225 0.045 0.09 0.135 0.18 Km
N
CWIS-FSM Support Cell

Plant Summary

No	Item	Description
1.	Plant Location	23.048003, 88.929841
2.	Area Name	Kagoj Pukuria, Benapole
3.	Installation Year	2022
4.	Treatment Capacity: Design and (Actual)	Design = $30m^3/d$ Actual = $10m^3/d$
5.	Type of end user served	Households /Institutions/Commercial building
6.	Type of on-site containment system	Septic Tank= 16% Single Pit= 60% Double Pit=23 % Others=1%
7.	Received Sludge/Septage Characteristics (Updated)	Total solids (TS)= $30kg/m^3$ (Average) BOD= Not tested yet COD= TSS= Not tested yet
8.	Treatment levels, liquid effluent Standard (reported)	Total solids (TS)= BOD= Not tested yet COD= TSS= Not tested yet
9.	Footprint of system/ Plant Area (ha)	1575 m^2
10.	Designed energy requirements (actual usage) kW	No need any energy for treatment
11.	Collection Unit	1 Vacutugs, $1.5m^3$
12.	Emptying fee	Not started yet
13.	Tipping fee at FSTP (per m^3)	N/A
14.	CapEx (Total)	Around 20000000BDT
15.	Land cost	N/A
16.	OpEx(annual costs)	Not started yet
17.	Design Criteria:	Land Area: Planted Drying Bed Number= 3 Size= 16.1mX9m
18.	Wastewater treatment:	Settler----→ ABR----→ AF--------→ Polishing Pond

Treatment Plant Flow Diagram:

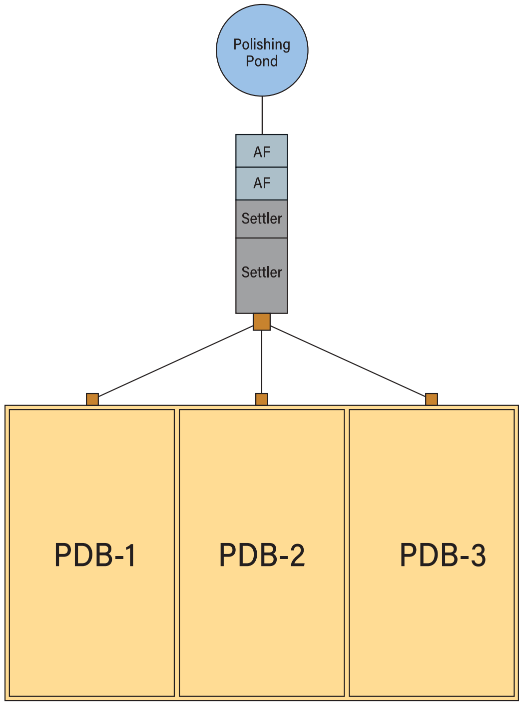
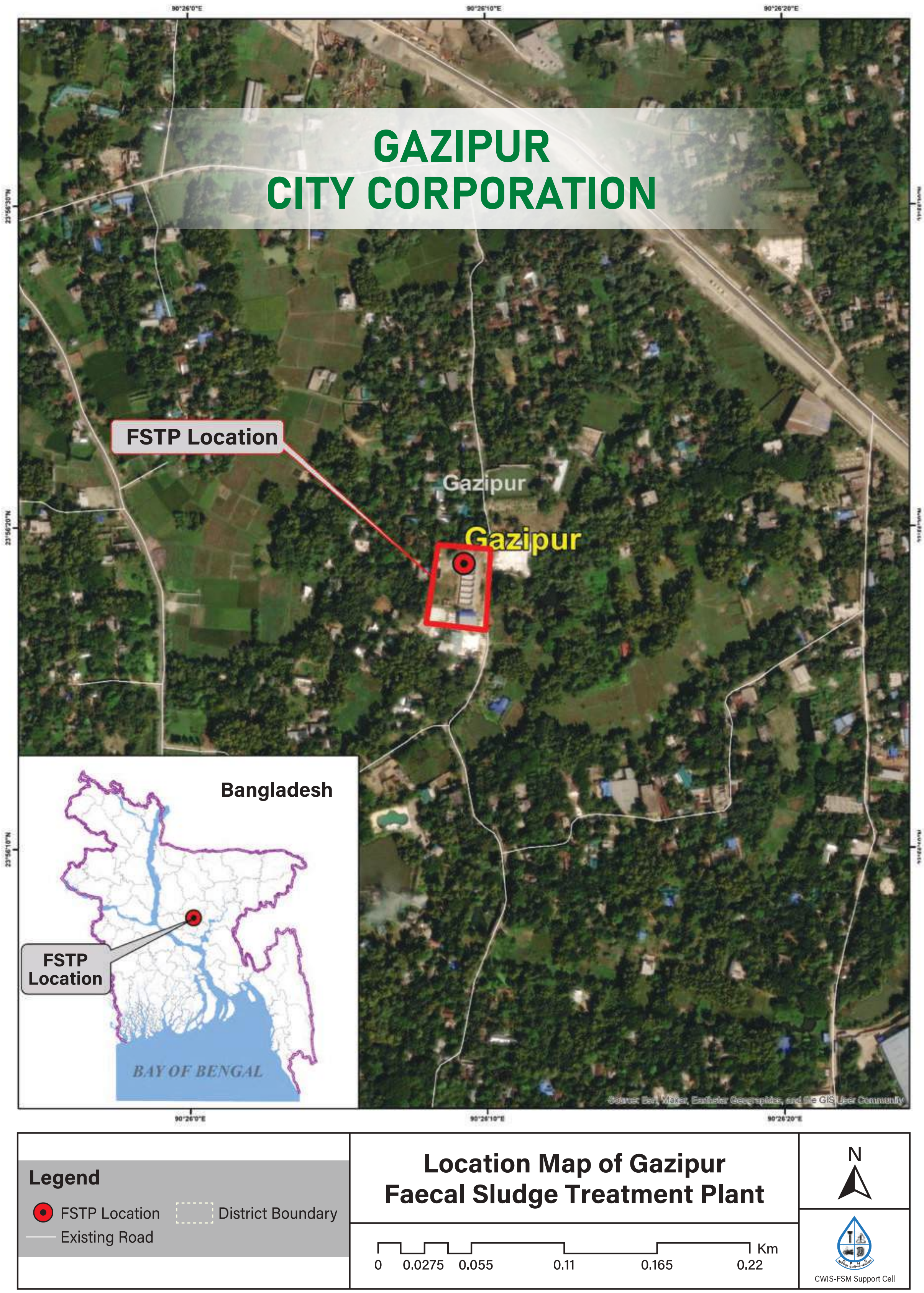


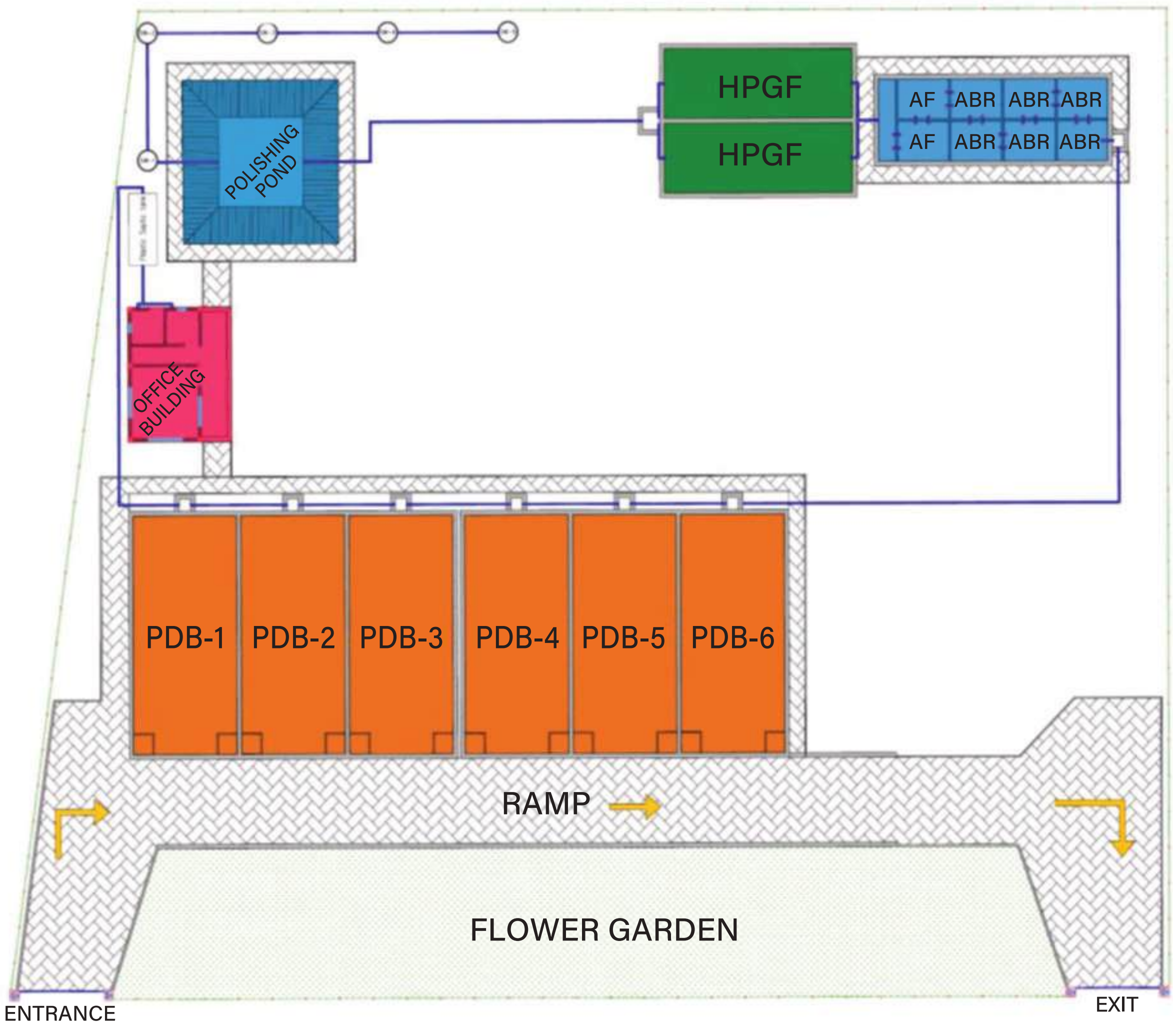
Figure 5.8: Birds eye view of the Benapole Farcal Sludge Treatment Plant

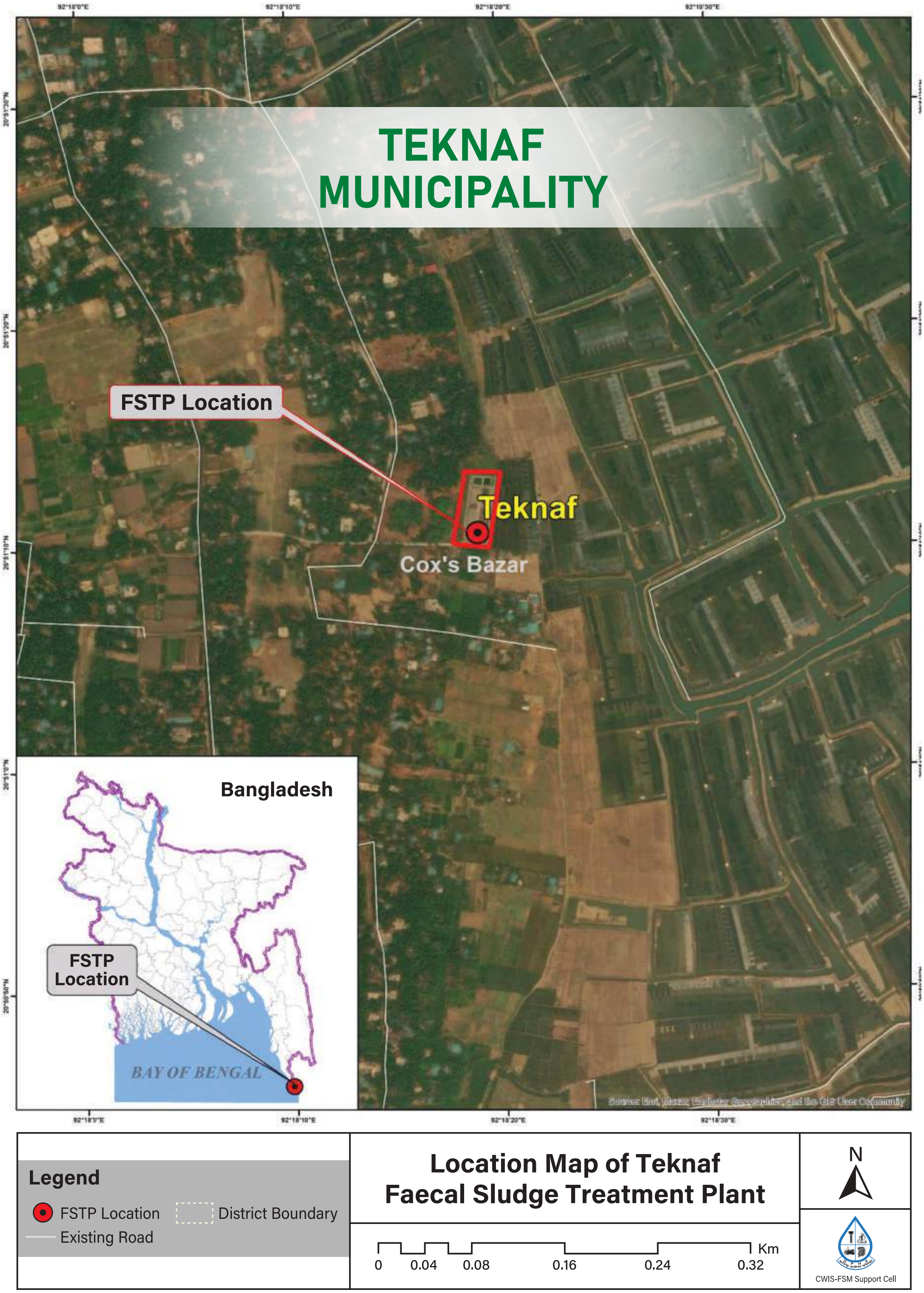

GAZIPUR
CITY CORPORATION
FSTP Location
Gazipur
Gazipur
Bangladesh
FSTP
Location
BAY OF BENGAL
Legend
FSTP Location
District Boundary
Existing Road
Location Map of Gazipur
Faecal Sludge Treatment Plant
0
0.0275
0.055
0.11
0.165
0.22
Km
N
CWIS-FSM Support Cell

Plant Summary

No	Item	Description
1.	Plant Location	23.938573, 90.435892
2.	Area Name	Meghdubi, Gazipur
3.	Installation Year	2022
4.	Treatment Capacity: Design and (Actual)	Design = 18m^3/d Actual = 18m^3/d
5.	Type of end user served	Households /Institutions/Commercial building
6.	Type of on-site containment system	Septic Tank= 50% Single Pit= 10.1% Double Pit=2.62 % Others=37.28%
7.	Received Sludge/Septage Characteristics (Updated)	Total solids (TS)= 30kg/m3 (Average) BOD= Not tested yet COD= TSS= Not tested yet
8.	Treatment levels, liquid effluent Standard (reported)	Total solids (TS)= BOD= Not tested yet COD= TSS= Not tested yet
9.	Footprint of system/ Plant Area (ha)	1800 m^2
10.	Designed energy requirements (actual usage) kW	No need any energy for treatment
11.	Collection Unit	3 Vacutugs, 2m^3
12.	Emptying fee	Not started yet
13.	Tipping fee at FSTP (per m^3)	N/A
14.	CapEx (Total)	70,00,000BDT
15.	Land cost	N/A
16.	OpEx(annual costs)	Not started yet
17.	Design Criteria:	Land Area: Planted Drying Bed Number= 6 Size= 12.5mX5m
18.	Wastewater treatment:	ABR---→AF-----→Horizontal Planted Gravel Filter----→Polishing Pond

Treatment Plant Flow Diagram:





TEKNAF
MUNICIPALITY
FSTP Location
Teknaf
Cox's Bazar
Bangladesh
FSTP Location
BAY OF BENGAL
92°18'0"E
92°18'10"E
92°18'20"E
92°18'30"E
Legend
FSTP Location
District Boundary
Existing Road
Location Map of Teknaf
Faecal Sludge Treatment Plant
0
0.04
0.08
0.16
0.24
0.32
Km
N
CWIS-FSM Support Cell

Plant Summary

No	Item	Description
1.	Plant Location	Map Link
2.	Area Name	Teknaf Municipality
3.	Installation Year	2020
4.	Treatment Capacity: Design and (Actual)	Design = $20m^3/d$ Actual = m^3/d
5.	Type of end user served	Households /Institutions/Commercial building
6.	Type of on-site containment system	Septic Tank= % Single Pit= % Double Pit= % Others=%
7.	Received Sludge/Septage Characteristics (Updated)	Total solids (TS)= BOD= COD= TSS=
8.	Treatment levels, liquid effluent Standard (reported)	Total solids (TS)= BOD= 64 mg/L COD= 168 mg/L TSS= 18mg/L
9.	Footprint of system/ Plant Area (ha)	N/A
10.	Designed energy requirements (actual usage) kW	100 to 120 KW
11.	Collection Unit	Two Vacu tugs (1,000L and 2,500L)
12.	Emptying fee	See attached file
13.	Tipping fee at FSTP (per m^3)	N/A
14.	CapEx (Total)	
15.	Land cost	Municipality Land
16.	OpEx(annual costs)	Approx. 11,75,000 BDT (in 2022)
17.	Design Criteria:	Land Area: 35m x 100m Drying Bed: Number= 9 Size= 45m2
18.	Wastewater treatment:	Treatment method= Planted and unplanted drying beds, followed by three stabilization ponds

Treatment Plant Flow Diagram:

PROCESS FLOW AND TREATMENT EFFICIENCY

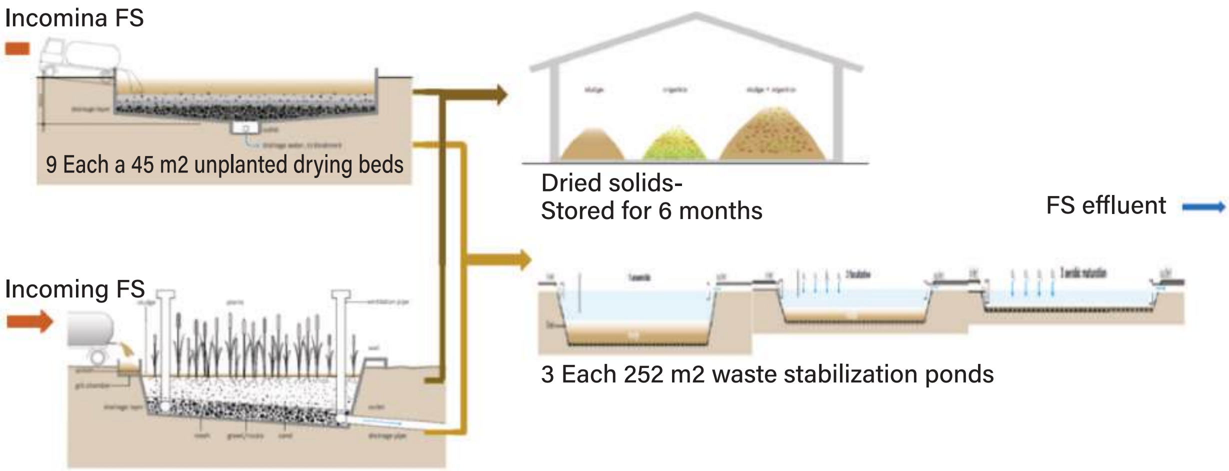


Figure 5.9 : Faecal Sludge Treatment plant at Teknaf Municipality (Photo Courtesy: ICRC)

ANNEX : Illustration Performance Report Card

Reporting of Service Level Benchmarks for FSTP (Sample)				
Name of the Municipality/ City Corporation	Sakhipur Municipality		**Reporting Year**	2023 (Baseline)
Performance Report Submitted to:	Municipality	√	**Reporting frequency**	January-December, 2023
	City Corporation			
	Local Government			
Indicators	**Performance Achieved**	**Performance Targeted**	**Performance Achieved as per Reliability of Measurement Level**	**Action Plan to Achieve the Target**
1.1. Adequacy of capacity for treatment of Faecal Sludge	80	90	B	
1.2. Adequacy of capacity for treatment of Solid Waste	85	90	B	
1.3. Efficiency of the drying bed to separation the solid part from the faecal sludge	90	100	B	
1.4. Efficiency of the liquid treatment unit	100	100	A	
1.5. Quality of Co-Composting	100	100	A	

DEPARTMENT OF PUBLIC HEALTH ENGINEERING
14, SHAHEED CAPTAIN MANSUR ALI SARANI,
KAKRAIL, DHAKA-1000